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Testimony

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NASA

Key Management and Program Challenges

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NASA

Key Management and Program Challenges

Why GAO Did This Study

The National Aeronautics and Space Administration (NASA) is in the midst of many changes and one of the most challenging periods in its history. The space shuttle is slated to retire this year, the International Space Station nears completion but remains underutilized, and a new means of human space flight is under development. Most recently, the administration has proposed a new direction for NASA.

Amid all this potential change, GAO was asked to review the key issues facing NASA. This testimony focuses on four areas: 1) retiring the space shuttle; 2) utilizing and sustaining the International Space Station; 3) continuing difficulty developing large-scale systems, including the next generation of human spaceflight systems; and 4) continuing weaknesses in financial management and information technology systems.

In preparing this statement, GAO relied on completed work.

To address some of these challenges, GAO has recommended that NASA: provide greater information on shuttle retirement costs to Congress, take actions aimed at more effective use of the station research facilities, develop business cases for acquisition programs, and improve financial and IT management. NASA concurred with GAO's International Space Station recommendations, and has improved some budgeting and management practices in response.

What GAO Found

The major challenges NASA faces include:

- **Retiring the Space Shuttle**. The impending end of shuttle missions poses challenges to the completion and operation of the International Space Station, and will require NASA to carry out an array of activities to deal with shuttle staff, equipment, and property. This year the shuttle is scheduled to fly its final six missions to deliver hardware, supplies, and an international laboratory to the International Space Station. NASA officials remain confident that the current manifest can be accomplished within the given time, and add that should delays occur, the space station can still function. According to NASA, there are trade-offs the agency can make in what it can take up to support and sustain the station. However, failure to complete assembly would further reduce the station's ability to fulfill its research objectives and short the station of critical spare parts that only the shuttle can currently deliver. Retirement of the shuttle will require disposing of facilities; ensuring the retention of critical skills within NASA's workforce and its suppliers; and disposing of more than 1 million equipment items.

- **Utilizing the International Space Station**. The space station, which is nearly complete, faces several significant challenges that may impede efforts to maximize utilization of its research facilities. These include the retirement of the shuttle and the loss of its unmatched capacity to move cargo and astronauts to and from the station; the uncertain future for the station beyond 2015; and the limited time available for research due to competing demands for the crew's time.

- **Developing Systems**. A common theme in NASA projects—including the next generation of space flight efforts—is that they cost more and take longer to develop than planned. GAO again found this outcome in a recently completed assessment of NASA's 19 most costly projects—with a combined life-cycle cost of $66 billion. Within the last 3 years, 10 of the 19 projects experienced cost growth averaging $121.1 million or 18.7 percent, and the average schedule growth was 15 months. A number of these projects had experienced considerable cost growth before the most recent baselines were set.

- **Managing Finances and IT**. NASA continues to struggle to put its financial house in order. GAO and others have reported for years on these efforts. The NASA Inspector General identified financial management as one of NASA's most serious challenges. In addition, NASA remains vulnerable to disruptions in its information technology network. NASA has made important progress in implementing security controls and aspects of its information security program. However, it has not always implemented sufficient controls to protect information and systems supporting its mission directorates.

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United States Government Accountability Office

Madam Chairwoman and Members of the Subcommittee:

Thank you for inviting me to discuss the challenges facing the National Aeronautics and Space Administration (NASA). NASA is in the midst of many changes and one of the most challenging periods in its history: the space shuttle is slated to retire this year after flying for 29 years; the International Space Station draws closer both to its completion but remains underutilized; and the future vehicles for human space flight are experiencing problems in development and have been hotly debated and recently reviewed by an independent commission.

The Administration in its 2011 budget is proposing to cancel the Constellation Systems program and replace it with a new approach that uses the commercial space industry and international partnerships to develop new technologies for space exploration. Amid all this potential change, one thing that will most likely remain constant is NASA's need to manage programs and projects within a fiscally constrained environment. This will require hard choices among competing priorities within the organization, which must balance its core missions in science, aeronautics, and human space flight and exploration. In addition, NASA will be competing for an ever-shrinking share of discretionary spending against other national priorities such as the economy, fighting terrorism, and health care reform.

Over the years NASA has had significant achievements exploring space, helping us understand Earth's environment, and conducting fundamental research in the aeronautical disciplines. Unfortunately, it has not achieved the same level of results on its business side. For 20 years, NASA acquisition management has been on GAO's list of federal programs and operations at high risk and vulnerable to fraud, waste, abuse, and mismanagement. To its credit, NASA has made a concerted effort to improve its acquisition management and continues to work constructively with GAO to address systemic weaknesses in program/project management, contractor performance, business processes, financial management, and information technology.

