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Subcommittee on Science and Space

Committee on Commerce, Science, and Transportation

United States Senate

Statement by:
Dr. Michael D. Griffin
Administrator

109th Congress

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Madam Chair and Members of the Subcommittee; thank you for the opportunity to appear before you today to discuss the status and role of the Space Shuttle in human space flight, our plans for the Shuttle's retirement, our progress in minimizing the gap between the retirement of the Space Shuttle and the introduction of the Crew Exploration Vehicle.

On January 14, 2004, President George W. Bush announced the *Vision for Space Exploration*. The President's directive gave NASA a new and historic focus and clear objectives. The fundamental goal of this directive for the Nation's space exploration program is "...to advance U.S. scientific, security, and economic interests through a robust space exploration program." In issuing this directive, the President committed the Nation to a journey of exploring the solar system and beyond, returning humans to the Moon, and sending robots and ultimately humans to Mars and other destinations. NASA embraced this direction and began a long-term transformation to enable us to achieve this goal.

The first steps in enabling the *Vision for Space Exploration* are to return the Space Shuttle fleet to flight, to focus the use of the Space Shuttle on completing assembly of the International Space Station, to retire the Space Shuttle by 2010, and to replace it as soon as possible thereafter with the new Crew Exploration Vehicle (CEV). Given the importance of ensuring that the Space Shuttle is returned to flight safely, the Space Shuttle program and, indeed, the whole of NASA has been devoting its available resources and human capital to ensuring that this first step is executed to the best of our abilities. Once the two Return to Flight missions are behind us and we have developed a higher level of confidence in the knowledge of the Shuttle debris environment, we can focus a greater level of attention on the important issues surrounding Space Shuttle transition and the development of the next generation of human spaceflight vehicles.

Space Shuttle Return to Flight

On April 28, 2005, the Space Shuttle program management recommended that we extend our planning for the first Return to Flight mission, STS-114, to support the launch window that opens in July 2005. I concurred with this recommendation. This change was not the result of any single problem, but instead reflected the need to take additional time to perform our verification and validation reviews, and to assess the results from the External Tank (ET) fueling test performed on April 14, 2005. We knew that there were some open questions going into these reviews and tests, and we had very detailed plans for

developing answers to those questions. We also understood that the reviews and tests might raise additional questions before Return to Flight, and that we would have to be prepared to review our plans and launch opportunities in light of this. That is exactly what happened. One of the most notable outcomes was our decision to modify the feed line bellows area with an electrically powered heater to further reduce or eliminate the ice that naturally forms in the area.

This decision to insert some additional planning time to support a mid-July launch opportunity was not made lightly. Everyone in the Space Shuttle program recognizes that we have an extremely important mission to carry out, and that completing assembly of the International Space Station and executing the *Vision for Space Exploration* cannot happen until we return the Space Shuttle to flight. At the same time, this change reflects our continuing commitment to remain focused on safety of flight considerations and prudent engineering decisions. Transporting people into space remains risky compared to most other human endeavors. We must make sure that every decision to send people on missions into space is made with the utmost concern for their safety.

Today, work continues in preparation for another ET tanking test scheduled for as early as tomorrow, May 19, while the STS-114 Shuttle stack is still at its launch pad. Engineers and technicians are adding instrumentation to the tank to help troubleshoot two problems that were detected during its first tanking test on April 14. The instrumentation will provide data to further analyze and diagnose the cause for these two problems: the liquid hydrogen sensors that gave intermittent readings and the liquid hydrogen pressurization relief valve that cycled more times than standard during last month's test. Following the tanking test, technicians will prepare for rolling back Discovery to the Vehicle Assembly Building (VAB) no earlier than May 24. In the VAB, Discovery will be removed from its ET and lowered into the transfer aisle.

