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SPACE SHUTTLE

Status of NASA's Efforts to Address Workforce Issues Related to the Space Shuttle's Retirement

Statement of Allen Li, Director
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Highlights of [GAO-05-718T](#), a testimony before the Senate Subcommittee on Science and Space, Committee on Commerce, Science, and Transportation, U.S. Senate

Why GAO Did This Study

The National Aeronautics and Space Administration's (NASA) space shuttle program is key to implementing the President's vision for space exploration, which calls for completing the assembly of the International Space Station (ISS) by the end of the decade. Currently, the space shuttle, which is to be retired after ISS assembly is completed, is the only launch system capable of transporting ISS components. To meet the goals of the President's vision and satisfy ISS's international partners, NASA is examining alternative launch vehicles and ISS configurations.

Retiring the space shuttle and, in the larger context, implementing the President's vision, will require NASA to rely on its most important asset—its workforce. Because maintaining a skilled workforce through retirement will be challenging, GAO was asked to discuss the actions NASA has taken to sustain a skilled space shuttle workforce and the challenges it faces in doing so—findings reported on in March 2005 (see *GAO, Space Shuttle: Actions Needed to Better Position NASA to Sustain Its Workforce through Retirement*, GAO-05-230).

What GAO Recommends

In its March 2005 report, GAO recommended that NASA take steps aimed at sustaining a critically skilled space shuttle workforce through retirement. NASA concurred with the recommendation.

www.gao.gov/cgi-bin/getrpt?GAO-05-718T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Allen Li at (202) 512-4841 or lia@gao.gov.

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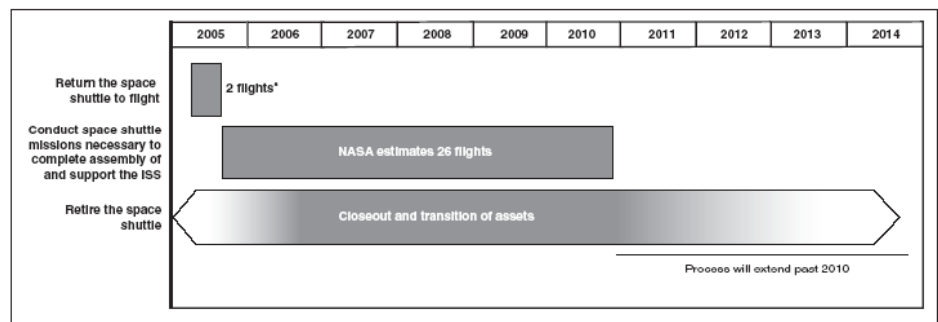
What GAO Found

While NASA recognizes the importance of sustaining a critically skilled workforce to support space shuttle operations, it has made limited progress toward developing a detailed long-term strategy to do so. At the time of our March 2005 review, the Space Shuttle Program had identified lessons learned from the retirement of comparable programs, and United Space Alliance—NASA's prime contractor for space shuttle operations—had begun to prepare for the impact of the space shuttle's retirement on its workforce. However, timely action to address workforce issues is critical given their potential impact on NASA-wide goals. Significant delays in implementing a strategy to sustain the space shuttle workforce would likely lead to larger problems, such as overstretched funding and failure to meet NASA program schedules. NASA and United Space Alliance acknowledge that sustaining their workforces will be difficult, particularly if a career path beyond the space shuttle's retirement is not apparent. Fiscal challenges facing the federal government also make it unclear whether funding for retention tools, such as bonuses, will be available.

Our March 2005 report identified several factors that have hampered the Space Shuttle Program's workforce planning efforts. For example, the program's near-term focus on returning the space shuttle safely to flight has delayed other efforts that will help the program determine its workforce requirements, such as assessing hardware and facility needs. Program officials also noted that due to uncertainties in implementing the President's vision for space exploration, requirements on which to base workforce planning efforts have yet to be defined. Despite these factors, our work on strategic workforce planning has shown that even when faced with uncertainty, successful organizations take steps, such as scenario planning, to better position themselves to meet future workforce requirements.

Since we issued our report and made our recommendation, NASA has publicly recognized, at its Integrated Space Operations Summit, that human capital management and critical skills retention will be a major challenge for the agency as it progresses toward retirement of the space shuttle.

Estimated Timeline for the Process of Retiring NASA's Space Shuttle



Source: NASA; GAO presentation.

