The Role of the Science Office for Mission Assessments (SOMA)

July 25, 2023

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Overview

- Office located at Langley Research Center (LaRC).
  - Firewalled from the Center in an access-controlled facility.
  - Reports directly to the SMD Deputy Associate Administrator for Research (D/AAR).
  - Includes 14 Acquisition Managers.
- Responsible for Technical, Management, and Cost (TMC) portions of AO Evaluations.
  - SOMA has directed the evaluation of more than 1100 proposals and Concept Study Reports submitted by PI-led teams since the office was formed.
- Works with the D/AAR to maintain the Standard AO Template (https://soma.larc.nasa.gov/StandardAO/sao_templates.html) and its successor the Simplified Standard AO Template (SSAOT)—the in-work version of which has served as the basis of recent AOs.
  - Note that many deferrals in the SSAOT will not apply to Single-Step solicitations (e.g., Earth Venture; Small, Innovative Missions for PLanetary Exploration [SIMPLEx]; and Vigil Focused Mission of Opportunity).
- Works with Program Scientists to develop AOs for proposals, Requirements and Criteria for Phase-A Concept Study Reports, Evaluation Plans, Proposal Team briefings (e.g., Pre-Proposal Conferences), and Transition Briefings to Program Offices.
- Maintains Acquisition Websites and other AO-related information (e.g., Planning List for SMD Solicitations) (https://soma.larc.nasa.gov/).
- Facilitates PI-Led-Team Masters Forums (https://soma.larc.nasa.gov/pi-masters-forums/ and https://appel.nasa.gov/multimedia/pi-team-masters-forums/).

TMC Evaluation

Proposal Evaluation

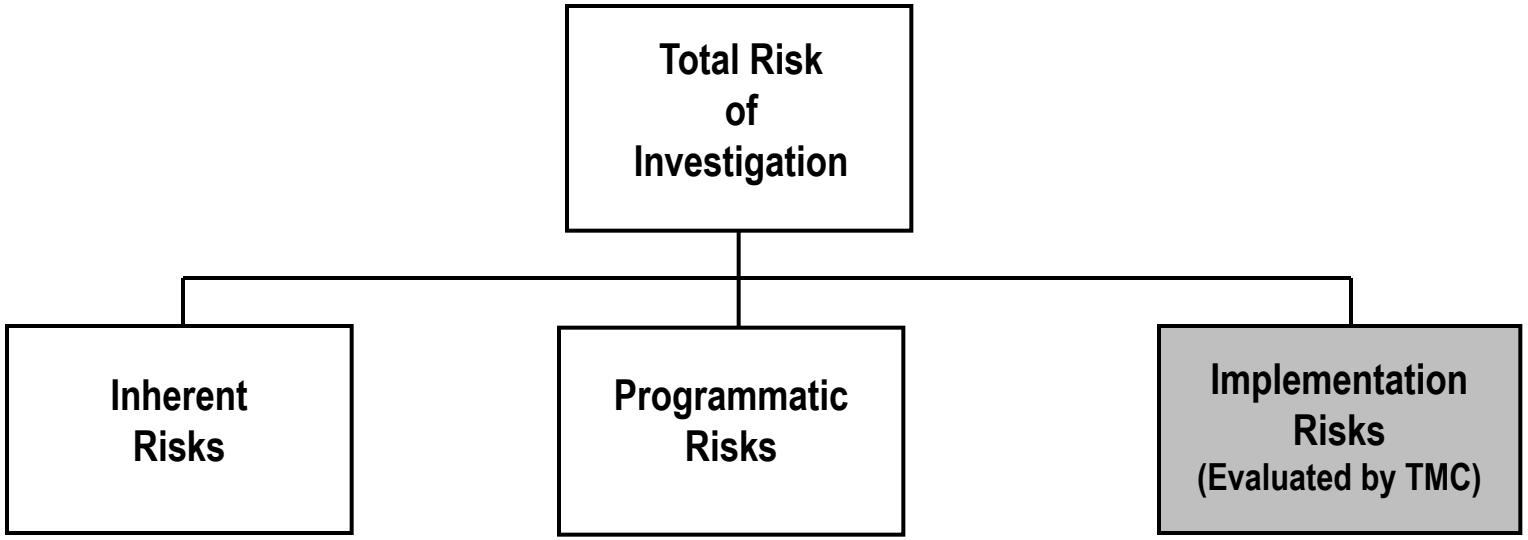
Evaluation Criteria:

