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SPACE ACQUISITIONS

DOD Poised to Enhance Space Capabilities, but Persistent Challenges Remain in Developing Space Systems

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Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss the Department of Defense's (DOD) space acquisitions. Each year, DOD spends billions of dollars to acquire space-based capabilities to support current military and other government operations, as well as to enable DOD to transform the way it collects and disseminates information. Despite the significant investment in space, the majority of large-scale acquisition programs in DOD's space portfolio have experienced problems during the past two decades that have driven up costs by hundreds of millions and even billions of dollars and stretched schedules by years and increased technical risks. To address the cost increases, DOD altered its acquisitions by reducing the number of satellites it intended to buy, reducing the capabilities of the satellites, or terminating major space systems acquisitions. Moreover, along with the cost increases, many space acquisitions have experienced significant schedule delays—of as much as 8 years—resulting in potential capability gaps in areas such as missile warning, military communications, and weather monitoring. These problems persist.

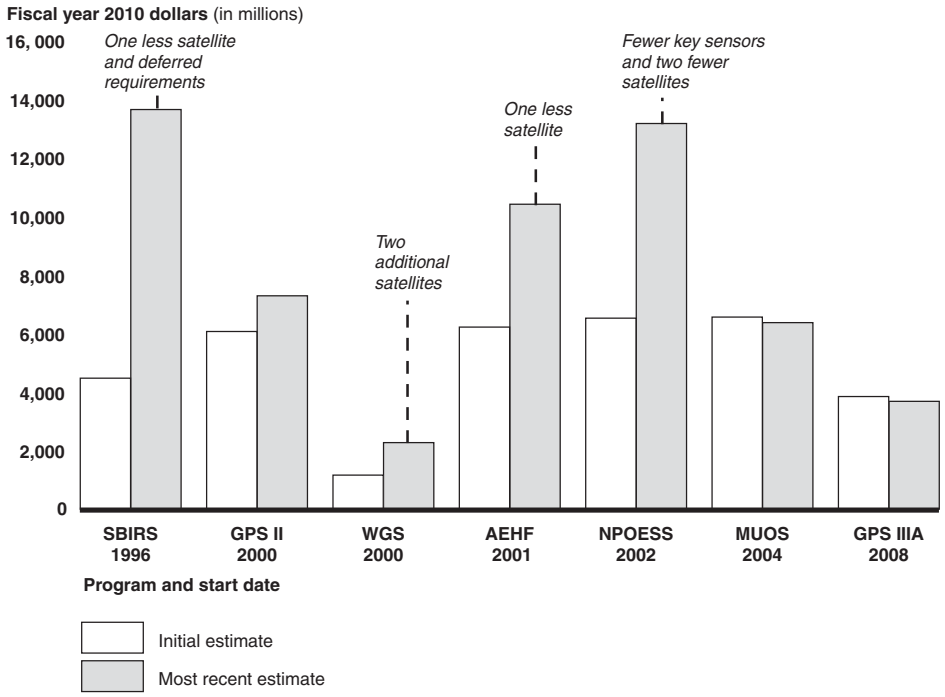
My testimony today will focus on: (1) the status of space acquisitions, (2) the efforts DOD is taking to address causes of problems and increase credibility and success in its space systems acquisitions, and (3) what remains to be done. Notably, DOD has taken the important step of acknowledging the acquisition problems of the past and is taking action to address them, including better management of the acquisition process and oversight of its contractors. Moreover, several high-risk space programs have finally resolved technical and other obstacles and are close to begin delivering capability. However, other space acquisition programs continue to face challenges in meeting their cost and schedule targets and aligning the delivery of space assets with the ground and user systems needed to support and take advantage of new capability. Additionally, it may take years for acquisition improvements to take root and produce benefits that will enable DOD to realize a better return on its investment in space. Lastly, DOD still needs to decide how to best organize, lead, and support space activities. If it does not do so, its commitment to reforms may not be sustainable.

Space Acquisition Challenges Persist

A long-standing problem in DOD space acquisitions is that program and unit costs tend to go up significantly from initial cost estimates, while in some cases, the capability that was to be produced goes down. Figures 1 and 2 reflect differences in total program and unit costs for satellites from the time the programs officially began to their most recent cost estimates. As figure 1 shows, in several cases, DOD has had to cut back on quantity and capability in the face of escalating costs. For example, two satellites and four instruments were deleted

from the National Polar-orbiting Operational Environmental Satellite System (NPOESS) and four sensors are expected to have fewer capabilities. This will reduce some planned capabilities for NPOESS as well as planned coverage. The figures below reflect the total program costs developed in fiscal year 2009. (Last year, we also compared original cost estimates to current cost estimates for the broader portfolio of major space acquisitions for fiscal years 2008 through 2013. However, we were unable to perform this analysis this year because, for most of its major weapon system programs, DOD in fiscal year 2009 did not issue complete Selected Acquisition Reports, which contain updated yearly program funding estimates needed to conduct the analysis.)