Madam Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss how the National Aeronautics and Space Administration (NASA) is positioning itself to sustain the critically skilled space shuttle workforce through the retirement of the Space Shuttle Program. NASA is in the midst of one of the most challenging periods in its history. It must demonstrate that the space shuttle can safely fly again, begin the process of retiring its largest program, and at the same time prepare for the uncertain future of space exploration. These challenges are further exacerbated by the complex task of maintaining the right workforce to support the space shuttle program while ensuring that the skills needed for future programs are not lost. Over the next several years, thousands of NASA civil service and contractor employees who support the Space Shuttle Program will be impacted by decisions made about the remaining life of the program and implementation of exploration goals. These include decisions about the final number of space shuttle flights and about future programs, such as the Crew Exploration Vehicle (CEV). As requested, my testimony today will discuss the actions that NASA is taking to position itself to sustain its critically skilled space shuttle workforce and the challenges that the agency faces in doing so—issues we reported on to Senators Inouye and McCain in March 2005.¹

In summary, we found that NASA had made limited progress in its planning efforts for sustaining the space shuttle workforce through the program's retirement. At the time of our March 2005 report, the Space Shuttle Program had taken preliminary steps, including identifying the lessons learned from the retirement of comparable programs, such as the Air Force Titan IV Rocket Program. Further NASA's prime contractor for space shuttle operations—United Space Alliance (USA)—had taken some initial steps to prepare for the impact of the space shuttle's retirement on its own workforce. However, its progress depends on NASA making decisions that impact contractor requirements through the remainder of the program. Timely action to address workforce issues, however, is critical given the potential impact that they could have on NASA-wide goals. Unaddressed, such issues would likely lead to schedule delays and overstretched funding for both the Space Shuttle Program and the agency. Both NASA and USA have acknowledged that sustaining their workforces will be difficult as the space shuttle nears retirement, particularly if a

¹GAO, *Space Shuttle: Actions Needed to Better Position NASA to Sustain Its Workforce through Retirement*, [GAO-05-230](#) (Washington, D.C.: Mar. 9, 2005).

career path beyond the space shuttle's retirement is not apparent to their employees. In addition, the federal government is facing fiscal challenges. Such challenges call into question whether funding for tools, such as retention bonuses, will be available for the agency to use to aid in retaining the space shuttle workforce.

In our report we identified several factors that have hampered the Space Shuttle Program's planning efforts. For example, because of the program's near-term focus on returning the space shuttle to flight, other efforts that will ultimately aid in determining workforce requirements, such as assessing hardware and facility needs, are being delayed. In addition, program officials indicated that they face uncertainties regarding the implementation of future aspects of the President's vision for space exploration (Vision) and have yet to define requirements on which workforce planning efforts would be based. Despite these factors, our prior work on strategic workforce planning has shown that, even when faced with uncertainty, successful organizations take steps, such as scenario planning, to better position themselves to meet future workforce requirements.

In our March 2005 report, we recommended that the agency begin identifying the Space Shuttle Program's future workforce needs based upon various future scenarios the program could face. The program can use the information provided by scenario planning to develop strategies for meeting the needs of its potential future scenarios. NASA concurred with our recommendation, and NASA's Assistant Associate Administrator for the Space Shuttle program is leading an effort to address the recommendation. Since we issued our report and made our recommendation, NASA has taken action and publicly recognized, through its Integrated Space Operations Summit, that human capital management and critical skills retention will be a major challenge for the agency as it progresses toward retirement of the space shuttle.

Background

On January 14, 2004, the President articulated a new vision for space exploration for NASA. Part of the Vision includes the goal of retiring the space shuttle following completion of the International Space Station (ISS), planned for the end of the decade. In addition, NASA plans to begin developing a new manned exploration vehicle, or CEV, to replace the space shuttle and return humans to the moon as early as 2015, but no later than 2020, in preparation for more ambitious future missions. As this Subcommittee is aware, NASA's Administrator has recently expressed his desire to accelerate the CEV development to eliminate the gap between

the end of the Space Shuttle Program, currently scheduled for 2010, and the first manned operational flight of the CEV, currently scheduled for 2014. If the CEV development cannot be accelerated, NASA will not be able to launch astronauts into space for several years and will likely have to rely on Russia for transportation to and from the ISS. A 1996 "Balance Agreement" between NASA and the Russian space agency, obligated Russia to provide 11 Soyuz spacecraft for crew rotation of U.S. and Russia crews. After April 2006, this agreement will be fulfilled and Russia no longer must allocate any of the seats on its Soyuzes for U.S. astronauts. Russian officials have indicated that they will no longer provide crew return services to NASA at no cost at that time. However, NASA may face challenges to compensating Russia for seats on its Soyuzes after the agreement is fulfilled due to restrictions in the Iran Nonproliferation Act.²

