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SPACE ACQUISITIONS

DOD Continues to Face Challenges of Delayed Delivery of Critical Space Capabilities and Fragmented Leadership

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Accessible Version

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GAO Highlights

Highlights of GAO-17-619T, a testimony before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

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Why GAO Did This Study

DOD's space systems provide critical capabilities that support military and other government operations and can take a long time to develop, produce, and launch. These systems can also be expensive to acquire and field, amounting to billions of dollars each year. Given the time and resource demands of DOD's space systems and the need to ensure taxpayer dollars are used effectively, especially in light of today's constrained government budget environment, it is essential that DOD manage system acquisitions carefully and avoid repeating past problems.

This statement focuses on (1) the current status and cost of major DOD space system acquisitions, (2) GPS, which is the only large DOD satellite program with systems currently in the development cycle, and (3) leadership for space acquisitions.

This statement highlights the results of GAO's work on space acquisitions over the past 8 years and presents preliminary observations from ongoing work on the Global Positioning System. For the ongoing work, GAO analyzed program documents and interviewed DOD and contractor officials.

What GAO Recommends

Past GAO reports have generally recommended that DOD adopt acquisition best practices to help ensure cost and schedule goals are met. DOD has generally agreed and taken some actions to address space acquisition problems; however, additional actions are still needed.

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What GAO Found

Many major Department of Defense (DOD) space programs GAO reviewed have experienced cost and schedule increases. For example, costs for the Advanced Extremely High Frequency satellite program grew 118 percent and its first satellite was launched more than 3.5 years late. Costs for the Space Based Infrared System grew nearly 300 percent and its scheduled launch was delayed roughly 9 years. Both programs are now in the production phase during which fewer technical problems tend to surface. Satellite ground systems have also been challenged by cost and schedule growth. In fact, ground system delays have been so lengthy that satellites sometimes spend years in orbit before key capabilities can be fully utilized. The table below provides some examples of program status.

Advanced Extremely High Frequency $6.9 billion Original cost $15.0 billion Current cost	**Schedule:** The first, second, and third launches occurred in August 2010, May 2012, and September 2013, respectively. The fourth satellite, currently in production, is scheduled to be launched in October 2017.
Global Positioning System Next Generation Operational Control System $3.6 billion Original cost $5.5 billion Current cost	**Schedule:** Because of poor program cost and schedule performance, the Air Force expects to establish new cost and schedule baselines for the program by June 2017.
Space Based Infrared System $5.0 billion Original cost $19.2 billion Current cost	**Schedule:** The third geosynchronous Earth orbit satellite launched in January 2017. The fourth satellite is to launch in November 2017. The fifth and sixth satellites are to be available for launch in 2021 and 2022.

Source: GAO analysis of Department of Defense information. | GAO-17-619T

GAO's preliminary results from an ongoing review of the Global Positioning System (GPS) show that the satellites, ground systems, and user equipment continue to be on a high-risk path. The launch of the first GPS satellite has been delayed almost 4 years because of technical problems. Additionally, development challenges for the satellite's ground system have resulted in delays so significant that the Air Force has started two other ground system efforts as workarounds to mitigate risk of delayed GPS capability. Additionally, it remains unclear how DOD will overcome a number of challenges that create high risk to the timely fielding of upgraded GPS user equipment for the warfighter.

GAO has reported over the years that DOD's culture has generally been resistant to changes in space acquisition approaches and that fragmented responsibilities have made it difficult to coordinate and deliver interdependent systems. Although some changes in leadership have been made, such as providing the Secretary of the Air Force with additional space responsibilities, it is too early to gauge whether these changes are sufficient to provide leadership for balancing needs against wants, ensure coordination among the many organizations involved with space, and ensure that resources are directed where they are most needed. Given the long-standing fragmentation in space leadership and consequent challenges DOD faces in synchronizing its extensive space enterprise, discussions with DOD officials and experts indicate further-reaching changes, ranging from establishing a space acquisition agency to instituting a new military department for space, may deserve a closer look.

Chairman Fischer, Ranking Member Donnelly, and Members of the Subcommittee:

I am pleased to have the opportunity to comment on the Department of Defense's (DOD) space system acquisitions. DOD's space systems provide critical capabilities that support military and other government operations and can take a long time to develop, produce, and launch. These systems can also be expensive to acquire and field, amounting to billions of dollars each year. Given the time and resource demands of DOD's space systems and the need to ensure taxpayer dollars are used effectively, especially in light of today's constrained government budget environment, it is essential that DOD manage system acquisitions carefully and avoid repeating past problems.

