

GAO

Report to the Subcommittee on  
Strategic Forces, Committee on Armed  
Services, U.S. Senate

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April 2008

# SPACE ACQUISITIONS

## DOD Is Making Progress to Rapidly Deliver Low Cost Space Capabilities, but Challenges Remain





Highlights of [GAO-08-516](#), a report to the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

## Why GAO Did This Study

The Department of Defense (DOD) invests heavily in space assets to provide the warfighter with intelligence, navigation, and other information critical to conducting military operations. In fiscal year 2008 alone, DOD expects to spend over \$22 billion dollars on space systems. Despite this investment, senior military commanders have reported shortfalls in tactical space capabilities in each recent major conflict over the past decade.

To provide short-term tactical capabilities as well as identify and implement long-term solutions to developing low cost satellites, DOD initiated operationally responsive space (ORS). Following a 2006 GAO review of ORS, the Congress directed DOD to submit a report that sets forth a plan for providing quick acquisition of low cost space capabilities.

This report focuses on the status of DOD's progress in responding to the Congress and is based on GAO's review and analyses of ORS documentation and interviews with DOD and industry officials.

## What GAO Recommends

GAO recommends that the Secretary of the Air Force develop an investment plan—approved by stakeholders—that identifies how to achieve future capabilities, establishes funding priorities, and implements mechanisms to measure progress. DOD concurred with the recommendation.

To view the full product, including the scope and methodology, click on [GAO-08-516](#). For more information, contact Cristina Chaplain, (202) 512-4859, [chaplainc@gao.gov](mailto:chaplainc@gao.gov)

## SPACE ACQUISITIONS

### DOD Is Making Progress to Rapidly Deliver Low Cost Space Capabilities, but Challenges Remain

#### What GAO Found

Since GAO last reported on DOD's ORS efforts in 2006, the department has taken several steps toward establishing a program management structure for ORS and executing research and development efforts. On the programmatic side, DOD provided Congress with a plan that lays out an organizational structure and defines the responsibilities of the newly created Joint ORS Office, and describes an approach for satisfying warfighters' needs. DOD has also begun staffing the office. On the research and development side, DOD has launched one of its TacSat satellites—small experimental satellites intended to quickly provide a capability that meets an identified need within available resources—and has begun developing several others. It has also made progress in developing interface standards for satellite buses—the platform that provides power, altitude, temperature control, and other support to the satellite in space—and continued its sponsorship of efforts aimed at acquiring low cost launch vehicles. Despite this progress, it is too early to determine the overall success of these efforts because most are still in their initial phases.

Achieving success in ORS will be challenging. With relatively modest resources, the Joint ORS Office must quickly respond to the warfighter's urgent needs, while continuing research and development efforts that are necessary to help reduce the cost and time of future space acquisitions. As it negotiates these priorities, the office will need to coordinate its efforts with a broad array of programs and agencies in the science and technology, acquisition, and operational communities. Historically, it has been difficult to transition programs from the science and technology environment to the acquisition and operational environment. At this time, DOD lacks a plan that lays out how it will direct its investments to meet current operational needs while pursuing innovative approaches and new technologies.

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## **Abbreviations**

DARPA	Defense Advanced Research Project Agency
DOD	Department of Defense
GAO	Government Accountability Office
ORS	operationally responsive space
SpaceX	Space Explorations Technologies

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United States Government Accountability Office  
Washington, DC 20548

April 25, 2008

The Honorable Bill Nelson  
Chairman  
The Honorable Jeff Sessions  
Ranking Member  
Subcommittee on Strategic Forces  
Committee on Armed Services  
United States Senate

The Department of Defense (DOD) is investing heavily in large, complex satellites and other space assets to provide the warfighter with communications, intelligence, navigation, missile-warning, and other information critical to conducting military operations. In fiscal year 2008 alone, DOD expects to spend over \$22 billion dollars to develop and procure satellites and other space systems. Yet, for the past two decades, major satellite programs have been beset with significant cost overruns and schedule delays. Moreover, in each major conflict over the past decade, senior military commanders reported shortfalls in tactical space capabilities, such as those intended to provide communications and imagery data to the warfighter in theater.

