NATIONAL ACADEMY OF SCIENCES

November 2, 2021

To: Interested Responders

Re: Request for Information (RFI)

The National Academy of Sciences ("NAS") is requesting information regarding research support for a study entitled ***Independent Technical, Risk, and Cost Evaluation (TRACE) for the National Academies of Sciences, Engineering, and Medicine's Decadal Survey on Biological and Physical Sciences Research in Space 2023-2032.*** NAS invites all interested responders to submit a written response to this Request for Information ("RFI").

This RFI is being sought strictly for the purpose of gaining knowledge of responders and capabilities available within a fast-track timeframe and should not be construed as intent, commitment, or promise to acquire services, support, or solutions offered. Submitting to this RFI is neither a disqualifier nor a guarantor of future work. No contract is guaranteed as a result of any response to this RFI.

Information submitted in response to this RFI will become the property of NAS.

NAS will not pay for any information or consultations herein requested nor is it liable for any cost incurred by the responder.

RFI responses must be sent to DYee@nas.edu no later than **Friday, December 3, 2021.**

Procedural, administrative, or contractual questions and answers may be directed to the email listed above. Technical or requirement questions may be directed to Sandra Graham, SGraham@nas.edu.

We appreciate your attention to this matter.

Sincerely yours,

Kevin Hale Digitally signed by Kevin Hale
Date: 2021.11.04 04:02:57
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Kevin Hale
Director, Procurement Services & Subaward Administration

National Academy of Sciences

Request for Information (RFI)

RFI: NAS-RFI-DEPS-2021-02

Independent Technical, Risk, and Cost Evaluation (TRACE)[1] for the National Academy of Sciences, Engineering, and Medicine's Decadal Survey on Biological and Physical Sciences Research in Space (the "Survey")

1. INTRODUCTION

The National Academy of Sciences ("NAS"), under sponsorship of the National Aeronautics and Space Administration ("NASA"), has established the Steering Committee for the Decadal Survey on Biological and Physical Sciences Research in Space ("the Committee"). Broadly, the Committee will generate consensus recommendations to implement a comprehensive strategy and vision for a decade of transformative science at the frontiers of biological and physical sciences research in space. Implementation and investment recommendations specific to NASA will be described in the final report. To support this goal, NAS intends to contract with an independent organization to estimate budget scope and schedule and assess concept technology readiness and risk of conducting campaign, scientific investigations, and facility projects identified by the Committee as potential priorities. This process is called the Technical, Risk, and Cost Evaluation (TRACE). Because most of the project concepts are pre-phase A, TRACE provides a "box" of cost and schedule ranges. The successful organization will support the Committee and its panels in gathering the requisite information and providing the necessary TRACE analyses to support the prioritization of projects and technical development activities for the coming decade.

A key objective of the Survey is to develop a comprehensive research strategy to advance the frontiers of biological and physical sciences research in space that will include identifying, recommending, and ranking the highest priority research activities — taking into account for each activity the scientific case, international and commercial activities, and opportunities for partnerships. Where feasible and useful, such factors as timing, cost category and cost risk, technical readiness, and technical risk, will also be considered. Establishing a profile (estimated cost box and estimated schedule) of a project equates to developing a preliminary plan fitting within the available projected project budget. The

[1] Formerly known as Cost and Technical Evaluation (CATE), the name is updated to better reflect the risk-based nature of the evaluation.

entire life cycle of the project must be scoped, including design, technology development, construction, and operation. In addition, contractor will support the Committee by reacting rapidly to contingency scenarios requested to develop various descope/rescope options, including budget and technical uncertainties.

Projects within the survey may consist of research campaigns which will address broad or large-scale goals and may span multiple topics or disciplines, multiple missions, or multiple platforms, as long as they logically aggregate into a single, defined mission concept. Such proposed campaigns may have total project cost of $100M or more, may include a dedicated spaceflight, and will have a maximum duration of 10 years. Projects within the survey may also include research activities and associated facilities & platforms. Some, but not all, potential projects and campaigns will be provided to the Committee in the form of community submitted white papers. The project information submission approach differs from previous decadal surveys published by the National Academies of Sciences, Engineering, and Medicine, such as the astrophysics and planetary science decadal surveys. Those decadal surveys sometimes had detailed mission concept studies to evaluate, whereas in this case proposed research projects, or broad concepts for research campaigns, will be evaluated. White papers will not include controlled unclassified information, ITAR-controlled information, or proprietary information.

2. TASKS

Contractor will support the Survey by carrying out the following tasks:

3.1 Task 1: Gather Information on Project Concepts

Most projects submitted to the Committee via white papers will contain little to no costing information. As such, the contractor will be responsible for gathering data needed for the TRACE analysis. The contractor, in consultation with the Committee or panels, will obtain information where it is necessary to fully assess the technical readiness, risk, schedule, and cost scope of the activity. As a sponsor for the project, NASA may be utilized for this purpose. The Committee recognizes that there may be a high level of uncertainty given the lack of current data on, for example, future research platforms. In some cases, it may be necessary to support the Committee by developing alternative implementations for accomplishing the goals of large research projects and campaigns.

