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SPACE ACQUISITIONS

Improvements Needed in Space Systems Acquisitions and Keys to Achieving Them

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GAO-06-626T

April 6, 2006

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Highlights

Highlights of GAO-06-626T, a testimony before the Subcommittee on Strategic Forces, Senate Committee on Armed Services

Why GAO Did This Study

DOD's space system acquisitions have experienced problems over the past several decades that have driven up costs by hundreds of millions, even billions of dollars, stretched schedules by years, and increased performance risks. GAO was asked to testify on its findings on space acquisition problems and steps needed to improve outcomes.

What GAO Recommends

GAO does not make recommendations in this testimony. However, GAO testified that there are steps DOD can take to ensure better outcomes for its space acquisitions programs. They include developing an overall investment strategy for space acquisition programs; revising policies supporting space to incorporate best practices; and addressing human capital and other shortfalls in capacity.

www.gao.gov/cgi-bin/getrpt?GAO-06-626T.

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

What GAO Found

DOD's space acquisition programs continue to face substantial cost and schedule overruns. At times, cost growth has come close to or exceeded 100-percent, causing DOD to nearly double its investment in face of technical and other problems without realizing a better return on its investment. Along with the cost increases, many programs are experiencing significant schedule delays—as much as 6 years—postponing delivery of promised capabilities to the warfighter. Outcomes have been so disappointing in some cases that DOD has had to go back to the drawing board to consider new ways to achieve the same capability.

These problems are having a dramatic effect on DOD's space investment portfolio. Over the next 5 years, there will be about $12 billion less dollars available for new systems as well as for the discovery of promising new technologies because of cost growth. And while DOD is pushing to start new, highly ambitious programs such as the Transformational Satellite and Space Radar, broader analyses of the nation's fiscal future indicate that spending for weapon systems may need to be reduced, rather than increased, to address growing deficits.

GAO has identified a number of causes behind these problems, but several stand out. First, DOD starts more space and weapons programs than it can afford, which pressures programs to under estimate costs and over promise capabilities. Second, DOD starts its space programs too early, that is, before it is sure the capabilities it is pursuing can be achieved within available resources and time constraints. DOD has also allowed new requirements to be added well into the acquisition phase.

DOD has appointed a new leadership to oversee space acquisitions who have committed to adopting practices GAO has recommended for improving outcomes. These include delegating the maturation of technologies to the S&T community; adopting an evolutionary development approach in which new systems would be developed in a series of discrete increments, or blocks; fund S&T appropriately so that significant technology breakthroughs can be continually pursued; and improving collaboration on requirements.

Adopting best practices for space acquisitions will not be an easy undertaking. DOD, as a whole, still operates in an environment that encourages competition for funding, and thus, behaviors that have been detrimental to meeting cost and schedule goals. Moreover, the changes being proposed will require significant shifts in thinking about how space systems should be developed and changes in incentives. By establishing investment priorities, embedding best practices in policy, and addressing capacity shortfalls, DOD can mitigate these challenges and better position programs for success.

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 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, gathers data on its adversaries, and attacks targets. In fiscal year 2007 alone, DOD expects to spend almost $20 billion dollars to develop and procure satellites and other space systems, including nearly $7 billion on the major space systems.[1] Despite its growing investment in space, however, DOD's space system acquisitions have experienced problems over the past several decades that have driven up costs by hundreds of millions, even billions of dollars, stretched schedules by years, and increased performance risks. In some cases, capabilities have not been delivered to the warfighter after decades of development.

As a result of these problems, DOD is now contending with important trade-off decisions such as whether to continue investing in long beleaguered efforts or undertake more promising alternatives. At the same time, leadership now recognizes the need to substantially change DOD's current space acquisition approach and the value of adopting practices that will lay a better foundation for program execution. Within this context, I will discuss our findings on space acquisition problems, recent steps DOD has taken in an effort to address these problems, and the changes that still need to occur if DOD is to break the cycle of acquisition problems.

Space Acquisition Problems Persist

The majority of satellite programs we have reviewed over the past 2 decades experienced problems during their acquisition that drove up costs and schedules and increased technical risks. Several programs were restructured by DOD in the face of delays and cost growth. At times, cost growth has come close to or exceeded 100-percent, causing DOD to nearly double its investment in face of technical and other problems without realizing a better return on its investment. Along with the cost increases, many programs are experiencing significant schedule delays—as much as 6 years—postponing delivery of promised capabilities to the warfighter.

[1]Estimates of fiscal year 2007 spending are based on DOD's Fiscal Year 2006 Future Year Defense Program (FYDP) plan. The fiscal year 2007 FYDP plan was not available to us at the time of this testimony.