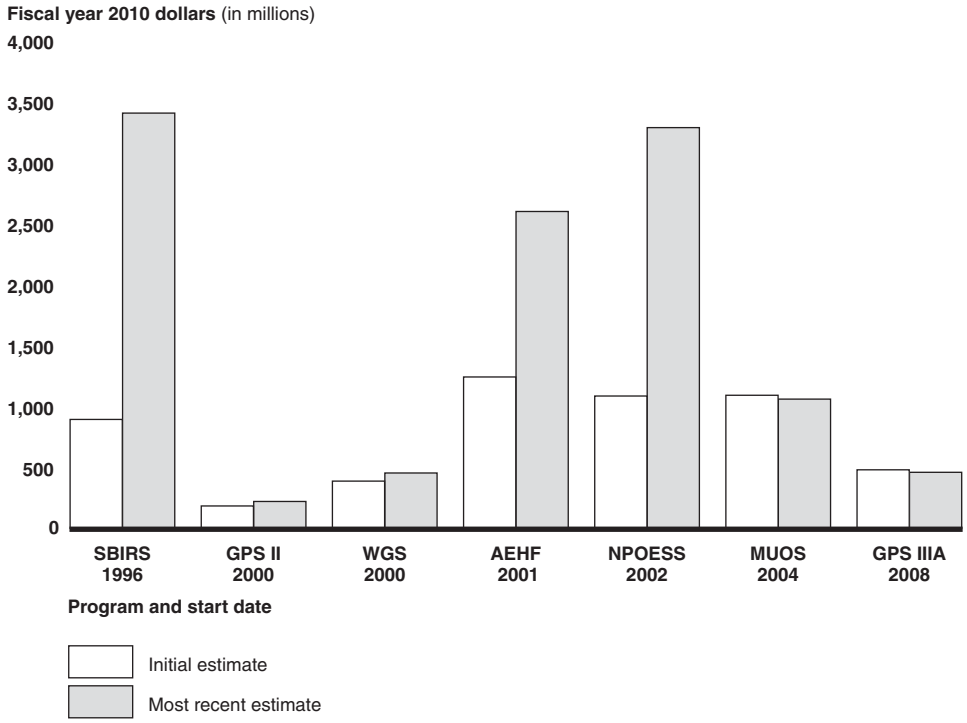
Figure 1: Differences in Total Program Costs from Program Start and Most Recent Estimates (Fiscal Year 2009)



Source: GAO analysis of DOD data.

Legend: SBIRS = Space Based Infrared System; GPS = Global Positioning System; WGS = Wideband Global SATCOM; AEHF = Advanced Extremely High Frequency; NPOESS = National Polar-orbiting Operational Environmental Satellite System; MUOS = Mobile User Objective System

Figure 2: Differences in Unit Costs from Program Start to Most Recent Estimates (Fiscal Year 2009)



Source: GAO analysis of DOD data.

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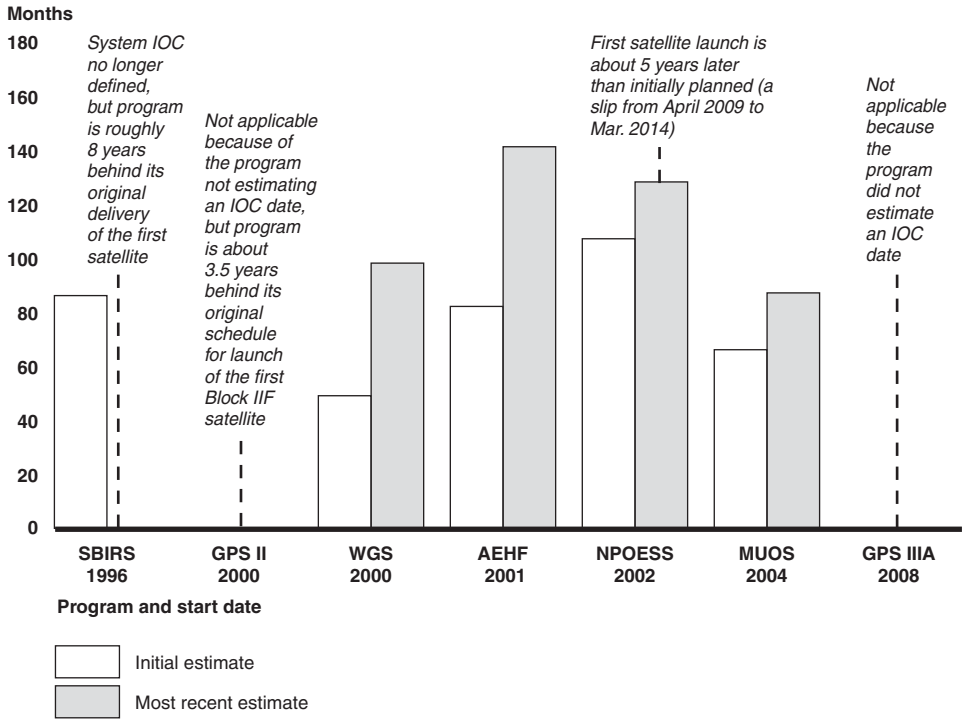
Several space acquisition programs are years behind schedule. Figure 3 highlights the additional estimated months needed for programs to deliver initial operational capabilities (IOC). These additional months represent time not anticipated at the programs' start dates. Generally, the further schedules slip, the more DOD is at risk of not sustaining current capabilities. For example, according to Air Force officials, they have requested information from the space community on how best to address a potential gap in missile warning capabilities.

