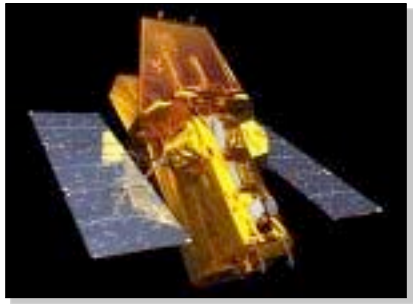
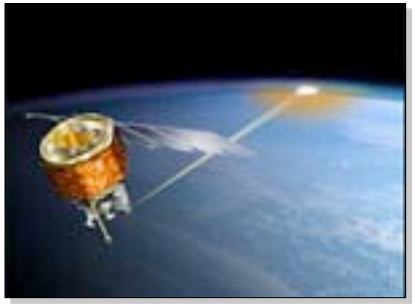
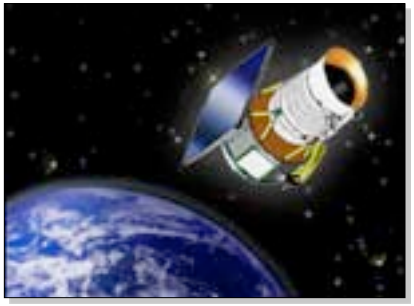
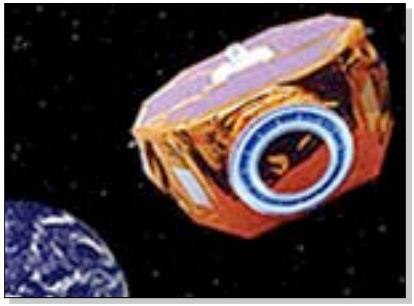





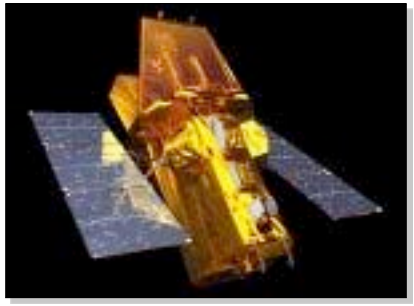
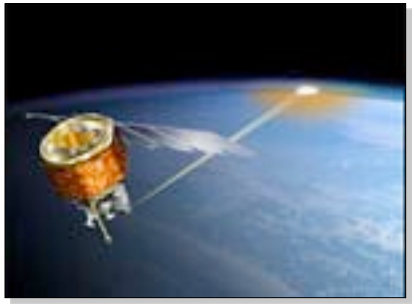
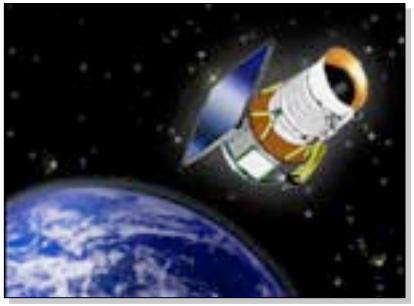
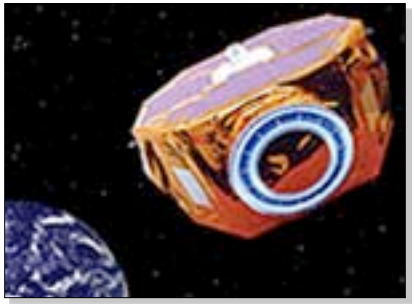
Explorer 2011 Technical, Management, and Cost Evaluation

Gloria Hernandez

Explorer Acquisition Manager

NASA Science Office for Mission Assessments

Not applicable to EX2011 USPI Proposals

TMC Proposal Evaluation Process

AO Released

Preproposal Briefing @HQ

Receipt of Notices of Intent

TMC Evaluation Kick Off

Receipt of Proposals

Compliance Check of Proposals

TMC Evaluation

TMC Evaluation Plenary Meeting

(Instrumehts)

Scientific Merit & Scientific implementation Merit Evaluation

Science Evaluation Team Meeting

Categorization Committee @ HQ

Program Scientist Briefing Package

Steering Committee @ HQ

Selection by SMD AA @ HQ

Debriefings to Proposers

TMC Evaluation

TMC Evaluation - The technical, management, and cost 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.