Outcomes have been so disappointing in some cases that DOD has had to go back to the drawing board to consider new ways to achieve the same capability. It is in such a position today, with its Space-based Infrared System (SBIRS) High program and possibly its National Polar-orbiting Operational Environmental Satellite System (NPOESS) program, both of which have been mired in expanding cost and schedule setbacks.

More specifically, DOD's investment in SBIRS High, a critical missile warning system, has been pushed to over $10.5 billion from the initial $4.1 billion estimate made over 9 years earlier. This 160-percent increase in estimated costs triggered a fourth Nunn-McCurdy[2] breach (see 10 U.S.C. 2433), requiring a review by the Secretary of Defense and a report to Congress, and resulted in the program being restructured for a third time, in late 2005. With costs and timelines spiraling out of control, DOD reduced the number of satellites it plans to procure—pushing the average per unit procurement cost up to 224-percent above 2002 baseline costs—and is now pursuing an alternative to SBIRS High while it continues with the scaled back program.

Initial cost and schedule estimates for NPOESS—a new satellite constellation intended to replace existing weather and environmental monitoring satellites—have also proven unreliable. NPOESS is managed by a tri-agency Integrated Program Office consisting of DOD, the National Oceanic and Atmospheric Administration, and National Aeronautics and Space Administration. In January 2006, the program reported a Nunn-McCurdy unit cost breach, at the 25-percent threshold, due to continuing technical problems, including problems with the development of key sensors. Specifically, in early 2005, DOD learned that a subcontractor could not meet cost and schedule targets due to significant technical issues on an imaging sensor known as the visible/infrared imager radiometer suite (VIIRS) sensor—including problems with the cryoradiator, excessive vibration of sensor parts, and errors in the sensor's solar calibration. These technical problems were further complicated by subcontractor management problems. To address these issues, DOD provided additional funds for VIIRS, capped development funding for

[2]10 U.S.C. § 2433. This oversight mechanism originated with an amendment to the Department of Defense Authorization Act, 1982. It was made permanent in the following year's authorization act and has been amended several times. Generally, the law requires DOD to review programs and report to Congress whenever cost growth reaches specified thresholds. The statute is commonly known as the Nunn-McCurdy amendment based on the names of the sponsors of the original legislation.

other critical technologies, and revised its schedule to keep the program moving forward. We also reported that based on our own analysis of contractor trends, the program will most likely overrun costs by $1.4 billion.[3] Given the challenges currently facing the program, the scheduled first launch date slipped 17 months to September 2010.

Another recent example of problems is evident in the Advanced Extremely High Frequency (AEHF) program. We reported in the past that this program experienced cost increases due to requirements changes, inadequate contract strategies, and funding shortfalls. We also reported that DOD had to cut back its planned purchase of satellites from five to three as a result. The outcome has been an 84-percent unit cost increase—each AEHF satellite is now estimated to cost about $2.1 billion. More recently, we reported that scheduling delays and the late delivery of cryptographic equipment have culminated into nearly a 3-year delay in the launch of the first satellite and that the program still faces schedule risk due to the continued concurrent development of two critical path items managed and developed outside the program.

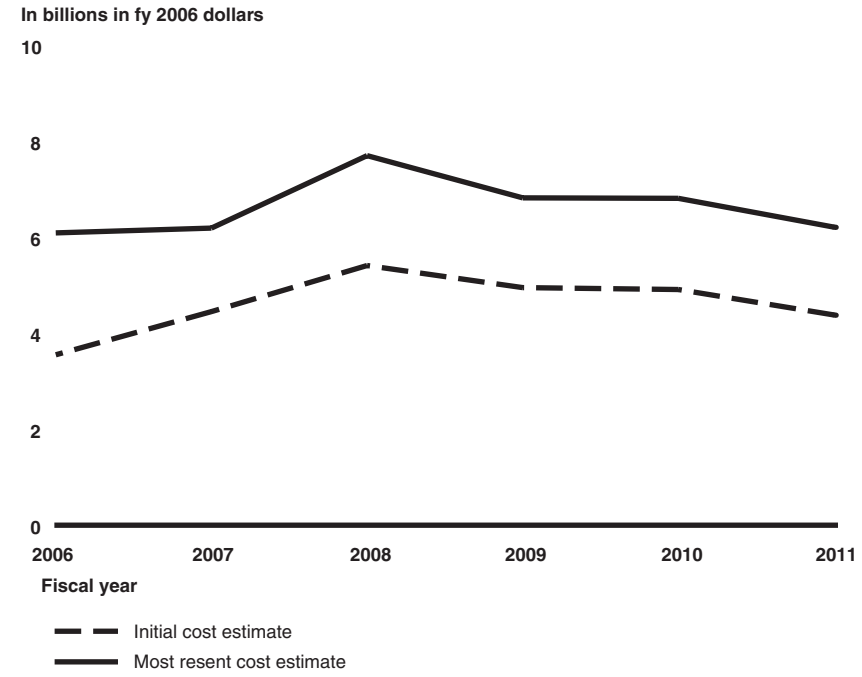
Acquisition problems have not been limited to the development of home-grown systems. DOD's purchase of an ostensible commercial satellite for the use of communications, the Wideband Gapfiller Satellite (WGS), is experiencing about a 70-percent cost growth, due in part to the problems a subcontractor was experiencing in assembling the satellites. Improperly installed fasteners on the satellites' subcomponents have resulted in rework on the first satellite and extensive inspections of all three satellites currently being fabricated. The cost for WGS has increased about $746.3 million but DOD estimates that about $276.2 million of this amount is largely due to cost growth associated with a production gap between satellites three and four. The launch of the first satellite has now been delayed for over 3 years and is currently scheduled for June 2007. The delay will increase program costs and add at least 22 months to the time it takes to obtain an initial operational capability from the system.