The broad changes proposed for NASA do not change the basic challenges facing the agency. Against this backdrop, my testimony today focuses on four management and program challenges: (1) retiring of the space shuttle, (2) utilizing and sustaining the International Space Station, (3) continuing difficulty developing large-scale systems, and (4) continuing weaknesses in financial management and information technology systems.

In preparing this statement, we relied on completed and ongoing work. All of the work used in preparing this statement was performed in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. We have made a number of recommendations to address some of the challenges we identified.

NASA Challenges

Retiring of the Space Shuttle

This year the space shuttle is scheduled to fly its final six missions to deliver hardware, supplies, and an international scientific laboratory to the International Space Station. NASA officials remain confident that the current flight manifest can be accomplished within the given time, and add that should delays occur, the International Space Station can still function. According to NASA, there are trade-offs the agency can make in what it can take up to support and sustain the station. However, failure to complete assembly as currently planned would further reduce the station's ability to fulfill its research objectives and deprive the station of critical spare parts that only the shuttle can deliver. The recent review completed by the U.S. Human Space Flight Plans Committee included the option of flying the space shuttle through 2011 in order to complete the International Space Station. However, the Committee noted that there are currently no funds in NASA's budget for additional shuttle flights. Most recently, the Administration is proposing over $600 million in the fiscal year 2011 budget to ensure that the space shuttle can fly its final missions, in case the space shuttle's schedule slips into fiscal year 2011.

Retirement of the shuttle will involve many activities that warrant special attention. These include: disposing of the facilities that no longer are needed while complying with federal, state, and local environmental laws and regulations; ensuring the retention of critical skills within NASA's workforce and its suppliers; and disposing of over 1 million equipment items. In addition, the total cost of shuttle retirement and transition—to include the disposition of the orbiters themselves—is not readily transparent in NASA's budget. We have recommended that NASA clearly identify all direct and indirect shuttle transition and retirement costs, including any potential sale proceeds of excess inventory and environmental remediation costs in its future budget requests. NASA

provided this information to the House and Senate Appropriations committees in July 2009 but did not identify all indirect shuttle transition and retirement costs in its fiscal year 2010 budget request. We look forward to examining the fiscal year 2011 budget request to determine whether this information is identified.

Lastly, NASA has recognized that sustaining the shuttle workforce through the retirement of the shuttle while ensuring that a viable workforce is available to support future activities is a major challenge. We commend NASA for its efforts to understand and mitigate the effect of the space shuttle's retirement on the civil service and contractor workforce. Nevertheless, how well NASA executes its workforce management plans as they retire the space shuttle will affect the agency's ability to maintain the skilled workforce to support space exploration.

Utilizing and Sustaining the International Space Station

Although it is nearing completion, the International Space Station faces several significant challenges that may impede efforts to maximize utilization of research facilities available onboard. These include: the retirement of the Space Shuttle in 2010 and the loss of its unmatched capacity to move cargo and astronauts to and from the station; the uncertain future for the station beyond 2015; and the limited time available for research due to competing demands for the crew's time.

We have previously reported that the International Space Station will face a significant cargo supply shortfall without the Space Shuttle's great capacity to deliver cargo to the station and return it to earth.[1] NASA plans on using a mixed fleet of vehicles, including those developed by international partners, to service the space station on an interim basis. However, international partners' vehicles alone cannot fully satisfy the space station's cargo resupply needs. Without a domestic cargo resupply capability to augment this mixed fleet approach, NASA faces a 40 metric ton (approximately 88,000 pounds) cargo resupply shortfall between 2010 and 2015. While NASA is sponsoring commercial efforts to develop vehicles capable of carrying cargo to the station and the administration has endorsed this approach, none of those currently in development has

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[1]GAO, *NASA: Commercial Partners Are Making Progress, but Face Aggressive Schedules to Demonstrate Critical Space Station Cargo Transport Capabilities*, GAO-09-618 (Washington, D.C.: June 16, 2009).

been launched into orbit, and the vehicles' aggressive development schedules leave little room for the unexpected.

Furthermore, upon completion of construction, unless the decision is made to extend station operations, NASA has only 5 years to execute a robust research program before the International Space Station is deorbited. The leaves little time to establish a strong utilization program. At present, NASA projects that its share of the International Space Station research facilities will be less than fully utilized by planned NASA research. Specifically, NASA plans to utilize only 48 percent of the racks that accommodate scientific research facilities onboard, with the remainder available for use by others.[2] Congress has directed NASA to take all necessary steps to ensure that the International Space Station remains a viable and productive facility capable of potential utilization through at least 2020.[3] The Administration is proposing in its fiscal year 2011 budget to extend operations of the International Space Station to 2020 or beyond in concert with its international partners.