My statement will focus on (1) the current status and cost of major DOD space system acquisitions, (2) the Global Positioning System, which is the only large DOD satellite program with systems currently in the development cycle, and (3) leadership for space acquisitions.

This statement is based on GAO reports on space programs issued over the past 8 years and recent work performed in support of our annual weapon systems assessments. It is also based on space-related work in support of our 2017 annual report on duplication, overlap, and fragmentation across the federal government; and GAO updates on cost increases, investment trends, and improvements in the last year. More information on our objectives, scope, and methodology is available in our related products.[1]

In addition, the statement includes preliminary observations from our ongoing work on the Global Positioning System (GPS). For this work, we analyzed Air Force GPS quarterly reports, program acquisition baselines, integrated master schedules, acquisition strategies, software development plans, test plans, and other documents for GPS III, Next Generation Operational Control System (OCX), Military GPS User Equipment (MGUE), Contingency Operations (COps), and M-code Early Use (MCEU) programs. We compared program acquisition strategies against GAO's criteria for best practices in systems development. We also interviewed officials from the GPS III, OCX, MGUE, and COps programs; the prime contractors for these four programs; the Defense

[1]See list of related GAO products at the end of this statement.

Contract Management Agency monitoring the programs; and where applicable officials from the Office of Cost Assessment and Program Evaluation; the Office of the Director, Operational Test and Evaluation; each of the military services involved with the planning and procurement of the MGUE program; and Air Force Space Command. DOD provided technical comments on the preliminary findings contained in this statement, which were incorporated as appropriate.

We conducted the work on which this statement is based 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. The ongoing work on which this statement is, in part, based is being conducted in accordance with generally accepted government auditing standards.

Status of Major Defense Space Programs

DOD space systems support and provide a wide range of capabilities to a large number of users, including the military services, the intelligence community, civil agencies, and others. These capabilities include positioning, navigation, and timing; meteorology; missile warning; and secure communications, among others. Space systems can take a long time to develop and often consist of multiple components, including satellites, ground control stations, terminals, and user equipment. DOD satellite systems are also expensive to acquire. Unit costs for current DOD satellites can range from $500 million to over $3 billion. The ground systems can cost as much as $5.5 billion and the cost to launch a satellite can climb to well over $100 million.

Many major DOD space programs have experienced significant cost and schedule increases. For instance, program costs for the Advanced Extremely High Frequency (AEHF) satellite program, a protected satellite communications system, had grown 118 percent since its first estimate as of our March 2017 review and its first satellite was launched over 3.5 years late.[2] For the Space Based Infrared System (SBIRS), a missile

[2]GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, GAO-17-333SP (Washington, D.C.: Mar. 30, 2017).

warning satellite program, costs grew nearly 300 percent and the launch of the first satellite was delayed roughly 9 years. Both programs are now in the production phase where fewer problems tend to surface, and where there is typically less risk of cost and schedule growth. The only major satellite program with systems in the development phase is the Global Positioning System (GPS), which has seen an almost 4-year delay and unit cost growth of 9 percent due to technical issues.

Cost and schedule growth has also been a challenge for satellites and their ground systems. In fact, delays with ground systems have been so lengthy, that satellites sometimes spend years in orbit before key capabilities can be fully exploited. For example, as discussed below, the command and control system for GPS III satellites, known as the Next Generation Operational Control System, or OCX, is at least 5 years behind schedule.[3] Because of these delays, the Air Force has had to start two separate back-up efforts to ensure the continuity of GPS capabilities and to make anti-jamming capabilities available via Military Code, or M-code, until OCX is delivered. Additionally, over 90 percent of the capabilities to be provided by Mobile User Objective System communications satellites—the first of which launched in 2012 and with five satellites now in orbit—are being underutilized because of problems with integrating the space, ground, and terminal segments and delays in fielding compatible user terminals. Figure 1 provides more details on the current status of DOD's major space programs.

[3]GAO-17-333SP.