To help address these issues, DOD recently initiated an effort known as operationally responsive space (ORS). The ORS initiative encompasses several separate endeavors with a goal to provide short-term tactical capabilities as well as identifying and implementing long-term technology and design solutions to reduce the cost and time of developing and delivering simpler satellites in greater numbers. More specifically, these include developing and launching small-size satellites, acquiring lower cost launch systems, developing standardized satellite components, as well as exploring a variety of new common design techniques. Though DOD has tried to make space acquisition more responsive in the past, the current ORS initiative is a concerted effort to create an environment where new concepts and ideas can be fostered and transitioned to users.

We reviewed aspects of the ORS initiative in 2006 and concluded that DOD needed a departmentwide strategy for pursuing low cost, responsive tactical capabilities—both satellite and launch—for the warfighter, and to

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identify corresponding funding.<sup>1</sup> Subsequently, the Congress directed DOD to submit a report that sets forth a plan for providing quick acquisition of low cost space capabilities.<sup>2</sup> Given the potential these efforts offer for changing the way DOD acquires and fields space capabilities, you asked us to report on the status of DOD's progress to date in implementing the program and assessing associated challenges. We also reviewed DOD's development of a higher level strategy to guide the ORS initiative, an action that we reported separately to you in March 2008. Further, we are reviewing ORS' requirements setting process and its integration into warfighting concepts of operation, which we will report on later in June 2008.<sup>3</sup>

To conduct our work for this report, we reviewed and analyzed ORS documentation and interviewed officials representing the ORS initiative as well as officials from the warfighting, acquisition, science, and technology communities and industry. We conducted this performance audit from May 2007 to February 2008 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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## Results in Brief

DOD is making progress in putting a program management structure in place for ORS as well as executing ORS-related research and development efforts. On the programmatic side, DOD provided Congress with a plan that lays out an organizational structure and defines the responsibilities of the newly created Joint ORS Office, and describes an approach for satisfying warfighters' needs. DOD has also begun staffing the office. On the research and development side, DOD has launched one of its small-sized satellites and begun developing several others, made progress in developing interface standards for satellite buses, and continued its

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<sup>1</sup> GAO, *Space Acquisitions: DOD Needs a Departmentwide Strategy for Pursuing Low-Cost, Responsive Tactical Space Capabilities*, [GAO-06-449](#) (Washington, D.C.: Mar. 14, 2006).

<sup>2</sup> The John Warner National Defense Authorization Act for Fiscal Year 2007, Pub. L. No. 109-364, § 913(c) (2006).

<sup>3</sup> GAO, *Defense Space Activities: National Security Space Strategy Needed to Guide Future DOD Space Efforts*, [GAO-08-431R](#) (Washington, D.C.: Mar. 27, 2008).

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sponsorship of efforts aimed at acquiring low cost launch vehicles. It is too early to determine how successful these efforts will be because most are still in their initial stages.

As DOD moves forward, it will be challenged on many fronts as ORS is expected to execute a range of efforts within relatively modest resources and amid competing demands and pressure to produce quick results. For example, rapid development and deployment of small satellites is being currently considered as a potential solution for various capability gaps that may occur because of schedule delays on larger acquisition programs. But concentrating efforts to fill just one gap could be relatively expensive and time consuming for the ORS initiative and divert resources from other ORS efforts. For example, some officials we spoke with asserted that not enough attention was being paid to acquiring low cost launch vehicles—a linchpin to reducing satellite development costs in the future. At this time, DOD currently lacks tools needed to negotiate these challenges—primarily, a plan that lays out how it will direct its investments to meet existing gaps while at the same time pursuing innovative approaches and new technologies to rapidly respond to future warfighter needs. To help DOD successfully negotiate this challenge, we are recommending that DOD develop an investment plan.

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## Background

In May 2003, the Office of Force Transformation began funding small experimental satellites to enhance the responsiveness to the warfighter and to create a new business model for developing and employing space systems.<sup>4</sup> As we have reported over the past two decades, DOD's space portfolio has been dominated by larger space system acquisitions, which have taken longer, cost more, and delivered fewer quantities and capabilities than planned.<sup>5</sup> The ORS initiative is a considerable departure from DOD's large space acquisition approach. The initiative aims to quickly deliver low cost, short-term tactical capabilities to address unmet needs of the warfighter. Unlike traditional large satellite programs, the ORS initiative is intended to address only a small number of unmet tactical needs—one or two—with each delivery of capabilities. It is not designed to replace current satellite capabilities or major space programs in

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<sup>4</sup> Department of Defense, *Quadrennial Defense Review Report* (September 2001).

