

GAO Highlights

Highlights of [GAO-14-385](#), a report to the Ranking Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate

Why GAO Did This Study

NASA is undertaking a trio of closely-related programs to continue human space exploration beyond low-Earth orbit: the SLS vehicle; the Orion capsule, which will launch atop the SLS and carry astronauts; and the supporting ground systems. As a whole, the efforts represent NASA's largest exploration investment over the next decade, potentially as much as \$22 billion, to demonstrate initial capabilities. Beyond 2021, NASA plans to incrementally develop progressively more-capable SLS launch vehicles complemented by Orion capsules and ground systems.

GAO was asked to assess the costs of NASA's human exploration program. This report examines the scope of NASA's preliminary cost estimates for the three programs. To conduct this work, GAO reviewed NASA information on cost estimates for the three programs, discussed the estimates with NASA officials, and assessed the estimates against best practices criteria in GAO's cost estimating guidebook as well as NASA's own requirements and guidance.

What GAO Recommends

NASA should establish separate cost baselines that address the life cycle of each SLS increment, as well as for any evolved Orion or ground systems capability, among other actions to enable assessment of affordability and enhance oversight.

In commenting on a draft of this report, NASA partially concurred with GAO's recommendations, citing that actions taken to structure the programs and track costs met their intent. However, GAO believes NASA's responses do not fully address the issues raised in this report.

View [GAO-14-385](#). For more information, contact Cristina Chaplain at (202) 512-4841 or chaplainc@gao.gov.

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NASA

Actions Needed to Improve Transparency and Assess Long-Term Affordability of Human Exploration Programs

What GAO Found

The scope of the National Aeronautics and Space Administration's (NASA) preliminary cost estimates for the Space Launch System (SLS), Orion Multi-Purpose Crew Vehicle (Orion), and associated ground systems encompasses only the programs' initial capabilities and does not include the long-term, life cycle costs associated with the programs or significant prior costs:

- The SLS estimate is based on the funding required to develop and operate the initial 70-metric ton variant through first flight in 2017 but not the costs for its second flight in 2021. NASA is now incurring some costs related to the second flight, but it is not currently tracking those costs for life cycle cost estimating purposes. Furthermore, the estimate does not include costs to incrementally design, develop, and produce future 105- and 130-metric ton SLS variants which NASA expects to use for decades. NASA is now funding concept development and analysis related to these capabilities.
- The Orion estimate does not include costs for production, operations, or sustainment of additional crew capsules, despite plans to use and possibly enhance this capsule after 2021. It also does not include \$4.7 billion in prior costs incurred during the approximately 4 years when Orion was being developed as part of NASA's now-defunct Constellation program.
- The ground systems estimate excludes costs to develop or operate the ground systems infrastructure beyond 2017, although NASA intends to modify ground architecture to accommodate all SLS variants.

NASA expects to use this same limited scope of work to establish the programs' baseline cost estimates in 2014. According to NASA, the agency is developing a tailored definition for the programs' life cycle cost estimates as allowed by NASA requirements. Agency officials stated that NASA chose its approach in part due to uncertainties about the programs' end dates and missions beyond 2021.

GAO recognizes that defining life cycle costs can be difficult when uncertainties exist, and that best practices for cost estimating look favorably on evolutionary development. Even so, best practices expect that a high-quality cost estimate will account for program uncertainties, forecast a minimum and maximum range for all life cycle costs, and clearly define the characteristics of each increment of capability so that a rigorous life cycle cost estimate can be developed. According to these practices as well as NASA's requirements and guidance, life cycle cost estimates should encompass all past, present, and future costs for a program, including costs for operations, support, and disposal. The limited scope that the agency has chosen for constructing preliminary and baseline cost estimates, however, means that the estimates are unlikely to serve as a way to measure progress and track cost growth over the life of the programs. For example, cost growth on the current SLS variant could be masked as the addition of scope associated with work for future variants, and the baseline estimate would no longer be applicable. Insight into program costs helps decision makers understand the long-term affordability of programs—a key goal of the National Space Transportation Policy—and helps NASA assess management of its portfolio to achieve increasing capabilities as directed in the NASA Authorization Act of 2010.