Figure 1: Status of Major Department of Defense (DOD) Space Acquisitions

Advanced Extremely High Frequency (AEHF)
(satellite communications)

Mission: AEHF satellites will replenish the existing Milstar system with higher-capacity, survivable, jam-resistant, worldwide, secure communication capabilities for strategic and tactical warfighters.

Acquisition phase:
Production

Original total program cost:
$6.9 billion
Current total program cost:
$15.0 billion

Original quantity: **5**
Current quantity: **6**

Schedule: The first, second, and third launches, occurred in August 2010, May 2012, and September 2013, respectively. The fourth satellite, currently in production, is scheduled to be launched in October 2017.

Enhanced Polar System (EPS)
(satellite communications)

Mission: EPS is expected to provide next-generation protected extremely high frequency satellite communications in the polar region.

Acquisition phase:
Development
Production

Original total program cost:
$1.4 billion
Current total program cost:
$1.4 billion

Original quantity: **2**
Current quantity: **2**

Schedule: The first EPS payload became available for on-orbit testing in March 2015. The Control and Planning Segment (CAPS) completed software development in October 2015 and is proceeding with testing. However, due to a delay in implementing the cybersecurity baseline, CAPS delivery has also been delayed. Inter-segment testing, which will test all elements together, was expected to be completed in August 2016, but will now be delayed until after June 2017 because of the CAPS delivery delay.

Evolved Expendable Launch Vehicle (EELV)
(launch)

Mission: EELV program provides critical spacelift support for DOD, national security, and other government missions using three families of launch vehicles—Atlas V, Delta IV, and Falcon 9.

Acquisition phase:
Production

Original total program cost:
$18.8 billion
Current total program cost:
$59.6 billion

Original quantity: **181**
Current quantity: **161**

Schedule: In March 2017, the Air Force awarded a competitively sourced contract to SpaceX to launch the third GPS III satellite in February 2019, and has multiple contracts, both competitive and sole-source, depending on launch requirements, to be awarded in the next few years. EELV is working with industry partners to certify additional launch systems for national security space missions.

Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) Command Post Terminals (CPT)
(satellite communications terminals)

Mission: FAB-T is expected to provide a family of satellite communications terminals for airborne and ground-based users to replace many program-unique terminals. The subprogram is expected to provide voice and data communications over military satellite networks for nuclear and conventional forces through ground command posts and E-6 and E-4 aircraft. Another subprogram, expected to provide force element capabilities on B-2, B-52, and RC-135 aircraft, is undergoing analysis and not yet funded.

Acquisition phase:
Production

Original total program cost:
$1.7 billion
Current total program cost:
$1.8 billion

Original quantity: **95**
Current quantity: **109**

Schedule: The program began production of terminals in September 2015 and first deliveries are expected in spring 2017. The program expects to meet initial operational capability in December 2019.