Figure 3: Differences in Total Number of Months to IOC from Program Start and Most Recent Estimates



Source: GAO analysis of DOD data.

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Some Acquisition Programs Have Overcome Problems and Have Satellites Ready for Launch

DOD has made progress on several of its high-risk space programs and is expecting significant advances in capability as a result. In 2009, DOD launched the third Wideband Global SATCOM (WGS) satellite, broadening communications capability available to warfighters—and a fourth WGS satellite is slated for launch in 2011. DOD also launched two Global Positioning System (GPS) IIR-M satellites, although one has still not been declared operational because of radio signal transmission problems. Lastly, DOD supported the launch of a pair of Space Tracking and Surveillance System satellites, designed to test the tracking of ballistic missiles in support of missile defense early missile warning missions—these suffered many delays as well. The Evolved Expendable Launch Vehicle (EELV) program had its 31st consecutive successful operational launch last week.

Moreover, though it has had long-standing difficulties on nearly every space acquisition program, DOD now finds itself in a position to possibly launch the first new satellite from four different major space acquisition programs over the next 12 months that are expected to significantly contribute to missions and capabilities. These include the Global Positioning System (GPS) IIF satellites, the Advanced Extremely High Frequency (AEHF) communications satellites, and the Space Based Space Surveillance (SBSS) satellite—all of which struggled for years with cost and schedule growth, technical or design problems, as well as oversight and management weaknesses. Table 1 further describes the status of these efforts.

Table 1: Systems Nearing Launch That Have Overcome Technical and Other Problems

GPS IIF	The first GPS IIF satellite is expected to launch in mid-2010 and will upgrade timing and navigation accuracy, and add a new signal for civilian use. The satellite has been delayed over 3 years from its original launch date to May 2010—representing a further 6 month slip since we reported last year. Also, the cost of the GPS IIF program is now expected to be about $1.7 billion—almost $1 billion over the original cost estimate of $729 million. (This approximately 133 percent cost increase is not apparent in figures 1 and 2 because the GPS II modernization program includes the development and procurement of 33 satellites, only 12 of which are IIF satellites.) According to the GPS Wing, the remaining technical issues with the first IIF satellite were resolved and will not affect the scheduled launch date—the last technical issue was a desire to provide additional fault protection and this is being addressed with enhanced ground operations procedures. Additionally, the GPS Wing stated that the ground control software needed to support the first IIF launch has been thoroughly tested and in place since early this month.
AEHF	AEHF, which appears to have overcome its technical problems that delayed the first satellite's launch and increased program cost, is expected to launch in September 2010, and is expected to deliver 10 times the communications bandwidth that is available today for secure and protected communications. The launch of the first satellite has slipped almost 6 years. DOD intends to buy three more satellites, bringing the total to six (two of these additional satellites are not reflected in figures 1 and 2). The program has decided that the design specifications for the first three satellites will remain unchanged for satellites four through six, which will thus be clones except for the replacement of obsolete parts. The program office estimates that the fourth AEHF satellite will cost significantly more than the third satellite because some components that are no longer manufactured will have to be replaced and production will have to be restarted after a 4-year gap. Because of these delays, IOC has slipped about 5 years—from 2008 to 2013. The AEHF program office estimates the cost of the fifth and sixth satellites to be about $1.6 billion and $1.7 billion (then-years dollars), with estimated launch dates in 2018 and 2020, respectively.
SBSS	The first SBSS Block 10 satellite is expected to launch in 2010 and is expected to provide greatly improved space situational awareness to help better understand location and mission capabilities of all satellites and other objects in space. The launch is expected to be about 3 years later than originally planned—in part because of launch vehicle issues unrelated to the satellite. Program officials and the SBSS contractors are studying the feasibility of launching the SBSS satellite on a Delta II rocket. The program was restructured in 2006 after an independent review found that the requirements were overstated and its cost and schedule targets could not be met.

Source: GAO analysis of DOD data and previous GAO reports.