It has taken an extraordinary effort to return the Space Shuttle fleet to flight readiness status. 116 individual hardware modifications (41 of which were directly related to the 15 Return to Flight recommendations of the *Columbia* Accident Investigation Board [CAIB]) and over 3.5 million work-hours have gone into Return to Flight, raising the bar, and launch processing activities on Space Shuttle *Discovery* alone. Our Return to Flight effort has been focused on identifying hazards, re-designing current systems to eliminate or control those hazards, providing means for warning that hazards might have occurred during flight, and emplacing standardized special procedures to counter any hazardous conditions that might arise. We have eliminated the External Tank bipod foam which was the proximate cause of the Space Shuttle *Columbia* accident on February 1, 2003. The crews on board *Discovery* and the International Space Station will now be able to detect critical damage to the Space Shuttle's thermal protection system during the first two development test flights and, in the unexpected event of severe damage, to take shelter in the International Space Station until a rescue mission can be launched. We have gone well beyond the recommendations of the CAIB to reduce risks and provide additional safety measures through added hardware improvements and procedural changes.

Return to Flight has been a massive effort, focusing the energies of every technical discipline across all the NASA Centers and Space Shuttle contractors on a very specific objective. It has been, in short, an example of NASA at its finest. I am very proud of this Space Shuttle team and this Agency for their hard work, their diligence, and their incomparable expertise and professionalism during these difficult times.

But returning the Space Shuttle fleet to flight status is only the first step in the Nation's *Vision for Space Exploration*. Over the next few years, the Space Shuttle fleet will resume executing some of the most complex missions ever attempted in space. The return to Space Shuttle operations means that NASA can once again return to assembly of the International Space Station. The first two Space Shuttle Return to Flight missions, STS-114 and STS-121, are development test and logistics missions which will focus on carrying cargo to the Station and thoroughly exercising the extensive hardware and process changes made

during the past twenty-seven months. Following those two flights, the crew of STS-115 will resume the assembly of the International Space Station. We will complete assembly of the International Space Station using the minimum number of Space Shuttle flights necessary.

Space Shuttle Transition - Scope

As the Space Shuttle resumes its mission, NASA will begin tackling an equally challenging assignment – ensuring a safe and orderly retirement of the Space Shuttle system by 2010 and a graceful transition of the Space Shuttle knowledge, workforce, and assets to future exploration missions. We need to maintain a robust program that is capable of safely executing the remaining Space Shuttle missions while, at the same time, not displacing the orderly pursuit of necessary transition activities.

This effort could very well be one of the largest single planned transitions NASA (or any federal agency) has ever undertaken. The Space Shuttle program occupies 640 facilities, utilizes over 900,000 equipment line items, and directly employs over 2,000 civil servants and more than 15,000 work-year-equivalent prime contractors, with an additional 3,000 people working indirectly on Space Shuttle activities at all NASA Centers. Thousands more are employed at the subcontractor level in 43 states across the country. The total equipment value held by the Program is over $12 billion. The total facilities value held by the Program is approximately $5.7 billion (approximately one-third of the value of NASA's entire facility inventory), mostly at the field centers. There are also approximately 1,500 active suppliers and 3,000 – 4,000 qualified suppliers that directly support the Space Shuttle program.

Of all these assets, the most important are, of course, the people. Space Shuttle transition will have an unavoidable impact on NASA's workforce. The early transition of workforce elements, the need to retain segments of that workforce, and the transition of program knowledge to future programs must all be addressed. We will ensure that this transition treats these dedicated people with the respect they deserve, and that their knowledge and experience will be captured or converted as we begin the next phase of exploration. There will be challenges, but we will ensure that critical skills are retained for safe mission execution through the operational life of the program.

NASA and the Space Shuttle program will also face significant challenges in terms of balancing different technical and programmatic requirements: (1) maintaining access to the necessary equipment, facilities, and vendors needed through Space Shuttle flyout; (2) identifying and maintaining those capabilities that may be needed for next-generation exploration systems activities, and; (3) retiring unneeded capabilities to free resources that will support future exploration. For example, because the amount of flight hardware accumulated (including spares) will be sufficient to meet the current mission manifest through 2010, several key Space Shuttle hardware vendors and sub-tier suppliers will be ending their relationship with the program prior to 2010. Draw-down decisions need to be made with regard to equipment and facilities which currently support (and are supported by) the Space Shuttle program. These resources will need to be characterized and dispositioned in such a way that either supports exploration goals or removes them from NASA's books.

