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Report to the Subcommittee on Air and Land Forces, Committee on Armed Services, House of Representatives

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DEFENSE ACQUISITIONS

Opportunities Exist to Achieve Greater Commonality and Efficiencies among Unmanned Aircraft Systems

On July 31, 2009, figure 1 on page 8, was revised to correct a typographical error in the reported cost difference for the UCAS-D (Navy) program.

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GAO-09-520

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Opportunities Exist to Achieve Greater Commonality and Efficiencies among Unmanned Aircraft Systems

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Highlights

Highlights of GAO-09-520, a report to the Subcommittee on Air and Land Forces, Committee on Armed Services, House of Representatives

Why GAO Did This Study

From 2008 through 2013, the Department of Defense (DOD) plans to invest over $16 billion to develop and procure additional unmanned aircraft systems. To more effectively leverage its acquisition resources, DOD recognizes that it must achieve greater commonality among the military services' unmanned aircraft programs. Doing so, however, requires certain trade-offs and complex budget, cost, and schedule interactions.

GAO was asked to assess the progress of selected unmanned aircraft acquisition programs, examine the extent to which the services are collaborating and identifying commonality among those programs, and identify key factors impacting the effectiveness their collaboration. GAO analyzed cost, schedule, and performance data for eight unmanned aircraft systems—accounting for over 80 percent of DOD's total planned investment in unmanned aircraft systems from 2008 through 2013—and two payload programs.

What GAO Recommends

GAO recommends that DOD (1) direct a comprehensive analysis and develop a strategy to gain commonality among current unmanned aircraft programs and (2) require new programs to demonstrate that opportunities for commonality were adequately assessed. DOD agreed with the recommendations except for the need for a comprehensive analysis. GAO believes this recommendation remains valid.

View GAO-09-520 or key components.
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What GAO Found

While proving successful on the battlefield, DOD's unmanned aircraft acquisitions continue to incur cost and schedule growth. The cumulative development costs for the 10 programs GAO reviewed increased by over $3.3 billion (37 percent in 2009 dollars) from initial estimates—with nearly $2.7 billion attributed to the Air Force's Global Hawk program. While 3 of the 10 programs had little or no development cost growth and 1 had a cost reduction, 6 programs experienced significant growth ranging from 60 percent to 264 percent. These outcomes are largely the result of changes in program requirements and system designs. Procurement funding requirements have also increased for most programs, primarily because of increases in the number of aircraft being procured, changes in system requirements, and upgrades and retrofits to equip fielded systems with capabilities that had been deferred. Overall, procurement unit costs increased by 12 percent, with unit cost increases of 25 percent or more for 3 aircraft programs. Finally, several programs have experienced significant delays in achieving initial operating capability, ranging from 1 to nearly 4 years.

Several of the tactical and theater-level unmanned aircraft acquisition programs GAO reviewed have identified areas of commonality to leverage resources and gain efficiencies. For example, the Marine Corps chose to procure the Army's Shadow system after it determined Shadow could meet its requirements, and was able to avoid the cost of initial system development and quickly deliver capability to the warfighter. Also, the Navy's Broad Area Maritime Surveillance system will use a modified Global Hawk airframe. However, other programs have missed opportunities to achieve commonality and efficiencies. The Army's Sky Warrior—which is a variant of the Air Force's Predator, is being developed by the same contractor, and will provide similar capabilities—was initiated as a separate development program in 2005. Sky Warrior development is now estimated to cost nearly $570 million. DOD officials continue to press for more commonality in the two programs, but the aircraft still have little in common.

Although several unmanned aircraft programs have achieved airframe commonality, service-driven acquisition processes and ineffective collaboration are key factors that have inhibited commonality among subsystems, payloads, and ground control stations. For example, the Army chose to develop a new sensor payload for its Sky Warrior, despite the fact that the sensor currently used on the Air Force's Predator is comparable and manufactured by the same contractor. To support their respective requirements, the services also make resource allocation decisions independently. DOD officials have not quantified the potential costs or benefits of pursuing various alternatives, including common systems. To maximize acquisition resources and meet increased demand, Congress and DOD have increasingly pushed for more commonality among unmanned aircraft systems.

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Abbreviations

ASIP	Airborne Signals Intelligence Payload
AT&L	Acquisition, Technology and Logistics
BAMS	Broad Area Maritime Surveillance
BCT	Brigade Combat Team
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
DOT&E	Director of Operational Test and Evaluation
FCS	Future Combat Systems
ISR	intelligence, surveillance, and reconnaissance
JCIDS	Joint Capability Integrated Development System
JTRS	Joint Tactical Radio System
J-UCAS	Joint Unmanned Combat Air Systems
LCS	Littoral Combat Ship
LRIP	Low Rate Initial Production
OSD	Office of the Secretary of Defense
MP-RTIP	Multi-Platform Radar Technology Insertion Program
RDT&E	Research, Development, Test, and Evaluation
SIGINT	Signals Intelligence
TCDL	Tactical Common Data Link
UAS	Unmanned Aircraft System
UCAS-D	Unmanned Combat Aircraft System Demonstration
VTUAV	Vertical Take-off and Landing Tactical Unmanned Air Vehicle
WIN-T	Warfighter Information Network - Tactical

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United States Government Accountability Office
Washington, DC 20548

July 30, 2009

The Honorable Neil Abercrombie
Chairman
The Honorable Roscoe Bartlett
Ranking Member
Subcommittee on Air and Land Forces
Committee on Armed Services
House of Representatives

From 2002 through 2008, the number of unmanned aircraft in the Department of Defense's (DOD) inventory increased from 167 to more than 6,000 in an effort to meet growing warfighter demand for these capabilities in Iraq and Afghanistan. DOD has noted that meeting this demand has been difficult because of the highly dynamic nature of supporting ongoing combat operations while developing new and emerging capabilities. The department plans to invest more than $16 billion from 2008 through 2013 to develop and procure additional unmanned aircraft systems. However, the growing number of national priorities competing for federal dollars will continue to challenge DOD's efforts to meet escalating demands for unmanned systems.

DOD recognizes that to more effectively leverage its acquisition resources, it must achieve greater commonality and efficiency among the military services' various unmanned system acquisition programs. Achieving commonality, however, can be difficult. We have reported in the past that programs that involve more than one service require complex budget, cost, and schedule interactions and are likely to require the services to make more trade-offs than a single service development would.[1] We have also found that joint development efforts have often been hampered by an inability to obtain and sustain commitments and support from the military services and other stakeholders.[2] However, given your interest in how DOD is establishing requirements for new intelligence, surveillance, and reconnaissance capabilities—including unmanned aircraft systems—and

[1] GAO, *Ballistic Missile Defense: More Common Systems and Components Could Result in Cost Savings*, GAO/NSIAD-99-101 (Washington, D.C.: May 21, 1999).

[2] For one example of these challenges, see GAO, *Defense Acquisitions: Restructured JTRS Program Reduces Risk, but Significant Challenges Remain*, GAO-06-955 (Washington, D.C.: Sept. 11, 2006).

considering opportunities to leverage existing capabilities or achieve commonality, you asked us to assess DOD's tactical and theater-level unmanned aircraft acquisition programs. Specifically, we (1) assessed the cost, schedule, and performance progress of selected tactical and theater-level unmanned aircraft acquisition programs; (2) examined the extent to which the military services are collaborating and identifying commonality among those programs; and (3) identified the key factors influencing the effectiveness of their collaboration.

To conduct our work, we collected and analyzed cost, schedule, and performance data for 10 acquisition programs: eight unmanned aircraft systems—Global Hawk, Reaper, Shadow, Predator, Sky Warrior, Fire Scout, Broad Area Maritime Surveillance (BAMS), and Unmanned Combat Aircraft System Demonstration (UCAS-D)—and two payload development programs—Multi-Platform Radar Technology Insertion Program (MP-RTIP) and Airborne Signals Intelligence Payload (ASIP). Collectively, the eight aircraft programs account for more than 80 percent of DOD's total planned investment in unmanned aircraft systems from fiscal year 2008 through fiscal year 2013. To determine the extent to which the military services are collaborating and identifying commonality and the factors affecting that collaboration, we reviewed and analyzed key program documents and prior GAO work and conducted numerous interviews with and received briefings from relevant DOD and contractor officials. For additional details on how we performed our review, see appendix I.

We conducted this performance audit from August 2008 to July 2009 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.

Results in Brief

Most of the unmanned aircraft programs we reviewed have experienced cost increases, schedule delays, performance shortfalls, or some combination of these problems. Development cost estimates for the 10 programs we assessed, collectively, have increased more than $3.3 billion (37 percent in 2009 dollars) from initial estimates—with $2.7 billion attributed to the Air Force's Global Hawk program. Global Hawk development cost estimates have increased more than 260 percent from original estimates, in large part to acquire a larger and unproven airframe with immature technologies. Procurement funding requirements have also increased for most programs, primarily because of increases in the number of aircraft being procured, changes in system requirements, and upgrades and retrofits to equip fielded systems with capabilities that had been deferred. Overall, procurement unit costs increased by 12 percent, with three aircraft programs experiencing unit cost increases of 25 percent or more. Four programs have reported delays of 1 year or more in delivering capability to the warfighter. The Army's Sky Warrior has already slipped its projected delivery date by nearly 4 years. Four unmanned aircraft systems—Global Hawk, Predator, Reaper, and Shadow—have been used in combat operations with notable success and key lessons learned. However, in some cases, rushing aircraft into service has led to performance issues and caused delays in development and operational testing and verification.