One program that appears to be overcoming remaining technical problems, but for which we are still uncertain whether it can meet its current launch date, is the

Space Based Infrared System (SBIRS) satellite program. The first of four geosynchronous earth-orbiting (GEO) satellites (two sensors have already been launched on a highly elliptical orbit) is expected to launch in December 2010 and is expected to continue the missile warning mission with sensors that are more capable than the satellites currently on orbit. Total cost for the SBIRS program is currently estimated at over $13.6 billion for four GEO satellites (and two sensors that have already been delivered and are operational), representing an increase of about $9.2 billion over the program's original cost, which included five GEO satellites. The most recent program estimate developed in 2008 set December 2009 as the launch goal for the first GEO satellite, but program officials indicate that the first GEO launch will be delayed at least another year, bringing the total delay to approximately 8 years. The reasons for the delay include poor government oversight of the contractor, technical complexities, and rework. The program continues to struggle with flight software development, and during testing last year, officials discovered hardware defects on the first GEO satellite, though the program reports that they have been resolved. The launches of subsequent GEO satellites have also slipped as a result of flight software design issues. Program officials indicate that they again intend to re-baseline the program to more realistic cost and schedule estimates by mid- to late-2010. Because of the problems on SBIRS, DOD began a follow-on system effort, now known as Third Generation Infrared Surveillance (3GIRS), to run in parallel with the SBIRS program. For fiscal year 2011, DOD plans to cancel the 3GIRS effort, but also plans to provide funds under the SBIRS program for one of the 3GIRS infrared demonstrations nearing completion.

Other Programs Still Susceptible to Cost and Schedule Overruns

While DOD is having success in readying some satellites for launch, other space acquisition programs face challenges that could further increase cost and delay targeted delivery dates. The programs that may be susceptible to cost and schedule challenges include NPOESS, Mobile User Objective System (MUOS), and GPS IIIA. Delays in both the NPOESS and MUOS programs have resulted in critical potential capability gaps for military and other government users. The GPS IIIA program was planned with an eye toward avoiding problems that plagued the GPS IIF program, but the schedule leaves little room for potential problems and there is a risk that the ground system needed to operate the satellites will not be ready when the first satellite is launched. Table 2 describes the status of these efforts in more detail.

Table 2: Programs Still Susceptible to Cost and Schedule Overruns

NPOESS	The NPOESS program has continued to experience technical problems resulting in further cost and schedule increases. The program was restructured in 2007, which led to a reduction in the number of satellites from six to four and deletions or replacements of satellite sensors. NPOESS was originally estimated to cost $6.5 billion but the latest estimate is about $13.2 billion—representing more than a 100-percent cost increase. Furthermore, the launch of the first satellite has slipped about 5 years—from April 2009 to March 2014. While the goal of the restructure was to lower future cost and schedule risks, it increased the risk of a satellite coverage gap and significantly reduced data collection capabilities. DOD programmed funds for NPOESS for fiscal year 2011, but according to the White House's Office of Science and Technology Policy, the NPOESS program is to be restructured. This would allow DOD and the Department of Commerce to embark on separate weather satellite programs to meet their unique needs. The cost and schedule estimates for the NPOESS program cited above do not reflect the latest events surrounding the program. At this juncture, many questions surround DOD's strategy for moving forward, including the following: (1) How does DOD intend to use the funding programmed for fiscal year 2011? (2) Is the NPOESS contract to be terminated, and if so, what are the anticipated termination costs for work under contract? (3) What aspects of the NPOESS program will continue to be utilized for future efforts? (4) Will the approach going forward be more or less costly, and will the delivery of capability be sooner or later than that of NPOESS? While many of these details have yet to be worked out, this major redirection so late in the acquisition process may pose significant risk to the nation's ability to reconstitute its weather satellites in a timely fashion to mitigate lapses in data collection capabilities.
MUOS	The MUOS communications satellite program now estimates a 21-month delay—from March 2010 to December 2011—in the delivery of on-orbit capability from the first satellite. This represents an additional 10-month slip from the slip we reported last year, which was caused by continuing satellite development challenges. In July 2009, a Navy-initiated review of the program found that while the technical challenges the program was experiencing could be solved, the MUOS budget was inadequate and its schedule was optimistic. Subsequently, in late 2009 the Navy established new cost and schedule baselines for the program (we have yet to obtain the new cost baseline, and as such, figures 1 and 2 do not reflect updated MUOS cost estimates). In January 2011, communications are predicted to degrade below the required level of availability and remain so until the first MUOS satellite is available for operations. The MUOS program office is addressing the potential capability gap by activating dual digital receiver unit operations on a legacy satellite, leasing commercial ultra-high-frequency satellite communications services, and examining the feasibility of expanded digital receiver unit operations on the legacy payloads of the MUOS satellites.
GPS IIIA	While the GPS IIIA program has been structured by the Air Force to prevent the mistakes made on the IIF program, the Air Force aims to deliver the GPS IIIA satellites 3 years faster than the IIF satellites. According to Air Force officials, the IIIA contractor retained some of its workforce from the IIR-M program and plans to incorporate a previously developed satellite bus—efforts that reduce program risk. However, we continue to believe the IIIA schedule is optimistic given the program's late start, past trends in space acquisitions, and challenges facing the new contractor.[a] To increase confidence in the schedule for delivering the ground control system for IIIA (the next generation operational control segment known as OCX), the GPS Wing added 16 months of development time to the effort. This means that OCX is now scheduled to be fielded after the May 2014 launch of the first GPS IIIA satellite. The Wing is currently assessing alternate approaches for resolving the fielding issue, which will likely have cost consequences.

