National Aeronautics and Space Administration

Technical Management and Cost (TMC)

Astrophysics Explorers Program 2026
Small Explorer (SMEX)

Pre-Proposal Conference

Omar Torres – Acquisition Manager
Terry Nienaber – Acquisition Manager
Chauncey Wu – Acquisition Manager
NASA Science Office for Mission Assessments (SOMA)

Announcement of Opportunity **NNH26ZDA011O**

Contents

Highlights of the APSMEX26 AO

SCaN nonrecurring costs and Letter of Acknowledgement (LoA)

- In addition to recurring (per pas, per minute) costs, proposals using SCaN services must also compute the estimated nonrecurring costs and report these in their proposal as an Adjustment to the AO Cost Cap.
  - Nonrecurring costs include Mission Planning and Integration (MP&I) activates and Nonrecurring Engineering (NRE) costs.
- Cost envelopes are provided for two scenarios the table

Scenario Classification	Cost Cap Reduction
Simple Low-Rate Use Cases	$1.2M
Medium/Complex and/or High-Rate Use Cases	$2.5M

- General characteristic of each scenario classification are provided in in section 5.2.7.3 of the AO.
- Investigations that propose the use of SCaN services must obtain a Letter of Acknowledgment (LoA) to confirm the appropriate scenario and to acknowledge that the mission can be supported.
- Requirement 34 and Requirement 41 require LoA from SCaN. If a proposed investigation triggers the criteria for both requirements, proposers may request that SCaN provide a single, combined LoA that satisfies both conditions.

NASA Far Supplement (NFS) Companion Guide

- The Federal Acquisition Regulation (FAR) and the NASA FAR Supplement (NFS) are currently under review
- NFS 1872 *ACQUISITION OF INVESTIGATIONS* has been moved to a Companion Guide (CG)
- A copy of the interim NFS CG is available in the APSMEX26 Program Library

- One notable change is to price threshold of EVM requirements applicable to contracts
  - NASA applies the Earned Value Management System (EVMS) requirement to all contracts, subcontracts, and task orders, inclusive of all options that—

    Are cost or fixed-price incentive fee;

    i. Have a value of $50 million or more;

    ii. Have a period of performance of at least 18 months; and

    iii. Contain development work scope

Quad Chart

- Proposers must provide a quad chart that will be used to relay all mission-critical information in a standard structure within a single page.
- A template and an sample quad chart are provided as guidance in the Program Library
- Quad charts must be provided in editable PowerPoint format and be submitted as part of the augmented submission.
- Quad chart are non evaluative, but must match the information in the proposal

CUI//SP-PROCURE/SP-SSEL

Investigation Name

PI: *First, M. Last*

Insert graphic of the spacecraft concept with labels.

Insert graphic of the instrument complement with labels.

Mission & Science Team:
- Principal Investigator (PI): *First, Last, Affiliation*
- Project Manager (PM): *First, Last, Affiliation*
- Project Systems Engineer (PSE): *First, Last, Affiliation*
- *Deputy Principal Investigator (DPI): First, Last, Affiliation*

Major Partners:
- *Organization A – Role(s)*
- *Organization B – Role(s)*
- *Organization C – Role(s)*
- …
- *Organization N – Role(s)*

Mission: *Brief introduction to the proposed mission.*

Science Goals: *Describe the science goals of the proposed investigation*
1. *Goal 1*
2. *Goal 2*
3. *Goal N*

Baseline Mission: *Summary of the mission measurements and how these address the science objectives of the investigation.*

Threshold Mission: *Describe any proposed descopes and the resulting investigation post descopes.*

Instrument(s): *Describe the instrument(s) characteristics. Include relevant specifications (e.g. TRL, type of instrument, sensor/detector size, FOV, focal length, spectral range, spectral/temporal/spatial sampling, frequency/wavelength, coatings, overall size, PSF, energy band)*

Heritage:
- *Instrument or component: heritage mission.*
- *Instrument or component: heritage mission.*

Mission Details:
- Launch Readiness Date: *Day Month, Year;* launch scenario *number*
- Mission Duration: *N months*
- Orbit: *characteristics*
- *Ground System Provider (SCaN or vendor name)*

Flight Systems Details:
- *Spacecraft Bus manufacturer, model*
- *Propulsion and method of control*
- *Pointing Accuracy*
- *Telecommunications link(s), total data volume per day*

Mass/Power [Margins %]:
- Dry Mass *(Kg) MEV [% Margin]*
- Spacecraft Power *(W) MEV [% Margin @ EOL]*

FY26 Cost: Total PIMMC: *$M (including $M UCR).* Adjusted Cost Cap: *$M.*

Phases B-D, $M including $M (%) reserves, and $M contributions.
Phases E/F, $M including $M (%) reserves, $M contribution.

Schedule: *N-mo Phases A-D, M-mo Phase E, X-mo Phase F, Z days of critical path FSR.*

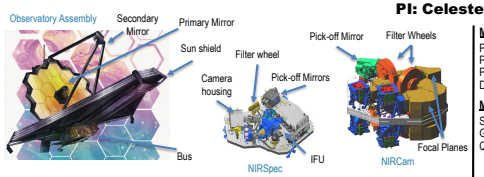
Descopes: *(if any): Brief description (savings and milestones)*

CUI//SP-PROCURE/SP-SSEL

APSMEX26 SAMPLE

Stellar Observatory and Mapping Array (SOMA)

PI: Celeste L. Light



Mission & Science Team:
PI: Celeste L. Light, Society for Telescope Analysis and Retrieval (STAR)
PM: James Webb, STAR
PSE: John Young, STAR
DPI: Johannes Kepler, Galaga Institute

Major Partners:
STAR – PI, PM, PSE, SOC, Mission Assurance
Galaga Institute – DPI, Instrument Development
Qasar 'R Us – Spacecraft, MOC

Mission: The Stellar Observatory and Mapping Array (SOMA) studies every phase in the history of our Universe, ranging from the first luminous glows after the Big Bang, to the formation of solar systems capable of supporting life on planets like Earth, to the evolution of our own Solar System.