The space shuttle, NASA's largest individual program,³ is an essential element of NASA's ability to implement the Vision because it is the only launch system presently capable of transporting the remaining components necessary to complete assembly of the ISS. NASA projects that it will need to conduct an estimated 28 flights over the next 5 to 6 years to complete assembly of and provide logistical support to the ISS. However, NASA is currently examining alternative ISS configurations to meet the goals of the Vision and satisfy NASA's international partners, while requiring as few space shuttle flights as possible to complete assembly.

Prior to retiring the space shuttle, NASA will need to first return the space shuttle safely to flight⁴ and execute whatever number of remaining missions are needed to complete assembly of and provide support for the ISS. At the same time, NASA will begin the process of closing out or

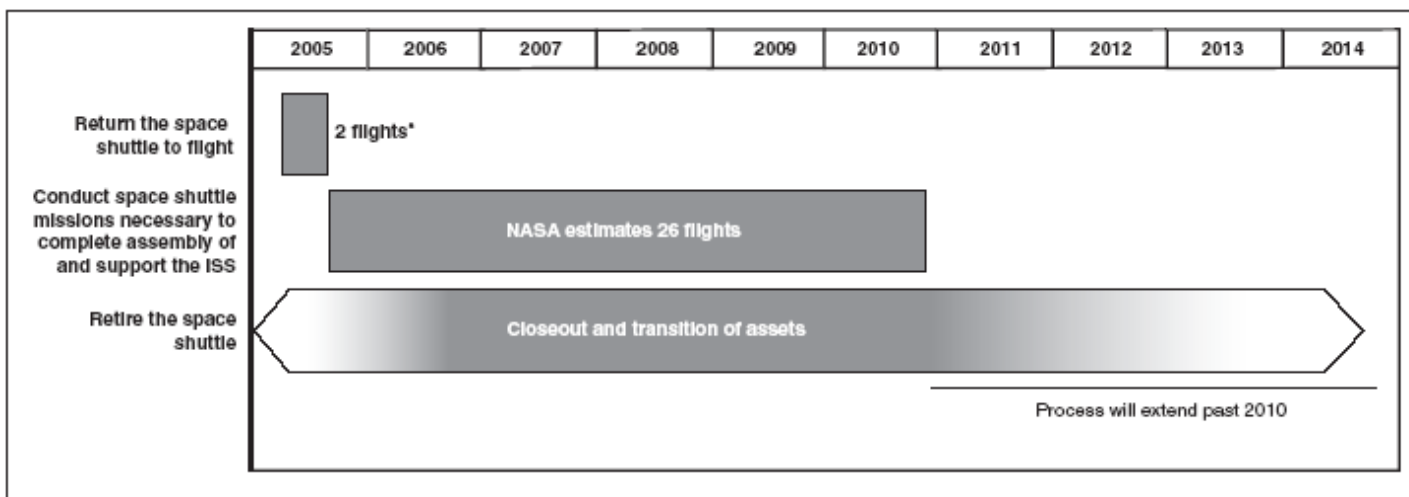
²The Iran Nonproliferation Act (P.L. 106-178). The Iran Nonproliferation Act bans the United States from making extraordinary payments to Russia in connection with the International Space Station, unless the President determines, among other things, that Russia demonstrated a commitment to prevent the transfer to Iran of goods, services, and technology that could materially contribute to developing nuclear, biological, or chemical weapons, or of ballistic or cruise missile systems.

³The Space Shuttle Program accounted for 27 percent of NASA's fiscal year 2005 budget request.

⁴To return the space shuttle to flight, NASA will conduct two flights, which are intended to test and evaluate new procedures for flight safety implemented as a result of the Space Shuttle Columbia accident. The planning window for the first flight is July 13 through July 31, 2005.

transitioning its space shuttle assets that are no longer needed to support the program —such as its workforce, hardware, and facilities—to other NASA programs. The process of closing out or transitioning the program’s assets will extend well beyond the space shuttle’s final flight (see fig. 1).