Many of these decisions depend upon the role that Space Shuttle knowledge, workforce, hardware, and infrastructure will play in follow-on launch vehicles. NASA is continuing to analyze next-generation crew and heavy-lift launch requirements in support of the *Vision for Space Exploration*, including the degree to which those requirements could be met by boosters derived from existing Space Shuttle propulsion components and systems. Flight-proven Space Shuttle propulsion elements (including the Space Shuttle Main Engines, the Solid Rocket Boosters, and the External Tank, as well as some of the existing Space Shuttle infrastructure and workforce) will be carefully evaluated, as their use may enable more rapid development of crew and heavy lift capability than other alternatives like Evolved Expendable

Launch Vehicles (Delta IV and Atlas V). A decision to use Space Shuttle propulsion elements as part of our next-generation space transportation architecture would have a significant impact on Space Shuttle transition planning. However, since these launch vehicle requirements are not yet fully defined, current Space Shuttle transition planning must take into account the risks of prematurely terminating Space Shuttle vendors and retiring equipment and facilities that could possibly be needed to fulfill these requirements.

Space Shuttle transition will also be affected by the number and pacing of flights needed to complete assembly of the International Space Station. NASA is also currently examining alternative configurations for the Space Station that meet the goals of the *Vision* and the needs of our international partners, while requiring as few Shuttle flights as possible to complete assembly. This effort will be a factor in the formulation of NASA's FY 2007 budget, and we will keep Congressional Committees informed as the study effort progresses.

I believe that Space Shuttle transition will be one of the largest, most complex, and most emotionally-charged tasks facing NASA during the initial phases of the *Vision*. It cannot be started too soon.

Space Shuttle Transition - Processes

The single most important requirement in Space Shuttle transition is to maintain the highest level of flight and ground safety through the life of the Program. The last flight of the Space Shuttle must be just as safe as the upcoming Return to Flight missions. The success of Space Shuttle transition will also depend upon serving the goals of the *Vision for Space Exploration* in such a way that takes maximum advantage of existing programs and personnel, minimizes the negative impacts of transition on Space Shuttle team morale and performance, and ensures full compliance with all relevant federal, state, and local laws and standards.

Our transition planning began soon after the release of the *Vision for Space Exploration* a year ago. While our efforts over the past two years have been dedicated to Return to Flight, NASA has also concluded the exploratory phase of its Space Shuttle transition activities and has begun to set out the next steps in transition planning. We have benchmarked phaseouts in other high-technology, systems-intense programs, including the ongoing retirement of the Titan IV program, which just had its final launch out of Cape Canaveral on April 29, 2005. The Space Shuttle program has also asked the National Academy of Public Administration (NAPA) to assist us in our transition activities, particularly in the development of strategies and plans for the transition from the Space Shuttle program to the programs that will implement the *Vision for Space Exploration.*

Through the recent Integrated Space Operations Summit this past March, NASA engaged a broad community on a number of issues affecting both the Space Shuttle and International Space Station programs. For this past year's annual Summit, NASA chartered one panel specifically to study Space Shuttle transition. That panel considered several programs, including the Titan IV, and developed recommendations intended to lay the foundation for managing Space Shuttle transition activities. In accordance with these recommendations, the Space Operations Mission Directorate will establish the position of Space Transportation System Transition Manager. The initial efforts of this manager will be to develop the planning as recommended by the Transition Panel and to look for candidate areas for transition from the Space Shuttle program. We will select an individual to fill this position shortly.