TMC Evaluation Principles

- **Basic Assumption**: Proposer is the expert on their 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.

- **All Proposals are evaluated to identical standards and not compared to other proposals.**

- **TMC Panels consist of evaluators who are experts in the areas of the proposals that they evaluate.**

TMC Evaluation Principles

- **TMC Panels develop findings for each proposal**
  - Findings: "As expected" (no finding), "above expectations" (strengths), "below expectations" (weaknesses).

- **Cost Analysis is integrated into overall risk**

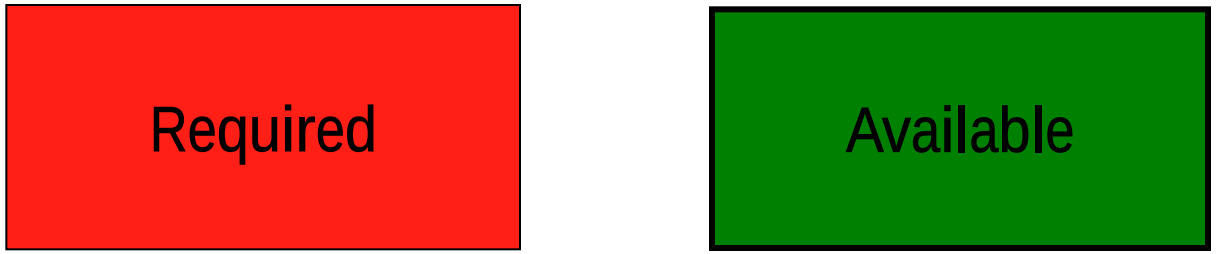
- **Step-One Proposal Risk Assessment:**
  - Step-One proposals are based on Pre-Phase-A concepts; TMC Risk Assessments give appropriate benefit of the doubt to the Proposer.

TMC Evaluation

- **The purpose of the TMC evaluation is to determine, for each Proposal, the level of risk of accomplishing the scientific objectives of the investigation, as proposed, on time and within cost.**
- **There are three possible Risk Levels: Low, Medium, and High**
  - **Low Risk:** There are no problems 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.
  - **Medium Risk:** Problems have been identified, but are considered within the proposal team's capabilities to correct with good management and application of effective engineering resources. Mission design may be complex and resources tight.
  - **High Risk:** Problems are of sufficient magnitude such that failure is highly probable given the resources proposed.