Science Goals:
1. Search for the first galaxies or luminous objects that formed after the big bang.
2. Determine how galaxies evolved from their formation up to the present time. Observe the formation of stars from the first stages to the formation of planetary systems.
3. Measure the physical and chemical properties of planetary systems, including our own solar system, and investigate the potential for life in those systems.

Baseline Mission: SOMA collects photons while in the Sun and during eclipse. The Baseline Mission is dependent on the contributed NIRCam instrument.

Threshold Mission: No NIRSpec instrument.

Instrument Details:
- NIRCam: TRL7, CCD focal plane array, 0.6-5 µm, 2 deg^2 FOV, Coronagraphic imaging at 1.8-5 µm, .1" HPD on-axis PSF, 48 element optical filter wheel. 10 Teledyne HgCdTe H2RG detectors 2040 × 2040 pixels.
- NIRSPec: TRL 5, 3 arcsec^2 FOV, enables 0.6–5.3 µm spectroscopy at resolving powers of ~100, ~1,000, and ~2,700 in 4 observing modes. Equipped with 2 5.3 µm cutoff Teledyne-Hawaii-2RG HgCdTe arrays, each 2048 × 2048 pixels.

Heritage:
- Near IR Camera (NIRCam): IRAD, Hubble.
- CCD: JWST, Chandra, OSIRIS-REx.

Mission Details:
- Launch Readiness Date: 30 Sep 2031, compatible with Launch Scenario 1.
- Mission Duration: 3-year science mission.
- Orbit: 15-deg inclination, at nominal 700 km.
- NSN-affiliated ground stations at North Pole, Alaska, and Kiruna Sweden.

Flight Systems Details:
- Qasar 'R Us Solar series bus.
- ACME-M Reaction wheels, ACME-N propulsion system, torque rods.
- Pointing control of 0.01° ± 1σ (37 arc-sec)
- 4 Ka-band downlinks per day (500 Gb/day), S-band command & telemetry.

Mass/Power [Margins %]:
- 600 kg dry mass MEV [30%]; 1500 W EOL solar array power [30%].

FY26 Cost: Total PIMMC $189.1M (including $44.6M UCR) ; Adjusted Cost Cap $178.3M

Phases B-D, $163M including $40.75M (25%) reserves, $3M contribution.
Phases E/F, $15.3M including $3.8M (25%) reserves, $0.5M contribution.

Schedule: 36-mo Phases A-D, 36-mo Phase E, 2-mo Phase F, 150-days of critical path FSR.

Descopes:
- Reduce mirror area by 20%. Save $20M at PDR and 60kg.
- Reduce solar shield to 3 layers. Save 6 months of I&T and 10 kg.

Collision Avoidance

- The APSMEX AO introduces a Collision Avoidance (CA) Requirement to support space sustainability and risk mitigation.
- The requirement states:
  - Requirement 46: Investigations with proposed orbit altitudes between 400 km and 1200 km shall discuss the resources and capabilities needed to be capable of executing at least three collision-avoidance mitigation actions during their prime mission.
- While the body of section *5.2.10 Conjunction Assessment Risk Analysis* mentions an expectation of 1 to 5 CA actions, there is no conflict; this specific solicitation establishes the required capability at exactly three collision-avoidance actions.
- Further guidance and detailed information on acceptable CA mitigation actions can be found in document OCE-51, located in the Program Library.

Page-Limited Sections

- Sections typically deferred to Step 2 are now required, but with strictly limited page counts to minimize proposer burden.
  - Reduced page-count aligns with reduced expectations on the level of detail.
- Open Science and Data Management Plan (OSDMP, 2-page limit)
  - Proposals should describe the approach for developing the Data Management Plan as part of the required Open Science and Data Management Plan (OSDMP).
  - Evaluation will be based only the approach.
- Driving Level 2 Project Requirements (8-page limit)
  - Focus on requirements that directly impact cost, schedule, and/or technical performance.
  - Avoids the burden of creating a full Mission Design Requirements Agreement (MDRA).
  - See the Guidance for the Driving Requirements Appendix for 2026 Astrophysics Small Explorer Proposals document in the Program Library.

Clarifications Process

- AO §7.1.1 states “Proposers should be aware that, during the proposal 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. NASA will request clarification in a uniform manner from all proposers.”
- In particular, before finalizing the proposal evaluation NASA will request clarification on potential major weaknesses (PMWs) in the A, B, and C factors that have been identified in the proposal.
- For APSMEX26, a second round of PMW clarification will be introduced to improve communication between the evaluation panels and the proposing community.
- A Clarifications Requirements document will be shared via the Program Library before the proposal due date.

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 Technical Management and Cost (TMC) panel. Only the responses will be provided to the other panel but not the PMWs.