Global Positioning System (GPS) III (positioning, navigation, and timing) **Mission:** GPS III is to supplement and eventually replace a constellation of multiple generations of GPS satellites that provide global positioning, navigation, and timing capability to both military and civil users worldwide.	Acquisition phase: Production	Original total program cost: $4.3 billion Current total program cost: $5.8 billion Original quantity: **8** Current quantity: **10**	**Schedule:** The first satellite was originally expected to be available for launch in April 2014; however, due to technical issues this date has been further delayed, and the Air Force has not set a new available for launch date, pending completion of a review of the satellite's propulsion system.
Global Positioning System Next Generation Operational Control System (GPS OCX) (command and control system for GPS III satellites) **Mission:** GPS OCX is to replace the current ground control system in order to operate current and new GPS III satellites.	Acquisition phase: Development	Original total program cost: $3.6 billion Current total program cost: $5.5 billion Original quantity: **1** Current quantity: **1**	**Schedule:** On June 30, 2016, DOD reached a critical Nunn-McCurdy breach. As part of the Nunn-McCurdy certification, DOD rescinded the program's Milestone B approval and program baselines. The Air Force is to submit a new request for Milestone B approval by June 2017.
Joint Space Operations Center Mission System (JMS), Increment 2 (command and control system for space) **Mission:** The JMS program is to provide applications, net-centric services and databases, and dedicated hardware to improve space situational awareness and command and control of space.	Acquisition phase: Development Integration Test	Original total program cost: $320.0 million Current total program cost: $469.9 million Original quantity: **1** Current quantity: **1**	**Schedule:** The JMS program plans to deliver capability in 2 increments. Increment 1 was completed and deemed fully deployed in April 2013. Increment 2—which is concurrently conducting development and testing—reported cost and schedule breaches last year resulting in a program restructure that deferred some capabilities. The substantial schedule delays and development cost increases are due to an aggressive schedule with significant concurrency, funding and manpower issues, development and testing challenges, and contract management. The program has delayed the full deployment decision by almost 3 years, to between May 2019 and November 2019.
Military GPS User Equipment (MGUE), Increment 1 (GPS receivers) **Mission:** The MGUE program is expected to develop modernized GPS receivers to provide users with enhanced positioning, navigation, and timing capabilities, while protecting the system from such threats as jamming.	Acquisition phase: Development	Original total program cost: NA Current total program cost: $1.1 billion Original quantity: **NA** Current quantity: **NA**	**Schedule:** In January 2017, the program received Milestone B approval. Operational testing on the four lead platforms is planned for completion between fiscal year 2019 and fiscal year 2020.
Mobile User Objective System (MUOS) (satellite communications) **Mission:** MUOS is expected to provide a worldwide, multiservice population of mobile and fixed-site terminal users with increased narrowband communications capacity and improved availability for small terminal users.	Acquisition phase: Production	Original total program cost: $7.3 billion Current total program cost: $7.4 billion Original quantity: **6** Current quantity: **6**	**Schedule:** MUOS has launched five satellites. The fourth satellite became operational in August 2016. The fifth satellite, an on-orbit spare, is undergoing acceptance testing, which is planned for completion in September 2017. Full operational capability, previously planned for fiscal year 2017, has been delayed to fiscal year 2020 primarily due to delays in successful operational testing of the new MUOS waveform.

Space Based Infrared System (SBIRS)
(missile warning, infrared intelligence, surveillance, and reconnaissance)

Mission: SBIRS is being developed to replace the Defense Support Program and perform a range of missile warning, missile defense, technical intelligence, and battlespace awareness missions. SBIRS is to consist of four GEO satellites, two sensors on host satellites in highly elliptical orbit, two replenishment satellites and sensors, and fixed and mobile ground stations.

Acquisition phase:
Production

Original total program cost:
$5.0 billion
Current total program cost:
$19.2 billion

Original quantity: **5**
Current quantity: **6**

Schedule: The third geosynchronous Earth orbit (GEO) satellite launched in January 2017. The fourth satellite is to launch in November 2017. The fifth and sixth satellites are to be available for launch in 2021 and 2022.

Space Fence Ground-Based Radar System Increment 1
(space object detection)

Mission: Space Fence is to use a radar to detect and track objects in low and medium Earth orbit in support of DOD's space surveillance network.

Acquisition phase:
Development
Production

Original total program cost:
$1.6 billion
Current total program cost:
$1.6 billion

Original quantity: **1**
Current quantity: **1**

Schedule: The program began testing its design on an integrated testbed prototype in early 2016. The program's software development was completed in October 2016.

Wideband Global SATCOM (WGS)
(satellite communications)

Mission: WGS provides worldwide communications services to U.S. warfighters, allies, and other special users.

Acquisition phase:
Production

Original total program cost:
$1.3 billion
Current total program cost:
$4.3 billion

Original quantity: **3**
Current quantity: **10** (includes 2 satellites funded by international partners)

Schedule: WGS reached full operational capability in May 2014, although it was initially expected in December 2005. Nine satellites are on orbit. Follow-on satellite 8 launched in December 2016, and 9 launched in March 2017. Satellite 10 is anticipated for launch in fiscal year 2018.

Source: GAO analysis of Department of Defense information. | GAO-17-619T

Note: Dollar figures are rounded to the nearest tenth and reported in fiscal year 2017 dollars based on the programs' original and most recent Selected Acquisition Reports or program office updates.

Cost and schedule growth in DOD's space programs is sometimes driven by the inherent risks associated with developing complex space technology; however, over the past 8 years we have identified a number of other management and oversight problems that can worsen the situation. These include making overly optimistic cost and schedule estimates, pushing programs forward without sufficient knowledge about technology and design, and experiencing problems in overseeing and managing contractors, among others. Some of DOD's programs in operation, such as SBIRS, were also exceedingly ambitious, which in turn increased technology, design, and engineering risks. While satellite programs have provided users with important and useful capabilities, their cost growth has significantly limited the department's buying power—at a time when more resources may be needed to protect space systems and to recapitalize the space portfolio.