Source: GAO analysis of DOD data and previous GAO reports.

[a]GAO, *Global Positioning System: Significant Challenges in Sustaining and Upgrading Widely Used Capabilities*, GA0-09-325, (Washington, D.C.: April 30, 2009).

Challenges in Aligning Space System Components

This past year we also assessed the levels at which DOD's satellites, ground control, and user terminals were synchronized to provide maximum benefit to the

warfighter.[1] Most space systems consist of satellites, ground control systems, and user terminals, though some space systems only require ground control systems to provide capability to users. Ground control systems are generally used to (1) download and process data from satellite sensors and disseminate this information to warfighters and other users and (2) maintain the health and status of the satellites, including steering the satellites and ensuring that they stay in assigned orbits.

User terminals, typically procured by the military services and managed separately from associated satellites and ground control systems, can range from equipment hosted on backpacks to terminals mounted on Humvees, airborne assets, or ships. Terminals can be used to help the warfighter determine longitude, latitude, and altitude via GPS satellites, or securely communicate with others via AEHF satellites. Some user terminals are not solely dedicated to delivering capability from a specific satellite system. For example, the Joint Tactical Radio System is the primary user terminal associated with the MUOS program, but the system is also designed to be the next generation of tactical radios, allowing extensive ground-to-ground communication as well.

Overall, we found the alignment of space system components proved to be challenging to DOD. Specifically, we found that for six of DOD's eight major space system acquisitions, DOD has not been able to align delivery of satellites with ground control systems, user terminals, or both. Of the eight major space system acquisitions, five systems' ground control system efforts are optimally aligned to deliver capability with their companion satellites, while three are not. For the five space systems requiring user terminals, none was aligned. In some cases, capability gaps of 4 or more years have resulted from delays in the fielding of ground control systems or user terminals. When space system acquisitions are not aligned, satellite capability is available but underutilized, though in some cases, work-around efforts can help compensate for the loss or delay of capability. Moreover, when ground systems, user terminals, or both are not

[1] GAO, *Defense Acquisitions: Challenges in Aligning Space System Components*, GAO-10-55 (Washington, D.C.: Oct. 29, 2009).

aligned with satellites, there are significant limitations in the extent to which the system as a whole can be independently tested and verified.[2,3]

Launch Manifest Issues

Another risk facing DOD space programs for the next few years is the potential for increased demand for certain launch vehicles. DOD is positioned to launch a handful of satellites across missions over the next 2 years that were originally scheduled for launch years ago. Until recently, DOD had four launch pads on the East Coast from which to launch military satellites. In 2009, DOD launched the final two GPS IIR-M satellites using the Delta II launch vehicle, thereby discontinuing its use of the Delta II line and its associated launch infrastructure. DOD now plans to launch most of its remaining satellites using one of DOD's EELV types—Atlas V or Delta IV—from one of two East Coast launch pads. At the same time, the National Aeronautics and Space Administration (NASA) plans to use the Delta II to launch at least three major missions before that launch vehicle is retired. In addition, NASA is already manifesting other major missions on the Atlas V. Given the expected increased demand for launches—many of which are considered high priority—and the tempo of launches DOD has achieved with EELV, it appears that the launch manifest is crowded. As a result, if programs still struggling with technical, design, or production issues miss their launch dates, the consequences could be significant, as it may take many months to secure new dates. Some of DOD's satellites are dual integrated, which means they can be launched on either type of EELV. The Air Force deserves credit for designing the satellites this way because it offers more flexibility in terms of launch vehicle usage, but there are also cost and schedule implications associated with rescheduling from one EELV type to the other. Moreover, DOD can request its launch provider to speed up the transition time between launches, although

[2] In making determinations about whether space system acquisitions were aligned, we examined whether there were gaps between fielding dates of satellite capabilities compared to ground system capabilities and whether lower percentages of user terminal types were planned to be fielded by the space system acquisitions' planned initial capability. Generally we considered aspects of a space acquisition unaligned if there was a gap of years, rather than months, between the fielding dates of significant capabilities. Regarding user terminals, we only considered these unaligned compared to satellite capabilities when user terminals did not meet DOD's measure of synchronization for military satellite communications space acquisitions. This measure, established by the U.S. Strategic Command, a primary user of DOD space systems, asserts that 20 percent of any type of user terminal should be fielded by a space system acquisition's initial capability date and 85 percent should be fielded by its full capability date.