TMC Evaluation

Evaluation Organization

Lead Program Scientist
Dan Moses
Astrophysics Division, SMD, NASA Headquarters

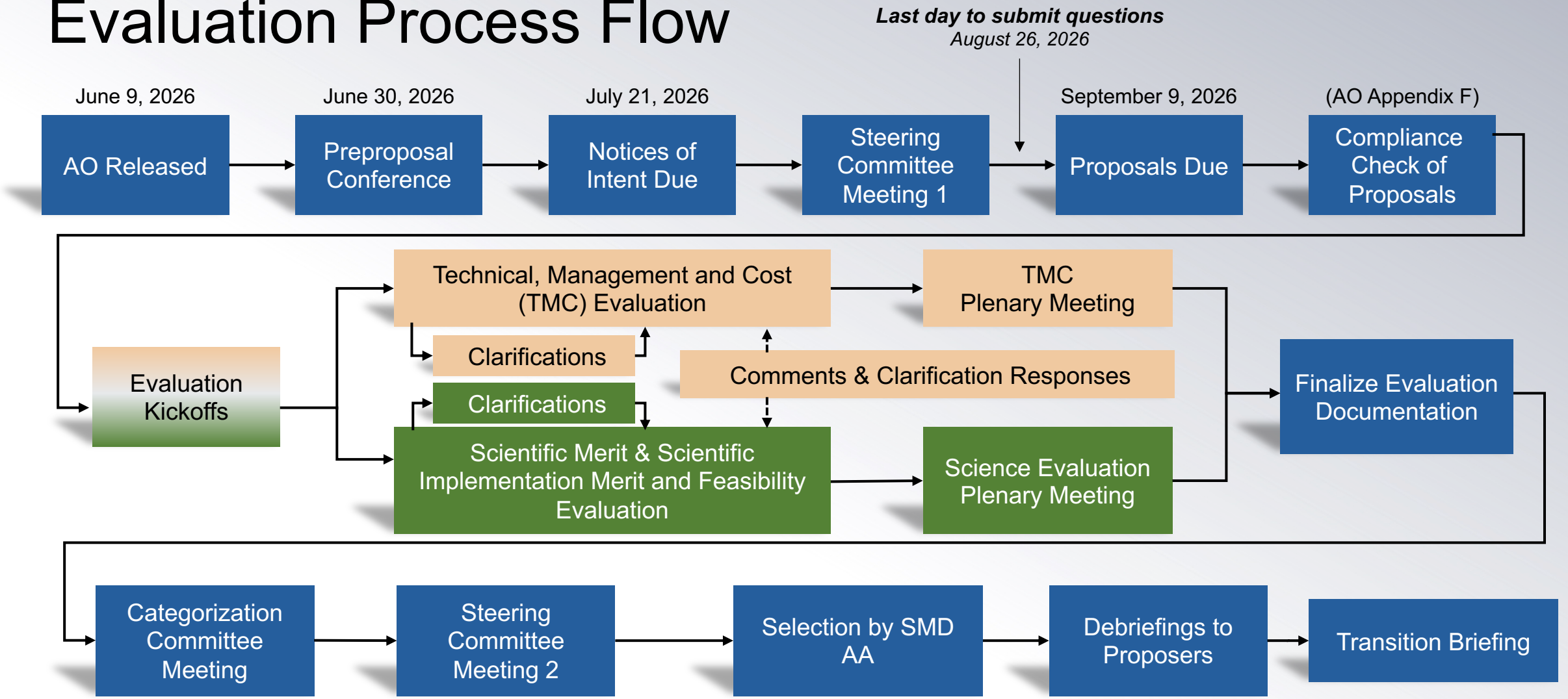
Astrophysics Division, SMD	
Hannah Jang-Condell	Deputy Program Scientist
Doris Daou	Deputy Program Scientist
Amber Young	Deputy Program Scientist
Lucien Cox	Program Executive

SOMA	
Omar Torres	Acquisition Managers
Terry Nienaber	
Chauncey Wu	Backup Acquisition Managers
Bernie Luna	
Washito Sasamoto	

Science Panel (Forms A & B)
Chair: Dan Moses
Deputy Chair: Hannah Jang-Condell

TMC Panel (Form C)
Chair: Omar Torres
Deputy chair: Terry Nienaber
Backup: Chauncey Wu

Evaluation Process Flow



TMC Evaluation Overview

Proposal Evaluation Criteria

A. Science Merit of the Proposed Investigation

B. Science Implementation Merit and Feasibility of the Proposed Investigation

C. TMC Feasibility of the Proposed Mission Implementation

The Technical, Management and Cost (TMC) panel evaluates the TMC Feasibility of the Proposed Mission Implementation, and produces Form C.

The first criterion is weighted approximately 35%; the second criterion is weighted approximately 30%; the third criterion is weighted approximately 35%.

TMC Evaluation Factors

TMC evaluation factors are presented in §7.2.4 *TMC Feasibility of the Proposed Mission Implementation*

The factors generally follow those of the template AO.

- Factor C-1. Adequacy and robustness of the instrument implementation plan.
- Factor C-2. Adequacy and robustness of the mission design and plan for mission operations.
- Factor C-3. Adequacy and robustness of the flight systems.
- Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team.
- Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk.

TMC Evaluation – What is Evaluated?

Risks that are unavoidable to perform the investigation:

- Launch environments
- Space environments
- Mission durations
- Unknowns
- *etc.*

Risks that are associated with implementing the project:

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

Principles of Evaluation

1. All proposals are to be treated fairly and equally.
2. Merit and Risk are to be assessed on the basis of the material provided in the proposal and through the clarification process.
3. Evaluation Ratings are to reflect the written strengths and weaknesses.
4. Everyone involved in the evaluation process is expected to act in an unbiased objective manner; advocacy for particular proposals is not appropriate.

General Evaluation Ground Rules

1. All proposals are evaluated to uniform standards established in the APSMEX26 AO, and without comparison to other proposals.
2. All evaluators are experts in the areas that they evaluate.
3. Specialist Evaluators (to provide special technical expertise to the TMC Panel) may be used based on need for expertise in a specific technology that is proposed.
4. Proposals are based on pre-Phase A concepts; TMC risk assessments give appropriate benefit of the doubt to the Proposer.

TMC Evaluation Products: Findings

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.

Findings that are considered "as expected" are not documented on the Form C.

TMC Evaluation Products – Risk Ratings

- Based on the narrative findings, each proposal will be assigned one of five risk ratings as follows:
  - Low Risk
  - Low-Medium Risk
  - Medium Risk
  - Medium-High Risk
  - High Risk

Only Major findings are considered in the risk rating.

TMC Risk Ratings – 5-bin Definitions

Rating	Definition
Low Risk	The proposal strongly supports accomplishment of the investigation **well within** the proposed resource envelope. Benefits associated with **the identified strength(s) significantly outweigh** the negative impacts associated with any identified weakness(es). The information presented instills **high confidence** in the team's ability to accomplish the investigation.
Low-Medium Risk	The proposal supports accomplishment of the investigation **within** the proposed resource envelope. Benefits associated with any identified strength(s) **outweigh** negative impacts associated with any identified weakness(es). Any identified weakness is considered to be **within** the team's abilities to correct.
Medium Risk	Accomplishment of the investigation within the proposed resource envelope **may be challenging**. Benefits associated with any identified strength(s) **essentially balance** negative impacts associated with identified weakness(es). Identified weakness(es) are considered to be within the team's abilities to correct **with effective management and application of engineering resources**.
Medium-High Risk	Accomplishment of the investigation within the proposed resource envelope **will be challenging**. Benefits associated with any identified strength(s) **are outweighed** by negative impacts associated with the identified weakness(es). One or more weaknesses are of sufficient magnitude and complexity to be considered difficult for the team to correct within the proposed resources.
High Risk	Accomplishment of the investigation is expected to **significantly exceed** the proposed resource envelope. Benefits associated with any identified strength(s) **are significantly outweighed** by negative impacts associated with the identified weakness(es). One or more weaknesses are of sufficient magnitude and complexity as to be deemed **unsolvable** by the team within the proposed resources.