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 have identified.

As shown in table 1, our previous work on weapons acquisitions in general, and space programs in particular, identified best practices for developing complex systems, such as developing more realistic estimates and ensuring technologies can work as intended before moving them into more complicated phases of the acquisition process.

Table 1: Summary of Best Practices GAO Has Identified 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 new development efforts.
Research and define requirements before starting programs 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 begin. Assign more ambitious technology development efforts to research departments until they are ready to be added to future generations (or 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 decisions to proceed, 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.
Encourage program managers to share bad news, and encourage collaboration and communication.
Hold suppliers accountable for delivering high-quality parts for their products through activities including regular supplier audits and performance evaluations of quality and delivery.

Source: GAO. | GAO-17-619T

In 2016, we testified that DOD had implemented actions to address space acquisition problems, and most of its major space programs had transitioned into the production phase where fewer problems tend to occur.[4] These range from improvements to cost estimating practices and

[4]GAO, *Space Acquisitions: Challenges Facing DOD as it Changes Approaches to Space Acquisitions*, GAO-16-471T (Washington, D.C.: Mar. 9, 2016).

development testing to improvements in oversight and leadership, such as the November 2010 addition of the Defense Space Council, designed to bring together senior leaders on important issues facing space. DOD had also started fewer new programs and even those were less ambitious than prior efforts, which helped to reduce the risk of cost and schedule growth. Given the problems we have identified in the GPS program, however, it is clear that more needs to be done to improve the management of space acquisitions.

Ongoing Work Shows GPS Acquisitions Are Still High Risk

In 2015, we reported that the Air Force was experiencing significant difficulties developing the GPS ground system, OCX, and consistently overstated its progress to the Office of the Secretary of Defense (OSD). At the time of our 2015 work, the program needed $1.1 billion and 4 years more than planned to deliver OCX due to poor acquisition decisions and a slow recognition of development problems. The Air Force began OCX development in 2010 prior to completing preliminary development reviews in contrast with best acquisition practices. It accelerated OCX development in 2012 to meet optimistic GPS III satellite launch timeframes even as OCX development problems and costs grew, and then paused development in 2013 to address problems and resolve what it believed were root causes. After a rebaseline to the schedule in late 2015, further evidence that OCX still had unaddressed problems surfaced in 2016 when the Air Force informed Congress the OCX program had breached a Nunn-McCurdy unit cost threshold.[5] We are continuing to monitor OCX's progress and challenges to determine if it is on the right track as part of our ongoing GPS review.

[5]Section 2433 of title 10 of the United States Code, commonly referred to as Nunn-McCurdy, requires DOD to notify Congress whenever a major defense acquisition program's unit cost experiences cost growth that exceeds certain thresholds. This is commonly referred to as a Nunn-McCurdy breach. Significant breaches occur when the program acquisition unit cost or procurement unit cost increases by at least 15 percent over the current baseline estimate or at least 30 percent over the original estimate. For critical breaches, when these unit costs increase at least 25 percent over the current baseline estimate or at least 50 percent over the original, DOD is required to take additional steps, including conducting an in-depth review of the program. Programs with critical breaches must be terminated unless the Secretary of Defense certifies to certain facts related to the programs and takes other actions, including restructuring the programs. 10 U.S.C. § 2433a.

In 2015, we also looked at the Air Force's military GPS user equipment (MGUE) program to develop for the military services GPS receiver cards capable of receiving the M-code signal. M-code is a stronger and encrypted, military-specific GPS signal which can help users operate in jamming environments. We found that the Air Force had revised MGUE's acquisition strategy several times. Even so, the military services were unlikely to have sufficient knowledge to make informed procurement decisions starting in fiscal year 2018, because operational testing that provides valuable information about MGUE performance would not be complete until fiscal year 2019.

On a positive note, at the time of our 2015 review, the current GPS constellation was proving to be much more reliable than the Air Force predicted when we last reported on it in 2010, giving the Air Force some relief in dealing with the delays with new GPS satellites. However, we found that OCX contingency plans were still necessary for sustaining the GPS constellation. We also found that initial M-code broadcast capability would not be available until the current ground system, the Operational Control System, or OCS, was modified in late-2019 at the earliest to make up for OCX delays. Full M-code capability—which includes both the ability to broadcast a signal via satellites and a ground system and user equipment to receive the signal—will take at least a decade once the services are able to deploy MGUE receivers in sufficient numbers.

