



United States General Accounting Office  
Washington, DC 20548

December 2, 2002

The Honorable Barbara Boxer  
United States Senate

Subject: *Relocation of Space Shuttle Major Modification Work*

Dear Senator Boxer:

At your request, we assessed the National Aeronautics and Space Administration's (NASA) rationale and documentation to support its decision to relocate Space Shuttle Orbiter Major Modification (OMM) work from Palmdale, California, to Kennedy Space Center, Florida. OMM work entails alterations to improve the Space Shuttle's safety, operational quality, and long-term support and to extend its life. To make our assessment, we reviewed NASA's cost analysis and supporting documents and held discussions about NASA's analysis with agency officials in Washington, D.C.; Johnson Space Center, Houston, Texas; and Kennedy Space Center, Florida; as well as NASA's prime contractor, subcontractor, and union officials representing hourly workers at the maintenance facility in Palmdale, California. At the conclusion of our work, we met with NASA officials at NASA's headquarters in Washington, D.C., to confirm the accuracy of the information we collected.

## **Background**

NASA maintains a fleet of four orbiters (Space Shuttles) in its space transportation system. The vehicles are taken out of service for OMM about every 3 years or after no more than eight flights. Structural inspections and major modifications are performed during OMM. Boeing, a subcontractor to United Space Alliance (USA), at U.S. Air Force Plant 42 in Palmdale, California, has performed maintenance and modification on each of the four orbiter vehicles. Vehicle processing—preparing the Shuttle for launch—is currently performed at Kennedy Space Center, Florida. In May 2001, the Associate Administrator for Space Flight and the Space Shuttle Program Manager directed the Vehicle Engineering Office at Johnson Space Center, Houston, Texas, to conduct a cost analysis to determine whether OMM could be performed more cost effectively at Kennedy Space Center or Palmdale.

## **Results in Brief**

NASA had a sound basis for its decision to relocate OMM work to Florida based on our assessment of the strengths and weaknesses of NASA's cost analysis and potential savings. However, NASA needs to do a better job in preparing and documenting the cost analysis and methodologies used in its decision-making process so that it can further strengthen its basis for making future decisions. The documentation provided by NASA was not of sufficient

detail to enable us to (1) verify the precise cost savings resulting from relocating OMM from Palmdale, California, to Kennedy Space Center, Florida, and (2) completely understand NASA's rationale until we had extensive discussions with agency officials. We also found that the written responses to the questions you submitted to NASA related to the relocation of OMM work need clarification.

### **Assessment of Cost Analysis**

NASA decided to relocate OMM work to Florida because it believes that location would be the most cost-effective location. NASA based its decision on a comparative analysis of costs at the current site at Palmdale, California, and Kennedy Space Center, Florida. After considering the strengths and weaknesses of the cost analysis, and potential savings, we found that NASA had a sound basis for its decision.

The cost analysis used by NASA analyzed key factors such as workforce and infrastructure utilization, cost, schedule, and risks. The risks considered included the availability of personnel, "stumble-on-work" (work discovered during inspections), and competition for workers doing vehicle processing. NASA's cost analysis also incorporated numerous past studies and analyses (such as two reports from NASA's Inspector General) that concluded that savings would be realized by relocating OMM from Palmdale, California, to Kennedy Space Center, Florida. These reports also concluded that relocation should not have taken place at the time these reports were written because of the high-anticipated flight schedule of about 12 flights a year. NASA currently has planned an average flight schedule of four per year for the foreseeable future. The reports also recommended that NASA reevaluate the location for OMM work when there is a significant change in the planned flight schedule. A further strength of the analysis was that it used the engineering approach, which sums the costs of components at each location. Of all cost techniques, this one is usually the most accurate if the data are reliable.

On the other hand, we observed several areas of the cost analysis that could be improved. First, the cost analysis did not provide sufficient detailed documentation to determine the precise amount of savings to be realized by relocating OMM. Expected savings ranged from \$16 million to \$70 million annually, and several of those estimates were about \$30 million. The amount of savings was imprecise because the estimates sometimes included professional judgment. For example, estimates were made on the amount of savings that may or may not be realized by integrating OMM work with normal vehicle-processing activities.

Second, although data provided by NASA's contractor were reviewed and considered to be reasonable by NASA officials, there was no formal, documented, and independent verification of contractor-provided data upon which NASA based its relocation decision.

Third, the security implications of collocating maintenance and launch capability, although considered, were not formally documented in the cost analysis. NASA Security Officials and Program Managers said that owing to the high level of current security at Kennedy Space Center in Florida, collocating OMM at the launch site was not a significant risk factor.

Finally, NASA's Policies and Procedures Manual for conducting a program or project evaluation does not contain specific guidelines for performing a cost analysis (including identifying what documentation would be necessary to support the analysis). We identified this weakness to NASA officials during the course of our work. They said that they did not currently have specific guidelines to conduct a cost analysis but said they plan to improve their cost analysis procedures, including documentation requirements, with the next revision of NASA's Policy and Procedures Manual 7120.5A. They are currently working on the revision.

### **Clarification Needed in Prior Responses to Senator Boxer**

Following extensive discussions with NASA officials, it became clear that three of NASA's written responses to your prior questions needed clarification.

First, you asked if NASA did a labor market survey of skilled workers in Florida. NASA replied that United Space Alliance, the prime contractor for Orbiter maintenance, did an annual labor market survey. We found that USA relied on data published by the U.S. Department of Labor, Division of Wage Determinations, rather than conducting its own labor market survey. The Department's data are published by metropolitan service area (e.g., by Florida counties) and includes wages and benefits by occupation.

Second, you asked what number of new workers would be hired at Kennedy to perform OMM work. NASA replied that USA planned for 235 workers to perform OMM at Kennedy Space Center without making it clear whether these workers would be new hires or current employees. We found that the 235 workers will be drawn from the total of about 1,900 that work directly on Shuttle Processing. These workers' experience averaged 13.5 years. USA will hire 176 new workers who will not necessarily work directly on OMM but will be assimilated throughout the entire workforce.

Third, you asked for the number of employees at the Palmdale facility that received offers to relocate to Florida. NASA responded that USA had extended 25 offers to workers in California to relocate to Kennedy Space Center, Florida. We found that 33 offers were extended and that 3 other offers to workers were planned but could not be made because the workers could not be contacted.

### **Agency Comments**

In written comments on a draft of this report, NASA's Deputy Administrator said that the agency concurs with our audit findings, adding that NASA is working to improve its cost analysis techniques.

### **Scope and Methodology**

To assess the reasonableness of the assumptions used to establish workforce and infrastructure needs, we obtained NASA's rationale for including/excluding factors in the analysis, obtained NASA's support for the conclusions reached, and discussed our observations with responsible officials. To assess the cost of relocating the OMM work, we

obtained NASA's analyses comparing the alternatives and discussed and verified our assessment with responsible NASA officials. We determined, through an analysis of NASA's documentation and discussions with NASA staff, the extent to which NASA assessed increased security risks. We also assessed the extent to which all available analysis supported the relocation decision, which was included in the available documentation that NASA believed supported its decision.

We performed our review from June through October 2002 in accordance with generally accepted government auditing standards.

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Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies of this report to the NASA Administrator; the Director Office of Management and Budget; and other interested parties. We will also make copies available to others on request. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

Please contact me at (202) 512-4841, if you or your staff have any questions about this report. Major contributors to this report were Jerry Herley, Thomas Hopp, William McNaught, and Sylvia Schatz.

Sincerely yours,



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