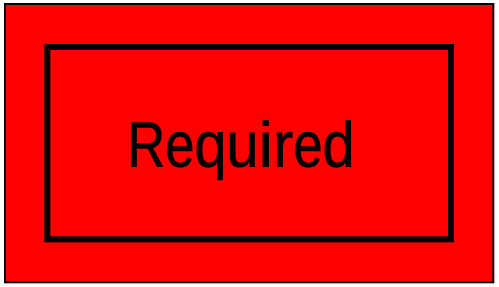
Concept of the Risk Envelope

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

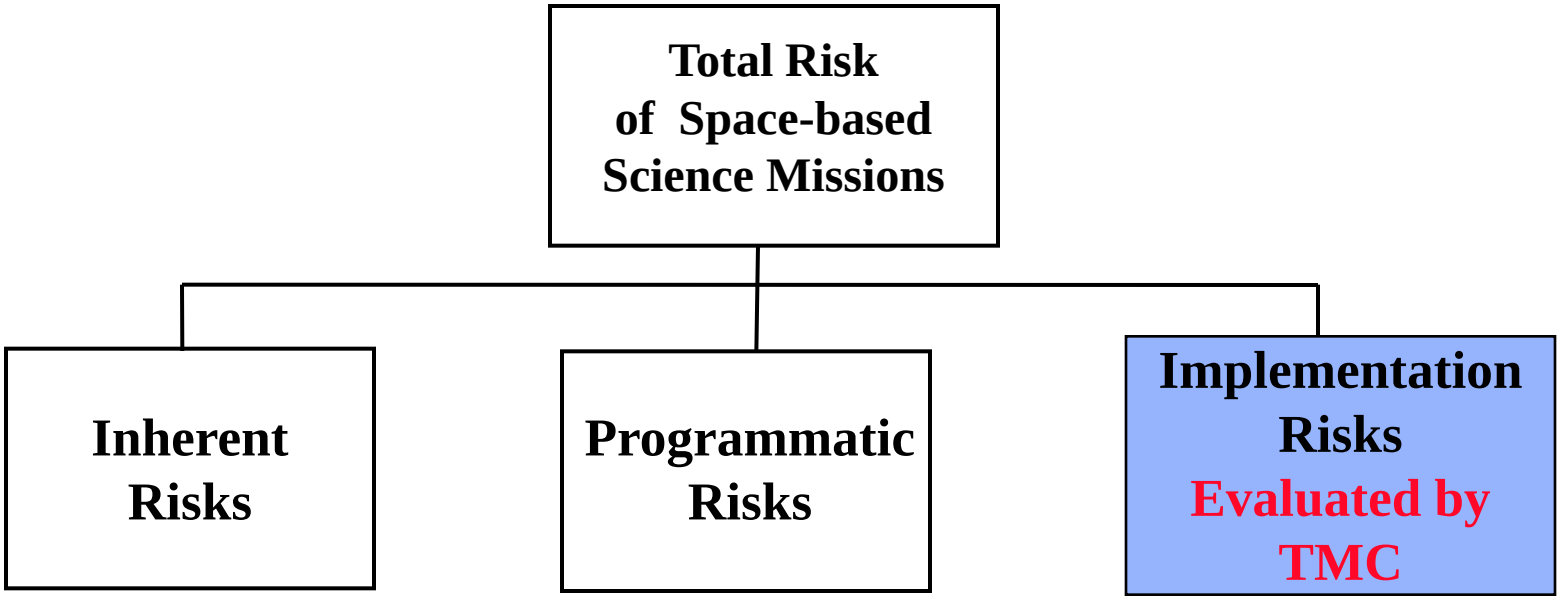


TMC's job is to validate the proposer's assertions that what is likely to be required is well covered by the resources that will be made available.

Concept of the Risk Envelope

Low Risk: Required resources fit well within available resources	
Medium Risk: Required resources just barely inside available resources. Tight, but project is likely doable given proposed resources	
High Risk: Required resources DO NOT fit inside available resources. Expect project to fail given the proposed resources	

Scope of TMC Evaluation



Risks unavoidable to the investigation:

- Launch environments
- Space environments
- Unknowns
- Etc.

Risks that are uncertainties due to matters beyond project control:

- Environmental Assessment approvals
- Budgetary uncertainties
- Political impacts
- 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 Evaluation Criteria

The technical and management approaches 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 mission implementation include the following:

- Factor C1 - Adequacy and robustness of the **instrument implementation plan.**
- Factor C2 - Adequacy and robustness of the **mission design and plan for mission operations**.
- Factor C3 - Adequacy and robustness of the **flight systems**.
- Factor C4 - Adequacy and robustness of the **management approach and schedule, including the capability of the management team.**
- Factor C5 **-** Adequacy and robustness of the **cost plan including cost feasibility and cost risk.**

TMC Evaluation Factors and Sub-Factors

Generally, the degree to which Proposals address the following factors directly relates to the rating of Low, Medium, or High Risk:

- Instrument
  - Instrument Design, Accommodation, and Interface
  - Design Heritage
  - Environment Concerns
  - Technology Readiness
  - Instrument Systems Engineering
- Mission Design and Operations
  - Mass Margins
  - Trajectory Analysis
  - Launch Services
  - Concept of Mission Operations
  - Ground Facilities – New/Existing
  - Telecom
- Flight Systems
  - Hardware/Software Design
  - Design Heritage
  - Spacecraft Systems Design
  - Design Margins (Excluding mass)
  - Qualification and Verification
  - Assembly, Test, and Launch Operations
  - Mission Assurance
  - Development of New Technology
- Management and Schedule
  - Roles and Responsibilities
  - Team Experience and Key Individuals' Qualifications
  - Project Management and Systems Engineering
  - Organizational Structure and Work Breakdown Schedule (WBS)
  - International Participation
  - Risk Management, Including Descope Plan and Decision Milestones
  - Project-Level Schedule
  - Proposed Subcontracting Plans and SDB Participation.
- Cost
  - Basis of Estimate (BOE)
  - Cost Realism and Completeness
  - Cost Reserves by Phase
  - Comparison with TMC Estimates (Including
  - Parametric Models/Analogies)

C1: 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.