- Scientific merit of the proposed investigation (A Factors)
- Scientific implementation merit and feasibility of the proposed investigation (B Factors)
- **Technical, management, and cost (TMC) feasibility of the proposed mission implementation (C Factors)**

Weighting: the first criterion is weighted approximately 40%; the second and **third criteria** are **weighted approximately 30%** each. AO-specific activities outside of the Baseline Investigation (e.g., Student Collaboration and Science Enhancement Options) are evaluated separately for consideration during the selection process.

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* for the Baseline Investigation, including an assessment of the likelihood of their completion within the proposed cost and schedule.

Risks Evaluated by TMC



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 Factors

- 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. **[Not a consideration for instrument-only opportunities.]**
- 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.
- Factor C-6. Adequacy of the risk management plan. **[Factor C-4 Subfactors moved and expanded for Step 2.]**
- Factor C-7. Ground systems. **[New for Step 2.]**
- Factor C-8. Approach and feasibility for completing Phase B. **[New for Step 2.]**

TMC Evaluation Principles

- Basic Principles:
  - It is assumed that the proposer is the expert on their proposal.
  - Proposer's task is to *demonstrate* that the investigation implementation is Low Risk.
  - 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 provided in the proposal and through the clarification process.
- All Proposals are evaluated to identical standards and not compared to other proposals.
- As proposals represent Pre-Phase-A concepts, TMC Risk Assessments give appropriate benefit of the doubt to proposers.

Cost Analysis

- Cost analyses are accomplished on the basis of information provided in proposals and through clarifications (consistency, completeness, proposed basis of estimate, contributions, use of full cost accounting, maintenance of reserve levels, cost management, etc.).
- One or more cost models are utilized to validate the proposed costs, both developmental and operational.
- Cost Threats are identified for all Major Weaknesses.
  - Impacts to the proposed unencumbered reserves are assessed (see Cost Threat Matrix Example on next slide). The remaining unencumbered reserves are compared to the minimum(s) required in the AO, for costs to complete.
- The entire panel participates in Cost deliberations.
- Cost validation findings are documented in Factor C-5 on Form C and considered in the TMC Risk Rating.

Cost Threat Matrix Example

- 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 Minimal/Limited/Moderate/Significant/Very Significant cost impact being realized during development and/or operations."
- 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 $400K for Phases B/C/D and $250K for Phase E.
- Unquantified cost threats may also be assessed.

			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**	**Minimal** $0.4M < CI ≤ 5% $0.25M < CI ≤ 5%	**Limited** 5% < CI ≤ 10% 5% < CI ≤ 10%	**Moderate** 10% < CI ≤ 15% 10% < CI ≤ 15%	**Significant** 15% < CI ≤ 20% 15% < CI ≤ 20%	**Very Significant** CI > 20% CI > 20%
Likelihood (L, %)	Almost Certain (L > 80%)						
	Very Likely (60% < L ≤ 80%)						
	Likely (40% < L ≤ 60%)						
	Possible (20% < L ≤ 40%)						
	Unlikely (L ≤ 20%)						