The Space Shuttle program recognizes the importance of maintaining an experienced workforce to safely execute the Space Shuttle's mission through the end of the decade. The NASA Workforce Flexibility Act of 2004 provides the Agency with vital tools, such as the authority to provide workforce retention

bonuses in critical skill areas, that will help retain the necessary human capital needed during mission execution. NASA has nine panels and teams looking at workforce issues across the Agency, in addition to the Integrated Space Operations Summit Transition Panel's workforce assessment. We have also invited human capital experts from government and private industry to advise us on best practices during Space Shuttle program phaseout.

Many of our contractor partners have begun taking steps (such as defining critical skill requirements and bringing in human capital consulting firms) to counter the impact of transition on mission execution. Provisions in the follow-on to the Space Flight Operations Contract (which runs through September 2006) will require the prime Space Shuttle operations contractor, United Space Alliance, to prepare for sustaining its required workforce, including submitting a critical skills retention plan.

Accelerating the Crew Exploration Vehicle

A cornerstone of the *Vision for Space Exploration* is a Crew Exploration Vehicle (CEV) and its associated launch system. The CEV will be developed in the latter part of this decade and deployed operationally as soon as possible. The primary mission of the CEV will be the exploration of the Moon and other destinations, but initially it will conduct missions in Earth orbit, including missions to the International Space Station.

Our earlier plans called for operational deployment of the CEV not later than 2014. As I testified during my confirmation hearing, I believe that the CEV development must be accelerated in order to minimize the gap between the 2010 Space Shuttle retirement and the first operational flight of the CEV. NASA has embarked upon a rigorous review of the Crew Exploration Vehicle (CEV) architecture to determine opportunities to accelerate the availability of the CEV. This assessment is a part of the "Exploration Systems Architecture Study" (ESAS), which I chartered on April 29, 2005. The product of this analysis is anticipated by mid-July 2005. Acceleration of the CEV program will be facilitated by down-selecting to a single contractor sooner than originally planned, and by deferring other elements of the exploration systems research and technology plan, like demonstration of nuclear electric propulsion, not required for the CEV or for the early phases of human return to the Moon.

The CEV will conduct missions in Earth orbit, including missions to the ISS, but its primary mission will be to support exploration of the Moon and other destinations. In addition, NASA's Exploration Systems Mission Directorate will be responsible for developing and acquiring crew and cargo services to support the International Space Station, and funds have been transferred to that Directorate, as reflected in the May update to the FY 2005 Operating Plan.

NASA needs to communicate our view of the CEV launch architecture and our requirements, and we will keep Congressional Committees informed as the ESAS study effort progresses. Going forward, the Agency will need a launch system for the CEV, one which does not at present exist. Two obvious possibilities exist by which we might obtain such a vehicle. The first is to develop a launch system derived from Shuttle components, specifically the SRB with a new upper stage. The second option is to upgrade the proposed heavy-lift versions of EELV, again in all likelihood with a new upper stage. As NASA Administrator, I must be a responsible steward of our funds, and a key aspect of the Agency's analysis of alternatives will be to capitalize on existing technical and workforce assets in a cost-effective and efficient way. NASA's goal is to develop a CEV capable of operating safely soon after the retirement of the Space Shuttle.

Summary

Space Shuttle transition represents an enormous challenge for NASA and for the Nation as a whole. While we have benchmarked other programs that are similar in scope to the Space Shuttle, the Shuttle is one of the largest single programs for which an orderly transition to disposal has ever been required. I do not want, and we should not want, to repeat the mistakes made in the aftermath of the Apollo program, where many unique capabilities were shut down abruptly and irretrievably. We must transition the Space Shuttle in a way that ensures continued safety in our ongoing operations, maximizes the efficiency with which we utilize our resources, respects the Space Shuttle workforce, and protects critical national capabilities that will be needed to support the *Vision for Space Exploration*. There will be hard decisions to be made over the next five years. It is vital, however, that we remain focused on the worthy and ambitious goals laid out by the President on January 14, 2004.

Thank you for the opportunity to testify today, and I look forward to responding to any questions you may have.