<sup>5</sup> GAO, *Space Acquisitions: Improvements Needed in Space Systems Acquisitions and Keys to Achieving Them*, [GAO-06-626T](#) (Washington, D.C.: Apr. 6, 2006).

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development. Also, the initiative potentially aims to identify and facilitate ways to reduce the time and cost for all future space development efforts.

As we have previously reported, managing requirements so that their development is matched with resources offers an opportunity to mature technologies in the science and technology environment—a best acquisition practice.<sup>6</sup> We also have reported that the ORS initiative could provide opportunities for small companies—who often have a high potential to introduce novel solutions and innovations into space acquisitions—to compete for DOD contracts. Consolidations within the defense industrial base for space programs have made it difficult for such companies to compete. ORS could broaden the defense industrial base and thereby promote competition and innovation.

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## DOD Has Made Progress to Develop a Management Structure and Build a Technological Foundation for ORS

Since we last reported on DOD's ORS efforts in 2006, the department has taken several steps toward establishing a program management structure for ORS and executing research and development efforts. Despite this progress, it is too early to determine the overall success of these efforts because most are still in their initial phases.

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## Program Management Structure

Congress directed that DOD submit a report that sets forth a plan for the quick acquisition of low cost space capabilities and establish a Joint ORS Office to coordinate and manage the ORS initiative. In the first half of 2007, DOD delivered an ORS plan to Congress and established a Joint ORS Office. DOD created the Joint ORS Office to coordinate and manage specific science and technology efforts to fulfill joint military operational requirements for on-demand space support and reconstitution. In addition, DOD is working with other government agencies to staff the office, developing an implementation plan, and establishing a process for determining which existing requirements for short-term tactical capabilities the office should pursue. Responsiveness is an attribute desired by the entire space community, including the National Aeronautics

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<sup>6</sup> GAO, *Best Practices: Stronger Practices Needed to Improve DOD Technology Transition Processes*, [GAO-06-883](#) (Washington, D.C.: Sept. 14, 2006).



and Space Administration and the military service laboratories. Most of the efforts under the ORS initiative are being executed by science and technology organizations and other DOD agencies. The office will be responsible for coordinating, planning, acquiring, and transitioning those efforts. Its work is to be guided by an executive committee, comprised of senior officials from DOD, the military services, the intelligence community, and other government agencies. Most requirements for needed short-term tactical capabilities are expected to come through the U.S. Strategic Command. To respond to unmet warfighter needs, ORS requirements will be based on existing validated requirements. Table 1 summarizes the status of some of DOD's efforts related to the management structure.

**Table 1: Status of Efforts to Develop a Management Structure by Action**

Status	Description
<b>Deliver a plan to Congress as required by the 2007 National Defense Authorization Act</b>	
Completed; DOD submitted the plan in April 2007	<ul style="list-style-type: none"> <li>The plan identifies a general approach for establishing the responsive space initiative and establishes an office to coordinate and execute ORS activities.</li> <li>The Joint ORS Office, located at Kirtland Air Force Base in Albuquerque, New Mexico, was officially activated in May 2007.</li> </ul>
<b>Staff the Joint ORS Office</b>	
In progress; 8 of the 20 expected government positions have been filled as of February 2008.	<ul style="list-style-type: none"> <li>The office is to be staffed with up to 20 government (military and civilian) positions to be provided by the various military services and agencies associated with responsive space activities.</li> <li>As of February 1, 2008, 8 government positions were staffed by personnel from the United States Air Force, Army, and Navy; the National Aeronautics and Space Administration; the National Reconnaissance Office; the National Security Agency; the Air National Guard; and Sandia Laboratory.</li> <li>Additional support is being provided by 14 Federally Funded Research and Development Centers<sup>a</sup> and Systems Engineering and Technical Assistance<sup>b</sup> contractors.</li> </ul>
<b>Develop an implementation plan</b>	
In progress; the plan is expected to be approved in February 2008	<ul style="list-style-type: none"> <li>In July 2007, the Deputy Secretary of Defense directed the Executive Agent for Space to develop an implementation plan that describes how the office will deliver existing space capabilities, evolve new capabilities, and leverage innovative approaches to meet requirements identified by the U.S. Strategic Command.</li> <li>DOD established a working group with five subgroups tasked with making recommendations on requirements, acquisitions, manpower, lead service, and executive committee. One of the subgroups is tasked with developing a charter for the Executive Committee that would define the roles and responsibilities of the committee members from the various and diverse agencies.</li> </ul>