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

Common Proposal TMC Major Weaknesses

- Overstated instrument or Flight System TRLs, resulting in missing (in the case of the proposal threshold of TRL 6 at WBS level 3) or inadequate plans to demonstrate existing component technologies in newly integrated systems or operating in new environments.
    - See NASA/SP-2016-6105 Rev 2 *NASA Systems Engineering Handbook*, https://lws.larc.nasa.gov/vfmo/pdf_files/TRL_Examples.pdf, https://lws.larc.nasa.gov/vfmo/pdf_files/TRL-example-Ver02.pdf, and https://lws.larc.nasa.gov/vfmo/pdf_files/Common-causes-TRL-Weaknesses-Ver03.080118.pdf.
    - PI-Team Developed Enhancing Technology Development Opportunities (TDOs), if offered, provide avenues for technology development that does not threaten Baseline or Threshold Investigations.
- Lack of support for instrument performance claims. These findings are usually combined with insufficient instrument design information to independently verify its feasibility.
- Proposed costs with their supporting Bases of Estimate (BoEs) could not be validated using independent cost models.
- Inadequate management plans that usually include unclear or incomplete discussions of organization roles, responsibilities or lines of authority.
- Lack of time commitment from key management team.
- Development schedules that lack sufficient detail to verify their feasibility, have missing elements, allocate too little time for typical activities without sufficient rationale (e.g., AI&T), or have too little funded schedule reserve for the identified development risks.
- Inadequate margins for technical resources. Mass and power are the most frequent cause of these weaknesses.
- Insufficient requirements to demonstrate feasibility at the system level.

See Backup and https://soma.larc.nasa.gov/pi-masters-forums/pi-masters-forum-8/pdf_files/SOMA%20Presentation_PIF8%20Lucas.pdf for additional details.

Proposal TMC Evaluation Risk Rating Definitions

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 Risk Ratings: Envelope Concept

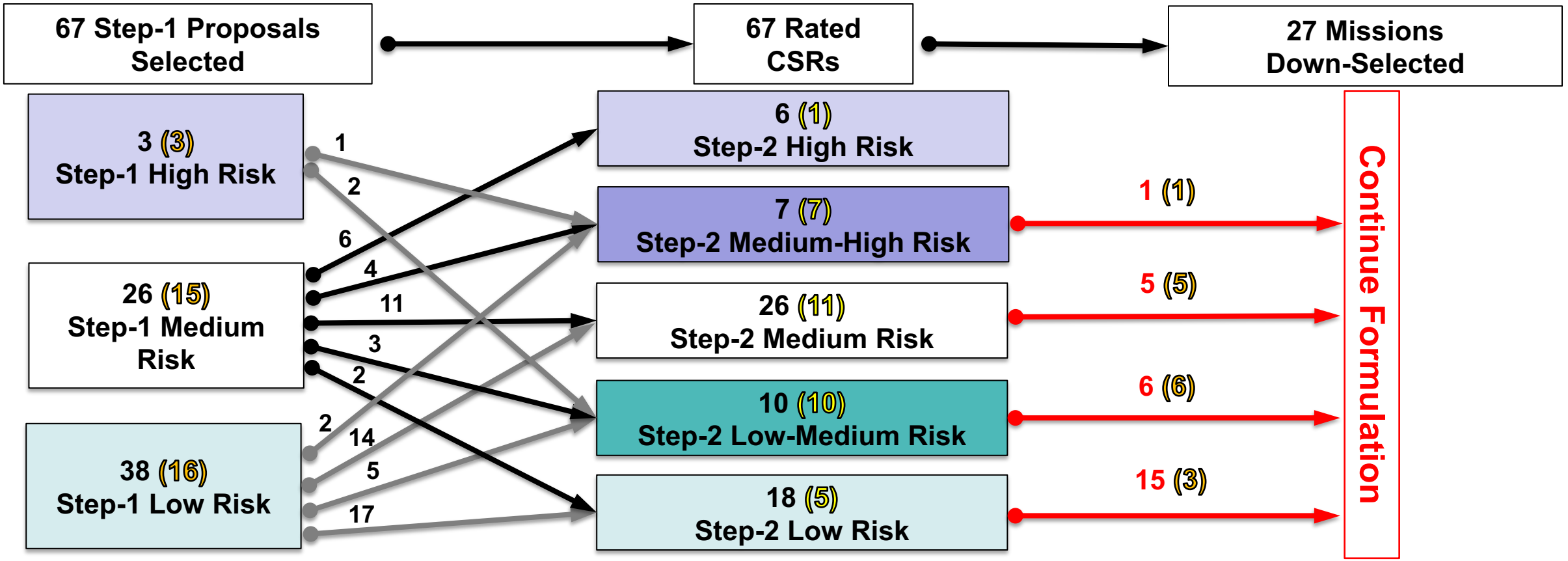
Envelope: All resources available to handle known and unknown development problems that occur, while maintaining the Baseline Investigation. Includes schedule and funding reserves; reserves and margins on resources such as mass, power, and data; fallback plans; and personnel.