Preliminary results from our ongoing review of GPS shows that the satellites, ground systems, and user equipment are all still on a high risk path; though satellite delays are still somewhat mitigated by the longer than anticipated performance of older GPS satellites. More specifically, the first GPS satellite is planned for launch in March 2018, over 3 years before OCX Block 1 is scheduled to become operational. Block 1 is needed to command and control the current and new generation of GPS satellites, bring M-code into operations, and provide enhanced cybersecurity capabilities. In light of delays with OCX, the Air Force has spawned two additional development efforts—one to ensure continuity in the ability to process GPS satellite positioning, navigation, and timing signals (known as Contingency Operations or COps) and another to help mitigate the delay in the ability to process the M-code signal (known as M-Code Early Use or MCEU). However, these efforts will have limited capabilities. Moreover, more than 11 years after launching the first M-code capable satellites, DOD has yet to deliver M-code capable MGUE receivers. DOD will not have a full M-code capability until receivers are deployed on sufficient numbers of weapons platforms and munitions to support the warfighter, yet it is following a high risk path to deliver them.

Based on our preliminary results, risks specific to each GPS segment are described below.

- **Satellites:** Since our 2015 report, the satellite program has encountered technical issues that have further delayed the first launch, which is almost 4 years later than the original estimate. Issues with failed and damaged capacitors have been a recent driver for the delays to the first satellite. Capacitors are components used to store and release electrical charges. According to program officials, each satellite has over 500 capacitors of the same design that experienced failures. The program discovered that a subcontractor had not qualified the capacitors for use in the GPS satellites and in response the program conducted qualification and reliability testing. However, the reliability testing was conducted using an incorrect circuit board, invalidating the test. The capacitor design was successfully qualified in December 2016. The Air Force decided to assume the risk of capacitor failure and proceed with the first satellite as-is, fitted with capacitors mostly from the questionable lot. The program replaced the suspect capacitors in the second and third satellites, the only other satellites that had the suspect parts.
- **OCX:** The contractor's performance over the past year suggests a 2-year extended schedule approved in 2015 is insufficient. The contractor has experienced code growth and high defect rates, and is operating under significant schedule compression and concurrency, with minimal schedule reserve to account for acquisition risk. Moreover, the contractor's current schedule estimates assume efficiencies from software engineering improvements, such as increased testing automation, that have not yet been demonstrated. These new processes have required the contractor to manage cultural changes. Additionally, the contractor almost doubled its staff to over 1,000 people to achieve the extension. According to Air Force officials, the 2-year extension will likely be extended by an additional 6 months.
- **MGUE Receivers:** In view of the importance of M-code to warfighting, statute generally prohibits DOD from obligating or expending funds for GPS user equipment after fiscal year 2017 unless that equipment is capable of receiving military code.[6] In February 2017, the services submitted implementation plans that identified systems they want to

[6]National Defense Authorization Act for Fiscal Year 2011, Pub. L. No. 111-383, § 913, the Secretary of Defense may waive this limitation under certain circumstances, or certain exceptions may apply.

upgrade with M-code, but these plans do not identify full resource needs. As a result, it is still unclear when M-code capable receivers will be fielded and at what cost. Though other weapon programs would normally have a production decision scheduled by this point in the development cycle, there is no scheduled production decision for the first increment of receivers and there are only tentative implementation plans as receiver cards are being verified by testing. Even after the MGUE program ends with limited operational testing on test articles on four initial weapons systems, the services may each have to conduct additional development both on those systems and any other systems. As a result of this uncertainty, the military services report that they have begun requesting waivers for the statutory requirement. In addition, in March 2016 the Army identified 25 functional gaps and technical issues that would hinder its ability to adopt MGUE technology. In September 2016, the Air Force responded with plans to address some of these functional gaps. However, Army officials are concerned that not all gaps have been addressed or will be addressed, which could impact its ability to field the receiver cards. Total development and procurement costs across all services remain unknown.