Status	Description
<b>Establish a requirements process</b>	
In progress	<ul style="list-style-type: none"> <li>• ORS requirements are to be based on existing but unsatisfied validated requirements to respond to combatant commanders' needs. The Joint ORS Office received a request from U.S. Strategic Command to develop a communications capability that cannot be satisfied by the current ultra high frequency system. The requested capability falls within the validated requirements set for the Mobile User Objective System, currently under development.<sup>c</sup></li> </ul>

Source: DOD data and GAO analysis.

<sup>a</sup>Federally Funded Research and Development Centers conduct research for the U.S. government.

<sup>b</sup>Systems Engineering and Technical Assistance contractors are civilian employees of government contractors who are contracted to assist DOD components and acquisition programs.

<sup>c</sup>The Navy's Mobile User Objective System is expected to provide low data rate voice and data communications capable of penetrating most weather, foliage, and man-made structures beginning in late 2009.

## Research and Development Efforts

DOD is continuing to make progress in developing TacSats—its small experimental satellite projects. In addition, DOD is funding research efforts by industry to facilitate the development of future capabilities and is working with industry and academia to develop standards for building satellite components. Finally, DOD is working to improve the capabilities of existing small launch vehicles and providing some funding for future launch vehicles.

### Development of Small-Sized Satellites

The TacSat experiments aim to quickly provide the warfighter with a capability that meets an identified need within available resources—time, funding, and technology. Limiting the TacSats' scope allows DOD to trade off higher reliability and performance<sup>7</sup> for speed, responsiveness, convenience, and customization. Once each TacSat satellite is launched, DOD plans to test its level of utility to the warfighter in theater. If military utility is established, DOD will assess the acquisition plan required to procure and launch numerous TacSats—forming constellations—to provide wider coverage over a specific theater. As a result, each satellite's capability does not need to be as complex as that of DOD's larger satellites and does not carry with it the heightened consequence of failure as if each satellite alone were providing total coverage. DOD currently has five TacSat experiments in different stages of development (see table 2).

<sup>7</sup> Existing systems have been designed for longer life and increased reliability, requiring years to develop and a significant investment of resources.

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**Table 2: Status of Efforts to Develop and Demonstrate TacSat Experimental Satellites**

Status	Description
<b>TacSat 1</b>	
In progress; satellite has been developed but not demonstrated.	<ul style="list-style-type: none"><li>• The Naval Research Laboratory led a year-long effort to develop TacSat 1, at a cost of \$23 million.</li><li>• TacSat 1 was completed in May 2004, but has yet to be demonstrated because of delays incurred with the development and testing of a low cost launch vehicle.</li><li>• Given the launch delay, the Naval Research Laboratory decided to add a new sensor—an automated identification system to support maritime missions. The new sensor and other new capabilities are estimated to cost \$10.5 million.</li><li>• The Joint ORS Office, the Navy, Coast Guard, and Department of Defense Research and Engineering are currently working to develop a cost sharing agreement.</li></ul>
<b>TacSat 2</b>	
Complete; satellite developed and demonstrated in 2006 through 2007.	<ul style="list-style-type: none"><li>• TacSat 2 development, led by the Air Force Research Laboratory, was completed in 29 months at a cost of \$39 million.</li><li>• Its payload includes tactical imaging and radio frequency equipment, and an automated identification sensor.</li><li>• TacSat 2 was launched in December 2006 on a Minotaur I launch vehicle and participated in military exercises during the summer of 2007.</li><li>• The Air Force Research Laboratory ended the demonstration in December 2007.</li></ul>
<b>TacSat 3</b>	
In progress; satellite expected to be launched in August 2008.	<ul style="list-style-type: none"><li>• The Air Force Research Laboratory is leading the effort to develop TacSat 3 which will provide the first implementation of selected bus standards.</li><li>• Its primary payload is a hyperspectral imager for tactical targeting of camouflaged and hard-to-detect targets.</li><li>• The cost is estimated to be \$62.7 million, and the planned launch date is August 2008 on a Minotaur I launch vehicle.</li></ul>
<b>TacSat 4</b>	
In progress; expected to be launched in September 2009.	<ul style="list-style-type: none"><li>• The Naval Research Laboratory is leading the effort to develop TacSat 4, which will include equipment to demonstrate mobile data communications services, friendly forces tracking, and data relay from terrestrial sensor.</li><li>• It will also evaluate the DOD system bus standards effort in a realistic launch-and-flight operations environment.</li><li>• The cost is estimated to be \$114 million, and the planned launch date is September 2009 on a Minotaur IV launch vehicle.</li></ul>
<b>TacSat 5</b>	
In progress; launch date to be determined.	<ul style="list-style-type: none"><li>• The Army Space and Missile Defense Center, the Joint ORS Office, the Air Force Research Laboratory, and Space and Missile Systems Center will lead the development of TacSat 5.</li><li>• Payload experiments have not been finalized.</li><li>• The cost and schedule are to be determined.</li></ul>