DOD's unmanned aircraft acquisition programs are collaborating and identifying areas of commonality to varying degrees. In some cases, programs have been able to leverage resources and achieve efficiencies. For example, the Marine Corps determined that the Army's Shadow system could sufficiently meet its current requirements and chose to procure the existing Army system. By pursuing a common solution, the Marine Corps was able to avoid the cost of initial system development and quickly deliver useful capability to the warfighter. While the Navy expects to save time and money on BAMS by using the existing Global Hawk airframe, as well as payloads and subsystems from other programs, risks remain. A Navy official noted that the Navy plans to spend over $3 billion in development, primarily to integrate payloads, make airframe modifications, and purchase aircraft. The Army and Air Force have not effectively collaborated on their Sky Warrior and Predator programs. Greater savings could have been achieved given that the Sky Warrior is a variant of the Predator and is being developed by the same contractor. The Army initiated the Sky Warrior development program, which is estimated to cost nearly $570 million in 2005 despite the fact that Predator was already successfully providing reconnaissance, surveillance, and target acquisition capabilities to the warfighter. DOD officials continue to press for more commonality in these two programs, but the two aircraft still have little in common.

Service-driven requirements and funding processes and ineffective collaboration are key factors that have limited the achievement of commonality. While several unmanned aircraft programs have achieved airframe commonality, most are pursuing service-unique subsystems, payloads, and ground control stations. Despite DOD's efforts to emphasize a more joint approach to identifying and prioritizing warfighting needs and to encourage commonality among programs, the services continue to drive program requirements. Service officials we spoke with cited specific reasons for service-unique requirements—some of which have raised concerns about potential inefficiencies caused by unnecessary duplication. For example, the Office of the Secretary of Defense (OSD) is concerned that the Army and Air Force are unnecessarily developing two different electro-optical and infrared sensor payloads for Sky Warrior and Predator when a common payload could be achieved—currently the basic sensors are 80 percent common and manufactured by the same contractor. However, according to Army officials, the Air Force sensor is more expensive and has capabilities, such as high-definition video, for which the Army has no requirements. Therefore, the Army does not believe a fully common solution is warranted. Likewise, the services independently make resource allocation decisions to support their respective requirements. DOD officials have not quantified the potential costs or benefits of pursuing various alternatives, including common systems. In general, the services have been reluctant to collaborate and efforts to do so have produced mixed results. However, to maximize acquisition resources and meet increased demand, Congress and DOD have increasingly pushed for more commonality among unmanned aircraft systems.

To achieve the goal of more effectively leveraging resources and increasing the efficiency in unmanned aircraft acquisition programs, we are making two key recommendations. First, the Secretary of Defense should direct a rigorous and comprehensive analysis of the requirements for current unmanned aircraft systems to identify areas where further commonality can be achieved, and develop a strategy for making systems and subsystems more common. The findings of this analysis should be reported to Congress. Second, we are recommending that before initiating new unmanned aircraft development programs, the Secretary should require the services to demonstrate in their acquisition plans and strategies that they are taking an open systems approach and that the potential for commonality has been rigorously examined. In commenting on a draft of this report, DOD partially agreed with the first recommendation and agreed with the second. The department agreed that there is significant cost benefit to leveraging commonality, but believes that sufficient analyses have been conducted and that a separate comprehensive analysis across all unmanned systems, with the specific purpose of identifying opportunities for commonality, is not needed. While the various analyses cited by DOD have identified opportunities for commonality on a case-by-case basis, we believe that the department would benefit from a more comprehensive, quantitative analysis that focuses on subsystems, payloads, and ground control stations across the unmanned aircraft portfolio.

Background

The intelligence, surveillance, reconnaissance, and strike capabilities provided by unmanned aircraft systems have proven to be a key asset in accomplishing combat missions in the Middle East. DOD is planning to expand unmanned aircraft capabilities to include persistent ground attack, electronic warfare, suppression of enemy air defenses, cargo airlift, and other missions. Unmanned aircraft systems generally consist of (1) multiple aircraft, which can be expendable or recoverable and can carry lethal or nonlethal payloads; (2) a flight control station; (3) information and retrieval or processing stations; and (4) in some cases, wheeled land vehicles that carry launch and recovery platforms. Unmanned aircraft fall into one of three classes: small, tactical, and theater (see table 1). From 2002 through 2008, the total number of unmanned aircraft in DOD's inventory increased from 167 to over 6,000. Most of the increase has been in small aircraft, with the more complex and expensive tactical and theater-level aircraft increasing from 127 to 521.

Table 1: DOD's Unmanned Aircraft by Class

Class	Gross takeoff weight, in pounds	Typical level of operational control	Mission focus
Small	Less than 55	Ground combat teams	Individual team priorities
Tactical	From 55 to 1,320	Operational units	Battalion or brigade priorities
Theater	Greater than 1,320	Joint Force Commander	Combatant Commander's priorities

Source: DOD, *Unmanned Systems Roadmap 2007 – 2032.*

Four major systems—Global Hawk, Predator, Reaper, and Shadow—have been deployed and used successfully in combat. Given this success, warfighters have demanded more systems and in many cases enhanced capabilities. However, we recently reported that some unmanned aircraft were not designed to meet joint service requirements or interoperability communications standards and, as a result, cannot easily exchange data, even within the same military service.[3] Additionally, certain

[3] GAO, *Unmanned Aircraft Systems: Additional Actions Needed to Improve Management and Integration of DOD Efforts to Support Warfighter Needs*, GAO-09-175 (Washington, D.C.: Nov. 14, 2008).

electromagnetic spectrum frequencies that are required for wireless communications are congested because a large number of unmanned aircraft and other weapons or communications systems use them simultaneously. Furthermore, DOD has been unable to fully optimize the use of its unmanned aircraft in combat operations because it lacks an approach to allocating and tasking them that considers the availability of all assets in determining how best to meet warfighter needs.

To manage the increased demand for unmanned aircraft systems and encourage collaboration among the military services, the department has created the Office of Unmanned Warfare, the Unmanned Aircraft Systems Task Force, and other entities. In addition, DOD has published the Unmanned Systems Roadmap (Roadmap) that provides a framework for the future development of unmanned systems and related technologies. The Roadmap states that there is the potential for an unprecedented level of collaboration to meet capability needs and reduce acquisition costs by requiring greater commonality among the military services' unmanned systems. We have reported that taking an open systems[4] approach and designing systems with common subsystems and components can reduce both production and life cycle costs as well as improve interoperability among systems. For maximum benefit, commonality should be incorporated into the design of a system when requirements are being established.[5] Unmanned aircraft systems can potentially achieve commonality in design and development, ranging from a complete system to a subsystem or component, as well as commonality in production facilities, tooling, and personnel.

[4] Open systems allow the use of commercially available and widely accepted standard products from multiple vendors, rather than developing unique components. GAO/NSIAD-99-101.

[5] GAO/NSIAD-99-101.

Unmanned Aircraft Acquisitions Have Experienced Cost Growth, Schedule Delays, and Performance Problems

Despite the proven success of unmanned aircraft on the battlefield and the growing demand for them, these acquisitions continue to incur cost and schedule growth (see fig. 1). The cumulative development cost for the 10 programs we reviewed increased by over $3 billion, or 37 percent, from initial estimates. While 3 of the 10 programs had little or no development cost growth and 1 had a cost reduction, 6 experienced substantial growth ranging from 60 percent to 264 percent. In large part, this cost growth was the result of changes in program requirements and system designs after initiating development. Total procurement funding requirements have grown in the past because of increased quantities; however, many of the programs have also experienced growth in procurement unit costs. Finally, a number of these programs have experienced problems in testing and in performance that required additional development that contributed to cost growth and schedule delays (see app. II for more detailed information about each program).

Figure 1: Development Cost Changes in Selected Programs

2009 dollars in millions

		Initial estimate	Current estimate	Cost difference	Percentage difference
Aircraft programs					
Global Hawk (Air Force)		$1,006.1	$3,657.5	$2,651.4	284
Reaper (Air Force)		195.4	385.5	190.1	97
Shadow (Army / Marine Corps)		198.1	356.6	158.5	80
Sky Warrior (Army)		333.1	568.5	235.4	71
Predator (Air Force)		267.3	428.2	160.9	60
Fire Scout (Navy)[a]		577.5	605.0	27.5	5
BAMS (Navy)		3,049.1	3049.1	0.0	0
UCAS-D (Navy)[b]		1,474.9	1,474.9	0.0	0
Payload programs					
ASIP (Air Force)		219.5	461.0	241.5	110
MP-RTIP (Air Force)		1,735.1	1,334.5	-400.6	-23
		$9,056.1	**$12,321.7**	**$3,264.7**	**37**

Sources: DOD and contractor (data); GAO (analysis and presentation).

[a]Data only represent the Navy portion of the Fire Scout program. The Army funding for Fire Scout is included in its Future Combat Systems funding and cannot be individually separated.

[b]UCAS-D is a demonstration effort and is not an official system development program.

In most cases, development cost growth was the result of beginning system development with unclear or poorly defined requirements, immature technologies, and unstable designs—problems we have frequently found in other major acquisition programs.[6] The Global Hawk program is a good example. In 2001, the Air Force began the Global Hawk program based on knowledge gained from a demonstration program and planned to incrementally integrate more advanced technologies over time. However, within a year, the Air Force fundamentally restructured and accelerated the program to pursue a larger and unproven airframe with multimission capability relying on immature technologies. The final design of the new airframe required more substantial changes than expected. Ultimately, frequent and substantive engineering changes drove development costs up nearly threefold. While BAMS has reported no cost growth, the program is just 1 year into its 7-year development, and the Navy plans to spend over $3 billion in development to modify the airframe—which is the existing Global Hawk airframe—and integrate payloads and other key equipment, modify ground stations, and purchase two developmental and three low rate production aircraft. BAMS program officials told us that they anticipate that the bulk of the development cost will result from modifying the size and shape of the existing radar payload to fit the Global Hawk airframe. Historically, similar weapons development efforts have had difficulty managing risk. Estimated development costs for MP-RTIP decreased 23 percent in large part because of a significant reduction in requirements caused by the termination of another aircraft program for which the radar was being developed.