TMC Panel Other Considerations

- The TMC panel can write comments to the Selection Official on topics relevant to programmatic considerations.
- While these comments will not be considered in the evaluation, they may be considered during selection.
- Examples include but are not limited to:
  - Size and nature of contributions,
  - fraction of PIMMC expended before KDP-C,
  - the managerial and spaceflight experience of the PI, and whether appropriate mentoring and support tools are in place,
  - extent to which the proposed investigation provides career development opportunities to train the next generation of engineering and management leaders.

TMC Cost Analysis

Cost Analysis Overview

- Cost is one important element of Technical, Management and Cost (TMC).
- Initial cost analyses are performed on the basis of information provided in the proposals
  - (*e.g.*, technical baseline, schedule, WBS, cost consistency and completeness, basis of estimate, contributions, use of full cost accounting)
- Cost models for TMC Base Independent Cost Estimates (“base ICE”)
  - Two or more cost models are used to validate the proposed cost for Phases A-D. One or more for Phase E.
  - Cost Models are chosen to be complementary to each other when possible, *i.e.,* different modeling approaches.
  - Cost model inputs are obtained from the information in the Proposal in order to develop the TMC ICE for the project “as proposed”.
- The TMC identifies implementation threats (weaknesses) and assigns Cost Threats where applicable.
  - Cost Threats are estimates of the cost to mitigate the identified threat and the likelihood that the mitigation will be needed. The total of all Cost Threats above a selected threshold are compared to the proposed unencumbered reserves.
- The entire panel participates in Cost deliberations. All information from the entire evaluation process is considered in the final cost assessment.

Decoding Cost Validation MW

A cost validation Major Weakness can take the following form:

A sum of cost elements over which the selected cost model(s) are validated against actuals.
Typically can be:
- WBS 1+2+3
- WBS 5
- WBS 6+10
- Total Phases B-D
- Total Phase E

The proposed costs for WBS X.XX cannot be validated, as the TMC Base Independent Cost Estimate exceeds the proposed cost by more than the error range.

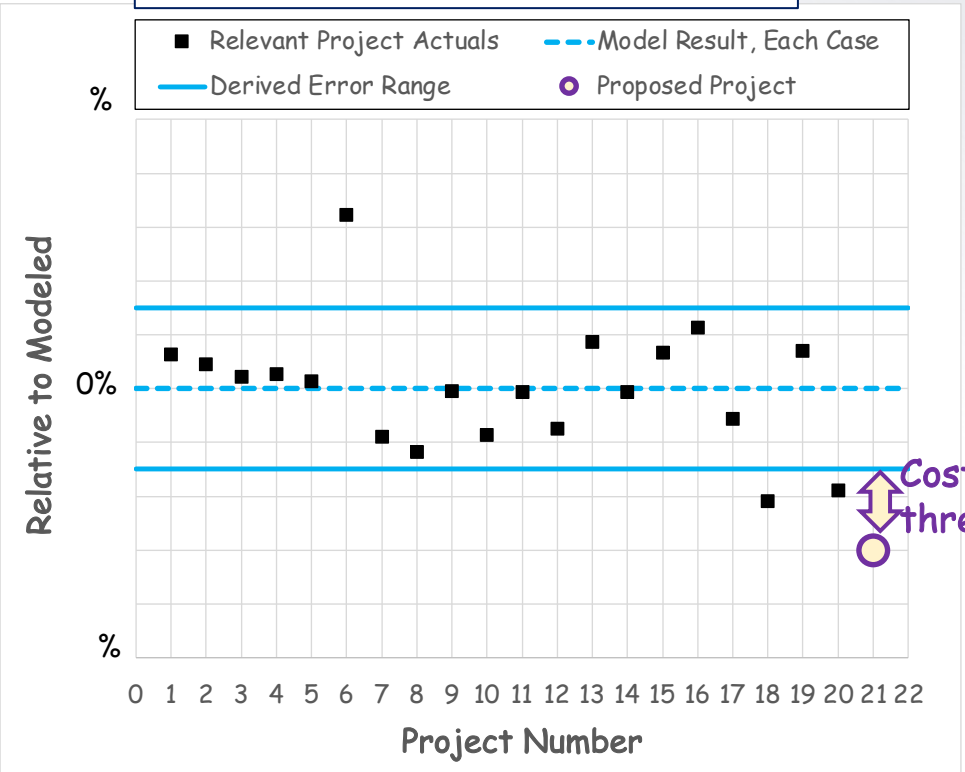
The TMC Base ICE:
- combines the results of the models used (no reserves)
- is performed with the best performing models selected after testing several models against past actuals relevant to this acquisition
- follows the same process, for all proposals in this acquisition
- uses inputs that are based exactly on information in the proposal (*incl.* MEL, schedule, heritage, TRL, cost BOE, *etc.*)

A specific error range is:
- defined prior to the start of proposal evaluations
- derived for this acquisition and each WBS group
- applied to the TMC Base ICE
- based on the combined performance of the selected models on past actuals relevant to this acquisition