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.

Step-1 and Step-2 Risk Ratings



The risk rating for most of this small set of missions selected for Step 2 either remained the same or got worse. This result may be explained, in part, by more detailed reviews and less "benefit of the doubt" given in Step 2.

Between 2017 and 2021 (highlighted in yellow) 16 Low, 15 Medium, and 3 High Risk proposals were selected. Of these selected proposals, 1 Medium-High, 5 Medium Risk, 6 Low-Medium Risk, and 3 Low Risk CSRs were down-selected to continue formulation.

See https://explorers.larc.nasa.gov/2021APMIDEX/pdf_files/SOMA_Lessons_Learned_PI_Forum_2022.pdf.

SSAOT Sections of Note

Project Management Requirement Options

4.1.1 NASA Flight Program and Project Requirements

Projects selected in response to this AO will be implemented in accordance with NASA space flight project management processes, as defined by NASA Procedural Requirements **(NPR) 7120.5**, *NASA Space Flight Program and Project Management Requirements*.

5.2.5.2 Technology Demonstration Opportunity—Enhancing

PI-Team-Developed Enhancing TDOs may be proposed to be **managed under the requirements of NPR 7120.8**, *NASA Research and Technology Program and Project Management Requirements*. Any PI-Team-Developed Enhancing TDO must use innovative technological approaches that may have continuing applicability to future SMD missions.

5.5.2 Student Collaboration (SC) (optional)

Flight hardware developed as an **SC may be proposed to be managed under the requirements of NPR 7120.8**, *NASA Research and Technology Program and Project Management Requirements*.

Earned Value Management

4.6.2 *Earned Value Management Plan*

The NASA FAR Supplement (NFS) places Earned Value Management (EVM) requirements on NASA contracts in clauses NFS 1852.234-2 and NFS 1834.201, amended by Procurement Class Deviation PCD 15-05. The requirements apply to all cost or fixed-price incentive contracts for development or production work, with specific levels of validated compliance with the ANSI/EIA-748 guidelines required for contracts **above $20M (RY)** and for those above $100M (RY). Full NFS compliance is required for all contracts.

In addition, **NPR 7120.5F requires ANSI/EIA-748-compliant EVM**, for both NASA in-house and contracted portions of the work, for projects with a Life Cycle Costs (LCC) greater than $250M (RY). **For projects with a LCC less than $250M (RY), NPR 7120.5F makes EVM optional but only for the NASA in-house portion of the work.**

For Class D projects with an estimated LCC below $150M (RY), not including access to space, SMD grants a deviation from the NFS EVM requirements on cost or fixed-price incentive contracts in the greater than $20M categories (see Approved Deviation from FAR and NFS EVMS Policy for SMD Class D document at https://soma.larc.nasa.gov/StandardAO/ClassD.html). **[Emphasis added.]**

5.2.14 Cybersecurity

With the rise in cyberattacks on all computer systems, NASA needs to be proactive in protecting all flight and ground assets. To protect mission IT assets, NASA requires projects to develop a System Security Plan (SSP) using the NIST 800-53 controls as a basis. The requirement to follow NIST 800-53 flows from NPR 2810.1F. The SSP begins with a description of the mission, including all end-to-end data flows, and uses NIST 800-series documents to develop the content of the SSP.

Many organizations have only used NIST SP 800-171 *Protecting Controlled Unclassified Information in Non-Federal Systems and Organizations*.