Source: DOD data.

In addition, DOD is sponsoring the development of new capabilities provided mostly by the small satellite industry. These efforts include the

Efforts to Develop and Test Satellite Interface and Bus Standards

ORS Payload Technology Initiative, which awarded 15 contracts to satellite industry contractors for payload technology concepts that may be developed in the future. The Air Force has been funding additional research conducted by small technology companies that could provide ORS capabilities, such as faster ways of designing satellites, and identifying the types and characteristics of components based on mission requirements.

DOD is also working to establish standards for the “bus”—the platform that provides power, attitude, temperature control, and other support to the satellite in space.<sup>8</sup> Establishing interface standards for bus development would allow DOD to create a “plug and play” approach to building satellites—similar to the way personal computers are built. According to DOD officials, interface standards would allow the development of modular or common components and would facilitate building satellites—both small and large—more quickly and at a lower cost. DOD’s service laboratories, industry, and academia have made significant progress to develop satellite bus standards. The service labs expect to test some standardized components on the TacSat 3 bus and system standards on the TacSat 4 bus. Table 3 provides a description of the bus standardization efforts and their status.

**Table 3: Status of Efforts to Develop and Test Satellite Interface and Bus Standards**

Status	Description
<b>Demonstrate “plug and play” architecture</b>	
In progress.	<ul style="list-style-type: none"> <li>The Air Force Research Laboratory is demonstrating capabilities of a “plug and play” architecture that accelerates satellite production through the use of standardized computer-like ports to connect standardized components.</li> <li>For example, the Air Force Research Laboratory is developing standard bus panels with an embedded wiring system and standard ports for easy assembly and integration.</li> </ul>
<b>Determine class of ORS satellites needed</b>	
Complete; report issued in March 2005.	<ul style="list-style-type: none"> <li>This effort, led by the Massachusetts Institute of Technology Lincoln Laboratory, determined the class of satellite needed to be militarily useful.</li> </ul>
<b>Develop interface standards, and develop TacSat 3 bus</b>	
In progress.	<ul style="list-style-type: none"> <li>This effort, being led by the Air Force Research Laboratory, is to provide interface standards between the bus and the payload, and to rapidly provide a bus for the TacSat 3 hyperspectral payload experiment.</li> </ul>

<sup>8</sup> Satellites primarily consist of the payload and the bus. Currently, DOD’s buses are custom-made for each space program.

Status	Description
<b>Develop bus standards for initial blocks of operational satellites, and transition plan</b>	
In progress.	<ul style="list-style-type: none"> <li>This effort, being led by the Naval Research Laboratory and the John Hopkins University Applied Physics Laboratory, is using a broad consortium of industry and government members to develop bus standards along with the associated costs and business considerations for acquisition.</li> <li>The consortium is also working to develop a plan that explains how to transition from a science and technology environment to an acquisition phase. The transition plan is in final coordination within DOD.</li> </ul>
<b>Acquire initial standardized satellite buses</b>	
Slated to begin after bus standards have been developed.	<ul style="list-style-type: none"> <li>This effort, to be carried out by the Joint ORS Office, will be the acquisition of the initial block of standard satellite buses.</li> </ul>

Source: DOD data.