Procurement costs also increased for six of the seven systems that reported procurement cost data, a large portion of which is due to the planned procurement of additional aircraft (see table 2). For example, the Air Force planed to procure an additional 272 Predators, and the Army planed to procure an additional 84 Sky Warriors. As a result, unit costs for the Predator and Sky Warrior decreased by 41 percent and 9 percent, respectively.[7] However, Reaper and Shadow had unit cost growth despite

[6] GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, GAO-09-326SP (Washington, D.C.: Mar. 30, 2009).

[7] According to OSD, Air Force, Army, and contractor officials we spoke with, the Air Force no longer plans to procure additional Predators beyond 2009. This plan is clearly reflected in the Air Force's fiscal year 2010 budget submission, in which it requested funding to procure 38 aircraft in 2009 and then no funding for procurement in 2010.

increased quantities. Reaper's unit costs increased in part because requirements for missiles and a digital electronic engine control were added—which resulted in design changes and increased production costs. Unit cost increases in the Shadow program were largely the result of upgrades to the airframe that were needed to accommodate the size, weight, and power requirements for integrating a congressionally mandated data link onto the aircraft.[8] The Army is also retrofitting fielded systems with capabilities that it had initially deferred, such as a heavy fuel engine. The procurement unit cost for Global Hawk increased the most, in large part because the Air Force not only increased the program's requirements but also reduced the number of aircraft it intended to purchase.

Table 2: Procurement Cost and Quantity Changes in Selected Programs

(2009 dollars in millions)

Program	Initial cost estimate	Initial quantity	Current cost estimate	Current quantity	Percentage procurement unit cost change
Global Hawk	$4,171.4	63	$5,929.7	54	66
Reaper[a]	508.7	33	2,405.7	118	32
Shadow	447.0	160	1,640.7	460	28
Fire Scout[b]	1,625.1	168	1,743.0	168	7
BAMS	9,048.6	65	9,048.6	65	0
Sky Warrior	647.5	48	1,614.2	132	-9
Predator	642.8	48	2,546.4	320	-41
Total	**$17,091.1**	**585**	**$24,928.3**	**1,317**	**12 (average)**

Sources: DOD (data); GAO (analysis and presentation).

Notes: MP-RTIP and ASIP procurement is managed and funded by the host platform program offices, primarily Global Hawk. Further, the Navy does not have any projected procurement costs or quantities for UCAS-D because it is a demonstration effort and not an official development program.

[a]Initial cost estimate provided for Reaper was based upon 33 aircraft. However, the Air Force initially planned for 63 aircraft.

[b]Data only represent the Navy portion of the Fire Scout program. The Army funding for Fire Scout is included in its Future Combat System funding and cannot be individually separated.

Four programs have also experienced delays in achieving initial operational capability by 1 to almost 4 years (see table 3). In some cases, program delays have been the result of expediting limited capability to the

[8] National Defense Authorization Act for Fiscal Year 2006, Pub. L. No. 109-163, § 141.

warfighter. For example, the production decision for the Sky Warrior was delayed by 2 years, and the Army now expects to deliver initial operational capability[9] to the warfighter almost 4 years later than originally planned. Similarly, initial operational testing to prove the larger Global Hawk airframe works as intended has been delayed by nearly 3 years. Delays for these two programs and BAMS and Fire Scout average more than 27 months—6 months longer than the average delays we found in our recent assessment of other major weapons acquisitions.[10] In contrast, the Reaper program expects to achieve initial operational capability 4 months earlier than originally planned—in large part because the Air Force expedited aircraft production to meet wartime demands.

Table 3: Changes in Development Schedule for Selected Unmanned Aircraft Programs

Program	Original planned initial operational capability	Current planned initial operational capability	Change in achieving initial operational capability
Sky Warrior	May 2009	April 2013	47 months
Global Hawk[a]	January 2007	October 2009	34 months
BAMS	August 2014	December 2015	16 months
Fire Scout[b]	September 2008	September 2009	12 months
Predator	March 1999	March 1999	0 months
Shadow	December 2002	September 2002	-3 months
Reaper	December 2009	August 2009	-4 months

Sources: DOD (data); GAO (analysis and presentation).

Note: UCAS-D was not included in this assessment because it is a demonstration effort and has not established an initial operational capability date.

[a]Global Hawk does not report its initial operational capability dates, so its schedule slip was assessed using completion of initial operational testing.

[b]Fire Scout data represent the Navy portion of the program only. The Army Fire Scout is managed within the Army's Future Combat Systems program—which has experienced significant schedule delays.

While Global Hawk, Predator, Reaper, and Shadow have been deployed with notable successes in theater—as well as identified lessons learned—rushing to field these capabilities resulted in a number of performance shortfalls and in some cases ultimately delayed meeting requirements. For

[9] DOD defines initial operational capability as the date the warfighter first has the means to effectively employ a new weapon system or equipment item operated by an adequately trained, equipped, and supported military unit.

[10] GAO-09-326SP.

example, Predator—the oldest program in our sample—directly transitioned from a successful technology demonstration program into production, skipping the development process entirely. Because little emphasis was placed on testing, performance requirements, and producibility, Predator experienced numerous problems when it was initially produced and deployed, such as unreliable communications and poor targeting accuracy.

Given the importance of supporting combat operations, Global Hawk demonstrators and early production aircraft were also quickly placed into operational service. Program officials noted that as a result, the availability of test resources and time for testing were limited, which delayed the operational assessment of the original aircraft model by 3 years. Similarly, in February 2009, the Air Force reported that initial operational testing for the larger more capable Global Hawk aircraft and the program's production readiness review had schedule breaches. Air Force officials cite the high level of concurrency between development, production, and testing; poor contractor performance; developmental and technical problems; system failures; and bad weather as key reasons for the most recent schedule breach. In a recent letter to the Global Hawk contractor, the Air Force's Chief Acquisition Executive noted that unless the program's problems are resolved quickly, the Air Force may have to consider deferring authorization of future production lots, terminating future modernization efforts, and canceling development and production of the aircraft that are planned to carry the MP-RTIP radar. According to program officials, they are currently in the process of developing a plan to address the schedule breaches.

Efforts to Achieve Commonality and Efficiencies among Unmanned Aircraft Programs Have Had Mixed Success

Consistent with DOD's framework for acquiring unmanned systems, several of the tactical and theater-level unmanned aircraft acquisition programs we reviewed have identified areas of commonality to leverage resources and gain efficiencies. However, others share little in common and have missed opportunities to achieve commonality and efficiencies. Even those programs that have achieved some commonality may have additional opportunities to leverage resources. Table 4 compares the levels of commonality for three of our case examples.

Table 4: Commonality among Selected Unmanned Aircraft Programs

Program	Services	Airframe	Payloads	Ground control station
Shadow	Army and Marine Corps	X	X	X
BAMS/Global Hawk	Navy and Air Force	X		
Predator/Sky Warrior	Air Force and Army			

Sources: DOD (data); GAO (analysis and presentation).

The Army and Marine Corps Have Achieved Full Commonality in the Shadow Program

In assessing options for replacing an aging tactical unmanned aircraft system,[11] the Marine Corps determined that the Army's Shadow system could meet its requirements for reconnaissance, surveillance, and target acquisition capabilities without any service-unique modifications. An official from DOD's Office of Unmanned Warfare emphasized that the Marine Corps believed that Shadow represented a "100 percent" solution. The Marine Corps also found that it could use the Army's ground control station to pilot the Shadow aircraft as well as other Marine Corps unmanned aircraft. A memorandum of agreement was established in July 2007 to articulate how the Marine Corps and the Army would coordinate to acquire Shadow systems. The agreement details the management structure, lines of accountability, and funding arrangements between the two services, and establishes that the Marine Corps will procure systems directly off the Army contract. While formal decisions to pursue common systems were made at the service executive level, Army officials told us

[11] Shadow was identified as a replacement system for the Marine Corps Pioneer unmanned aircraft. Specifically, the cost for maintaining the Pioneer fleet was cited as a reason for selecting the Shadow. The Marine Corps is considering a future replacement to the Shadow, which is not expected before 2015.

that collaboration initiated at the program office level was the primary driver in achieving commonality.

By forgoing any service-unique modifications in order to achieve a high level of commonality, the Marine Corps was able to avoid the costs of developing the Shadow. Those costs were borne by the Army and totaled over $180 million. The Marine Corps plans to spend almost $9 million from fiscal years 2009 through 2015 to support development of additional capabilities for the Shadow, to include a backup takeoff mechanism for the automatic takeoff and landing system. Additionally, the Marine Corps and Army are likely to realize some benefits in supporting and maintaining the systems because the components are interchangeable. According to an official at the Navy, the Marine Corps has been able to realize savings or cost avoidance in other areas such as administration, contracting, and testing, although quantitative data on these savings were not available. The Army's Shadow program office agreed that commonality has allowed the two services to realize economies of scale while meeting each service's needs.

Maintaining a high level of commonality in the Shadow program will require continued commitment from the services and careful management. Specifically, as the Army and Marine Corps explore ways to add additional capabilities to Shadow, the services will need to continue to collaborate to maximize efficiencies. For example, in order to maintain commonality with the Army, the Marine Corps is spending money to add capabilities that meet Shadow requirements established by the Army. Likewise, the Army is interested in adopting capabilities that the Marine Corps developed for Shadow. Army officials told us that the Marine Corps is exploring ways to retrofit the Shadow so that it can carry a weapons payload. They stated that although the Army does not have a requirement for a weapons payload and has no plans to spend money on its development, the Army would be interested in acquiring this capability.