Clarifications

7.1.1 Evaluation Process

Proposers should be aware that, during the evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer's response must be in writing. […] Proposers will be allowed up to eight combined pages in total (with some restrictions) for clarifications associated with the Scientific Merit of the Proposed Investigation (A Factors) plus Scientific Implementation Merit and Feasibility of the Proposed Investigation (B Factors) evaluation criteria. Up to six pages in total (with some restrictions) will be allowed for clarifications associated with the TMC Feasibility of the Proposed Investigation Implementation (C Factors) evaluation criterion. These **clarifications may include text, tables, and figures to address the Potential Major Weaknesses (PMWs) and to provide additional information. [Emphasis added.]** The requirements and constraints of the clarification process will be addressed in the Pre-proposal Web Conference (see Section 6.1.1 of this AO) and the Evaluation Plan that will be located on the Acquisition Homepage (see Section 6.1.4).

PIs whose proposals have no PMWs will be informed that no PMWs have been identified.

All PIs are allowed the same number of pages for Clarifications, including those who have no PMWs.

The full set of clarification responses to the factors above will be considered by the Science panel, and the TMC panel. Only the responses will be provided to the other panel.

Proposers will have at least 48 hours to respond.

Experience

7.2.4 TMC Feasibility of the Proposed Mission Implementation

Factor C-4. 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; the management approach including the roles; the commitment, qualifications, and experience of any named Key Management Team members, the implementing organization, and the known partners; the expected commitment, qualifications and experience of the Key Management Team members not named; **the spaceflight experience of any named Key Management Team members (PI excepted [in the case of Class D])**; the implementing organization 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 scope of work covering all elements of the project, including contributions.

[In the case of Class D] The capability of the management team will be evaluated as a whole, as opposed to assessing the capabilities of each of the Key Team Members independently. The panel evaluating the "Technical, Management, and Cost Feasibility" will provide comments to the Selection Official about the mission experience of the PI and whether appropriate mentoring and support tools are in place.

Class D

Payload Risk Class D

NPR 8705.4A *Risk Classification for NASA Payloads* (https://lws.larc.nasa.gov/vfmo/pdf_files/N_PR_8705_004A_.pdf) establishes baseline criteria that enable a definition of the risk classification level for NASA payloads. It defines four payload risk levels or classes, A thru D, and provides guidance for programmatic options during development based on this class. The requirements for each class are specified in Appendix C of NPR 8705.4A and are applied at the deployed mission level.

The *NASA Science Mission Directorate (SMD) Class-D Tailoring/Streamlining Decision Memorandum* (https://lws.larc.nasa.gov/vfmo/pdf_files/SMD_Class_D_Policy.pdf) describes the approach that has been approved by SMD leadership to guide the implementation of Class-D projects. In effect, the Decision Memorandum defines a pre-approved package of tailoring of requirements.

> Some of the primary tenants of Class-D missions are low cost, short development and operations lifecycle, and **higher risk posture [emphasis added]**. This policy is a natural progression of SMD's recent approach to develop a tailored/streamlined process for implementing Class-D missions.

Mission Assurance Requirements

All new Class-D investigations will be under Science Policy Document 39 (SPD-39) *SMD Standard Mission Assurance Requirements For Payload Classification D* (https://soma.larc.nasa.gov/standardao/pdf_files/5.48722_SMD_Class_D_MAR_(OSMA_Final)_04-01-21_SMD_Final_rev2.pdf).

8.1 GENERAL

The Developer shall document and implement a Parts Control Plan (PCP) (DRD MA-19). Per NASA-STD-8739.10, **Level 4 or Commercial-Off-The-Shelf (COTS) parts may be used without additional screening**.

The Developer should address the following for part selection, screening, and usage in the PCP when information is available:

- Prior usage of the part and qualification for the specific application
- Parts manufacturing variability, within lots and from lot-to-lot
- Traceability and pedigree of parts
- Reliability basis for parts
- Parts stress/application conditions

The PCP shall address counterfeit parts in accordance with SAE AS5553.

