

National Aeronautics and Space Administration
Office of the Administrator
Washington, DC 20546-0001



July 21, 2008

The Honorable Harrison H. Schmitt
Chairman
NASA Advisory Council
Washington, DC 20546

Dear Chairman Schmitt:

Enclosed is the response to the recommendation from your February 7, 2008, quarterly meeting of the NASA Advisory Council. The Science Mission Directorate is actively engaged in addressing the points that the Council has raised.

Please do not hesitate to contact me if the Council would like further background on the information provided in the enclosures.

I look forward to receiving continued advice from the Council.

Sincerely,

A handwritten signature in black ink, appearing to read "M. D. Griffin", written in a cursive style.

Michael D. Griffin
Administrator

2 Enclosures:

1. S-08-01
2. Draft Terms of Reference

S-08-01

Compare the Cost Drivers of Earth and Space Science Missions

Recommendation

The costs of Earth Science missions appear systemically higher than Space Science missions for comparable class missions. A cost analysis study should be conducted for Earth Science, Space Science, and Planetary Science missions (1) to document the comparative costs and (2) to identify cost drivers and their sources in requirements, vendor, and partner types, and ways of doing business

Major Reasons for Proposing the Recommendation

The National Research Council (NRC) released its first decadal survey for Earth Science in January 2007. NASA, via its FY2009 budget request, is beginning implementation of the decadal survey. NASA has done a comparison of NRC's estimates of decadal survey mission costs with its own and found that some are close and others are off by a factor of two or more. Further, some Space Science missions making analogous types of measurements are found to cost less, and it is important to learn if this is due to scientific and technical requirements such as accuracy, calibration, and simultaneity or to acquisition approaches and sources. For example, in the Space Sciences, instruments are often built by universities and involve student labor, whereas in Earth Science, most instruments are built by industrial contractors. Understanding the sources of differences in cost drivers is important to planning acquisition strategies for additional decadal survey missions.

NASA Response

NASA concurs with the recommendation and has developed an approach to accomplish this study. The draft Terms of Reference for the study is enclosed. NASA will brief the results to the NAC Science Committee upon completion.

**Science Mission Directorate Earth and Space Mission Cost Driver Comparison
Terms of Reference
Draft**

1.0 Background

The NASA Advisory Council (NAC) Science Committee has recommended that NASA compare the cost drivers of Earth and Space Science missions. A short description of the proposed recommendation is as follows:

The costs of Earth Science missions appear systemically higher than Space Science missions for comparable class missions. A cost analysis study should be conducted for Earth Science, Space Science, and Planetary Science missions: (1) to document the comparative costs; and (2) to identify cost drivers and their sources in requirements, vendor and partner types, and ways of doing business.

The basis for the NAC Science Committee's recommendation is that NASA's analysis of mission cost estimates presented in the recent National Research Council (NRC) Earth Science decadal survey found that some are close and others are off by a factor of two or more. Further, some Space Science missions making analogous types of measurements seemingly cost less. Accordingly, the committee believes that it is important to learn if these differences are due to scientific and technical requirements such as accuracy, calibration, and simultaneity, or to acquisition approaches and sources. Understanding the sources of differences in cost drivers is important to planning acquisition strategies for additional decadal survey missions.

2.0 Objectives

The commissioned study will determine if the costs of Earth Science missions and instruments are systemically higher than Space Science missions and instruments for comparable class missions and trace the cost drivers of any such differences. The study will:

- Document the comparative costs of different mission and instrument types.
- Identify cost drivers and their sources in mission requirements or implementation work elements.
- Explore possible causes for differences in cost, including possible differences in implementation approach.
- Examine the science rationale associated with observed cost differences.
- Make recommendations concerning the planning and acquisition for future missions, particularly future Earth Science decadal survey missions.

3.0 Scope

This study will perform a comparison of the Earth and Space Science missions and instrument cost drivers. The study will define instrument classifications/groups to be used to organize comparisons and work breakdown structure (WBS)-specific metrics to elucidate differences between Earth and Space missions. This study will include readily

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available cost breakdown information for a relevant sampling of missions across the four Science Mission Directorate (SMD) divisions (i.e. Earth, Heliophysics, Astrophysics, and Planetary). The study will also be limited to NASA robotic science missions. If in the course of conducting this study the study team determines that insufficient data are available, the study team will get approval in writing for a change in scope from SMD senior management before proceeding.