Figure 1 shows that, overall for fiscal years 2006 through 2011, estimated costs for DOD's major space acquisition programs have increased a total of about $12.2 billion—or nearly 44-percent in total—above initial

[3]GAO, *Defense Acquisitions: Assessment of Selected Major Weapon Programs*, GAO-06-391 (Washington, D.C.: March 31, 2006).

estimates. Figure 2 breaks out this trend among key major space acquisitions.

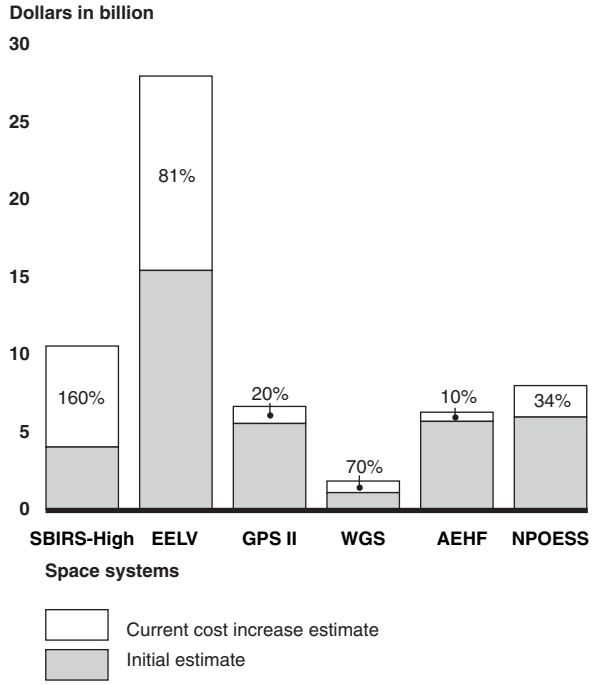
Figure 1: Comparison between Original Cost Estimates and Current Cost Estimates for Major Space Acquisition Programs[a] for Fiscal Years 2006 through 2011



Source: GAO analysis of DOD data.

[a]Includes: AEHF, Evolved Expendable Launch Vehicle, Global Broadcast Service, Global Positioning System II, Mobile User Objective System, NPOESS, SBIRS High, TSAT, and WGS.

Figure 2: Cost Growth in Selected Current Space Programs in Base Year Dollars



Source: GAO analysis of DOD data.

Notes: Original AEHF cost was for five satellites; the latest estimate for AEHF is for three satellites. SBIRS High data is through the latest Selected Acquisition Report, dated September 2005.

As both figures illustrate, cost increases have had a dramatic impact on DOD's overall space portfolio. To cover the added costs of poorly performing programs, DOD has shifted scarce resources away from other programs, creating a cascade of cost and schedule inefficiencies. For example, to fund other space programs, DOD has had to push off the start of a new version of the Global Positioning System (GPS), which has forced costs to increase for the current version under development. Meanwhile, DOD is also contending with cost increases within its Evolved Expendable Launch Vehicle (EELV) program. These are largely due to misjudgments about the extent to which DOD could rely on commercial demand to leverage its investment. Nevertheless, the resulting $12.6 billion increase has added pressures to make tradeoffs.