The Developer may include the Parts Control Plan deliverable in the Mission Assurance Implementation Plan (DRD MA-1) in lieu of a separate deliverable as long as the preparation information contained in DRD MA-19 is included.

See the recent Pre-Proposal Conference presentation by Jesse Leitner, Chief Engineer for Safety and Mission Assurance (NASA/GSFC) at https://lws.larc.nasa.gov/vfmo/pdf_files/07_VFMO_PPC_Leitner_SMA.pdf for additional details.

Access to Space

The Venture-Class Acquisition of Dedicated and Rideshare (VADR) contract in an AO-Provided Access to Space option for Class-D investigations. Planning for operational and scientific flexibility increases SMD's ability to manifest investigations. Note that the launch provider will not be known until 24 months before launch.

The *Launch Vehicle Secondary Payload Adapter Rideshare Users Guide with Do No Harm* (https://explorers.larc.nasa.gov/HPSMEX22/pdf_files/6a_SMD%20SPA%20RUG%20with%20DNH_HPD_SMEXMO2022_Final.pdf) provides requirements for Rideshares on Secondary Payload Adaptors (SPA). One of the most demanding is "RPLs shall have first fixed-free fundamental frequencies above 75 Hz constrained at the separation system interface plane."

For Class-D PI-Provided Access to Space, when allowed, may represent an equivalent risk to that of NASA's Launch Vehicle Risk Category 1 (a new common launch vehicle configuration with no prior demonstrated flight history and completion of NASA audits and evaluation of documentation, per NPD 8610.7D, *NASA Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA Sponsored Payloads/Missions*).

Backup

Common Step-1 TMC Major Weakness (1 of 8)

Instruments

The number of Instrument MWs continues to trend up. A third (33%) of the pre-2009 evaluations had instrument MWs compared with 46% for the the 2009-2013 evaluations, 56% of those from 2013-2017, and 67% from 2017-2019.

The two most common sources of instrument MWs from the most recent evaluations are:

1) Overstated instrument TRLs or inadequate plans to demonstrate existing component technologies in newly integrated systems or in new environments. A missing or inadequate technology backup plan in the event that the TRL development efforts are unsuccessful contributed to many of these findings.
2) Insufficient support for instrument performance claims (via first principles or heritage scaling). This issue is usually combined with insufficient instrument design information to independently verify the feasibility of the instrument.

Common Step-1 TMC Major Weakness (2 of 8)

Cost

For evaluations since 2009 about half of all proposals (50% for 2009-2013, 51% for 2013-2017, and 43% for 2017-2019) had at least one Cost major weakness.

The most common causes of these MWs were:

1. The TMC uses independent models with proposal information to estimate costs. When these costs, with generous error bounds, significantly exceed the proposed costs, a cost validation major weakness results.
2. The cost Basis of Estimate (BOE) is flawed – there are missing cost elements or the rationale is incomplete, inconsistent or has unsupported assumptions.

Common Step-1 TMC Major Weakness (3 of 8)

Management

The percentage of proposals with a management MW has remained approximately constant at 26% prior to 2009, 29% between 2009 and 2013, 33% for 2013 to 2017, and 21% for 2017 to 2019.

The primary causes of these management MWs were:

1) Unclear or incomplete discussion of organization roles, responsibilities or lines of authority
2) Organizational or individual expertise for a specific role is missing or inadequately demonstrated
3) Time commitment is too low for essential members of the core management team

Common Step-1 TMC Major Weakness (4 of 8)

Schedule

The percentage of proposals with a schedule MWs has also remained approximately constant with 17% of all proposals having a schedule MW prior to 2009, 23% for 2009-2013, 15% for 2013-2017, and 24% for 2017-2019.

The primary causes of these schedule MWs were:

1) Inadequate schedule detail presented for the TMC to verify its feasibility
2) Inadequate funded schedule reserve
3) Too ambitious of a schedule for the planned activities, especially during AI&T or Phase B TRL advancement efforts.