[3] It should be noted that while there are criteria for communications satellites, there are no criteria available in DOD that determine the optimum alignment or synchronization for the broader portfolio of satellite programs. This is principally because of inherent differences in satellite missions and their associated ground and user assets, according to officials involved in space system development as well as acquisition oversight.

this would also increase costs. Nevertheless, Air Force officials stated that they were confident that the higher launch rates could be achieved, especially if a particular satellite's priority increased. According to Air Force officials, they have already begun to implement means to address these issues.

DOD Is Taking Actions to Address Space and Weapon Acquisition Problems

DOD has been working to ensure that its space programs are more executable and produce a better return on investment. Many of the actions it is taking address root causes of problems, though it will take time to determine whether these actions are successful and they need to be complemented by decisions on how best to lead, organize, and support space activities.

Our past work has identified a number of causes behind the cost growth and related problems, but several consistently stand out. First, on a broad scale, DOD starts more weapon programs than it can afford, creating a competition for funding that encourages low cost estimating, optimistic scheduling, overpromising, suppressing bad news, and for space programs, forsaking the opportunity to identify and assess potentially more executable alternatives. Second, DOD has tended to start its space programs too early, that is, before it has the assurance that the capabilities it is pursuing can be achieved within available resources and time constraints. This tendency is caused largely by the funding process, since acquisition programs attract more dollars than efforts concentrating solely on proving technologies. Nevertheless, when DOD chooses to extend technology invention into acquisition, programs experience technical problems that require large amounts of time and money to fix. Moreover, there is no way to accurately estimate how long it would take to design, develop, and build a satellite system when critical technologies planned for that system are still in relatively early stages of discovery and invention. Third, programs have historically attempted to satisfy all requirements in a single step, regardless of the design challenge or the maturity of the technologies necessary to achieve the full capability. DOD has preferred to make fewer but heavier, larger, and more complex satellites that perform a multitude of missions rather than larger constellations of smaller, less complex satellites that gradually increase in sophistication. This has stretched technology challenges beyond current capabilities in some cases and vastly increased the complexities related to software. Programs also seek to maximize capability on individual satellites because it is expensive to launch.

In addition, problematic implementation of an acquisition strategy in the 1990s, known as Total System Performance Responsibility, for space systems resulted in problems on a number of programs because it was implemented in a manner that enabled requirements creep and poor contractor performance—the effects of which space programs are still addressing. We have also reported on shortfalls in

resources for testing new technologies, which coupled with less expertise and fewer contractors available to lead development efforts, have magnified the challenge of developing complex and intricate space systems.

Our work—which is largely based on best practices in the commercial sector—has recommended numerous actions that can be taken to address the problems we identified. Generally, we have recommended that DOD separate technology discovery from acquisition, follow an incremental path toward meeting user needs, match resources and requirements at program start, and use quantifiable data and demonstrable knowledge to make decisions to move to next phases. We have also identified practices related to cost estimating, program manager tenure, quality assurance, technology transition, and an array of other aspects of acquisition program management that could benefit space programs. These practices are detailed in appendix I.

DOD is implementing an array of actions to reform how weapons and space systems are acquired. For space in particular, DOD is working to ensure critical technologies are matured before large-scale acquisition programs begin; requirements are defined early in the process and are stable throughout; and that system design remains stable, according to the Director of Space and Intelligence under DOD's Office of the Secretary of Defense for Acquisition, Technology and Logistics. DOD also intends to follow incremental or evolutionary acquisition processes versus pursuing significant leaps in capabilities involving technology risk. The Director of Space and Intelligence also told us that DOD is revisiting the use of military standards in its acquisitions and providing more program and contractor oversight. The approach described to us by the Director of Space and Intelligence mirrors best practices identified in our reports. Moreover, some actions—described in the table below—have already been taken to ensure acquisitions are more knowledge-based.

Table 3: Actions being Taken to Address Space Acquisition Problems

Requirements	The Air Force leadership signed the Acquisition Improvement Plan which lists five initiatives for improving how the Air Force obtains new capabilities—one of these initiatives covers requirements generation and includes the direction for the Air Force to certify the acquisition community can successfully fulfill required capabilities in conjunction with the Air Force Requirements for Operational Capabilities Council. Certification means the required capabilities can be translated in a clear and unambiguous way for evaluation in a source selection, are prioritized if appropriate, and organized into feasible increments of capability.