At the same time that DOD is juggling resources on existing programs, it is undertaking two new efforts—the Transformational Satellite Communications System (TSAT) program and Space Radar program—which are expected to be among the most ambitious, expensive, and

complex space systems ever. Moreover, DOD is relying heavily on their planned capabilities to fundamentally enable DOD to transform how military operations are conducted. In fact, many other weapon systems will be interfaced with these satellites and highly dependent on them for their own success. Together, these systems have been preliminarily estimated to cost about $40 billion. While DOD is planning to undertake the new systems, broader analyses of the nation's fiscal future indicate that spending for weapon systems may need to be reduced, rather than increased, to address growing deficits.

Underlying Causes of Acquisition Problems

Our reviews have identified a number of causes behind the problems just described, but several consistently stand out. First, on a broad scale, DOD starts more weapon programs than it can afford, creating a competition for funding which encourages low cost estimating, optimistic scheduling, over promising, suppressing bad news, and for space programs, forsaking the opportunity to identify and assess potentially better alternatives. Programs focus on advocacy at the expense of realism and sound management. Invariably, with too many programs in its portfolio, DOD and even Congress are forced to continually shift funds to and from programs—often undermining well-performing programs to pay for poorly performing ones.

Second, DOD starts its space programs too early, that is, before it has 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 out technologies. Nevertheless, when DOD chooses to extend technology invention into acquisition, programs experience technical problems that have reverberating effects and require large amounts of time and money to fix. When programs have a large number of interdependencies, even minor "glitches" can cause disruptions.

A companion problem for all weapon systems is that DOD allows new requirements to be added well into the acquisition phase. Many times, these significantly stretch the technology challenges (and consequently, budgets) the program is already facing. This was particularly evident in SBIRS High up until 2004. While experiences would caution DOD not to pile on new requirements, customers often demand them fearing there may not be another chance to get new capabilities since programs can take a decade or longer to complete.

Third, space programs have historically attempted to satisfy all requirements in a single step, regardless of the design challenge or the maturity of the technologies to achieve the full capability. Increasingly, DOD has preferred to make fewer, but heavier, larger, and complex "Battlestar Galactica-like" 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 the capability of many potential contractors and vastly increased the complexities related to software—a problem that affected SBIRS High and AEHF, for example.

Our reviews have identified additional factors that contribute to space acquisition problems, though less directly affecting cost and schedule problems we have reported on. For example, consolidations within defense supplier base for space programs have made it more difficult for DOD to incorporate competition into acquisition strategies. Since 1985, there were at least ten fully competent prime contractors competing for the large programs and a number that could compete for subcontracts. Arguably today, there are only two contractors that could handle DOD's most complex space programs. DOD has exacerbated this problem by not seeking opportunities to restructure its acquisitions to maximize competition, particularly for the small suppliers who have a high potential to introduce novel solutions and innovations into space acquisitions. In the 1990s, DOD also structured contracts in a way that reduced oversight and shifted key decisionmaking responsibility onto contractors. DOD later found that this approach—known as Total System Performance Responsibility, or TSPR—magnified problems related to requirements creep and poor contractor performance.

Another factor contributing to problems is the diverse array of officials and organizations involved with a space program, which has made it even more difficult to pare back and control requirements. The Space Radar system, for example, is expected to play a major role in transforming military as well as intelligence-collecting operations and other critical governmental functions, such as homeland security. As a result, its constituency includes combatant commanders, all of the military services, intelligence agencies, and the Department of Homeland Security. The Global Positioning System not only serves the military, it provides critical services to civilian users, the transportation sector, the information technology sector, among many other industries.

In addition, short tenures for top leadership and program managers within the Air Force and the Office of the Secretary of Defense has lessened the

sense of accountability for acquisition problems and further encouraged a short-term view of success, according to officials we have interviewed. Though still in a pre-acquisition phase, TSAT and Space Radar have already had one program director each. The SBIRS High program, meanwhile, has seen at least three program directors. At the highest levels of leadership, for many years, DOD did not invest responsibilities for its space activities in any one individual—leaving no one in charge of establishing an integrated vision for space or of mediating between competing demands. In 1994, it established such a position within the Office of the Secretary of Defense, but dissolved this position in 1998. In 2002, DOD established a space leadership position within the Under Secretary position in the Air Force, combined it with the directorship of the National Reconnaissance Office in order to better integrate DOD and intelligence space activities, and allowed the Under Secretary to have milestone decision authority for major space systems acquisitions. After the first Under Secretary of the Air Force in charge of space retired in 2005, DOD split these responsibilities and temporarily reclaimed milestone decision authority for all major space programs. Changes in leadership and reorganizations are common across DOD, but again, they make it more difficult to enforce accountability and maintain the right levels of support for acquisition programs.

