

Report on controlling NASA mission costs

July 13 2010

NASA should develop a broad, integrated strategy to contain costs and maintain schedules as earth and space science missions are planned and designed, says a new report by the National Research Council. The report also calls on NASA, Congress, and the Office of Management and Budget (OMB) to consistently use the same method to quantify and track costs.

"Cost and schedule considerations are important for [NASA](#) missions," said Ronald M. Sega, chair of the committee that wrote the report and the Woodward Professor of Systems Engineering, Colorado State University, Fort Collins. "Although the agency is already taking action to address these issues, NASA needs a comprehensive plan to improve the mission planning and development process. Containing costs and staying on schedule will enable additional NASA mission opportunities for earth and space sciences in the future."

NASA recently made improvements in how missions are developed, including modifying how programs are budgeted and requesting independent appraisals of cost and technical risks for decadal surveys -- 10-year plans provided by the Research Council for NASA research projects and missions. However, the report says, it is too early to assess how effective these changes will be in containing costs, and an overall strategy to stay within budget for all earth and space science missions is still lacking.

For budgeting and funding purposes, NASA, Congress, and OMB should use as a baseline cost estimates that cover the life cycle of the mission

from preliminary design review through completion of operations. Currently, Congress generally considers the baseline to be the estimates that are first mentioned when a mission appears as a budget line item in an appropriations bill. This is typically before NASA's preliminary design review; and it is very difficult to create a reliable cost estimate at this early point in a mission's development. In the past, some mission cost estimates did not include the cost of launch or mission operations. These inconsistencies make it hard to gain a clear understanding of trends in cost and schedule overruns, the report says.

The committee examined 10 previous independent cost analyses and studies, noting that the studies often reached divergent conclusions because they looked at different sets of missions and used varying methods to calculate cost growth -- mission costs that exceed initial estimates. With such variation, a single, reliable value for the average cost growth of NASA Earth and space science missions is difficult to derive, the report says. For example, prior studies calculated values for average cost overruns ranging from 23 percent to 77 percent. Some studies consider only development costs -- not including launch costs -- while others include all costs through the end of each mission.

The prior studies indicate that overly optimistic and unrealistic cost estimates, project and funding instability, problems with development of instruments and other spacecraft technology, and issues with launch services are the most common drivers of cost growth, the report concludes. Problems that delay mission schedules also contribute to and magnify cost growth; if one mission is not meeting its schedule, it may also lead to planning delays for other missions. A relatively small number of missions appear to be responsible for most cost overruns, the report says.

The report identifies several steps NASA should take to improve its cost-estimate process, including strengthening its ability to conduct

"parametric" cost estimates. These estimates are generally more realistic and reliable than traditional estimates because they are based on historical statistical data about relationships between cost and technical and programmatic variables such as mass, power, and complexity. The report says that NASA should obtain independent parametric cost estimates at several stages of mission development, compare them with other estimates, and reconcile the differences.

NASA should pay particular attention to the cost and schedule of missions that will run \$500 million or more, the report says. Cost growth in these already expensive missions has a potential to diminish NASA's earth and space science missions as a whole. The agency should also make sure there are incentives for program and project managers to establish realistic cost estimates and minimize or avoid cost growth at every phase of the mission.

To assure that key technologies are mature and available, NASA should devote more resources to the early phases of mission development. Instrument development should be initiated well in advance, and a robust development effort relevant to all classes of earth and space science missions should be established. In addition, NASA should ensure that decadal surveys include guidance on instrument and technology development.

Problems with the procurement of launch vehicles and services can be a significant source of cost overruns, the report says, noting issues such as cost increases for expendable launch vehicles, delays in availability, and weather and vendor related problems. Prior to preliminary design review, NASA should minimize launch-site processing requirements for each mission and should also select the appropriate launch vehicle as early as possible to minimize potential changes.

Provided by National Academy of Sciences

Citation: Report on controlling NASA mission costs (2010, July 13) retrieved 30 June 2024 from <https://phys.org/news/2010-07-nasa-mission.html>

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