4.0 Implementation

The study will be conducted in four subtasks in order to meet its objectives:

Subtask 1: Definition of Instrument Types/Classes. The study will develop instrument classes to support comparative analyses of Earth and Space Science missions. Each instrument from the candidate missions set with available information will be categorized to support comparisons and analyses. The candidate mission set includes approximately 30-35 missions. Data sources will include contractors' history files related to past assessments and independent review teams, CADRe reports where available, and project documents submitted to NASA.

Subtask 2: Definition of WBS-Specific Performance Metrics. For each major WBS area, performance metrics will be defined representing technical, cost, and schedule. Major WBS areas will be evaluated and refined as needed as the study progresses. There are seven initial candidate WBS areas: Project Management, Systems Engineering, Mission Assurance, Science Team, Science Instruments, Flight System and Integration & Test, and Mission Operations and Ground Data Systems. Launch vehicle costs are to be recorded but not analyzed.

Subtask 3: Technical, Cost, and Schedule Performance Metric Comparisons. Comparisons and trend analyses will be conducted with existing data using the instrument types/classes from Subtask 1 and the performance metrics from Subtask 2. For cost comparisons, the cost data should reflect accrued mission costs documented in either the NASA accounting system or in the Monthly Contractor Financial Management Reports (NASA Form 533) or equivalent documentation of cost accruals.

Subtask 4: Characterization of Differences between Earth and Space Science Instruments and Missions. Results from Subtask 3 will be used to support findings and conclusions regarding differences between Earth and Space Science instruments and missions. Recommendations will be developed to refine and test findings and conclusions.

5.0 Participants

This study will involve the following:

- The Science Support Office (SSO) at NASA Langley Research Center (LaRC) will perform the study management and contract monitoring function and assist in the assessment of the data. SSO will hire a team of contractor technical experts to perform the functions listed in Subtasks 1-4.

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- In addition, a team of technical experts from NASA facilities will assist the SSO and the contractor technical experts in assessing the mission cost data and in interpreting the connections between the requirements and the implementation approaches taken. This group will include experts with experience in mission science, data handling, project management, and mission operations and in both Space Science and Earth Science missions and instruments. The technical team will interact with the SSO primarily through one or two analysis workshops.
- If required, a group of non-NASA experts with experience in mission science and management will evaluate the findings of the SSO/NASA technical expert team and provide a high-level assessment of the data and findings. The group members will be selected in consultation with the NAC Earth Science subcommittee and will present their results to the NAC Earth Science subcommittee. All of the activities of this group will comply with Federal Advisory Committee Act (FACA) regulations, with the Science Committee's Executive Secretary serving as the Designated Federal Official, if required.

6.0 Deliverables

The following deliverables are planned:

- Identification of a set of missions and instruments for which sufficient detail is available.
- Initial categorization of missions and instruments and assessment of cost driver comparison.
- Hypothesized reasons for observations, including alternatives as appropriate.
- Assessment of science rationale for hypothesized reasons for observed correlations.
- Final report and presentation material.
- Briefing to SMD management of final results and conclusions.

7.0 Schedule

The overall task should be completed by September 30, 2008. Within this period there is sufficient schedule to allow for collection of mission data, definition of instrument classes and work breakdown elements, a mid-term workshop involving NASA and contractor technical experts, a series of data analysis rounds, and preparation of a report to the NAC Earth Science subcommittee

8.0 Resources

A funding level not to exceed \$365K is to be utilized to accomplish the specified task. The NASA SSO will coordinate with NASA SMD on the placement and management of the directed funds.

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9.0 Risks

The following are potential risks to the completion of the key deliverables or to the validity of some or all of the results. Mitigation steps for these risks are identified below:

Risk: Insufficient mission and instrument information available.

Mitigation: If insufficient data are found, develop plan for additional data collection, and renegotiate scope and deliverables for this study.

Risk: Pressure for growth in scope and additional lines of inquiry based upon interaction with the NAC ad hoc task group.

Mitigation: Clearly communicate to the NAC members and leadership that changes in scope will delay delivery of study results. The NAC is an independent advisory committee. If they recommend additional work, NASA will respond to this recommendation as appropriate.