Figure 1: Estimated Timeline for the Process of Retiring NASA’s Space Shuttle



Source: NASA; GAO (presentation).

*The planning window for the first flight is July 13 through July 31, 2005.

Retiring the space shuttle and, in the larger context, implementing the Vision, will require that the Space Shuttle Program rely on its most important asset—its workforce. The space shuttle workforce consists of about 2,000 civil service⁵ and 15,600 contractor⁶ personnel, including a

⁵Number is based on a full-time equivalent calculation. Full-time equivalent is a measure of staff hours equal to those of an employee who works 40 hours per week in 1 year; therefore, the actual number of employees who work part-time or full-time on the Shuttle Program is greater than 2,000. The number was calculated by averaging the number of civil service employees over fiscal year 2004.

large number of engineers and scientists. While each of the NASA centers support the Space Shuttle Program to some degree, the vast majority of this workforce is located at three of NASA's Space Operations Centers: Johnson Space Center, Kennedy Space Center, and Marshall Space Flight Center. Data provided by NASA shows that approximately one quarter of the workforce at its Space Operations centers is 51 years or older and about 33 percent will be eligible for retirement by fiscal year 2012.⁷

The space shuttle workforce and NASA's human capital management have been the subject of many GAO⁸ and other reviews⁹ in the past that have highlighted various challenges to maintaining NASA's science and engineering workforce. In addition, over the past few years, GAO and others in the federal government have underscored the importance of

⁶The number was calculated by averaging the number of contractor employees over fiscal year 2004. This number includes data from NASA's prime contractor for space shuttle operations, United Space Alliance, and other NASA contractors. United Space Alliance, established in 1996 as a joint venture between Lockheed Martin and Boeing to consolidate NASA's various Space Shuttle Program contracts under a single entity, and its approximately 10,400 employees are responsible for conducting the space shuttle's ground and flight operations under the Space Flight Operations Contract. The remaining contractor personnel are associated with other space shuttle components, such as its propulsion systems.

⁷Data provided by NASA is as of September 30, 2004. GAO did not perform a reliability assessment of the data.

⁸GAO, *Space Shuttle: Human Capital Challenges Require Management Attention*, [GAO/T-NSIAD-00-133](#) (Washington, D.C.: Mar. 22, 2000) and GAO, *Space Shuttle: Human Capital and Safety Upgrade Challenges Require Continued Attention*, [GAO/NSIAD/GGD-00-186](#) (Washington, D.C.: Aug. 15, 2000).

⁹*Columbia Accident Investigation Board, Report Volume I* (Washington, D.C.: August 2003); Aerospace Safety Advisory Panel, *Annual Report for 2001* (Washington, D.C.: March 2002); Behavioral Sciences Technology, Inc., *Assessment and Plan for Organizational Culture Change at NASA* (Ojai, Calif.: March 15, 2004).

Progress toward Developing a Strategy to Sustain the Space Shuttle Workforce Is Limited

human capital management and strategic workforce planning.¹⁰ In response to an increased governmentwide focus on strategic human capital management, NASA has taken several steps to improve its human capital management. These include steps such as devising an agencywide strategic human capital plan, developing workforce analysis tools to assist in identifying critical skills needs, and requesting and receiving additional human capital flexibilities.¹¹

NASA has made only limited progress toward developing a detailed long-term strategy for sustaining its workforce through the space shuttle's retirement. While NASA recognizes the importance of having in place a strategy for sustaining a critically skilled workforce to support space shuttle operations, it has only taken preliminary steps to do so. For example, the program identified lessons-learned from the retirement of programs comparable to the space shuttle, such as the Air Force Titan IV Rocket Program. Among other things, the lessons learned reports highlight the practices used by other programs when making personnel decisions, such as the importance of developing transition strategies and early retention planning.