C1: Adequacy and Robustness of the Instrument Implementation Plan

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** and the adequacy of backup plans to mature systems within the proposed cost and schedule when technologies having a TRL less than 6 are proposed.

C2: Adequacy and Robustness of the Mission Design and Plan for Mission Operations

This factor includes an assessment of the overall mission design and mission architecture, the spacecraft design and design margins (including margins for launch mass, delta-V, and propellant), the concept for mission operations (including communication, navigation/tracking/trajectory analysis, and ground systems and facilities), 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**.

C3: 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.

C3: Adequacy and Robustness of the Flight Systems

This factor includes the plans for the development and use of new technology and the adequacy of backup plans to ensure success of the mission when technologies 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.

C4: Adequacy and Robustness of the Management Approach and Schedule, Including the Capability of the Management Team

This factor includes:

- the adequacy of the proposed **organizational structure and WBS**;
- the management approach including **project level systems engineering**;
- the **roles, qualifications, and experience** of the PI, PM, other named key management team members, and implementing organization, mission management team, and known partners;
- the **commitment, spaceflight experience, and relevant performance** of the PI, PM, other named key management team members, and implementing organization, mission management team, and known partners **against the needs of the investigation**;
- the commitments of partners and contributors; and the team's **understanding of the scope of work** covering all elements of the mission, including contributions.

C4: Adequacy and Robustness of the Management Approach and Schedule, Including the Capability of the Management Team

Also evaluated under this factor is the adequacy of the proposed **risk management approach**, including any risk mitigation plans for new technologies, any long-lead items, and the adequacy and availability of any required manufacturing, test, or other facilities.

The approach to any proposed descoping of mission capabilities will be assessed against the 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 adequacy of contingency plans for coping with the failure of a proposed cooperative arrangement or contribution.

C4: Adequacy and Robustness of the Management Approach and Schedule, Including the Capability of the Management Team

This factor also includes assessment of proposal 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 launching by the proposed launch date.

Also evaluated under this factor are the proposed project and schedule management tools to be used on the project along with the subcontracting plan, including small and small disadvantaged businesses.

C5. Adequacy and Robustness of the Cost Plan, Including Cost Feasibility and Cost Risk

This factor includes proposal 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).

Proposals will be evaluated for the adequacy of the cost reserves and whether proposals with inadequate cost reserves demonstrate a thorough understanding of the cost risks.

This factor also includes an assessment of the proposed cost relative to estimates generated using parametric models and analogies.