Lastly, NASA faces a significant constraint for science on board the space station because of limited crew time. There can only be six crew members aboard the station at one time due to the number of spaces available in the "lifeboats," or docked spacecraft that can transport the crew in case of an emergency. As such, crew time cannot presently be increased to meet increased demand. Though available crew time may increase as the six-person crew becomes more experienced with operating the space station efficiently or if the crew volunteers its free time for research, crew time for U.S. research remains a limiting factor. According to NASA officials, potential National Laboratory researchers should design their experiments to be as automated as possible or minimize crew involvement required for their experiments to ensure that they are accepted for flight.

We have recommended that NASA implement actions, such as developing a plan to broaden and enhance ongoing outreach to potential users and creating a centralized body to oversee U.S. space station research decision making, including the selection of all U.S. research to be conducted on

[2]Scientific research facilities currently available inside the space station are generally mounted in modular, refrigerator-sized mounts called racks or ExPRESS racks, which provide the utilities necessary for conducting research.

[3]National Aeronautics and Space Administration Authorization Act of 2008, Pub. L. No. 110-422 § 601.

board and ensuring that all U.S. International Space Station National Laboratory research is meritorious and valid. NASA concurred with our recommendation and is researching the possibility of developing a management body to manage space station research, which would make the International Space Station National Laboratory similar to other national laboratories.

Continuing Difficulty Developing Large-scale Systems

NASA projects have produced ground-breaking research and advanced our understanding of the universe. However, one common theme binds most of the projects—they cost more and take longer to develop than planned. As we reported in our recently completed assessment of NASA's 19 most costly projects—which have a combined life-cycle cost that exceeds $66 billion—the agency's projects continue to experience cost growth and schedule delays.[4] Ten of the 19 projects, which had there baselines set within the last 3 years, experienced cost growth averaging $121.1 million or 18.7 percent and the average schedule growth was 15 months.[5] For example, the Glory project has recently breached its revised schedule baseline by 16 months and exceeded its development cost baseline by over 14 percent—for a total development cost growth of over 75 percent in just 2 years.[6] Project officials also indicated that recent technical problems could cause additional cost growth. Similarly, the Mars Science Laboratory project is currently seeking reauthorization from Congress after experiencing development cost growth in excess of 30 percent. Many of the other projects we reviewed experienced challenges, including developing new or retrofitting older technologies, stabilizing engineering designs, and managing the performance of contractors and development partners.

Our work has consistently shown that reducing these kinds of problems in acquisition programs hinges on developing a sound business case for each

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[4]GAO, *NASA: Assessments of Selected Large-Scale Projects*, GAO-10-227SP (Washington, D.C.: Feb. 1, 2010.

[5]Of the 19 projects included in our review, 4 are still in the formulation phase, including Ares I and Orion, where cost and schedule baselines have yet to be established. Five of the projects just entered the implementation phase in fiscal year 2009 and therefore have not experienced cost and schedule growth.

[6]If development cost of a program will exceed the baseline estimate by more than 30 percent, then NASA is required to seek reauthorization from Congress in order to continue the program. If the program is reauthorized, NASA is required to establish new cost and schedule baselines. 42 U.S.C. § 16613(e).

project. Such a business case provides for early recognition of challenges, allows managers to take corrective action, and places needed and justifiable projects in a better position to succeed. Product development efforts that have not followed a knowledge-based business case approach have frequently suffered poor cost, schedule, and performance outcomes. A sound business case includes development of firm requirements, mature technologies, a preliminary design, a realistic cost estimate, and sound estimates of available funding and time needed before the projects proceed beyond preliminary design review. If necessary, the project should be delayed until a sound business case, demonstrating the project's readiness to move forward into product development, is in hand.

In particular, two of NASA's largest projects—Ares I and Orion, which are part of NASA's Constellation program to return to the moon—face considerable technical, design, and production challenges. NASA is actively addressing these challenges. Both projects, however, still face considerable hurdles to meeting overarching safety and performance requirements, including limiting vibration during launch, mitigating the risk of hitting the launch tower during liftoff, and reducing the mass of the Orion vehicle. In addition, we found that the Constellation program, from the onset, has faced a mismatch between funding and program needs. This finding was reinforced by the Review of U.S. Human Spaceflight Plans Committee, which reported that NASA's plans for the Constellation program to return to the moon by 2020 are unexecutable without increases to NASA's current budget.

To its credit, NASA has acknowledged that the Constellation program, for example, faces knowledge gaps concerning requirements, technologies, funding, schedule, and other resources. NASA stated that it is working to close these gaps and at the preliminary design review the program will be required to demonstrate that the program and its projects meet all system requirements with acceptable risk and within cost and schedule constraints, and that the program has established a sound business case for proceeding into the implementation phase. Even though NASA has made progress in developing the actual vehicles, the mismatch between resources and requirements remains and the administration's proposed fiscal year 2011 budget leaves the future of the program in question.