Common Step-1 TMC Major Weakness (5 of 8)

Technical Margin

The percentage of evaluations with a technical margin major weakness has dropped from 41% for evaluations completed before 2009 to 28% for 2009-2013 to 12% for 2013 and 2017. The evaluations between 2017 and 2019 increased from the previous period to 20%.

The most common technical margin major weaknesses are based on flawed mass margins and contingencies for both flight systems and instruments. For example:

- 1) Heritage masses do not account for potential design modifications.
- 2) Margins and contingencies are clearly stated and verifiable, but are deemed by the TMC to be too low given the associated development risks.
- 3) Missing or undersized elements (e.g., launch vehicle payload adapter) create an immediate lien on the claimed mass margin.

Power margins are the second most common source of technical margin MWs due to these same issues. In addition, not using the most critical or most demanding operating mode for power margin calculations has led to MWs.

Similar MWs have resulted from inadequate margins on other technical resources, including: CPU use, communication links, propellant budgets and static or dynamic launch vehicle envelope.

Common Step-1 TMC Major Weakness (6 of 8)

Systems Engineering

Systems Engineering (SE) MWs dropped significantly from 30% (pre-2009) to 8% (2009-2013), but they have increased to 12% (2013-2017) and 20% (2017-2019) in the more recent periods.

The most common causes of these MWs were:

1) Significantly flawed or incomplete requirement traceability is included in this MW category. These flaws include missing, untraceable or unquantified requirements as well as expected performance that does not meet the proposed requirements.
2) Inadequate or flawed systems engineering plans, tools or processes for requirements and interface development and risk management.
3) The scope of the systems engineering effort was significantly underestimated or the systems engineering roles and responsibilities were poorly described.

Common Step-1 TMC Major Weakness (7 of 8)

Flight System TRL

A common major weakness in the 2017-2019 dataset occurs when the proposal does not demonstrate that a major element of Flight System will reach TRL 6 by PDR. These findings occurred for 16% of these proposals.

The primary causes of these MWs were:

1) Lack of support for assertions that a system (e.g., propulsion) is already at TRL 6. Often the applicability of heritage claims is insufficiently supported.
2) Insufficient evidence that Phase B activities to reach TRL 6 are adequate.
3) Lack of a backup plan for cases where TRL 6 cannot be achieved by PDR.

Common Step-1 TMC Major Weakness (8 of 8)

Operations

About 13% of the 2013-2017 proposals and 11% of the 2017-2019 proposals had Operations Major Weaknesses.

Insufficient or inconsistent proposal information, including operations timelines and data flows, needed to confirm mission operations feasibility was the primary cause.

NASA-STD-1006A SPACE SYSTEM PROTECTION STANDARD

4.1.1 Command Stack Protection

[SSPR 1] **Programs/projects shall protect the command stack with encryption** that meets or exceeds the Federal Information Processing Standard (FIPS) 140, Security Requirements for Cryptographic Modules, Level 1.

4.1.1.a [Rationale: Command link incidents with civil space missions have demonstrated potential impacts to safe operations. Additionally, NASA end of mission (EOM) experiments found that spacecraft without encryption or authentication are particularly susceptible to these impacts.]

4.1.1.b This requirement may be tailored to accommodate the nature of the mission. ***The following tailoring is suggested for use by applicable missions****:*

i. ***Hosted instruments*** *only require protection of the instrument command stack.*

ii. ***Hosted instruments*** *are only responsible for protection of the command stack until the host spacecraft operations center receives commands. This protection may be provided either via encryption (preferred) or authentication.*

iii. ***Deep space missions*** *may choose to limit controls applied to the space link if certain controls (e.g., encryption and authentication) pose significant burden to operability or mission success, and if the threat to the space link is low.*

iv. Any ***Category 3/Class C or Class D missions, or equivalent, that do not have propulsion*** *may authenticate without encryption.*

v. This requirement does not apply to balloon or sounding rocket projects. ***[Emphasis added.]***