Lastly, there are capacity shortfalls that have constrained DOD's ability to optimize and oversee its space programs. These include: shortages in the pipeline of scientists and engineers, shortages of experts in systems and software engineering, and uneven levels of experience among program managers. Contractors are also facing workforce pressures similar to those experienced by the government, that is, not enough technical expertise to develop complex space systems. In addition, we have reported that there is a lack of low-cost launch opportunities, which are needed to increase the level of experimental testing in space.

DOD Has Expressed Its Commitment to Improve Its Approach to Space Acquisitions

DOD has recently expressed a commitment to improve its approach to space acquisitions and embrace many of the recommendations we have made in the past.

Our previous recommendations have been focused on providing a sound foundation for program execution. Namely, 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 demonstratable knowledge to make decisions to move to next phases. In

addition, we have called on DOD to develop an overall investment strategy for space in order to help DOD rebalance its investments in space acquisition programs as it continues to contend with cost increases from its programs.

These recommendations are based on a body of work that we have undertaken over the last several years that examines weapon acquisition issues from a perspective that draws upon lessons learned from best product development practices. Leading commercial firms expect that their program managers will deliver high-quality products on time and within budget. Doing otherwise could result in the customer walking away. Thus, those firms have created an environment and adopted practices that put their program managers in a good position to succeed in meeting these expectations. Collectively, these practices comprise a process that is anchored in knowledge. It is a process in which technology development and product development are treated differently and managed separately. The process of developing technology culminates in discovery—the gathering of knowledge—and must, by its nature, allow room for unexpected results and delays. Leading firms do not ask their program or product managers to develop technology. Rather, they give responsibility for maturing technologies to science and technology organizations. The process of developing a product culminates in delivery and, therefore, gives great weight to design and production. The firms demand—and receive—specific knowledge about a new product before production begins. A program does not go forward unless a strong business case on which the program was originally justified continues to hold true.

While the practices we have recommended represent commonly accepted sound business practices, until recently, they have not been accepted by DOD's space acquisition community for large space acquisitions. By contrast, these practices were implemented for the development of a small, experimental satellite, intended for direct use by a combatant command, (known as TacSat 1). We recently reported that by including only mature technologies and limiting new requirements, DOD was able to develop the satellite for less than $10 million (including surplus hardware valued at $5 million) and within 12 months.

In disagreeing with our recommendations, DOD asserted its desire to push programs to advance technologies as far as possible. Other reasons that space officials have given for extending technology development into acquisition include the greater ability to secure funding for costly technology development within an acquisition program versus a science

and technology program, a belief among the acquisition community that labs in charge of developing space technologies do not understand their needs, as well as communication gaps between the science and technology (S&T) and acquisition communities.

Moreover, while DOD officials told us they were pursuing evolutionary development for space systems, we found that they were beginning programs by challenging programs managers to achieve significant leaps in capability with the intention of abandoning those efforts later in the development cycle should too many problems be encountered. This is not a true evolutionary approach, as it leaves DOD facing increased technical challenges at the beginning of a program and thus, increased risks, and it raises the expectations on the part of stakeholders who may be unwilling to accept less capability later on. Two of the systems we were most concerned about in this respect were and TSAT and Space Radar —they were already expected to cost about $40 billion. DOD was planning to start these acquisitions even when many of their critical technologies were still immature and it was pursuing a highly ambitious path in terms of the technology push. Given that these systems were among the most complex programs ever undertaken for space, they were being counted on to enable wider DOD transformation efforts, and DOD was already contending with highly problematic space efforts, we believed DOD could not afford to pursue such risky approaches for TSAT and Space Radar.

Since we last testified before this subcommittee in July 2005, DOD has appointed a new Under Secretary of the Air Force to be in charge of space acquisitions, who, in turn, has embraced adopting best practices, or, as he terms it, “going back to the basics.” Specifically, the Under Secretary has expressed a desire to

- Delegate the maturation of technologies—to the point of being tested in a relevant environment or operational environment, if appropriate—to the S&T community.

- Adopt an evolutionary development approach in which new systems would be developed in a series of increments, or blocks. Any desired technology that is not expected to be matured in time to start a new block would be assigned to a later block. Each block would have a discrete beginning and end point.

- Fund S&T appropriately so that significant technology breakthroughs can be continually pursued.

- Improve collaboration on requirements—consulting with warfighters on the content of each new block.

In addition, the Under Secretary is focused on estimating cost and funding new acquisitions to an 80-percent confidence level; strengthening systems engineering and strengthening the acquisition workforce.