## Launch Infrastructure

To get new tactical space capabilities to the warfighter sooner, DOD must secure a small, low cost launch vehicle on demand. Current alternatives include Minotaur launch vehicles, ranging in cost from about \$21 million to \$28 million, and an Evolved Expendable Launch Vehicle—DOD’s primary satellite launch vehicles—at an average cost of roughly \$65 million (for medium and intermediate launchers). DOD is looking to small launch vehicles, unlike current systems, that could be launched in days, if not hours, and whose cost would better match the small budgets of experiments. Both DOD and private industry are working to develop small, low cost, on-demand launch vehicles. Notably, DOD expects the Defense Advanced Research Projects Agency’s (DARPA) FALCON launch program to flight-test hypersonic technologies and be capable of launching small satellites such as TacSats. In addition to securing low cost launch vehicles, DOD plans to acquire a more responsive, reliable, and affordable launch tracking system to complement the existing launch infrastructure. Table 4 describes DOD’s efforts to develop a launch infrastructure and their status.

**Table 4: Efforts to Develop a Launch Infrastructure**

Status	Description
<b>Develop low cost launch vehicles through DOD’s FALCON program</b>	
In progress.	<ul style="list-style-type: none"> <li>• DARPA, along with the Air Force, established FALCON, to accelerate efforts to develop a vehicle that can send 1,000 pounds to low-earth orbit for less than \$5 million with an operational cost basis of 20 flights per year for 10 years.</li> <li>• DARPA contracted with Space Exploration Technologies (SpaceX) to develop a two-stage vehicle for launches into space. According to DOD, SpaceX completed its activity for the FALCON program with a test launch of their rocket in March 2007.</li> <li>• For fiscal year 2008, the Appropriations conferees encouraged ORS to continue to work with the FALCON program to develop a small launch vehicle. Another SpaceX flight demonstration is expected to occur in mid 2008.</li> <li>• According to DARPA, between fiscal years 2003 and 2007, it provided SpaceX with a total of more than \$15.6 million dollars for advanced technology development, facilities, test-range and mission support, and program office support.</li> </ul>
<b>Develop new launch vehicle capabilities through the Air Force Research Laboratory</b>	
In progress.	<ul style="list-style-type: none"> <li>• The Air Force Research Laboratory continues its work on spacecraft payload shock protection and noise reduction technologies during launch.</li> <li>• The laboratory has developed technologies to reduce vibration in launch vehicles that have been used on the Minotaurs.</li> <li>• The laboratory has also funded science and technology research on solid rocket motors.</li> </ul>
<b>Develop other elements that support responsive launch systems</b>	
In progress	<ul style="list-style-type: none"> <li>• In September 2006, the DOD Executive Agent for Space signed a memorandum stating that by January 1, 2011, all DOD, civil, and commercial vehicles launched will need to be tracked through use of the Global Positioning System.<sup>a</sup> The DOD Executive Agent for Space sees this as the first logical step towards a space-based control system that is more responsive, reliable, and affordable than the current terrestrially based system.</li> </ul>

Source: DOD data.

<sup>a</sup>The Global Positioning System is a space-based radio-positioning system nominally consisting of a 24-satellite constellation providing navigation and timing data to military and civilian users worldwide.

## ORS Challenges Magnified by Lack of a Plan to Guide Investments and Efforts

DOD faces several challenges in succeeding in its ORS efforts. With relatively modest resources, the Joint ORS Office must quickly respond to the warfighter’s urgent needs, including gaps in capabilities, as well as continue its longer-term research and development efforts that are necessary to help reduce the cost and time of future space acquisitions. As the office negotiates these priorities, it will need to coordinate its efforts with a broad array of programs and agencies in the science and technology, acquisition, and operational communities. Historically it has been difficult to transition programs initiated in the science and technology environment to the acquisition and operational environment. At this time, DOD lacks tools which would help the program office navigate within this environment—primarily, a plan that lays out how the

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office will direct its investments to meet current operational needs while at the same time pursuing innovative approaches and new technologies.