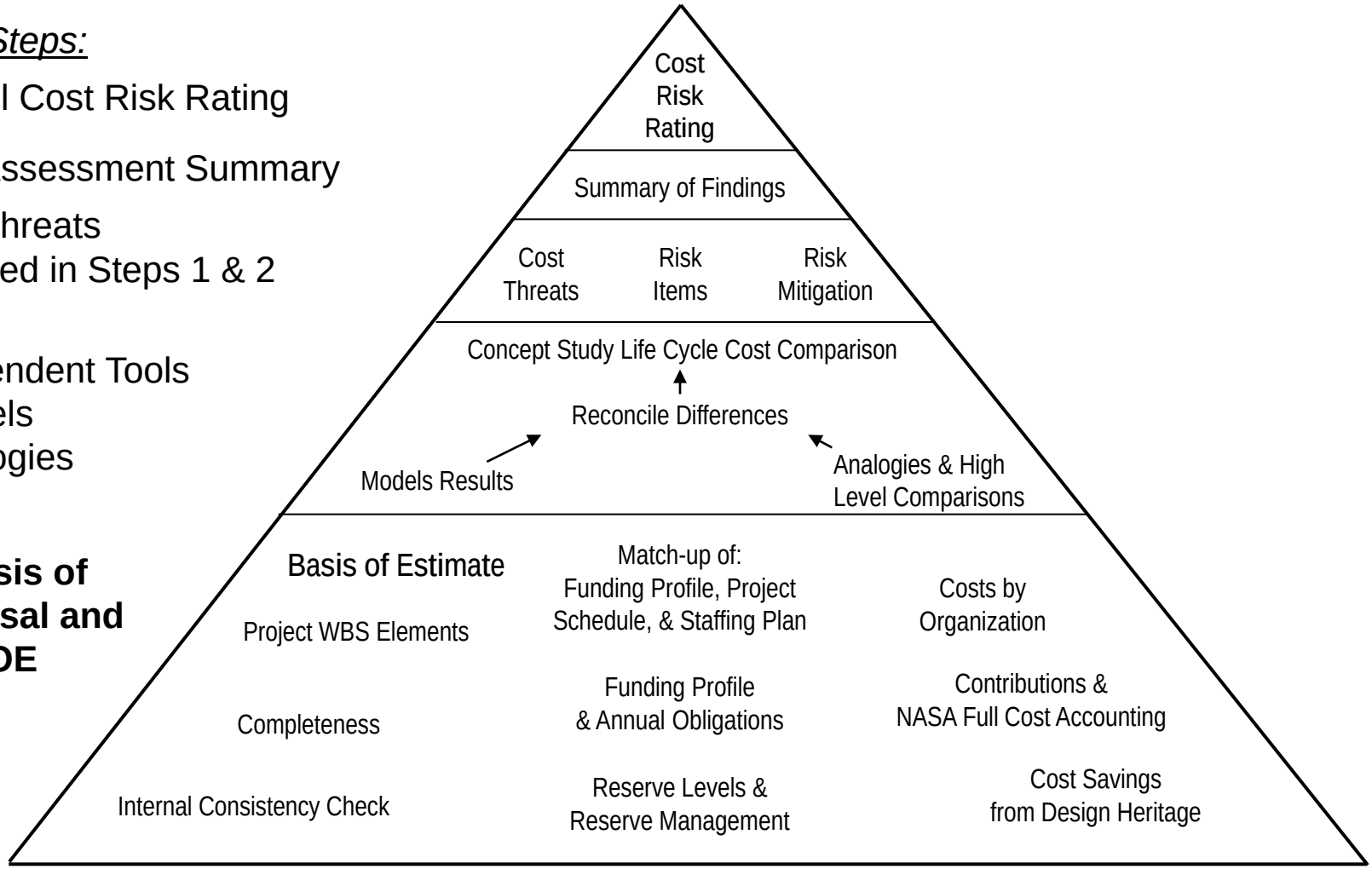
Also evaluated under this factor are the proposed cost management tools to be used on the project.

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 and the BOE**



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?

Typical TMC Evaluation Questions

- 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?
- 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?

Typical TMC Evaluation Questions

- Will proposed management approach (e.g., institutions and personnel, 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 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.

Characteristics of Low Risk Ratings

- 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

Instrument Implementation

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

Complex Operations

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

Characteristics of High Risk Ratings

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

- Confusing/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.

References

Explorer Acquisition Home Page

An Explorer Acquisition Homepage, available at http://explorers.larc.nasa.gov/EX/, will provide updates and any AO addenda during the Explorer AO solicitation process. It provides links to the Program Library, a list of potential teaming partners, and questions and answers regarding the AO.

Program Library

The Explorer Program Library provides additional regulations, policies, and background information on the Explorer Program. The Program Library is accessible at http://explorers.larc.nasa.gov/EX/ex_Library.html

Lessons Learned from Technical, Management, and Cost Review of Proposals 2nd Edition

http://sso.larc.nasa.gov/TMCLessonsLearned_Step1_Update_120409_2.pdf

Questions?