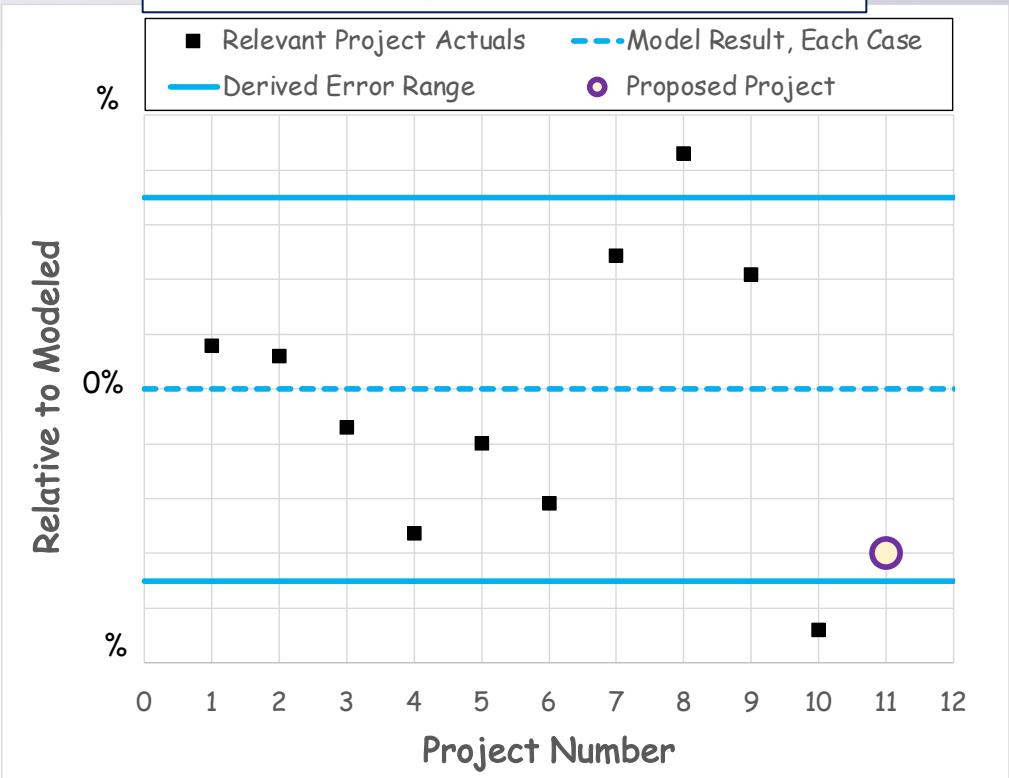
Notional Validation Error Bar Example

- How large a difference from the cost model is needed to trigger a validation finding?
  - It depends on how well the chosen cost model combination validates against actuals of relevance, statistically.

Notional Example 1: Validation MW



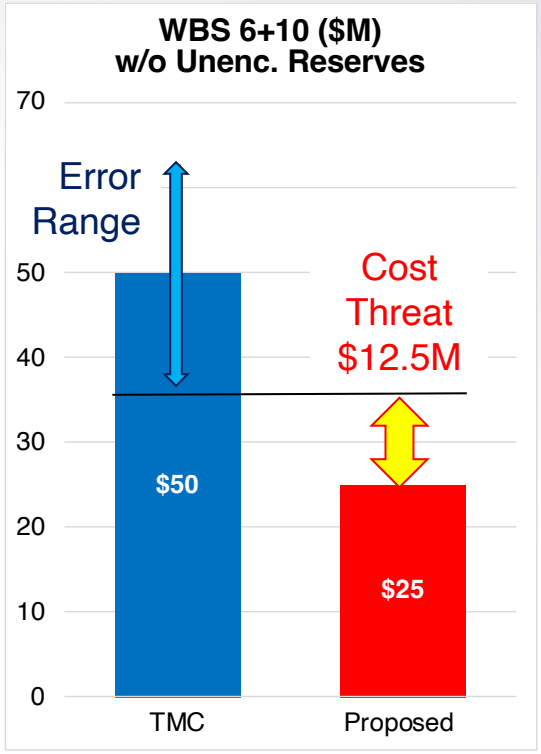
Notional Example 2: No Validation MW



Decoding Cost Validation MW: Example

Notional Proposal A: validates

Notional Proposal B: does not validate



- The situation shown in notional example A would not result in a validation finding.
- The situation shown in notional example B would result in the following finding:

"The proposed costs for the sum of WBS 6 and 10 cannot be validated, as the TMC Base Independent Cost Estimate exceeds the proposed cost by more than the error range. "

…followed by a cost threat statement.

Cost Threat Matrix

- The likelihood and cost impact, if any, of each weakness is estimated then stated in terms of Likelihood and Impact categories
  - 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 threat.
- The cost threat matrix defines the adjectives that describe the likelihood and cost impact.
- The minimum cost threat is $*TBD*M for Phases A-D *and $TBDK for Phase E*.

Normal black text shows the Phases B/C/D version of the CTM
Italics blue text shows the Phase E version of the CTM

	Likelihood of Occurrence	Weakness	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					
			Very Minimal 0.5% < CI ≤ 2.5% ($xM < CI ≤ $xM) *1% < CI ≤ 2.5%* *($xM < CI ≤ $xM)*	**Minimal** 2.5% < CI ≤ 5% ($xM < CI ≤ $xM) *2.5% < CI ≤ 5%* *($xM < CI ≤ $xM)*	**Limited** 5% < CI ≤ 10% ($xM < CI ≤ $xM) *5% < CI ≤ 10%* *($xM < CI ≤ $xM)*	**Moderate** 10% < CI ≤ 15% ($xM < CI ≤ $xM) *10% < CI ≤ 15%* *($xM < CI ≤ $xM)*	**Significant** 15% < CI ≤ 20% ($xM < CI ≤ $xM) *15% < CI ≤ 20%* *($xM < CI ≤ $xM)*	**Very Significant** CI > 20% (CI > $xM) *CI > 20%* *(CI > $xM)*
Likelihood (L, %)	Almost Certain (L > 80%)							
	Very Likely (60% < L ≤ 80%)							
	Likely (40% < L ≤ 60%)							
	Possible (20% < L ≤ 40%)							
	Unlikely (L ≤ 20%)							

Note: Each “$xM” is converted to dollars according to the associated percentage depending on the proposed PIMMC.