Aspects of this approach have recently been incorporated in to DOD's TSAT program. For the first block, satellites 1 and 2, the Air Force has reduced its expectations in the level of sophistication of these satellites to increase the confidence in the schedule for launching the first satellite in 2014. Higher performing levels of the technologies to support laser communications and an Internet-like processor router will be pushed off to a subsequent block, along with the multi-access laser communications—a more robust laser capable of transmitting vast amounts of data within seconds. Program officials have also stated that the TSAT program will not enter into product development, that is, formal acquisition, until its critical technologies are proven.

These are good steps when looking at TSAT as an individual program. It is important, however, that the Air Force ensure warfighters accept lower capability and that it makes sense to pursue the current approach versus the alternative of buying more AEHF or WGS satellites.

Keys to Realizing DOD's New Goals for Space Acquisitions

DOD's desire to adopt best practices for space acquisition is a positive and necessary first step toward reform. However, these changes will not be easy to undertake. They require significant shifts in thinking about how space systems should be developed; changes in incentives and perceptions; as well as further policy and process changes. Moreover, they will need to be made within a larger acquisition environment that still encourages a competition for funding and consequently pressures programs to view success as the ability to secure the next installment rather than the end goal of delivering capabilities when and as promised. In addition, DOD's space leaders will be challenged to sustain a commitment to adopting best practices, given the myriad of missions and programs that compete for the attention of DOD's leadership and resources, frequent turnover in leadership positions, and potential resistance from the many diverse organizations involved with space acquisitions.

There are steps, however, that DOD can take to substantially mitigate these challenges.

- First, DOD can guide its decisions to start space acquisition programs with an overall investment strategy. More specifically, DOD could identify overall capabilities and how to achieve them, that is, what role space will play versus other air-, sea-, and land-based assets; identify priorities for funding space acquisitions; and implement mechanisms that would enforce the strategy and measure progress. Optimally, DOD would do this for its entire weapon system investment portfolio so that space systems that are expected to play a critical role in transformation could be prioritized along with other legacy and transformational systems and so that DOD could reduce pressures associated with competition for funding. But in the absence of a departmentwide strategy, DOD could reexamine and prioritize its space portfolio with an eye toward balancing investments between legacy programs and new programs as well as between S&T programs and acquisition programs. In addition, DOD could prioritize S&T investments. This is particularly important since DOD is undertaking a range of initiatives—collectively known as operationally responsive space (ORS)—designed to facilitate evolutionary development, more testing of technologies before acquisition, and ultimately enable DOD to deliver space-based capabilities to the warfighter much faster and quicker. While ORS investments hold great potential, there are other S&T projects competing for the same resources, including those focused on discovering and developing technologies and materials that could greatly enhance future capabilities, reduce costs, and maintain U.S. superiority in space.

- Second, DOD could revise policies and processes supporting space as needed to adopt the best practices being embraced. For example, DOD's space acquisition policy could be further revised to ensure that a true evolutionary approach is being pursued and that blocks, or increments, will include only technologies that have been sufficiently matured. DOD could also implement processes and policies, as needed, that stabilize requirements, particularly for acquisitions that are being shared with other stakeholders, such as the intelligence community, and that ensure warfighters are bought into capabilities being pursued for each new system increment. In recent years, it has instituted processes for some individual systems, such as SBIRS High, that could serve as a model.

- Third, DOD could continue to address other capacity shortfalls. These include shortages of staff with science and engineering backgrounds; shortages of experience within the program manager workforce; limited opportunities and funding for testing for space technologies; and the lack of low-cost launch vehicles. At the same time, DOD could

continue to work toward strengthening relationships between the S&T and acquisition communities and coordination within the S&T community. The Under Secretary is uniquely positioned to do this given his previous position as DOD's Director of Defense Research and Engineering and his participation in previous efforts to develop a strategy for space S&T.

- Fourth, we have recommended that DOD take steps departmentwide to hold people and programs accountable when best practices are not pursued. This will require DOD to empower program managers to make decisions related to funding, staffing, and moving into subsequent phases and to match program manager tenure with development or delivery of a product. It may also require DOD to tailor career paths and performance management systems to incentivize longer tenures. Until these actions have been taken, space leaders could take steps now to ensure space program managers have the right levels of experience to execute large programs and have sufficient authority so that they can be held accountable. Likewise, DOD's space leaders can take steps to hold its contractors accountable by structuring contracts so that incentives actually motivate contractors to achieve desired acquisition outcomes and withholding award fees when those goals are not met.