BAMS and Global Hawk Have Achieved Some Commonality, but Greater Efficiencies Are Possible

The Navy BAMS and Air Force Global Hawk programs have achieved some commonality between their unmanned aircraft systems—specifically, the airframes for the two systems are common. However, the payload and subsystem requirements differ; and while some BAMS ground station requirements are common with those of the Global Hawk, the BAMS contractor noted that the Navy also has some unique requirements. To meet its requirement for persistent maritime intelligence, surveillance, and reconnaissance capability, the Navy awarded the development contract to the Global Hawk contractor, which had proposed a variant of the Global Hawk airframe. Given the commonality between the two airframes, the Navy expects to avoid some development costs and gain efficiencies in production. Since the development contract award, the Navy and Air Force have worked together to identify commonalities to gain additional efficiencies where possible. According to a Navy official, one of the goals of this partnership is for the BAMS program to benefit from lessons learned by the Global Hawk program and thereby avoid the types of problems Global Hawk experienced during development.[12] Officials from the Defense Contract Management Agency emphasized the importance of using these lessons.

The BAMS payload and subsystem requirements differ from those of Global Hawk. However, the Navy has identified opportunities to achieve commonality with other aircraft programs rather than developing a service-unique solution. For example, the Navy plans to equip BAMS with the same electro-optical and infrared sensor used on the Air Force's Reaper unmanned aircraft. In addition, the Navy plans to equip BAMS with a maritime search radar based on radars used on the Air Force's F-16 and F-22 aircraft. BAMS will also rely on communications equipment that has been fielded on multiple weapon systems. Furthermore, BAMS will use an open systems approach in developing its payloads. A BAMS program official told us that the Navy expects to gain efficiencies in development, operations, training, and manpower.

Even with these areas of commonality, the Navy anticipates spending more than $3 billion on development, a substantial portion of which will be used to modify the airframe and ground stations and to integrate payloads, including the radar, to meet Navy-specific needs. According to a program official, the radar technology is mature because it has proven to be functional on fighter aircraft. However, the radar will require modifications to both size and shape before it can be integrated onto the airframe; these modifications are expected to constitute a large portion of the BAMS development cost. Although OSD certified that all BAMS critical technologies were mature at the start of development, OSD officials recently told us that they have some concerns about the radar's level of

[12] GAO, *Unmanned Aerial Vehicles: Changes in Global Hawk's Acquisition Strategy Are Needed to Reduce Program Risks*, GAO-05-6 (Washington, D.C.: Nov. 5, 2004), and *Unmanned Aircraft Systems: Global Hawk Cost Increase Understated in Nunn-McCurdy Report*, GAO-06-222R (Washington, D.C.: Dec. 15, 2005). Additionally, we have addressed problems with the Global Hawk program in our annual assessment of weapon systems. See GAO-09-326SP.

maturity. The Navy also plans to upgrade existing Global Hawk ground stations, in large part to allow analysts to view and assess information more quickly. This ground station upgrade will require both hardware and software development.

Greater efficiencies may also be possible in production. While production of the first two BAMS aircraft will occur at the same California facility where Global Hawk is currently produced, the remaining BAMS aircraft are expected to be produced at another facility in Florida. We believe that this approach has the potential to create duplication in production by having two facilities staffed and equipped to conduct essentially the same work. However, contractor officials point out that while the California facility has the capacity to accommodate BAMS production, having two separate facilities would minimize the impact of potential work surges. They also note that using the California facility for initial BAMS production will give them time to gain knowledge that could help get the Florida facility up and running. Yet neither contractor nor Navy officials provided an analysis to justify using the Florida facility. According to an official with the BAMS program office, the Navy considers this a contractor business decision, and according to contractor officials, the official analysis will not be done for several years. In the meantime, it is unclear whether the benefits of a second production facility outweigh the costs—such as additional tooling and personnel.

The Army and Air Force Have Missed Opportunities to Achieve Commonality and Efficiencies between Sky Warrior and Predator

OSD's efforts to consolidate and achieve greater commonality between the Army Sky Warrior and the Air Force Predator have generally not been successful. In 2001 the Army began defining requirements for a replacement to the aging Hunter unmanned aircraft system. According to the Army, the limited number of unmanned aircraft in DOD's inventory and its lack of direct control over these assets drove its decision to pursue the development of Sky Warrior. The aircraft was originally intended to satisfy the Army's requirement for wide-area, near real-time reconnaissance, surveillance, and target acquisition capability. However, both the Air Force and the Joint Staff responsible for reviewing Sky Warrior's requirements and acquisition documentation raised concerns about duplicating existing capability—specifically, capability provided by Predator. Nevertheless, the program received approval to forgo an analysis of alternatives that could have determined if existing capabilities would meet its requirements. The Army noted that such an analysis was not needed and not worth the cost and effort. Instead, it conducted a source selection competition and began the Sky Warrior development program, citing battlefield commanders' urgent need for this capability.

In 2005, the Army awarded the Sky Warrior development contract to the same contractor working with the Air Force to develop and produce Predators and Reapers. As a variant of Predator, Sky Warrior is now being assembled in the same facility. In 2006, the Army and Air Force signed a memorandum of understanding to work together to identify complementary requirements for the Sky Warrior and Predator programs. Despite this memorandum, limited progress was made, and in 2007, the Deputy Secretary of Defense directed the two services to combine their respective programs into a single acquisition program. The services subsequently signed a formal memorandum of agreement. However, the services have maintained separate program offices and funding for their respective programs and the two aircraft still have little in common. Sky Warrior is larger, longer, and heavier; has a wider wing span; and has significantly more payload capacity than Predator. The Air Force is also acquiring the Reaper—formerly Predator B—which is even larger and more capable than both the Sky Warrior and Predator.[13] However, all three systems have similar missions to seek, target, and attack enemy forces.

Although the ground control station the Army is developing for Sky Warrior is expected to be used to control other Army unmanned aircraft, it will not be common with the Predator and Reaper ground control station used by the Air Force. According to Army officials, however, they are currently using legacy ground control stations that are essentially the same as the Air Force's. The Army officials further noted that the Sky Warrior systems that the Army plans to deploy this summer will each be deployed with both an Army-unique ground control station and a legacy ground control station, to provide backup takeoff and landing capability in case the automatic takeoff and landing technology on Sky Warrior encounters problems.

The Army and Air Force are pursuing service-specific payloads and subsystems for these aircraft. For example, the services are pursuing separate solutions to meet similar requirements for a signals intelligence capability.[14] Specifically, the Army is developing a unique signals intelligence payload for Sky Warrior, while the Air Force is developing the

[13] Reaper is designed to provide a ground attack capability to find, fix, track, target, engage, and assess mobile or fixed targets, and is capable of flying at greater speeds and higher altitudes than Predator. For more information on Reaper and Predator, see app. II.

[14] Signals intelligence is derived from communications, electronic, and foreign instrumentation signals, regardless of how they are transmitted.

Airborne Signals Intelligence Payload for Predator, Reaper, and Global Hawk. Further, the Army is developing its own electro-optical and infrared sensor for Sky Warrior—and potentially other Army aviation platforms—and awarded an $11 million sensor development contract to the same contractor producing the Predator's electro-optical and infrared sensor.

Service-Driven Acquisition Processes and Ineffective Collaboration Have Reduced Opportunities for Commonality

While several of the unmanned aircraft programs we examined have achieved commonality at the airframe level, factors such as service-driven acquisition processes and ineffective collaboration have resulted in service-unique subsystems, payloads, and ground control stations. Despite DOD's efforts to emphasize a more joint approach to identifying and prioritizing warfighting needs and to encourage commonality among the programs, the services continue to drive requirements and make independent resource allocation decisions on their respective platforms. DOD officials have not quantified the potential costs or benefits of pursuing various alternatives, including systems with commonalities. With some notable exceptions, the services have been reluctant to collaborate and efforts to do so have produced mixed results. However, to maximize acquisition resources and meet increased demand, Congress and DOD have increasingly pushed for more commonality among unmanned aircraft systems.

Officials Cite the Need for Service-Unique Requirements

In 2003, DOD implemented a new requirements generation system intended to identify warfighter needs from a joint, departmentwide perspective—not from an individual service or program perspective. This process, referred to as the Joint Capabilities and Integration Development System (JCIDS), provides a framework for reviewing and validating capability needs. However, as we reported in 2008,[15] requirements continue to be driven primarily by the individual services with little involvement from the combatant commands,[16] which are largely

[15] GAO, *Defense Acquisitions: DOD's Requirements Determination Process Has Not Been Effective in Prioritizing Joint Capabilities*, GAO-08-1060 (Washington, D.C.: Sept. 25, 2008).

[16] Combatant commands are joint commands comprised of military equipment and personnel from each of the military services. Six combatant commands have geographic responsibilities to plan and execute military operations in their respective regions. Four combatant commands have functional responsibilities, for example, providing transportation services.

responsible for planning and carrying out military operations. In reviewing JCIDS documentation related to new capability proposals, we found that most—nearly 70 percent—were sponsored by the military services with little involvement from the joint community.[17] By continuing to rely on capability needs defined primarily by the services individually, DOD may be losing opportunities to improve joint warfighting capabilities and to reduce duplication of capabilities. In a separate report issued that same year,[18] we also noted that DOD did not have key management tools needed to ensure that its intelligence, surveillance, and reconnaissance investments reflected enterprisewide priorities and strategic goals. We further noted that DOD lacked assurance that its investments in intelligence, surveillance, and reconnaissance capabilities—including those in unmanned aircraft—were providing solutions that best minimize inefficiency and redundancy.

