

  
**GAO**  
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**Highlights**

Highlights of [GAO-04-203](#), a report to congressional requesters

## Why GAO Did This Study

The Columbia tragedy has accentuated the need to modernize the 20-year-old space shuttle, the only U.S. launch system that carries people to and from space. The shuttle will now be needed for another two decades. As it ages, the spacecraft's components will also age, and it may become increasingly unreliable.

GAO examined the National Aeronautics and Space Administration's (NASA) plans to upgrade the shuttle through 2020, how it will identify and select what upgrades are needed, how much the upgrades may cost, and what factors will influence that cost over the system's lifetime.

## What GAO Recommends

NASA needs to fully define shuttle upgrade requirements so decisions on upgrade projects can be integrated with its transportation plan. The agency must improve how it selects upgrades by developing an indicator that shows how upgrading will increase shuttle life or safety as well as other analytic tools to help its staff make judgments. It must develop a thorough estimate of the total life-cycle cost of upgrades through 2020, to determine the funding that will be needed for shuttle upgrades.

NASA fully concurred with most GAO recommendations, and agreed with the intent of the recommendation to develop a cost estimate for all shuttle upgrades through 2020.

[www.gao.gov/cgi-bin/getrpt?GAO-04-203](http://www.gao.gov/cgi-bin/getrpt?GAO-04-203).

To view the full product, including the scope and methodology, click on the link above. For more information, contact Allen Li at (202) 512-3600 or [lia@gao.gov](mailto:lia@gao.gov).

## SPACE SHUTTLE

# Further Improvements Needed in NASA's Modernization Efforts

## What GAO Found

NASA cannot fully define shuttle upgrade requirements until it resolves questions over the shuttle's operational life and determines requirements for elements of its Integrated Space Transportation Plan such as the International Space Station. Prior efforts to upgrade the shuttle have been stymied because NASA could not develop a strategic investment plan or systematically define the spacecraft's requirements because of changes in its life expectancy and mission.

NASA is trying to improve how it identifies, selects, and prioritizes shuttle upgrades. In March 2003, it institutionalized a Space Shuttle Service Life Extension Program to ensure safe and effective operations, along with a management plan documenting roles and responsibilities and an annual process for selecting upgraded projects and studies. In addition, NASA will try to improve shuttle safety by implementing the recommendations of the Columbia Accident Investigation Board (CAIB).

NASA's estimate of the total cost to upgrade the shuttle—\$300 million-\$500 million a year, or a total of \$5 billion-\$8 billion through 2020—is reasonably based but could be significantly higher, as it does not include potential projects such as a crew escape system. It will be difficult for NASA to make an accurate estimate until it firmly establishes the basic requirements (such as life expectancy) for the shuttle and the process for selecting shuttle upgrades. A number of potential changes could significantly increase the cost of shuttle upgrades, including responses to the recommendations of the CAIB.

### Space Shuttle Atlantis Lift-Off



Source: NASA.