Other efforts have been initiated or are planned; examples include the following:

¹⁰GAO, *High-Risk Series: An Update*, [GAO-01-263](#) (Washington, D.C.: January 2001); GAO, *High-Risk Series: An Update*, [GAO-03-119](#) (Washington, D.C.: January 2003); GAO, *High-Risk Series: An Update*, [GAO-05-207](#) (Washington, D.C.: January 2005); GAO, *Performance Accountability Series--Major Management Challenges and Program Risks: A Governmentwide Perspective*, [GAO-01-241](#) (Washington, D.C.: January 2001); GAO, *Major Management Challenges and Program Risks: A Governmentwide Perspective*, [GAO-03-95](#) (Washington, D.C.: January 2003); GAO, *Major Management Challenges and Program Risks: National Aeronautics and Space Administration*, [GAO-01-258](#) (Washington, D.C.: January 2001); and GAO, *Major Management Challenges and Program Risks: National Aeronautics and Space Administration*, [GAO-03-114](#) (Washington, D.C.: January 2003); GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, [GAO-04-39](#) (Washington, D.C.: Dec. 11, 2003); GAO, *A Model of Strategic Human Capital Management*, [GAO-02-373SP](#) (Washington, D.C.: Mar. 15, 2002); and GAO, *Human Capital: A Self-Assessment Checklist for Agency Leaders*, [GAO/OCG-00-14G](#) (Washington, D.C.: Sept. 1, 2000). See also www.gao.gov/pas/2005.

¹¹Enacted in February 2004, the NASA Flexibility Act of 2004 (P.L. 108-201) amends title 5, United States Code, by inserting a new chapter 98 in that title, which provides new authorities to NASA. On March 26, 2004, NASA submitted a written workforce plan for using its new authorities to Congress.

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- contracted with the National Academy of Public Administration to assist it in planning for the space shuttle's retirement and transitioning to future programs and
 - began devising an acquisition strategy for updating propulsion system prime contracts at MSFC to take into account the Vision's goal of retiring the space shuttle following completion of the ISS.

NASA's prime contractor for space shuttle operations, USA, has also taken some preliminary steps, but its progress with these efforts depends on NASA making decisions that impact contractor requirements through the remainder of the program. For example, USA has begun to define its critical skills needs to continue supporting the Space Shuttle Program, devised a communication plan, contracted with a human capital consulting firm to conduct a comprehensive study of its workforce; and continued to monitor indicators of employee morale and workforce stability. Contractor officials said that further efforts to prepare for the space shuttle's retirement and its impact on their workforce are on hold until NASA first makes decisions that impact the space shuttle's remaining number of flights and thus the time frames for retiring the program and transitioning its assets.

The Potential Impact of Workforce Problems and Other Challenges the Space Shuttle Program Faces Highlight the Need for Workforce Planning

Making progress toward developing a detailed strategy for sustaining a critically skilled space shuttle workforce through the program's retirement is important given the impact that workforce problems could have on NASA-wide goals. According to NASA officials, if the Space Shuttle Program faces difficulties in sustaining the necessary workforce, NASA-wide goals, such as implementing the Vision and proceeding with space exploration activities, could be impacted. For example, workforce problems could lead to a delay in flight certification for the space shuttle, which could result in a delay to the program's overall flight schedule, thus compromising the goal of completing assembly of the ISS by 2010. In addition, officials said that space exploration activities could slip as much as 1 year for each year that the space shuttle's operations are extended because NASA's progress with these activities relies on funding and assets that are expected to be transferred from the Space Shuttle Program to other NASA programs.

NASA officials told us they expect to face various challenges in sustaining the critically skilled space shuttle workforce. These challenges include the following:

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- *Retaining the current workforce.* Because many in the current workforce will want to participate in or will be needed to support future phases of implementing the Vision, it may be difficult to retain them in the Space Shuttle Program. In addition, it may be difficult to provide certain employees with a transition path from the Space Shuttle Program to future programs following retirement.
 - *Impact on the prime contractor for space shuttle operations.* Because USA was established specifically to perform ground and flight operations for the Space Shuttle Program, its future following the space shuttle's retirement is uncertain. Contractor officials stated that a lack of long-term job security would cause difficulties in recruiting and retaining employees to continue supporting the space shuttle as it nears retirement. In addition, steps that the contractor may have to take to retain its workforce, such as paying retention bonuses, are likely to require funding above normal levels.
 - *Governmentwide budgetary constraints.* Throughout the process of retiring the space shuttle, NASA, like other federal agencies, will have to contend with urgent challenges facing the federal budget that will put pressure on discretionary spending—such as investments in space programs—and require NASA to do more with fewer resources.