Decoding Cost Threat Statement

When a Cost Threat is associated with a Major Weakness, the cost threat statement takes the following form:

Estimated likelihood of the cost threat being realized:
- Unlikely: < 20% (weight 10%)
- Possible: 20% - 40% (weight 30%)
- Likely: 40% - 60% (weight 50%)
- Very Likely: 60% - 80% (weight 70%)
- Almost Certain: > 80% (weight 90%)

This finding represents a cost threat assessed to have a [LIKELIHOOD] likelihood of a [IMPACT] cost impact being realized during development and/or operations, which results in a reduction from the proposed unencumbered cost reserves.

Estimated magnitude of the cost threat relative to the proposed cost (PIMMC in that phase):
- Very minimal: 0.5% – 2.5% (subject to lower $ threshold)
- Minimal: 2.5% - 5%
- Limited: 5% - 10%
- Moderate: 10% - 15%
- Significant: 15% - 20%
- Very Significant: > 20%

(Can be a specific estimate or middle of the range)

Phase affected by cost threat
- Cost threat impact ranges established separately for Phases B-D and Phase E
- Cost threats evaluated separately against Phases B-D and Phase E
- Impact of cost threats on reserves applied separately to Phases B-D reserves and to Phase E reserves

If realized, cost threats would consume unencumbered cost reserves
- By definition, TMC-identified cost threats are above and beyond the proposed cost basis and the proposed encumbered cost reserves

Decoding Cost Threat Statement: Examples

Example of cost threat statement 1: cost validation Major Weakness

- The cost validation process results in a cost threat of $12.5M for WBS 6+10. The notional example PIMMC for Phases B-D is $100M.
- The TMC ponders the case made in the proposal for cost-reducing paradigm and gives further benefit of the doubt to the proposer. The likelihood of this cost threat is estimated in the range 20%-40%.
- The TMC appends the following statement to the cost validation MW:

> *This finding represents a cost threat assessed to have a **Possible** likelihood of a **Moderate** cost impact being realized during **development**, which results in a reduction from the proposed unencumbered cost reserves.*

Example of cost threat statement 2: technical Major Weakness

- The TMC considers that the Technology Readiness Level (TRL) is overstated and that it is likely that a TRL development plan will be required before KDP-C. The notional example PIMMC for Phases B-D is $100M.
- The TMC estimates that the cost for an adequate TRL development plan would be in the range of $2.5M to $5M
- The TMC writes the technical MW and appends the following statement:

> *This finding represents a cost threat assessed to have a **Likely** likelihood of a **Minimal** cost impact being realized during **development**, which results in a reduction from the proposed unencumbered cost reserves.*

Decoding Summary Statement

Cumulative impact of cost threats

- The Form C "Overall Evaluation/Rationale" Summary could include a statement of the following form.
- When present, this statement informs the risk rating, together with all of the Major Findings. This statement alone does not automatically result in any specific rating.

Example (could also be Phase E)

Subtract total from the total proposed unencumbered cost reserves in that phase

Applies to unencumbered only. (Encumbered reserves are already assigned to other, specific risks.)

The TMC-identified cost threats reduce the Phases B–D unencumbered cost reserves below the 25% required by the AO.

Total of all identified threats
- weigh impact by likelihood
- add %unencumbered reserves required by the AO (25% for Phases B-D, 15% for Phase E)

TMC compares remaining to AO-required %
- An informational statement
- TMC also assesses the appropriateness of the proposed %unencumbered cost reserves for the specific proposed scope, as justified by the proposal

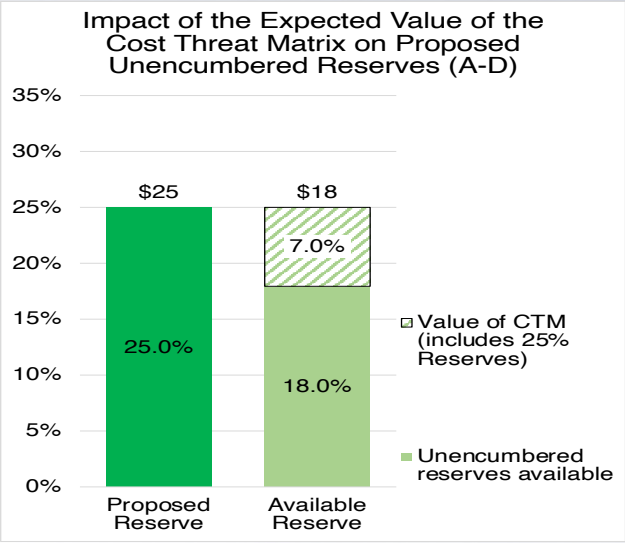
Decoding Summary Statement: Example

Example of cumulative impact (notional)

The cumulative impact of the cost threats for this notional example brings the unencumbered cost reserves level from the proposed level of 25% down to 18%.

Example for Phases B/D	
PIMMC without unenc. reserves	$100.0
Proposed unenc. reserves %	25%
Proposed unenc. reserves	$25.0
Total expected cost threat impact	$5.6
Reserves % on cost threats	25%
Total impact of cost threats	$7.0
Proposed unenc. reserves minus expected cost threats	$18.0
Proposed unenc. reserves minus expected cost threats %	18.0%

		Cost Impact (CI) % of Baseline Mission Cost to complete Phases B-D not including unencumbered cost reserves or contributions					
Likelihood of Occurrence	**Weakness**	**Very Minimal** $1.0M<CI≤2.5% ($1M<CI≤$2.5M)	**Minimal** 2.5%<CI≤5% ($2.5M<CI≤$5M)	**Limited** 5%<CI≤10% ($5M<CI≤$10M)	**Moderate** 10%<CI≤15% ($10M<CI≤$15M)	**Significant** 15%<CI≤20% ($15M<CI≤$20M)	**Very Significant** CI>20% (CI>$20M)
AlmostCertain (L>80%)							
VeryLikely (60%<L≤80%)							
Likely (40%<L≤60%)	**TRL Maturation**		**$1.9**				
Possible (20%<L≤40%)	**Cost Validation**		*$3.75M x 50% = $1.9M*		**$3.7**		
Unlikely (L≤20%)							



Clarification of Cost PMWs

The Clarification process offers a chance for updating cost information

- Information from proposers provided during clarifications may be relevant to cost threat statements associated with PMWs.