Fragmented Space Leadership Exacerbates Acquisition Problems

We have reported over the years that DOD's culture has generally been resistant to changes in space acquisition approaches and that fragmented responsibilities have made it difficult to coordinate and deliver interdependent systems. For example, in 2012 we found that although some improvements in leadership have been made, there was no single person or organization held accountable for balancing acquisition needs against wants, ensuring coordination among the many organizations involved with space systems acquisitions, and ensuring that resources are directed where they are most needed.[7] In October 2015, DOD re-designated the Executive Agent for Space role as the Principal DOD Space Advisor (PDSA). In 2016 we determined it was too early to gauge

[7]GAO, *2012 Annual Report: Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue,* GAO-12-342SP (Washington, D.C.: Feb. 28, 2012).

whether the PDSA has sufficient authority to consolidate space leadership responsibilities.[8]

Some examples of leadership and coordination issues we have identified in our prior and ongoing work include:

- In a February 2012 report, we found that the National Polar-orbiting Operational Environmental Satellite System (NPOESS), which attempted to converge defense and civil environmental monitoring requirements and avoid duplication through a tri-agency program office, was canceled in 2010, in part, because there was no single authority in charge of resolving conflicts or setting priorities.[9]
- In a March 2016 report we found that, in assessing alternatives for future weather systems, DOD consulted with a wide range of DOD stakeholders in conducting the analysis of alternatives (AOA), but it did not effectively coordinate with the National Oceanic and Atmospheric Administration (NOAA) (on a case-by-case basis, NOAA represents DOD's interests with international partners regarding space-based environmental monitoring data).[10] NOAA was not involved in reviews of the AOA or regular discussions with AOA study leadership. Without NOAA's input, the AOA study determined that the likelihood a critical gap would not be filled was low, based on historical trends. As a result, DOD did not fully assess solutions for cloud characterization and theater weather imagery data needs. As of August 2016, DOD was still assessing what to do about these gaps and the Air Force recently signed a memorandum of agreement with NOAA that enables a broad range of mutually beneficial support activities.
- In our ongoing work on the Global Positioning System, Army officials have also observed that the lack of a central point of authority and accountability is hampering coordination on GPS user equipment. It is unclear who is in charge of coordinating and prioritizing fielding efforts or setting criteria for M-code waivers—be it the DOD Chief Information

[8]GAO, *Defense Space Acquisitions: Too Early to Determine if Recent Changes Will Resolve Persistent Fragmentation in Management and Oversight*, GAO-16-592R (Washington, D.C.: July 27, 2016).

[9]GAO-12-342SP.

[10]GAO, *Defense Weather Satellites: Analysis of Alternatives is Useful for Certain Capabilities, but Ineffective Coordination Limited Assessment of Two Critical Capabilities,* GAO-16-252R (Washington, D.C.: Mar. 10, 2016).

Officer, Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)), or the Council on Oversight of the Department of Defense Positioning, Navigation and Timing Enterprise (PNT Oversight Council). This is significant because of the risk of duplicated efforts—and rising costs— between services; and the lack of leadership influences when and if services are pushed to procure M-code user equipment and thus realize DOD's goals for anti-jamming GPS capabilities.

- In a July 2016 report, expert space officials told us that because programs experience too much bureaucracy, it can take a minimum of 3 years to develop an acquisition strategy, issue a request for proposal, conduct source selection, and award a contract.[11] By then, technologies and requirements can be obsolete. For example, one contractor told us that it took over a year for the Air Force to develop a request for proposal for a low-dollar, $2 million study. While USD(AT&L) officials emphasized that DOD's acquisition policy is very tailorable and that programs can take advantage of its flexibility, Air Force officials said that this does not play out in practice. They told us that oversight entities are reluctant to waive or change steps out of fear they will be blamed later.
- In a July 2016 report, we reported that space officials believe USD(AT&L) is the only real decision-making authority for space-related topics.[12] Some senior officials report that this can have unexpected effects, such as the Under Secretary having to make broader space architecture decisions, which are larger issues that fall outside his responsibility. Officials noted that such decisions fall to the Under Secretary by default because there is no space-specific authority.[13]

In Senate Report 114-49 accompanying S.1376, a bill for the National Defense Authorization Act for Fiscal Year 2016, the Senate Armed Services Committee included a provision for GAO to review the effectiveness of the current DOD space acquisition and oversight model and to evaluate what changes, if any, could be considered to improve the governance of space system acquisitions and operations. In 2016, we found that DOD space leadership responsibilities are fragmented among

[11]GAO-16-592R.