3.2 Task 2: Estimate Budget Scope and Schedule for Proposed Activities

Contractor shall select the methodology for assessing the budget scope and schedule for each activity set. Contractor shall assure that methods and tools utilized are appropriate for conceptual level assessments and will cross-check model results with analogy-based cost and schedule estimates to provide robust estimates from multiple independent sources for each activity. Contractor may request data from the sponsor (NASA) and Committee, however, the contractor's cost estimating methodology and basis of estimate shall remain independent from the cost estimates provided by government agencies. Contractor shall validate its budget estimates through an independent method.

3.3 Task 3: Assess Concept Technology Readiness and Risk

Contractor shall identify, as appropriate, programmatic risks associated with the key considerations such as technology development requirements, spacecraft/flight systems, instrumentation, campaign/project/facility design, and campaign operations. Contractor shall assess technology readiness and assign low, medium or high-risk ratings based on the technology maturity level of the concept. Contractor shall then associate each of the aforementioned considerations with a cost and schedule impact, and incorporate these into the cost and schedule estimates. This activity will be carried out in collaboration with subject matter experts on the Committee and its supporting panels.

3.4 Task 4: Summary and Comparison of Data

Contractor shall develop a series of top-level quad-charts for each activity concept using these four quadrants: a) activity description including technology development requirements, b) cost and schedule estimates, c) funding profile, and d) technology readiness and risk rating. Contractor shall also provide an "S-curve" that is generated by the cost model on a separate chart for the Committee's consideration. The quad-charts will provide a top-level snapshot of each concept for summary purposes and an overview of its technical, risk, schedule, and cost issues; and expected budgeting requirements. All information provided in the quad-charts is to be supported by contractor's independent analysis.

3.5 Task 5: Develop Tools for Budget Analysis

Contractor will also provide a clear and independent validation methodology developed for analyzing the consistency of the set of recommended activities with the expected budgets of the federal agencies and other organizations who would be sponsoring the proposed project. Contractor will support the Committee, using these tools, to develop a

set of scenarios for phasing and implementing a set of activities consistent with the predicted budget profiles. In addition, contractor should be ready to conduct re-examination of a small subset of the original TRACE analysis, to explore variations of the originals (i.e., descopes and rescopes), with a fast turnaround.

3.6 Considerations for All Tasks

Contractor will have the capability and resources to conduct the analyses to support the Survey's goals. Contractor shall be able to analyze projects with the following considerations: (1) projects in a range of environments including low-Earth orbit, sub-orbital, Earth-based, lunar orbit, and other space-based platforms; (2) research activities, associated facilities and platforms, and proof-of-concept research campaigns no less than $100 million; (3) potential for evaluating actions ranging from increased investments (upscopes) to reduced investments (descopes) and termination; and (4) an overall ability to assess projects to destinations in the solar system at all phases of development. Some of the final material will be made public in the survey report.

The contractor will be expected to

- Work closely with the designated Committee panel (Engineering and Science Interface Panel) in understanding the needs of the study;
- Assist in defining the ground rules and processes for information collection, normalization and assessment;
- Serve as a conduit to NASA for data collection purposes;
- Present their analyses to the Committee, supporting panels, and/or agency;
- Perform iterative analyses and work closely with the Committee and its panels on such tasks;
- Provide other technical support as defined during the course of the study, within available resources.

3.7 Reporting

The contractor shall develop a final report that consists of the TRACE charts developed for each of the projects and all applicable supporting documentation and analysis as identified in Task 5. The report shall be provided in a to-be-specified format to facilitate incorporation into and/or compatibility with the Survey Committee's report and findings. The full TRACE analyses will not be released to the public.

The description of these tasks may be modified, based on the responses to this RFI or on the needs of the Committee before a contractor is selected.

4. RESPONSE

We request that responders provide a description of previous experience in independent cost estimating for human spaceflight and space platform costs. The respondent should describe:

1) Expertise and experience with technical, risk, cost, and schedule evaluation of project concepts.
2) Approach to budget and schedule estimation, including relevant databases and analogy information. Include a description of the commonalities and differences in approach for project concepts. Responses will be evaluated based on how unknown factors shall be addressed.
3) Qualification of staff who will be performing analyses and interfacing with the Committee and the members of its supporting panels.
4) Methodology for budget estimation and independent cost validation.
5) Approach to dealing with potential conflicts of interest and assurances that all materials provided from contractor to NAS will be unclassified; and processes for handling proprietary, controlled unclassified, ITAR-sensitive, or non-public information.
6) Abilities to directly correspond with the survey sponsor, NASA, and other organizations which hold proprietary and other information vital to analyses.

The response should be no more than 20 pages.

DRAFT SCHEDULE FOR THE SURVEY (SUBJECT TO CHANGE)	
August 2021	• Steering group meetings commence
September – November 2021	• Steering group identifies science themes and steering questions
October 2021	• Science white papers due
November – December 2021	• Accepting submissions for TRACE RFI
December 2021	• Science panel meetings commence • Research campaign white papers due
January 2022	• TRACE contractor selected
February 2022	• TRACE contractor begins meetings with Committee and supporting panels

September 2022	• Focus meeting with TRACE contractor and committee • Campaign elements and costs are finalized
January 2023	• Draft survey report sent to external reviewers
May 2023	• Revision of report completed • Report approved for release
July 2023	• Deliver report to NASA in prepublication format • Dissemination activities and formal publication of survey report by NAP
November 2023	• End of NASA contract