For example, the following types of information may be folded into the cost analysis even after the clarifications.

- Past actuals for efforts justified as being similar or otherwise relevant.
- References to past efforts justified as being similar, for which past actuals in CADRe exist.
- Further basis of estimate details, for the specific area(s) identified in the PMW.
- Resolution of inconsistencies or clarification of any misunderstanding affecting cost model inputs.

Benefit of the Doubt in Cost Validation

The TMC Cost Validation process has been geared in several ways towards providing proposers the benefit of the doubt.

1. The inputs to the cost models are derived directly from the descriptions in the proposal, “as proposed”
    a. This includes all heritage and TRL level claims.
    b. TMC’s independent assessment of technical parameters, if it differs from that of the proposal, is not factored into the Base ICE. It would be reflected in separate findings, with associated cost threats if applicable.
2. Validation error bars are derived specifically for each solicitation. They reflect how well the selected cost model combination performs against actuals of relevance to the solicitation.
    a. A cost validation finding major weakness is written only if the proposed cost is outside that error bar.
3. The validation cost threat impact only reflects excursions outside of the error bar (not the full delta between modeled and proposed).
4. The validation cost threat impact is weighted by the cost threat likelihood.
5. Proposal and clarification content can affect the likelihood of the validation cost threat.

Evaluation of the Cost Basis of Estimate

- AO Req. B-53 describes requirement for the Basis of Estimate (BOE):
  - Traceable to the WBS of Table B3,
  - Description of the methodologies and assumptions used to develop the proposed cost estimate,
  - Description of cost reserves that provides insight into their adequacy and robustness,
  - Any additional BOE data to assist the validation of the cost estimates.
- The type of data useful to support a BOE depends on the method used for the cost estimate
  - Example if based on analogy: list heritage cost and rationale for adjustments
  - Example if using parametric model: model name and version, key inputs used with rationale
  - Example if using bottom-up estimates: breakout of labor vs material, FTEs and/or WYEs and average labor rates, list of significant hardware with date and importance to investigation.
- No external independent cost validation estimates are expected in the proposal, nor are they evaluated or considered if submitted.
- TMC's evaluation of the quality of the proposer's basis of estimate is separate from TMC's ICE analysis.
- Different findings can result from the BOE and from the ICE. If the findings are Major, they are both considered during polling for the final risk rating.

Cost Validation Lessons Learned

- Proposal teams who do the following tend to better support their proposed cost
- Estimate both schedule and cost iteratively, starting early in proposal development; let that inform the proposed scope.
- Estimate both schedule and cost conservatively by accounting for remaining unknowns and for expected cost growth during proposal development and during Phase A.
- Identify cost-driving parameters clearly and consistently (including TRL, modifications from heritage, engineering models & spares, etc.)
- Use NASA Standard WBS definitions and terminology.

Cost Threats Lessons Learned

- **Proposal teams who do the following tend to better support their proposed reserves posture**
- Apply risk management process early; plan mitigations appropriate for the proposed project class.
- Encumber appropriate amounts of cost reserves against those risks that could impact schedule and/or cost.
- Determine the levels of funded schedule reserve and of unencumbered cost reserves that would be adequate and robust for the proposed project –as well as their phasing.
  - Unencumbered cost reserves higher than the minimum AO requirement, and funded schedule reserves higher than typical practices, may be necessary for some elements of some projects, such as those requiring specific technology maturation.
  - Remember to also carry unencumbered cost reserves against the encumbered cost reserves; encumbered cost reserves are part of the base PIMMC.
- Remember that appropriate cost reserves could be either the minimum required by the AO, or higher as assessed by the TMC evaluation panel based on the justification provided by the proposal.

Additional Information on Cost Estimation

- **NASA WBS Handbook in the Program Library** https://explorers.larc.nasa.gov/APSMEX26/SMEX/pdf_files/NASA03_NASA_WBS_Handbook.pdf
- **NASA Cost Estimating Handbook:** https://www.nasa.gov/ocfo/ppc-corner/nasa-cost-estimating-handbook-ceh/

- **Note that several NASA cost models that may be relevant to some projects are free to proposers and do not require cost expert training (spreadsheet-based and compatible with Mac and PC). These include:**
  - Project Cost Estimating Capability (PCEC)
  - NASA Instrument Cost Model (NICM)
  - Mission Operations Cost Model (MOCET)
  - Access can be requested at https://software.nasa.gov/software/category/all/aw/1/cost.
  - Use of these models is not a requirement nor an expectation.

Q&As Highlights

Q&As

Q55: The AO lists conflicting LRDs. The Foreword (page i), as well as Requirement 98 (page 58), state that the selected mission must be ready to launch no later than September 30, 2031. However, Section 3, Proposal Opportunity Period and Schedule, states that the LRD be NLT December 5, 2031. Which LRD needs to be met?

A55: The required LRD is NLT December 5, 2031. The conflicting date in the Foreword and in Requirement 98 is an error and will be corrected in an amendment to the AO

Q: Where should Level 1 requirements be addressed?

A: The proposal should identify Level 1 Requirements in *Section D.2 Science Requirements* of the proposal. Three additional pages have been provided for the addition. Driving Level 2 requirements should be identified in Appendix *J.15 Driving Level 2 Requirements*.

Q&As

Q: AO Requirement 97 requires a commitment by the PI for the cost, schedule, and scientific performance of the investigation, but the AO is unclear on a method to demonstrate compliance. How should proposals document the commitment?

> **A:** Proposers may satisfy Requirement 97 by including either a Personal Letter of Commitment (LoC) from the Principal Investigator OR a simple written statement affirming the PI's commitment to the cost, schedule, and scientific performance of the investigation. This commitment must be placed in Section A of the proposal. An amendment to the AO will update the table of page limits to explicitly allocate a 1-page limit in Section A for this PI commitment.

Q: How does the proposing organization demonstrate commitment to the proposal when there is no allowance in the AO for an *Authorizing Official* signature?

> **A:** The commitment by the proposing organization is provided by the *Authorized Organizational Representative (AOR)* when providing the certification of compliance on Section V of the NSPIRES submission.