In closing, we are encouraged with the acquisition approach being embraced by DOD's space leadership. It can enable DOD to begin to match resources to requirements before starting new programs and therefore, better position programs for success. Successful implementation, however, will hinge on the ability of DOD's current space leaders to instill and sustain commitment to adopting best practices over the short and long term. In doing so, best practice approaches should be reflected in policy and manifested in decisions on individual programs or reform will be blunted. They should also be accompanied by an investment strategy for space, and ultimately DOD, to separate wants from needs and to alleviate long-standing pressures associated with competition within DOD to win funding. By embracing a model that incorporates all these elements, DOD can achieve better outcomes for its space programs.

Scope and Methodology

In preparing for this testimony, we relied on previously issued GAO reports on assessments of individual space programs, incentives and pressures that drive space system acquisition problems, common problems affecting space system acquisitions, space science and technology strategy, and DOD's space acquisition policy, as well as our reports on best practices for weapon systems development. We also

analyzed DOD's Selected Acquisition Reports to assess cost increases and investment trends. In addition, we met with the Air Force Under Secretary to discuss his "back to basics" approach. We conducted our review between March 6 and April 3, 2006 in accordance with generally accepted government auditing standards.

Contacts and Acknowledgments

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Table 1 highlights recent findings from our reports on cost and schedule overruns for DOD's current and planned space programs. The table also notes that many programs are still addressing past mistakes in acquisition approaches and contractor oversight as well as technical, design, and manufacturing problems.

Table 1: Highlights of Recent Findings for Current and Planned Space Programs

Description	Recent Findings
Space Based Infrared System High (SBIRS High): Ballistic missile warning system being developed by the Air Force to replace its legacy warning system. **Development** **Start**[4]- October 1996	With unit cost increases of more than 315-percent over the 1996 initial estimate, the program has undergone four Nunn-McCurdy unit cost breaches. Total program costs have increased from about $4 billion to more than $10 billion. The launch schedule has slipped over 6 years; the first satellite is currently scheduled to be delivered in September 2008. DOD officials recently called for initiating planning efforts for the development of a new missile warning system, parallel to SBIRS; it is unclear whether this program will replace or compete against SBIRS.
Global Broadcast Service (GBS): Part of the overall DOD military satellite communication architecture being developed by the Air Force for one-way transmission of video, imagery and other high-bandwidth information to the warfighter. **Development** **Start-** November 1997	Total program costs have increased by 72-percent since the contract was awarded in 1997, largely due to the transition from a legacy system architecture to internet protocol, additional production quantities, and operation and maintenance tasks. In June 2005, a quarterly exception selected acquisition report was submitted to reflect initial operational capability delays of six months or more due to a delayed operational test schedule. GBS currently uses broadcast payloads on three Ultra-High Frequency Follow-on (UFO) satellites and will use broadcast payloads on up to five Wideband Gapfiller Satellites (WGS) satellites when they are launched.
Evolved Expendable Launch Vehicle (EELV): Acquisition of commercial launch services from two competitive families of launch vehicles. **Development** **Start-** October 1998	The program cost has risen over 81-percent, with a cost per unit increase of about 138-percent and triggered a Nunn-McCurdy breach. A chief reason for cost increases is a decline in the commercial launch market upon which the program's business case was based. In 2005, the two primary contractors agreed to form a joint venture to combine production, engineering, test and launch operations for U.S. government launches that is under review by the Federal Trade Commission.

[4]The National Security Space Acquisition Policy specifies that key decision point B (also referred to as Milestone B by the DOD 5000 series or Product Development Start by GAO best practice work) is the official program initiation point when programs develop a formal Acquisition Program Baseline (APB) and submit Special Acquisition Reports (SAR) to the Congress.