The Joint ORS Office has a budget totaling about \$646 million for fiscal years 2008 through 2013 and with no more than 20 government staff. These resources are relatively modest when compared with the resources provided major space programs. For example, the ORS fiscal year 2008 budget represents less than 12 percent of the budget of the Transformational Satellite Communications System program<sup>9</sup> which is in the concept development phase, and staffing is about a quarter of that program's staff. While the Joint ORS Office's responsibilities are not the same as those of large, complex acquisition programs, it is expected to address urgent tactical needs that have not been met by the larger space programs. At this time, for example, the office has been asked to develop a solution to meet current communications shortfalls that cannot be met by the current Ultra High Frequency Follow-On satellite system.<sup>10</sup> And, while the office has not yet been asked, officials have told us that ORS could potentially satisfy a gap in early missile warning capabilities because of delays in the Space Based Infrared Systems program, as well as gaps in communications and navigation capabilities. Taking on any one of these efforts will be challenging for ORS as there are constraints in available technologies, time, money, and other resources that can be used to fill capability gaps.

At the same time, the Joint ORS Office will be pressured to continue to sponsor longer term research and development efforts. According to the Air Force Research Laboratory, the average cost of a small satellite is about \$87 million. This is substantially higher than the target acquisition cost of about \$40 million for an integrated ORS satellite in the 2007 National Defense Authorization Act.<sup>11</sup> In addition, concerns are being expressed that not enough funding and support are being devoted to acquiring low cost launch capabilities. Some government and industry officials believe that achieving such capabilities is a linchpin to reducing satellite development costs in the future. The current alternatives for launching ORS satellites—an Evolved Expendable Launch Vehicle and

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<sup>9</sup> The Air Force's Transformational Satellite Communications System is expected to provide high data rate military satellite communications services to DOD users.

<sup>10</sup> This system is expected to be replaced by the Navy's Mobile User Objective System.

<sup>11</sup> The John Warner National Defense Authorization Act for Fiscal Year 2007, Pub. L.No. 109-364 § 913(b)(1)(2006)(codified at 10 U.S.C. § 2273a(e)(5)).

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Minotaur launch vehicles—do not meet DOD’s low cost goal. DARPA expects its responsive launch capabilities, currently in development, will total about \$5 million to produce—a significantly lower cost than that of current capabilities. However, in order to achieve the lower cost launch capability, DOD will have to continue to fund research beyond the \$15.6 million already spent on advanced technology development, facilities, test-range and mission support, and program office support.

To execute both its short- and long-term efforts, the Joint ORS Office will also need to gain cooperation and consensus from a diverse array of officials and organizations. These include science and technology organizations, the acquisition community, the U.S. Strategic Command, the intelligence community, and industry. We have previously reported on difficulties DOD has encountered in bringing these organizations together, particularly when it comes to setting requirements for new acquisitions and transitioning technologies from the science and technology community to acquisition programs. As a new and relatively small organization, the Joint ORS Office may well find it does not have the clout to gain cooperation and consensus on what short- and long-term projects should get the highest priority.

Despite the significant expectations placed on the Joint ORS Office and the challenges it faces, DOD does not have an investment plan to guide its ORS decisions. DOD has begun to develop an ORS strategy that is to identify the investments needed to achieve future capabilities. However, the strategy is not intended to become a formalized investment plan that would (1) help DOD identify how to achieve these capabilities, (2) prioritize funding, and (3) identify and implement mechanisms to enforce the plan. At the same time, there are other science and technology projects in DOD’s overall space portfolio competing for the same resources, including those focused on discovering and developing technologies and materials that could enhance U.S. superiority in space. Further, as DOD’s major space acquisition programs continue to experience cost growth and schedule delays, DOD could be pressured to divert funds from ORS. We have previously recommended that DOD prioritize investments for both its acquisitions and science and technology projects—the ORS plan could be seamlessly woven into an overall DOD investment plan for space. However, DOD has yet to develop this overall investment plan.

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## Conclusions

Providing the warfighter with needed space capabilities in a fiscally constrained and rapidly changing technological environment is a daunting task. ORS provides DOD with a unique opportunity to work outside the



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typical acquisition channels to more quickly and less expensively deliver these capabilities. However, even at lower costs, pressure on ORS funding will come in DOD's competition for its resources. As DOD moves forward, decisions on using constrained resources to meet competing demand will need to be made and reevaluated on a continuing basis. Until DOD develops an investment plan, it will risk forgoing an opportunity to get continuing success out of the ORS initiative.