Q&As

Q: Given that Science Enhancement Options (SEOs) and Student Collaboration (SC) are deferred to Phases A&B, does the proposal need to show an Enhanced PIMMC line in the proposal?

A: Yes. Proposals that plan to incorporate SEO and/or SC activities in the combined Phase A&B, must include an Enhanced PIMMC in the cost table. The cost for these elements should be listed as $TBD, making the Enhanced PIMMC = baseline PIMMC + $TBD.

Note that the cost for any SC activities that exceed the incentive will have to be covered by the PIMMC.

Q: How should proposers handle the half-page limit for Sections D and E to avoid formatting penalties?

A: To eliminate confusion regarding the half-page limit, SMD is increasing the combined page limit for Sections D and E from 31.5 to exactly 32 pages. Proposers must continue to follow all other formatting guidelines defined in the AO. This change will be officially documented in an amendment to the AO.

Q&As

Q: There appears to be inconsistent requirements regarding Letters of Acknowledgment (LoA) from SCaN in two subsections of the AO. Can you clarify?

A: While there is overlap, the requirements serve distinct purposes and are not inconsistent.

Requirement 41 seeks confirmation from SCaN that the mission telecommunication requirements fit within the standard scenarios listed in the *Ground Station Costs* table and classifies the mission in one of the two scenarios.

Requirement 34 Applies only to missions proposing capabilities outside the standard SCaN catalog. It seeks acknowledgment from SCaN that these non-standard mission requirements can be met within the proposed schedule.

If a proposed investigation triggers the criteria for both requirements, proposers may request that SCaN provide a single, combined LoA that satisfies both conditions.

Q&As

Q53: Given that the LEGS program is on hold, what alternative telecommunications infrastructure is currently available or planned to support missions operating in the lunar and cislunar regions it was intended to serve?

A53: NASA is actively pursuing alternate solutions to provide the telecommunication and navigation services that were previously planned under the LEGS GOCO (Government-Owned, Contractor-Operated) architecture.

While the specific configurations of these new systems have not yet been fully defined, SMD recognizes the need for guidance during the proposal process. For the purposes of developing current concept designs, proposers are instructed to use the existing LEGS GOCO parameters and information in the LEGS brochure currently available the Program Library as their baseline.

For the purposes of APSMEX26, SMD will not update this guidance prior to selection.

Additionally, for proposal budgeting purposes, proposers that plan to use LEGS should calculate their telecommunications costs using the new anticipated rate of $56 per minute. This cost figure supersedes the costs in the MOCS v5 document available in the Program Library.

The official announcement that places the hold on the LEGS procurement can be found on the SAM.gov website at https://sam.gov/opp/78a2877d601e42cbb15616a90e92bf4a/view.

Q&As

Q49: What are the launch vehicle insertion errors that should be assumed for each Scenario?

A49: The spacecraft propellant budget must include a margin for LV insertion errors, based on the orbit type. While a unique, mission-specific orbit may drive a need for additional assessment, the general 3-sigma injection variability for the anticipated class of LVs is as follows:

a. LEO (Scenario 1 and Scenario 2): Perigee +/-20 km, Apogee +/- 20 km, Inclination +/- 0.1 deg, RAAN +/- 0.15 deg, Argument of Perigee +/- 0.3 deg
b. High Energy (Scenario 2): C3 +/- 0.1 km^2/s^2
c. Note these are commonly used parameters, but are not intended to be all-encompassing or fully needed for every orbit.

References

AO Reference Material

APSMEX26 Acquisition Home Page

- The APSMEX26 acquisition home page is available at

  https://explorers.larc.nasa.gov/APSMEX26/SMEX/index.html

- The contents of the web site include the following:
  - Community announcements
  - Links to the APSMEX26 AO and to SAM.gov Annoucement
  - Program Library
  - APSMEX26 AO Q&As
  - Evaluation Plan*
  - Teaming interest
  - Preproposal conference materials

* The APSMEX26 Evaluation Plan is forthcoming

AO Reference Material

- **Program Library**
  - The Library provides additional regulations, policies, and background information. The Library is accessible at https://explorers.larc.nasa.gov/APSMEX26/SMEX/programlibrary.html
  - It is incumbent upon the proposer to ensure that the documents used in proposal preparation are of the date and/or revision available in the Program Library.
  - A detailed Change Log has been implemented, and will continually document updates to the Program Library.

- **Questions and Answers**
  - Questions sent to the PS and AM are answered on the Acquisition Homepage
  - Questions are welcome up to 2 weeks before proposal due date (August 26th).
  - Questions are anonymized before publication on the web page.
    - The Evaluation Panels are not made aware of what proposers originated which questions.
  - Publication ensures that all proposers have equal access to the same information.

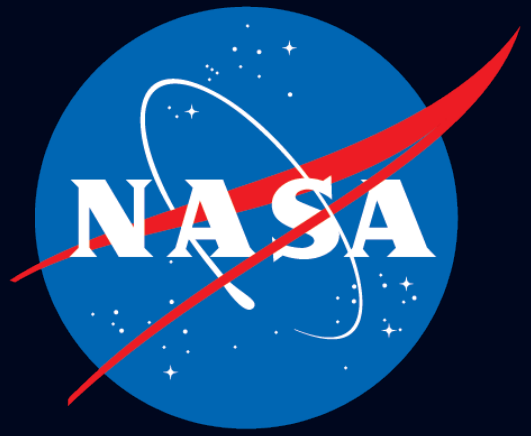
TMC Evaluation

Common Causes of Major Weaknesses References

- Technology Readiness Level:
  - *Assessment of TRL in AO-Based Evaluations and Common Causes of Major TRL Weaknesses*
  - Located in the APSMEX26 Program Library:

    https://explorers.larc.nasa.gov/APSMEX26/SMEX/pdf_files/Prog07b_Common-causes-TRL-Weaknesses-Ver03-080118.pdf

- Management:
  - *Common Management Major Weaknesses in Step One Proposals*
  - Located at SOMA website:
    https://soma.larc.nasa.gov/tmcII/ManagementFindingsStudy-to-post-R3.pdf


NASA