Continuing Weakness in Financial Management and Information Technology Systems

NASA has continually struggled to put its financial house in order. GAO and others have reported for years on these efforts.[7] In fact, GAO has made a number of recommendations to address NASA's financial management challenges. Moreover, the NASA Inspector General has identified financial management as one of NASA's most serious challenges. In a November 2008 report, the Inspector General found continuing weaknesses in NASA's financial management process and systems, including internal controls over property accounting. It noted that these deficiencies have resulted in disclaimed audits of NASA's financial statements since fiscal year 2003. The disclaimers were largely attributed to data integrity issues and poor internal controls. NASA has made progress in addressing some of these issues, but the recent disclaimer on the fiscal year 2009 audit shows that more work needs to be done.

We have also reported that NASA remains vulnerable to disruptions in its information technology network.[8] Information security is a critical consideration for any organization reliant on information technology and especially important for NASA, which depends on a number of key computer systems and communication networks to conduct its work. These networks traverse the Earth and beyond, providing critical two-way communication links between Earth and spacecraft; connections between NASA centers and partners, scientists, and the public; and administrative applications and functions. NASA has made important progress in implementing security controls and aspects of its information security program. However, NASA has not always implemented sufficient controls to protect the confidentiality, integrity, and availability of the information and systems supporting its mission directorates. Specifically, NASA did not consistently implement effective controls to prevent, limit, and detect unauthorized access to its networks and systems. A key reason for these weaknesses is that NASA has not yet fully implemented key activities of its information security program to ensure that controls are appropriately designed and operating effectively.

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[7]GAO, *Property Management: NASA's Goal of Increasing Equipment Reutilization May Fall Short without Further Efforts*, GAO-09-187 (Washington, D.C.: Jan. 30, 2009); *GAO; Business Modernization: NASA Must Consider Agencywide Needs to Reap the Full Benefits of Its Enterprise Management System Modernization Effort*, GAO-07-691 (Washington, D.C.: July 20, 2007); and GAO, *Financial Management Systems: Additional Efforts Needed to Address Key Causes of Modernization Failures*, GAO-06-184 (Washington, D.C.: Mar. 15, 2006).

[8]GAO, *Information Security: NASA Needs to Remedy Vulnerabilities in Key Networks*, GAO-10-4 (Washington, D.C.: Oct. 15, 2009).

During fiscal years 2007 and 2008, NASA reported 1,120 security incidents that resulted in the installation of malicious software on its systems and unauthorized access to sensitive information. NASA established a Security Operations Center in 2008 to enhance prevention and provide early detection of security incidents and coordinate agency-level information related to its security posture. Nevertheless, the control vulnerabilities and program shortfalls—which GAO identified—collectively increase the risk of unauthorized access to NASA's sensitive information, as well as inadvertent or deliberate disruption of its system operations and services. They make it possible for intruders, as well as government and contractor employees, to bypass or disable computer access controls and undertake a wide variety of inappropriate or malicious acts. As a result, increased and unnecessary risk exists that sensitive information is subject to unauthorized disclosure, modification, and destruction and that mission operations could be disrupted.

GAO has recommended actions the NASA Administrator should take to mitigate control vulnerabilities and fully implement a comprehensive information security program including: developing and implementing comprehensive and physical risk assessments; conducting sufficient or comprehensive security testing and evaluation of all relevant security controls; and implementing an adequate incident detection program. In response to our report, the Deputy Administrator noted that NASA is implementing many of our recommendations as part of an ongoing NASA strategic effort to improve information technology management and information technology security program deficiencies. The Deputy Administrator also stated that NASA will continue to mitigate the information security weaknesses identified in our report. The actions identified by the Deputy Administrator, if effectively implemented, will improve the agency's information security program.

Concluding Observations

In executing NASA's space exploration, scientific discovery, and aeronautics research missions, NASA must use its resources as effectively and efficiently as possible because of the severity of the fiscal challenges our nation faces and the wide range of competing national priorities. Establishing a sound business case before a project starts should also better position NASA management to deliver promised capability for the funding it receives. While space development programs are complex and difficult by nature, and most are one-time efforts, the nature of its work should not preclude NASA from being accountable for achieving what it promises when requesting and receiving funds. Congress will also need to do its part to ensure that NASA has the support to hold poorly performing

programs accountable in order to provide an environment where the systems portfolio as a whole can succeed with the resources NASA is given. NASA shows a willingness to face these challenges. We look forward to continuing work with NASA to develop tools to enhance the management of acquisitions and agency operations to optimize its investment in space and aeronautics missions.

Madam Chairwoman, and Members of the Subcommittee, this concludes my prepared statement. I would be happy to answer any questions you may have at this time.

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