For the unmanned aircraft systems we reviewed, the services established requirements that were often so specific that they demanded service-unique solutions—thereby precluding opportunities for commonality. Yet none of the programs were able to provide us quantitative analyses to justify pursuing their unique solutions or to show why common solutions would not work.

In some cases, service-unique requirements appear to be necessary. For example, the Navy requires BAMS for maritime missions, which are distinct from the land missions of its counterpart, Global Hawk. Specifically, radar functionality depends on the operational environment—that is, water, a moving surface, compared to land, a relatively static surface. Distinct radar capabilities are required to create images of sufficient quality to recognize a target in these unique environments. The Navy is also modifying the Global Hawk design to accommodate BAMS's altitude agility requirements. Unlike Global Hawk, which is designed to fly continuously at high altitudes, BAMS is intended to fly at low, medium, and high altitudes during a mission. Consequently, the wings on the airframe need to be structurally reinforced to handle the loads and wind gusts associated with frequent changes in altitude. Altitude changes also make BAMS more susceptible to icing conditions, and therefore require a

[17] GAO-08-1060.

[18] GAO, *Intelligence, Surveillance, and Reconnaissance: DOD Can Better Assess and Integrate ISR Capabilities and Oversee Development of Future ISR Requirements*, GAO-08-374 (Washington, D.C.: Mar. 24, 2008).

de-icing capability for the wing, tail, and engine. Such differences in requirements have limited commonality in BAMS and Global Hawk beyond the basic airframe.[19]

While some of the differences between Global Hawk and BAMS requirements appear to be necessary, an OSD official we spoke with noted that there is concern that other distinctions in requirements that the services cited for other systems could lead to duplication and inefficiencies. For example, an Army official cited the need to develop an electro-optical and infrared sensor for the Army's Sky Warrior that had unique capabilities from the sensor the Air Force uses on the Predator. The Army noted that it does not need specific sensor capabilities that the Air Force is pursuing, such as high-definition video, which could require costly upgrades to existing Army systems. Currently, however, Predator's sensor does not use high-definition video and thus could be employed by the Sky Warrior system. Concerned that the government is paying a premium to build two separate sensors with essentially the same capability—the two systems are 80 percent common—OSD directed the services to evaluate the feasibility of and potential savings associated with purchasing a common sensor. An Army official, however, pointed out that the Army had negotiated a unit cost for its version of the sensor that is nearly $450,000 cheaper than unit cost of the Air Force sensor. Similarly, Army and Air Force officials cited the need for unique flight control requirements for Sky Warrior and Predator—"point and click" versus "stick and rudder"—because the Army uses enlisted operators to fly the aircraft, whereas the Air Force uses actual trained pilots. These different approaches require the services to develop and acquire unique ground control stations as well as other capabilities, such as automatic takeoff and landing capability, that have not been used before, resulting in additional cost and schedule risk.

In some cases, the services collaborated to identify common configuration, performance, and support requirements, but ultimately did not maximize efficiencies. For example, the Army and Navy have different data link requirements for their respective variants of Fire Scout, primarily because of the Army's requirement for its Fire Scout to operate within the Future Combat Systems network. However, the Future Combat Systems has been beset with problems and delays—which may not be resolved

[19] The BAMS program is leveraging technologies of other systems, like the radar from the F-22 and Joint Strike Fighter and the electro-optical and infrared sensor from Reaper.

until 2015—and as a result, there are eight manufactured Fire Scouts sitting in storage that according to the Fire Scout contractor, could be equipped with the same data link as the Navy Fire Scout and the Army's Shadow and Sky Warrior systems. Though the services could not agree on a common data link, the Army and Navy settled on common Fire Scout requirements for the air vehicle, engine, radar, navigation, and some core avionics subsystem requirements. The services also agreed to use one contract to procure the airframe.

DOD's Funding Process Can Hinder Collaboration and Commonality

The majority of needs that the military services identify are validated and approved without accounting for the necessary resources to achieve desired capabilities. The funding of proposed programs takes place through a process called the Planning, Programming, Budgeting, and Execution system, which is not synchronized with JCIDS but is similarly service-driven. Within the funding system each service has the responsibility and authority to prioritize its own budget, which allows it to make independent funding decisions supporting unique requirements. Therefore, once a service concludes that a unique solution is warranted, the service has the authority to budget for that unique solution, to the exclusion of other possible solutions that could achieve greater commonality and efficiency among the services. While DOD collectively reviews the individual service budgets, this review does not occur until the end of the funding process, at which point it is difficult and disruptive to make changes, such as terminating programs.

For example, OSD has directed the Army and the Air Force to merge their respective Sky Warrior and Predator programs. However, the services have concluded that continuing separate programs is warranted to meet their individual service needs. According to Air Force officials, the Air Force does not have a requirement for Sky Warrior, and it is not clear if the system would meet the service's current operational needs. Therefore, the Air Force has moved forward with its plan to end Predator procurement entirely and transition to an all Reaper fleet. DOD officials noted that the Air Force's future year budget plans have accordingly eliminated funding for Predator and increased the Reaper budget. OSD was concerned about the implications of this plan from a requirements and acquisition standpoint. Nevertheless, the Air Force will continue to procure its unique Reaper system and the Army will proceed with the development and production of its unique Sky Warrior system.

Efforts to Encourage Collaboration Have Had Limited Effect

Seven of the 10 programs we reviewed have established memorandums of agreement to foster collaboration and drive the programs toward commonality. However, these agreements generally lacked rigor and did not specify areas of commonality to be pursued. Therefore, it is unclear to what extent these agreements have helped programs leverage resources, particularly considering that little commonality has been achieved. The agreements often included caveats that allowed the services to deviate from the agreement if they determined that service-unique requirements had to be met. In some cases, the agreement was so explicit about service-unique needs and requirements that there was little incentive to pursue common solutions. In contrast, the memorandum of agreement between the Army and the Marine Corps for the Shadow program has specific statements that highlight their intention to meet both services' requirements. For example, the memorandum states that the two services would procure a fully common aircraft off the same contract, assume the same requirements, and use the same documentation.

At the department level, OSD established the Unmanned Aircraft Systems Task Force and the Office of Unmanned Warfare primarily to facilitate collaboration and encourage greater commonality among unmanned aircraft programs. While the two groups act as advisors and have implemented OSD's recommendations regarding areas where further commonality might be achieved—most prominently, for the Sky Warrior and Predator programs—key officials from these groups emphasized to us that they do not have direct decision-making or resource allocation authority.[20] OSD has repeatedly directed the services to collaborate on these two programs, and in recent memos has clearly expressed disapproval with the services' amount and pace of progress in doing so. Despite this direction, the services have continued to pursue unique systems. In response to OSD's most recent direction to merge their service-unique signals intelligence payload efforts into a single acquisition program, the Army and Air Force concluded that continuing their separate programs was warranted, and recommended that OSD direct an objective, independent organization—such as a federally funded research and development center—to conduct a business case analysis to assess the impact of merging the two programs. Table 5 summarizes OSD's directions and the services' responses over the past few years.

[20] GAO recently reported (GAO-09-175) that the Under Secretary of Defense for Acquisition, Technology and Logistics created the task force in 2007 to lead a DOD-wide effort to coordinate critical unmanned aircraft systems issues and develop a way ahead to enhance operations and streamline acquisitions.

Table 5: OSD and Service Efforts to Achieve Predator and Sky Warrior Commonality

	OSD	Services
November 2006	Under Secretary of Defense for AT&L establishes goal for the programs to have a common aircraft, propulsion system, and avionics configuration	
September 2007	Deputy Secretary of Defense directs the services to combine the programs into a single acquisition program and to migrate to a single contract by October 2008	
February 2008		Army and Air Force program executive officers sign a memorandum of agreement
May 2008	Under Secretary of Defense for AT&L reiterates the Deputy Secretary of Defense's directive to combine the programs into a single acquisition program, states that fiscal year 2009 funds can only be used to purchase a common airframe, and expresses dissatisfaction with the progress made on achieving a common electro-optical and infrared sensor	
October 2008	Undersecretary of Defense for AT&L grants a waiver to the Air Force to buy 20 additional Predators, but also directs the Air Force to buy five common airframes and noted that no additional waivers would be granted	
January 2009	Deputy Under Secretary for Acquisition and Technology and the Deputy Under Secretary of Defense (Intelligence) for Portfolio, Programs, and Resources direct the services to conduct a comprehensive business case analysis to assess the impacts of migrating to a single signals intelligence payload acquisition program	
February 2009		Acting Assistant Secretary of the Army (Acquisition, Logistics, and Technology) and Assistant Secretary of the Air Force (Acquisition) issue a joint memorandum, noting that despite more than 15 months of work and a dozen meetings, neither service supports the assertion that a joint program makes sense, and recommend that an objective, independent agency or organization do the business case analysis

Source: GAO.

Congress and DOD Continue to Direct Increased Collaboration and Commonality

In section 144 of the National Defense Authorization Act for Fiscal Year 2009, Congress directed "[t]he Secretary of Defense, in consultation with the Chairman of the Joint Chiefs of Staff, [to] establish a policy and an acquisition strategy for intelligence, surveillance, and reconnaissance payloads and ground stations for manned and unmanned aerial vehicle systems. The policy and acquisition strategy shall be applicable throughout the Department of Defense and shall achieve integrated research, development, test, and evaluation, and procurement commonality."[21] The Act further identifies the objectives that Congress expects the policy and acquisition strategy to achieve. Those objectives include, among others, the procurement of common payloads by vehicle class, achieving commonality of ground system architecture by vehicle class, common management of vehicle and payload procurements, ground station interoperability standardization, and common standards for exchanging data and metadata. Finally, DOD was directed to deliver a report containing the policy and acquisition strategy to Congress no later than 120 days after the enactment of the authorization act, which occurred on October 14, 2008. However, as of May 15, 2009, OSD had not issued the report. An OSD official within the Office of Unmanned Warfare told us that the department had requested an extension on the report.[22]

In an acquisition decision memorandum issued on February 11, 2009, the Under Secretary of Defense for Acquisition, Technology and Logistics (AT&L) identified the opportunity to adopt a common unmanned aircraft ground control station architecture that supports future capability upgrades through an open system and modular design. The memo notes that adopting a common DOD architecture using a core open architecture model would provide a forum for competition among companies to provide new capabilities. It also states that the military services can be given flexibility to adjust the man-to-machine interfaces for their respective ground control stations while still maintaining commonality on the underlying architecture and computing hardware. In addition, the memo identifies an opportunity to implement common technologies, such as autonomous takeoff and landing, across the military services. The military services are directed to work together—and with OSD in one instance—to assess various aspects of ground control station and technology commonality, and to report their findings to OSD. As of May 15, 2009, the services had not yet reported their findings.