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## Recommendation for Executive Action

To better ensure that DOD meets the ORS initiative's goal, we recommend that the Secretary of the Air Force develop an investment plan to guide the Joint ORS Office as it works to meet urgent needs and develops a technological foundation to meet future needs. The plan should be approved by the stakeholders and identify how to achieve future capabilities, establish funding priorities, and identify and implement mechanisms to ensure progress is being achieved.

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## Agency Comments

We provided a draft of this report to DOD for review and comment. DOD concurred with our findings and our recommendation but clarified that the Secretary of the Air Force, specifically the Executive Agent for Space, would be responsible for developing an investment plan since the Under Secretary of the Air Force position is vacant. Full comments can be found in appendix I.

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## Scope and Methodology

To assess DOD's progress to date in implementing its ORS goal and addressing associated challenges, we interviewed and reviewed documents from officials in Washington, D.C., at the Office of the Deputy Under Secretary of Defense for Advanced Systems and Concepts; National Security Space Office; Office of the Director of Defense Research and Engineering; Office of the Director of Program Analysis and Evaluation; Office of the Joint Chiefs of Staff; the U.S. Naval Research Laboratory; and the Office of the Assistant Secretary of the Navy for Research, Development and Acquisition. We also interviewed and reviewed documents from officials in Virginia at the Office of the Assistant Secretary of Defense for Networks Information and Integration; Office of the Under Secretary of the Air Force; Defense Advanced Research Project Agency; and U.S. Army Space and Missile Defense Command. In addition, we interviewed and reviewed documents from officials at the Navy Blossom Point Satellite Tracking Facility in Maryland; Air Force Space Command, Peterson Air Force Base, Colorado; Space and Missile Systems Center, Los Angeles Air Force Base, California; the U.S. Strategic Command, Offutt Air Force Base, Nebraska; and the Air Force Research

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Laboratory and Joint Operationally Responsive Space Office, Kirtland Air Force Base, New Mexico. We also interviewed officials from the National Aeronautics and Space Administration, Washington, D.C., and industry representatives involved in developing small satellites and commercial launch vehicles. We reviewed and analyzed the documents that we received.

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We will send copies of the letter to the Department of Defense and other interested congressional committees. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

Should you or your staff have any questions on matters discussed in this report, please contact me at (202) 512-4859 or [chaplainc@gao.gov](mailto:chaplainc@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Principal contributors to this report were Art Gallegos, Assistant Director; Maria Durant; Jean Harker; Arturo Holguin; and Karen Sloan.

A handwritten signature in black ink, appearing to read 'Cristina Chaplain', with a stylized, cursive script.

Cristina Chaplain  
Director  
Acquisition and Sourcing Management

# Appendix I: Comment from the Department of Defense



NETWORKS AND  
INFORMATION INTEGRATION

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE  
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WASHINGTON, DC 20301-6000

Ms. Christina T. Chaplain  
Director, Acquisition and Sourcing Management  
Government Accountability Office  
441 G Street, N.W.  
Washington, D.C. 20548

Dear Ms. Chaplain:

The Department of Defense (DoD) concurs with the GAO Draft Report, GAO-08-516, 'SPACE ACQUISITIONS: DoD Is Making Progress to Rapidly Deliver Low Cost Space Capabilities, but Challenges Remain,' dated March 14, 2008 (GAO Code 120648). For clarification, the investment plan should be worked by the DoD Executive Agent for Space, currently the Secretary of the Air Force, and not the Under Secretary of the Air Force as that position is vacant. Thank you for the opportunity to review and comment on this report.

Sincerely,

A handwritten signature in black ink, appearing to read "S. Huybrechts".

Steven M. Huybrechts  
Director, Space Programs and Policy



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# Appendix II: GAO Contact and Staff Acknowledgments

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## Contact

Cristina Chaplain (202) 512-4859 or [chaplainc@gao.gov](mailto:chaplainc@gao.gov)

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## Acknowledgments

In addition, key contributors to the report include Maria Durant, Art Gallegos, Jean Harker, Arturo Holguin, and Karen Sloan.

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