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Program Management	The Space and Missile Systems Center—the Air Force's primary organization responsible for acquiring space systems—resurrected a program management assistance group in 2007 to help mitigate program management, system integration, and program control deficiencies within specific ongoing programs. This group assists and supplements wing commanders and program offices in fixing common problems, raising core competencies, and providing a consistent culture that sweeps across programs. According to the GPS Wing Commander, this group was an integral part of the overall process providing application-oriented training, templates, analyses, and assessments vital to the GPS IIIA baseline review.
Workforce	The Air Force is continuing efforts to bring space operators and space system acquirers together through the Advanced Space Operations School and the National Security Space Institute. The Air Force anticipates that this higher-level education will be integral to preparing space leaders with the best acquisition know-how.
Cost Estimating	Both the Air Force and the National Reconnaissance Office (NRO) are taking actions to strengthen cost-estimating. For example, we recommended that the Secretary of the Air Force ensure that cost estimates are updated as major events occur within a program that could have a material impact on cost, and that the roles and responsibilities of the various Air Force cost-estimating organizations be clearly articulated.[a] An Air Force policy directive now requires that cost estimates for major programs be updated annually, and lays out roles and responsibilities for Air Force cost-estimating organizations. Furthermore, in its attempts to make more accurate cost estimates for commercial-like programs (characterized by use of fixed-price contracts, less complex satellites, lower costs, and short development timeframes), the NRO cost analysis improvement group has developed a cost-estimating methodology that considers acquisition complexity (such as level of oversight and amount of program reporting), in addition to program technical complexity, and stated it is considering applying the methodology to more traditional satellite acquisition programs.
Acquisition Policy	DOD recently eliminated the tailored national security space acquisition policy and moved the acquisition of space systems under DOD's updated acquisition guidance for defense acquisition programs (DOD Instruction 5000.02). DOD is currently developing an addendum for the Instruction that would introduce specific management and oversight processes for acquiring major space systems.
Alignment of Ground Control Systems	In better aligning space system components, DOD acknowledged that the integration and consolidation of satellite ground control systems has many benefits, and established the Space and Intelligence Office to more effectively conduct oversight of the space and intelligence enterprise. DOD further disestablished two oversight boards that were deemed less effective in providing oversight.

Source: GAO analysis of DOD data and previous GAO reports.

[a]GAO, *Space Acquisitions: DOD Needs to Take More Action to Address Unrealistic Initial Cost Estimates of Space Systems*, GAO-07-96, (Washington, D.C.: November 17, 2006).

Congress has also acted on a broader scale through the Weapon Systems Acquisition Reform Act, which was signed into law on May 22, 2009.[4] The goal of this new statute is to improve acquisition outcomes in DOD, with specific emphasis on major defense acquisition programs (MDAP) and major automated

[4] Pub. L. No. 111-23, 123 Stat. 1704 (2009).

information systems. According to the President of the United States this legislation is designed to limit cost overruns before they spiral out of control and will strengthen oversight and accountability by appointing officials who will be charged with closely monitoring the weapons systems being purchased to ensure that costs are controlled. DOD states in its 2010 Quadrennial Defense Review[5] that the law also will substantially improve the oversight of major weapons acquisition programs, while helping to put MDAPs on a sound footing from the outset by addressing program shortcomings in the early phases of the acquisition process. DOD also states that it is undertaking a far-reaching set of reforms to achieve these goals and to improve how DOD acquires and fields critical capabilities for current and future wars and conflicts.

Additional Decisions on Leadership, Organization, and Support Are Still Needed

The actions that the Air Force and Office of the Secretary of Defense have been taking to address acquisition problems are good steps. However, there are still more significant changes to processes, policies, and support needed to ensure that reforms can take hold. Recent studies and reviews examining the leadership, organization, and management of national security space have all found that there is no single authority responsible below the President and that authorities and responsibilities are spread across the department. In fact, the national security space enterprise comprises a wide range of government and nongovernment organizations responsible for providing and operating space-based capabilities serving both military and intelligence needs.

In 2008, for example, a congressionally chartered commission (known as the Allard Commission)[6] reported that responsibilities for military space and intelligence programs were scattered across the staffs of DOD organizations and the intelligence community and that it appeared that "no one is in charge" of national security space. The same year, the House Permanent Select Committee on Intelligence reported similar concerns, focusing specifically on difficulties in bringing together decisions that would involve both the Director of National Intelligence and the Secretary of Defense.[7] Prior studies, including those conducted by the Defense Science Board and the Commission to Assess United States National Security Space Management and Organization (Space

[5] Department of Defense, *Quadrennial Defense Review Report* (Washington, D.C., Feb. 1, 2010).

[6] Institute for Defense Analyses, *Leadership, Management, and Organization for National Security Space: Report to Congress of the Independent Assessment Panel on the Organization and Management of National Security Space* (Alexandria, VA., July 2008).

[7] House Permanent Select Committee on Intelligence, *Report on Challenges and Recommendations for United States Overhead Architecture* (Washington, D.C., October 2008).

Commission),[8] have identified similar problems, both for space as a whole and for specific programs. While these studies have made recommendations for strengthening leadership for space acquisitions, no major changes to the leadership structure have been made in recent years. In fact, an executive agent position within the Air Force that was designated in 2001 in response to a Space Commission recommendation to provide leadership has not been filled since the last executive resigned in 2007.

Diffuse leadership has a direct impact on the space acquisition process, primarily because it makes it difficult to hold any one person or organization accountable for balancing needs against wants, for resolving conflicts among the many organizations involved with space, and for ensuring that resources are dedicated where they need to be dedicated. Many of the cost and schedule problems we identified for the GPS IIF program, for instance, were tied in part to diffuse leadership and organizational stovepipes, particularly with respect to DOD's ability to coordinate delivery of space, ground, and user assets. In fact, DOD is now facing a situation where satellites with advances in capability will be residing for years in space without users being able to take full advantage of them because investments and planning for ground, user, and space components were not well-coordinated.