Similar to OSD's approach to ground control stations, the Air Force Unmanned Aircraft Systems Task Force—which is currently developing a long-term unmanned aircraft plan—expects future unmanned aircraft to be developed as open, modular systems to which new capabilities can be added instead of developing entirely new systems each time a new

[21] Pub. L. No. 110-417, § 144.

[22] On July 6, 2009, we received a copy of the *Department of Defense Report to Congress on Common Control Stations and Payloads for Manned and Unmanned Aircraft Systems* that was issued in late June 2009.

capability is needed. It anticipates that this open systems approach will allow the Air Force to hold competitions for new payloads that can simply be plugged into the aircraft—or “plug-and-play” payloads. In addition, the Air Force recognizes the need for more joint unmanned aircraft solutions and increased teaming among programs and services. A leading task force official told us that given the limited resources DOD has to work with, it is imperative that the services explore more joint solutions and work together and find commonality—which the official noted must begin in the requirements process. He also noted that DOD should be focused on providing incremental capabilities to the warfighter and upgrading them later as the need arises and the technology matures. He pointed out that for most missions the warfighters do not need an optimal system—a 100 percent solution—they usually only need one or two of the functions the system can provide.

Conclusions

DOD is challenged to meet the warfighter’s ever-increasing demand for unmanned aircraft systems within available resources. Many of DOD’s tactical and theater-level unmanned aircraft acquisition programs have experienced significant cost growth, schedule delays, and performance shortfalls. DOD recognizes that to more effectively leverage its acquisition resources it must achieve greater commonality among the military services’ various unmanned system programs. While the Army and the Marine Corps achieved a high level of commonality in the Shadow program, other programs had less success. In general, the military services continue to establish unique requirements and prioritize resources without fully considering opportunities to achieve greater efficiencies. As a result, commonality has largely been limited to system airframes and in most cases has not been achieved among payloads, subsystems, or ground control stations. An objective, independent examination of DOD’s current unmanned aircraft portfolio and the methods for acquiring future unmanned aircraft could go a long way to ensuring that DOD gets a better return on every dollar it invests in unmanned aircraft.

Recommendations for Executive Action

To more effectively leverage resources and increase the efficiency in unmanned aircraft system acquisition programs, we recommend that the Secretary of Defense take the following two actions:

- Direct a rigorous and comprehensive analysis of the requirements for current unmanned aircraft programs, develop a strategy for making systems and subsystems among those programs more common, and report the findings of this analysis to Congress. At a minimum, this analysis should quantify the costs and benefits of alternative approaches, identify specific actions that need to be taken, and summarize the status of DOD's various ongoing unmanned aircraft-related studies.

- Prior to initiating any new unmanned aircraft program, require the military services to identify and document in their acquisition plans and strategies specific areas where commonality can be achieved, take an open systems approach to product development, conduct a quantitative analysis that examines the costs and benefits of various levels of commonality, and establish a collaborative approach and management framework to periodically assess and effectively manage commonality.

Agency Comments and Our Evaluation

In written comments on a draft of this report DOD partially agreed with the first recommendation and agreed with all elements of the second. DOD's comments are reprinted in appendix III.

Regarding our first recommendation to conduct a comprehensive analysis of requirements and opportunities for commonality among current unmanned aircraft systems, the department agreed that there is significant cost benefit to leveraging commonality, but noted that the Unmanned Aircraft Systems Task Force had conducted such analyses. Therefore, the department did not agree that a separate comprehensive analysis across all unmanned systems with the specific purpose of identifying opportunities for commonality was needed. Going forward, we believe that the department could benefit from a more comprehensive, quantitative analysis that looks across unmanned aircraft systems and focuses on subsystems, payloads, and ground control stations as well as airframes. The analyses DOD has done to date have been done on a case-by-case basis, and have primarily resulted in airframe commonality.

DOD agreed with each element of our second recommendation related to specific actions that the military services should be required to take before initiating new unmanned aircraft programs. The department believes that current requirements and acquisition policies and processes—some of which were recently revised—satisfy the intent of our recommendation. To ensure that resources are effectively leveraged to gain efficiencies, DOD must ensure the consistent and disciplined implementation of these policies and processes.

We are sending copies of this report to the Secretary of Defense, the Secretary of the Army, the Secretary of the Air Force, the Secretary of the Navy, the Commandant of the Marine Corps, and the Director of the Office of Management and Budget. The report also is available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or sullivanm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. A list of key contributors to this report can be found in appendix IV.

Michael J. Sullivan, Director
Acquisition and Sourcing Management

Appendix I: Objectives, Scope, and Methodology

This report examines the Department of Defense's (DOD) development and acquisition of unmanned aircraft systems. The primary focus of this work is to identify practices and policies that lead to successful collaborative efforts to field unmanned aircraft systems to the warfighter at the right time and for the right price. Specifically, our objectives were to (1) assess the cost, schedule, and performance progress of selected tactical and theater-level unmanned aircraft acquisition programs; (2) examine the extent to which the military services are collaborating and identifying commonality among those programs; and (3) identify the key factors influencing the effectiveness of their collaboration.

We selected 10 programs to include in our review: eight unmanned aircraft programs and two payload development programs. The eight unmanned aircraft programs included in our review—Global Hawk, Reaper, Shadow, Predator, Sky Warrior, Fire Scout, Broad Area Maritime Surveillance (BAMS), and Unmanned Combat Aircraft System (UCAS)—make up more than 80 percent of DOD's planned investment in unmanned aircraft systems from 2008 through 2013. The two payloads—Multi-Platform Radar Technology Insertion Program (MP-RTIP) and Airborne Signals Intelligence Payload (ASIP)—are being developed for use on unmanned aircraft.

To assess the extent to which selected tactical and theater-level unmanned aircraft systems are meeting their cost, schedule, and performance targets, we compared current data to baseline cost, schedule, and performance data for the 10 programs in our review. We collected and reviewed data from acquisition program baselines, acquisition decision memorandums, selected acquisition reports, presidential budget documents, and technology and operational assessments. We worked with knowledgeable GAO staff to ensure the use of current, accurate data and incorporated information, where applicable, from our recent assessment of major weapon programs.[1]

To examine the extent to which the military services are collaborating and identifying commonality among those programs, we reviewed key documents such as acquisition decision memorandums and policy directives, as well as program acquisition strategies and program briefings. We examined the acquisition approaches of the 10 programs included in our review to identify any collaborative efforts taken among programs. We

[1] GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, GAO-09-326SP (Washington, D.C.: Mar. 30, 2009).

also reviewed relevant DOD and Joint Staff policies and guidance to identify established criteria for effective collaboration. As part of our analysis, we compared and contrasted requirements for the systems in our review in order to assess areas of potential or apparent similarity as possible opportunities for collaboration. We did not assess the validity of the military services' requirements for the selected unmanned aircraft programs in our review.

To identify and assess which factors influenced the effectiveness of collaboration among the selected programs in our review, we examined the roles and responsibilities of DOD and military service acquisition and requirements organizations in fostering collaboration among programs. We examined the impact that officials and organizations within the acquisition and requirements communities have on collaboration. We also reviewed recent DOD acquisition initiatives, such as portfolio management and configuration steering boards, as well as service-level plans and activities related to collaboration and commonality among unmanned aircraft programs.

In performing our work, we obtained information and interviewed unmanned aircraft systems program officials from Wright-Patterson Air Force Base, Ohio; Hanscom Air Force Base, Massachusetts; Redstone Arsenal, Alabama; and Patuxent River, Maryland, and officials from the Air Force, Army, and Navy acquisition and requirements organizations, the Office of the Secretary of Defense, and Joint Chiefs of Staff offices, Washington, D.C. Further, we interviewed officials from the UAS Joint Center of Excellence, Nellis Air Force Base, Nevada; the Air Force UAS Task Force, Washington, D.C.; and U.S. Central Command, MacDill Air Force Base, Florida. We also met with officials from defense contractors General Atomics in Rancho Bernardo, California, and Northrop Grumman, in San Diego and Palmdale, California, to obtain information on the development and production efforts of seven of the eight unmanned aircraft system programs in our review.

We conducted this performance audit from August 2008 to July 2009 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.

Appendix II: Summary of Unmanned Aircraft Program Ongoing and Future Efforts

This appendix provides additional information about the eight unmanned aircraft[1] and two payload programs assessed in the body of this report. Each program summary in this appendix includes an aircraft photo, a brief description of the system's mission and program status and our observations on program execution and outcomes, and where applicable, the summaries also highlight recent GAO work. To provide additional insights into the magnitude of recent and expected future investments in these programs, the summaries include details on DOD's planned investment from 2008 through 2013 as contained in the department's fiscal year 2009 budget.[2] The budget information in tables 8 through 17 is expressed in then year dollars, and due to rounding the numbers may not add exactly. The fiscal year 2008 funding shown in the tables has been appropriated by Congress. The funding requested in DOD's fiscal year 2010 budget submission for each program is captured in notes to the tables—DOD's fiscal year 2010 budget did not contain any funding projections beyond 2010. Tables 6 and 7 detail many key characteristics and compare the capabilities of the systems discussed in this appendix.