[12]GAO-16-592R.

[13]The National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, § 901 eliminates the position of USD(AT&L). This provision is effective in February 2018.

a number of organizations.[14] We identified approximately 60 stakeholder organizations across DOD, the Executive Office of the President, the Intelligence Community, and civilian agencies. Of these, 8 organizations have space acquisition management responsibilities; 11 have oversight responsibilities; and 6 are involved in setting requirements for defense space programs.

In October 2015, the Deputy Secretary of Defense designated the Secretary of the Air Force as the Principal DOD Space Advisor (PDSA). The PDSA, supported by an advisory body called the Defense Space Council (DSC), is responsible for promoting a unified approach to space issues, including acquisitions; overseeing the entire DOD space portfolio, including all space policies, strategies, and plans across DOD; and serving as an independent advisor on all space matters to top DOD officials. PDSA officials stated that the PDSA role is expected to have new responsibilities that will help it effectively consolidate space leadership. Some of these responsibilities include reviewing all service budgets for conformity with national security space policy, and giving independent assessments and recommendations to top DOD officials when there is no DSC consensus. However, because the position is relatively new, it remains to be seen whether the PDSA will be effective in unifying space leadership and authority.

The organization of space acquisitions and oversight has been studied in depth over the last 20 years; however, DOD has not made some of the significant changes to space leadership that were recommended by the four most relevant studies that we identified in our July 2016 report.[15] For example, these studies made recommendations such as combining the National Reconnaissance Office (NRO) and Air Force space acquisition functions into a unified organization or establishing an Under Secretary of Defense-level official with responsibility for planning and executing national security space programs.[16] Some of the acquisition problems

[14]GAO-16-592R.

[15]R*eport of the Commission to Assess US National Security Space Management and Organization*; Hon. Donald H. Rumsfeld, Chairman (2001); *Joint Task Force on Acquisition of National Security Space Programs*, Defense Science Board and Air Force Scientific Advisory Board (2003); *Leadership, Management, and Organization for National Security Space Report*, Institute for Defense Analyses (2008); and *Report on Challenges and Recommendations for United States Overhead Architecture*, House Permanent Select Committee on Intelligence (2008).

[16]The NRO develops Intelligence Community space systems. These systems can be very challenging to develop and expensive to acquire and field.

identified in past studies and GAO reports persist, such as insufficient program manager empowerment and excessive reviews, which contribute to inefficiencies. As we reported in July 2016, officials and experts we spoke with stated that the challenges are magnified in space programs because space technologies are frequently obsolete by the time they are deployed. The officials and experts also stated that DOD space acquisitions generally take too long due to fragmented leadership, a redundant oversight bureaucracy, and difficulty coordinating among numerous stakeholders. Many officials and experts stated that no one seems to be in charge of space acquisitions and many remain skeptical that the recently designated PDSA will have sufficient decision-making authority to address these concerns. However, others—including from the PDSA—stated a strong belief that the position will be able to effectively consolidate fragmented leadership responsibilities.

In conclusion, given the long-standing fragmentation in space leadership and consequent challenges faced by DOD in synchronizing its extensive space enterprise, other, more significant reform measures may deserve a closer look. Our past work has identified some suggested themes for reform that include: (1) streamlining reviews; (2) delegating more decision-making authority to lower levels; (3) increasing unity of national security space decisions between DOD and the NRO; (4) achieving lasting change that cannot be quickly undone and to allow time for the changes to work; and (5) providing sufficient acquisition, execution, and budget authority. Our work has also identified and examined several potential approaches to reforming DOD space acquisitions that were suggested and supported by DOD and expert officials. They include allowing time for the recent PDSA change to work; combining military space functions into one agency; combining Air Force and NRO space acquisition functions into a space acquisition agency; and creating a new military department for the space domain - a Space Force. Except for the first option, these would likely involve significant short-term disruption to DOD's space organizational structure, roles, and responsibilities. Moreover, their consequences would extend far beyond the acquisition arena. Careful consideration of any such changes is therefore essential for helping to ensure a better track record of providing warfighters with the capabilities they need on time and within costs.

Chairman Fischer, Ranking Member Donnelly, and Members of the Subcommittee this concludes my statement. I am happy to answer any questions you have.

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