Congressional and DOD studies have also called for changes in the national security space organizational structure to remove cultural barriers to coordinating development efforts and to better incorporate analytical and technical support from an organization that is augmented with military and intelligence community expertise.

Finally, studies have identified insufficient numbers of experienced space acquisition personnel and inadequate continuity of personnel in project management positions as problems needing to be addressed in the space community. Our own studies have identified gaps in key technical positions, which we believed increased acquisition risks. For instance, in a 2008 review of the EELV program, we found that personnel shortages at the EELV program office occurred particularly in highly specialized areas, such as avionics and launch vehicle groups.[9] These engineers work on issues such as reviewing components responsible for navigation and control of the rocket. Moreover, only

[8] Department of Defense, *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, D.C., Jan. 11, 2001).

[9] GAO, *Space Acquisitions: Uncertainties in the Evolved Expendable Launch Vehicle Program Pose Management and Oversight Challenges*, GAO-08-1039 (Washington, D.C.: Sept. 26, 2008).

half the government jobs in some key areas were projected to be filled. These and other shortages in the EELV program office heightened concerns about DOD's ability to effectively manage the program using a contracting strategy for EELV that required greater government attention to the contractor's technical, cost, and schedule performance information. In a recent discussion with GAO, the Director of Space and Intelligence under DOD's Office of the Secretary of Defense for Acquisition, Technology and Logistics stated that the primary obstacle to implementing reforms in space is the lack of "bench strength," primarily technical and systems engineering expertise.

Concluding Remarks

In conclusion, DOD space is at a critical juncture. After more than a decade of acquisition difficulties, which have created potential gaps in capability, diminished DOD's ability to invest in new space systems, and lessened DOD's credibility to deliver high-performing systems within budget and on time, DOD is finally positioned to launch new generations of satellites that promise vast enhancements in capability. Moreover, recent program cancellations have alleviated competition for funding and may have allowed DOD to focus on fixing problems and implementing reforms rather than taking on new, complex, and potentially higher-risk efforts. But these changes raise new questions. Specifically, when can investments in new programs be made? How can reforms really take hold when leadership is diffuse? How can reforms take hold when there are still organizational barriers that prevent effective coordination? And lastly, how can acquisitions be successful if the right technical and programmatic expertise is not in place? Clearly, there are many challenges ahead for space. We look forward to working with the DOD to help ensure that these and other questions are addressed.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions you or members of the subcommittee may have at this time.

Contacts and Acknowledgements

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Appendix I: Actions Needed to Address Space and Weapon Acquisition Problems

Before undertaking new programs	
□	Prioritize investments so that projects can be fully funded and it is clear where projects stand in relation to the overall portfolio.
□	Follow an evolutionary path toward meeting mission needs rather than attempting to satisfy all needs in a single step.
□	Match requirements to resources—that is, time, money, technology, and people—before undertaking a new development effort.
□	Research and define requirements before programs are started and limit changes after they are started.
□	Ensure that cost estimates are complete, accurate, and updated regularly.
□	Commit to fully fund projects before they begin.
□	Ensure that critical technologies are proven to work as intended before programs are started.
□	Assign more ambitious technology development efforts to research departments until they are ready to be added to future generations (increments) of a product.
□	Use systems engineering to close gaps between resources and requirements before launching the development process.
During program development	
□	Use quantifiable data and demonstrable knowledge to make go/no-go decisions, covering critical facets of the program such as cost, schedule, technology readiness, design readiness, production readiness, and relationships with suppliers.
□	Do not allow development to proceed until certain thresholds are met—for example, a high proportion of engineering drawings completed or production processes under statistical control.
□	Empower program managers to make decisions on the direction of the program and to resolve problems and implement solutions.
□	Hold program managers accountable for their choices.
□	Require program managers to stay with a project to its end.
□	Hold suppliers accountable to deliver high-quality parts for their products through such activities as regular supplier audits and performance evaluations of quality and delivery, among other things.
□	Encourage program managers to share bad news, and encourage collaboration and communication.

Source: GAO.

Appendix II: Scope and Methodology

In preparing this testimony, we relied on our body of work in space programs, including previously issued GAO reports on assessments of individual space programs, common problems affecting space system acquisitions, and the Department of Defense's (DOD) acquisition policies. We relied on our best practices studies, which comment on the persistent problems affecting space acquisitions, the actions DOD has been taking to address these problems, and what remains to be done, as well as Air Force documents addressing these problems and actions. We also relied on work performed in support of our annual weapons system assessments, and analyzed DOD funding estimates to assess cost increases and investment trends for selected major space acquisition programs. The GAO work used in preparing this statement was conducted 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.

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