Several Factors Have Impeded Workforce Planning Efforts

While the Space Shuttle Program is still in the early stages of planning for the program's retirement, its development of a detailed long-term strategy to sustain its future workforce is being hampered by several factors:

- *Near-term focus on returning the space shuttle to flight.* Since the Space Shuttle Columbia accident, the program has been focused on its near-term goal of returning the space shuttle safely to flight. While this focus is understandable given the importance of the space shuttle's role in completing assembly of the ISS, it has led to the delay of efforts to determine future workforce needs.
- *Uncertainties with respect to implementing the Vision.* While the Vision has provided the Space Shuttle Program with the goal of retiring the program by 2010 upon completion of the ISS, the program lacks well-defined objectives or goals on which to base its workforce planning efforts. For example, NASA has not yet determined the final configuration of the ISS, the final number of flights for the space shuttle, how ISS operations will be supported after the space shuttle is retired, or the type of vehicle that will be used for space exploration. These determinations are important because they impact decisions

about the transition of space shuttle assets. Lacking this information, NASA officials have said that their ability to progress with detailed long-term workforce planning is limited.

Despite Uncertainties, NASA Could Follow a Strategic Human Capital Management Approach

Despite these uncertainties, the Space Shuttle Program could follow a strategic human capital management approach to plan for sustaining its critically skilled workforce. Studies by several organizations, including GAO, have shown that successful organizations in both the public and private sectors follow a strategic human capital management approach, even when faced with an uncertain future environment.

In our March 2005 report, we made recommendations aimed at better positioning NASA to sustain a critically skilled space shuttle workforce through retirement. In particular, we recommended that the agency begin identifying the Space Shuttle Program's future workforce needs based upon various future scenarios the program could face. Scenario planning can allow the agency to progress with workforce planning, even when faced with uncertainties such as those surrounding the final number of space shuttle flights, the final configuration of the ISS and the vehicle that will be developed for exploration. The program can use the information provided by scenario planning to develop strategies for meeting the needs of its potential future scenarios. NASA concurred with our recommendation, and NASA's Assistant Associate Administrator for the Space Shuttle program is leading an effort to address the recommendation.

Since we issued our report and made our recommendation, NASA has taken action and publicly recognized that human capital management and critical skills retention will be a major challenge for the agency as it moves toward retiring the space shuttle. This recognition was most apparent at NASA's Integrated Space Operations Summit held in March 2005. As part of the Summit process, NASA instituted panel teams to examine the Space Shuttle Program's mission execution and transition needs from various perspectives and make recommendations aimed at ensuring that the program will execute its remaining missions safely as it transitions to supporting emerging exploration mission needs. The reports that resulted from these examinations are closely linked by a common theme—the importance of human capital management and critical skills retention to ensure success. In their reports, the panel teams highlighted similar challenges to those that we highlighted in our report. The panels made various recommendations to the Space Flight Leadership Council on steps that the program should take now to address human capital concerns. These recommendations included developing and implementing a critical skills retention plan, developing a communication plan to ensure the

workforce is informed, and developing a detailed budget that includes funding for human capital retention and reductions, as well as establishing an agencywide team to integrate human capital planning efforts.

Conclusions

There is no question that NASA faces a challenging time ahead. Key decisions have to be made regarding final configuration and support of the ISS, the number of shuttle flights needed for those tasks, and the timing for development of future programs, such as the CEV—all in a constrained funding environment. In addition, any schedule slip in the completion of the construction of the ISS or in the CEV falling short of its accelerated initial availability (as soon as possible after space shuttle retirement) may extend the time the space shuttle is needed. But whatever decisions are made and courses of action taken, the need for sustaining a critically skilled workforce is paramount to the success of these programs. Despite a limited focus on human capital management in the past, NASA now acknowledges that it faces significant challenges in sustaining a critically skilled workforce and has taken steps to address these issues. We are encouraged by these actions and the fact that human capital management and critical skills retention was given such prominent attention throughout the recent Integrated Space Operations Summit process. The fact that our findings and conclusions were echoed by the panel teams established to support the Integrated Space Operations Summit is a persuasive reason for NASA leadership to begin addressing these human capital issues early and aggressively.

Madam Chairman, this concludes my prepared statement. I would be pleased to respond to any questions that you or other Members of the Subcommittee may have.

Contacts and Acknowledgments

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