Table 6: Characteristics of Selected Tactical and Theater-Level Unmanned Aircraft

Aircraft	Length (feet)	Wing span (feet)	Gross weight (pounds)	Payload capacity (pounds)	Endurance (hours)[a]	Maximum altitude (feet)
Predator	27	55	2,250	450	24+	25,000
Sky Warrior	28	56	3,200	800	40	25,000
Reaper	36	66	10,500	3,750	24	50,000
Shadow	11	14	375	60	6	15,000
Fire Scout	23	28	3,150	600	6+	20,000
Global Hawk[b]	48	131	32,250	3,000	28	60,000
BAMS	48	131	32,250	3,200	34+	60,000
UCAS-D	38	62	46,000	4,500	9	40,000

Sources: DOD, *Unmanned Systems Roadmap 2007 – 2032,* and BAMS program office.

[a]Endurance capacity reported here is the maximum endurance possible, without external payloads. For some aircraft, the addition of external payloads can affect endurance capacity.

[b]Information on the RQ-4B Global Hawk is presented in this table.

[1] The appendix contains 11 program summaries because the Navy and Army Fire Scout programs are reported separately.

[2] Because the Army Fire Scout is considered a part of the Future Combat Systems program, no funding details are presented in the program summary.

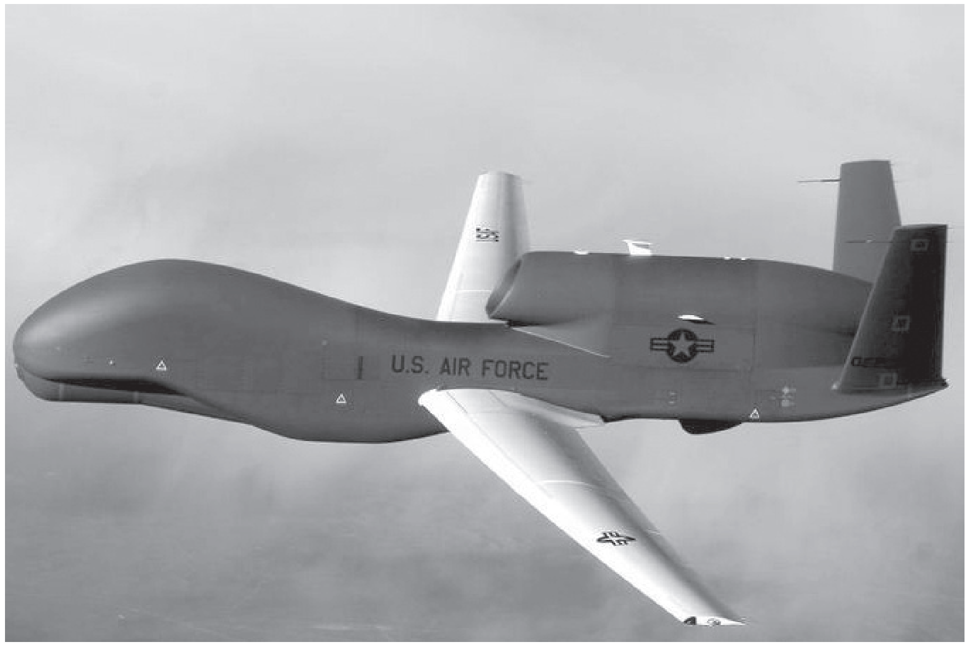
Table 7: Comparison of Key System Capabilities

	Imagery intelligence			Signals intelligence		
System	Electro-optical/ infrared	Synthetic aperture radar	Full motion video	Communications intelligence	Electronic intelligence	Weapons
Global Hawk	X	X		X	X	
Predator	X	X	X	X		X
Reaper	X	X	X	X		X
Sky Warrior	X	X	X			X
Shadow	X		X			
Fire Scout - Navy	X		X			
Fire Scout - Army	X	X	X	X	X	
BAMS	X	X	X			
ASIP				X	X	
MP-RTIP		X				

Sources: DOD (data); GAO (analysis and presentation).

Note: While we also assessed the Navy's Unmanned Combat Aircraft System Demonstration (UCAS-D) as part of our review, UCAS-D is a demonstration effort and will not be equipped with any mission payloads.

Figure 2: RQ-4 Global Hawk



Source: DOD.

Mission

The Global Hawk system is a high-altitude, long-endurance unmanned aircraft with an integrated sensor suite and ground segment that provides intelligence, surveillance, and reconnaissance (ISR) capabilities. The system is intended to provide high-resolution, high-quality, digital synthetic aperture radar to include ground moving target indicator, plus electro-optical and infrared imagery of targets and other critical areas of interest. A signals intelligence payload and advanced radar are also being developed.

Program Status

Global Hawk is being developed and procured in four configurations. Block 10 aircraft, designated RQ-4A, are based on an airframe similar to the original demonstrators and employ imaging intelligence sensors (synthetic aperture radar, electro-optical, and infrared). The other three configurations are larger and more capable systems, designated RQ-4B. Block 20 aircraft employ enhanced imaging intelligence sensors. Block 30 aircraft provide multiple intelligence capabilities—signals intelligence as well as the enhanced imaging intelligence sensors. Block 40 aircraft will employ an advanced radar being developed by the Multi-Platform Radar Technology Insertion Program.

According to the original contract, the contractor was expected to deliver 19 Global Hawk systems by the end of December 2008. However, as of January 2009, the contractor had only delivered 14 systems, 9 of which were more than 8 months late. All seven Block 10 aircraft have been delivered to the Air Force and have supported ongoing military operations. All six Block 20 aircraft have also been delivered. The Block 20 aircraft are currently in testing and recently underwent an operational assessment. DOD's top acquisition official noted that the assessment provided useful insight into the performance of the enhanced integrated sensor suite. Block 20 initial operational test and evaluation (IOT&E) was expected to be completed in October 2009. However, the Air Force reported in February 2009 that operational testing had slipped beyond the acquisition program baseline threshold date, but did not specify the expected length of the delay. According to program officials a high level of concurrency in the program—concurrent development, production, and testing—coupled with developmental testing delays, unforeseen system failures, and excessive weather-related flight test cancellations were to blame for the schedule slip.

The Air Force received the first of a planned purchase of 26 Block 30 aircraft from the contractor in November 2007—10 months later than the original contract delivery date. The aircraft was subsequently equipped with an Airborne Signals Intelligence Payload (ASIP) sensor, and began developmental flight testing in September 2008. While ASIP developmental testing on the Global Hawk has gone relatively well, Block 30 IOT&E has been delayed in concert with Block 20.

According to the contractor, the critical design review for Block 40 has been completed, and the first Block 40 aircraft is in the final stages of assembly. Contractor officials also noted that the MP-RTIP sensor will be integrated onto Global Hawk and begin testing in May 2009. Block 40 operational testing—which was originally expected to begin no later than November 2010—has been delayed, and no new date has been established. The Air Force currently plans to purchase a total of 15 Block 40 Global Hawks.

GAO Observations

Global Hawk concurrently entered development and limited production of the RQ-4A in March 2001, after completing a successful demonstration program. One year later, the Air Force chose to pursue the larger, more capable RQ-4B airframe. Although the two airframes were expected to have substantial commonality, differences were much more extensive than anticipated. The final design of the RQ-4B required more substantial changes than expected to the fuselage, tail, and landing gear. Frequent and substantive engineering changes during the first year of production increased development and airframe costs and delayed delivery and testing schedules. The system unit cost has more than doubled since development began, and the program has been restructured three times.

Completion of Block 20 operational testing has been delayed more than 3 years from initial estimates. Developmental test results indicate that the Block 20 aircraft's enhanced sensors did not achieve the desired level of clarity. However, DOD's top acquisition official in an October 2008 acquisition decision memorandum directed the Air Force to go ahead with the procurement of the Block 20 sensors—noting that the sensor performance requirement was a subjective measure and current performance was satisfactory. The Air Force expects to have purchased more than 60 percent of total Global Hawk quantities before Block 20 testing is complete.

In October 2008, 1 month after beginning Block 30 ASIP testing, the Office of the Secretary of Defense (OSD) issued an acquisition decision memorandum stating that the ASIP development appeared to be on track to meet user requirements and approving the purchase of a limited number of sensors—pending successful completion of the sensor calibration. According to ASIP program officials, sensor calibration and developmental testing are finished. They also noted that they were planning to conduct dedicated ASIP operational testing on the U-2, which they believe will further reduce risk in the program before beginning Global Hawk Block 30 operational testing, which has been delayed indefinitely in concert with Block 20 operational testing.

According to a recent Director of Operational Test and Evaluation (DOT&E) report, the Air Force's plan to complete Block 40 development in 2010 is in jeopardy because development of the advanced MP-RTIP radar has experienced delays. The report cites a failure to design useful sensor calibration and poor system software stability as the primary culprits. In addition, the DOT&E notes that the potential exists for the contractor to deliver up to 6 of the 15 planned Block 40 systems before MP-RTIP will be able to deliver any operational capability.

The Air Force's 2009 budget request contained over $5 billion for Global Hawk development and procurement. The Global Hawk procurement budget includes funding to purchase and integrate the ASIP and MP-RTIP payloads. ASIP and MP-RTIP development are funded separately.