Navstar Global Positioning System (GPS) Modernization: A space-based radio-positioning system that nominally consists of 24-satellite constellation providing navigation and timing data to military and civilian users worldwide. **Development** **Start-** February 2000	Total costs of the GPS II modernization program have increased by over 20-percent, largely due to DOD's decision to delay the start of the follow-on GPS III program, which will require DOD to buy additional GPS IIF satellites. The first GPS IIR-M satellite with the new military code capability was launched in September 2005. A total of 18 satellites with this code need to be on orbit to provide initial operational capability to the warfighter and this number is expected to be reached in fiscal year 2011. However, the software for the control system needed to support the operational capability of these satellites will not be operational until fiscal year 2012. Thus the satellites on orbit with the new military code will not be fully utilized.
Wideband Gapfiller Satellites (WGS): Satellites based almost exclusively on commercial parts being developed by the Air Force to provide interim communications support. **Development** **Start-** November 2000	Total program costs increased about 70-percent from $1.06 billion in 2000 to $1.81 billion in 2005. The program office estimates an increase since last year of about $276.2 million for the program, largely due to cost growth resulting from a production gap between satellites three and four. Launch of the first satellite has now been delayed for over 3 years and is currently scheduled for June 2007. The delay will increase costs and add at least 22 months to the time it takes to obtain an initial operational capability from the system. The contractor continues to experience problems assembling the satellites.
Advanced Extremely High Frequency (AEHF): Communications satellite system being developed by the Air Force to replace its legacy protected communications satellites. **Development** **Start-** September 2001	Unit cost has increased by about 84-percent. In 2004, the program experienced cost increases of more than 15-percent, which required a Nunn-McCurdy notification to Congress. The program was restructured in 2004 when key cryptographic equipment was not delivered to the payload contractor in time to meet the launch schedule. Current plans are to meet full operational capability with three AEHF satellites and the first Transformational Satellite Communication System (TSAT) satellite, but additional AEHF satellites may be acquired if there are deployment delays with TSAT.
Space Tracking and Surveillance System (STSS): Two satellites that are going to be launched in 2007 as technology demonstrations for missile defense tests to assess whether missiles can be effectively tracked from space. **Development** **Start-** Restructured April 2002	Total program costs have increased by about 35-percent due to the addition of funds for designing and developing the program's operational constellation. The initial increment of this program, which started in 2002, is composed of two demonstration satellites that were built under the previous Space Based Infrared System-Low (SBIRS Low) program. SBIRS Low had incurred cost increases and schedule delays and other problems that were so severe, DOD abandoned the effort. The STSS program has experienced system quality and system engineering problems with the payload, however, the program office still expects early delivery and launch of the satellites.
National Polar-orbiting Operational Environmental Satellite System (NPOESS): Weather and environmental monitoring satellites being developed by the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, and DOD to replace those in use by the agencies. **Development** **Start-** August 2002	Unit costs increased by about 34-percent, triggering a Nunn-McCurdy review in January 2006. The launch of the first satellite has been delayed by at least 17 months (until September 2010) and could result in a gap in satellite coverage of at least 3 years. According to program officials, every aspect of the program is being evaluated by internal and external groups and several options are being reviewed for technical viability and cost effectiveness. The program office noted that any changes resulting from this process may produce substantial cost, schedule, and technical performance changes, such as removing a key sensor from the first satellite, delaying launches of the first two satellites, and not launching a preliminary risk-reduction satellite.

Transformational Satellite Communications System (TSAT): Communication satellites being developed by the Air Force to employ advanced technologies in support of DOD's future communication architecture. **Program Initiation-** January 2004	Total program costs have increased about 3-percent from $15.5 billion in June 2004 to nearly $16 billion in December 2004, and the initial launch of the first TSAT satellite has slipped from 2011 to 2014.The TSAT program is currently being restructured to follow an incremental development approach—an approach that is intended to help it stay within projected costs and provide capabilities to the war fighter sooner.
Mobile User Objective System (MUOS): Navy effort to develop a family of unprotected, narrow-band satellites that can support mobile and fixed-site users worldwide. **Development** **Start-** September 2004	This is a relatively new effort. In June 2004, DOD delayed the first MUOS satellite launch by one year to fiscal year 2010 due to a delay in awarding the development contract and to mitigate schedule risk. We reported that early procurement of long lead items before achieving a stable design for this Navy communications system could lead to cost increases and the program's development schedule remains compressed—posing risks should software development or other technical or design problems be encountered.
Planned Programs	
GPS III: Next generation of GPS being developed to add advanced jam resistant capabilities and provide higher quality and more secure navigational capabilities. **Planned Development Start Date-** Third quarter of fiscal year 2007	This is a relatively new effort. Initial plans were to develop these satellites and begin launching them in 2012, but DOD has delayed the start of this program so the planned first satellite launch date is now 2013. Program officials intend to use an incremental development approach for acquiring these satellites. A recent Defense Science Board study recommended a 30 satellite, three plane constellation for GPS III instead of the current 24 satellite, six plane constellation. The same study also recommended that cost and weight be key parameters in the design of the GPS III satellites, and specifically recommended measures to limit GPS III weight so that two satellites could be launched aboard a medium-class launch vehicle.
Space Radar (SR): Reconnaissance satellites being developed by the Air Force to find, identify, track and monitor moving or stationary targets under all weather conditions. **Planned Development Start Date -**August 2008	This is a relatively new effort with no reported cost increases or schedule delays. The planned cost estimate is about $23 billion. A decision to develop on-orbit demonstration satellites to validate technology maturity and cost won't be made until 2007. The program is undergoing restructure, including a new Integrated Program Office, a new plan for risk reduction activities and revised cost estimates, and an acquisition strategy that calls for development of a smaller constellation of high performing, more affordable satellites.

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

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