Table 8: DOD Planned Investment for Global Hawk, Fiscal Years 2008-2013

Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$274.7	$284.3	$243.9	$195.9	$168.7	$170.7	**$1,338.2**
Procurement[b]	580.9	712.2	517.0	533.5	558.7	475.1	**$3,377.4**
Total	**$855.6**	**$996.5**	**$760.9**	**$729.4**	**$727.4**	**$645.8**	**$5,186.4**

Source: DOD fiscal year 2009 budget.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 Research, Development, Test, and Evaluation (RDT&E) funding amount of $268.6 million and a fiscal year 2010 RDT&E budget request of $245.4 million for Global Hawk.

[b]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 procurement funding amount of $710.0 million and a fiscal year 2010 procurement budget request of $667.8 million for Global Hawk.

Figure 3: MQ-9 Reaper

Source: DOD.

Mission

The Air Force's MQ-9 Reaper is a multirole, medium-to-high-altitude, long-endurance unmanned aerial vehicle system capable of flying at faster speeds and higher altitudes than its smaller predecessor, the MQ-1 Predator. While Predator is primarily a surveillance and reconnaissance asset, Reaper is designed for armed reconnaissance missions. It is expected to provide around-the-clock capability to detect, attack, and destroy mobile, high-value, time-sensitive targets. Reaper will carry missiles, laser-guided bombs, and the Joint Direct Attack Munition. Reaper also will support net-centric military operations. Each system consists of four aircraft, a ground control station, and a satellite communications suite.

Program Status

Because of recent budget increases, the Reaper program may soon be designated a major defense acquisition program. Based on current projections, Reaper will achieve initial operational capability in August 2009. Its full-rate production decision was recently postponed over a year, pending the decision about its acquisition category. It recently completed initial operational testing, receiving a rating of partially mission capable. The Air Force has taken delivery of 27 aircraft to date. Total aircraft quantity requirements have increased from 63 to 118, and may increase even further since the Air Force plans to increase procurement in its upcoming budget submission. Reaper's second increment, comprising the small diameter bomb and automatic takeoff and landing capability, is scheduled to begin development in late fiscal year 2010.

GAO Observations

The Reaper program began in January 2002 in the aftermath of the September 11, 2001, terrorist attacks. Since inception, Reaper—designated an urgent operational need—has followed a nontraditional acquisition path, resulting in concurrent development and production and increased risk. Shortly after development began, the user required accelerated aircraft deliveries to achieve an interim combat capability. Two years later, the user required additional aircraft for an even more robust early fielding capability. In response to user demands, the Air Force has contracted for over 30 percent of the total quantity before completing initial operational testing.

Performance enhancements, such as adding missiles and a digital electronic engine control, increased the weight of the aircraft, requiring stronger landing gear, fuselage, and flight control surfaces. In addition to requirements changes, the aircraft quantity increased 87 percent since the start of development. The increase—from 63 to 118 aircraft—was due in part to demands of the war on terror. The quantity may increase even further because the Air Force plans to curtail future Predator procurement and buy only Reapers. Despite the significant quantity increase, procurement unit costs have not decreased; they have increased about 32 percent since development began. This cost growth is due to inefficiencies associated with the early fielding process and requirements changes.

Although initial operational testing was completed in August 2008, two of three key capabilities were not fully assessed. Reaper was effective in destroying targets, but radar problems prevented the test team from completing an assessment of its ability to detect and identify targets. The net-centric operations support capability was not assessed at all. Other areas of concern included operator workload, off-board communications, and system reliability. Because tests were limited by weather, climate, and radar reliability and training, additional testing will be required to assess these capabilities. The Air Force testers gave Reaper a rating of partially mission capable; DOD's independent test organization has not yet completed its assessment of the test results.

Reaper has been funded under the Predator program element since its inception. In its fiscal year 2008 budget, the Air Force began reporting Reaper as a separate program element, thereby isolating program costs.

Table 9: DOD Planned Investment for Reaper, Fiscal Years 2008-2013

Then year dollars in millions

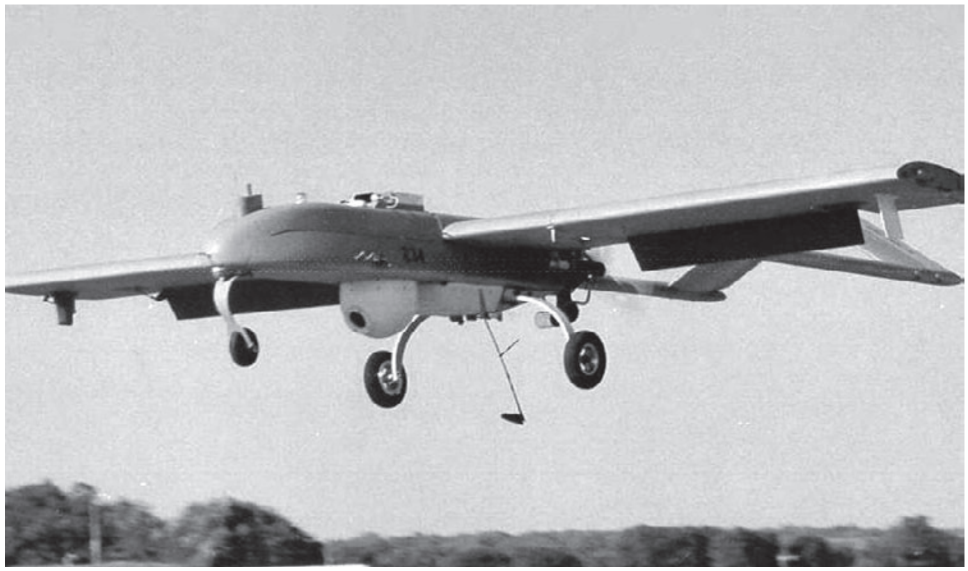
	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$63.9	$43.6	$37.7	$37.2	$19.7	$20.1	**$222.2**
Procurement[b]	58.1	161.4	193.4	193.0	144.8	147.2	**$897.9**
Modifications	20.4	24.6	30.2	31.5	31.0	31.5	**$169.2**
Supplemental	340.7						**$340.7**
Total	**$483.1**	**$229.6**	**$261.3**	**$261.7**	**$195.5**	**$198.8**	**$1,630.0**

Source: DOD fiscal year 2009 budget.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $46.4 million and a fiscal year 2010 RDT&E budget request of $39.2 million for Reaper.

[b]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 procurement funding amount of $248.6 million and a fiscal year 2010 procurement funding request of $489.5 million for Reaper.

Figure 4: RQ-7B Shadow 200 (Tactical Unmanned Aerial Vehicle)



Source: DOD.

Mission

The Shadow 200 unmanned aircraft system provides reconnaissance, surveillance and target acquisition and force protection at the Army brigade level. One Shadow system consists of four air vehicles and associated ground control equipment, including two ground control stations and an air vehicle launcher.

Shadow is equipped with automatic takeoff and landing capability and operates at up to 15,000 feet in various weather conditions. The air vehicle has electro-optical/infrared capabilities. Planned system upgrades include integration of the Tactical Common Data Link (TCDL) and the Army's heavy fuel engine. As a brigade-level asset, the Shadow aircraft is intended to allow for mission payloads to be changed on the aircraft within 30 minutes.

Program Status

The Shadow program is an acquisition category II program and grew out of an advanced concept technology demonstration program. The Shadow program entered full-rate production in 2002 without the TCDL or the heavy fuel engine. Program funding after 2002 has been used for Shadow fleet upgrades, such as integrating the heavy fuel engine. TCDL development is ongoing; retrofitting is scheduled to begin in 2009.

According to program officials, 252 Shadow aircraft have been fielded to the Army, with an additional 104 aircraft procured but not yet delivered to the warfighter. The Army plans to procure a total of 460 aircraft. In addition, the Marine Corps signed a memorandum of agreement with the Army in 2007 to acquire 52 Shadow aircraft. The Marine Corps systems are identical to the Army's, and are being procured through the existing Army contract.

GAO Observations

Shadow systems were intended to be fielded as quickly as possible with "no bells and whistles," eventually evolving into more capable systems with the TCDL and heavy fuel engines. According to program officials, initial research and development funding was designated for the basic Shadow system, which program officials estimated to cost $198.1 million. Program officials told us that when Shadow achieved initial operational capability in 2002—effectively ending development—the Army had only spent $181.2 million, or 9 percent less than the initial estimate. Officials stated that development funding since 2002 has been used to upgrade the basic Shadow system. The cost of these upgrades, officials told us, was initially estimated at $99.1 million, but the current estimate has risen to $175.4 million.

According to the program office, total research and development costs for the Shadow system have increased 80 percent since program start in 1999, while total procurement costs have increased 267 percent. Program officials stated that increases in the number of aircraft being procured, which has nearly tripled from 164 to 460, along with upgrades and retrofits have contributed to cost growth in the Shadow program.

By following an incremental approach for the Shadow program, the Army was able to minimize program risk by delivering basic capability to the warfighter within the initial development cost estimate. To field a more capable, robust system, the program has continued to pursue development of additional capabilities that were not available when the system was initially fielded, such as the TCDL and heavy fuel engine. However, risk remains as the costs for retrofit and upgrade activities have increased.

The Marine Corps has benefited from the Army's development of the Shadow system by avoiding the costs of initial development and purchasing a mature system. However, as the Army upgrades and retrofits Shadow, the Marine Corps will also have to fund these efforts if it wants to maintain the same level of commonality with the Army. Program officials told us that the Marine Corps is exploring ways to add additional capabilities to Shadow aircraft to allow it to carry a weapons payload. Although the Army has no requirement for this capability, the service would be interested in retrofitting Shadow systems with a weapons payload if the capability were developed. Consequently, we believe that the Army and Marine Corps need to carefully manage how they maintain commonality.

Table 10: DOD Planned Investment for Shadow, Fiscal Years 2008-2013

Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$7.9	$8.2	$7.9	$8.1	$9.1		**$41.2**
Procurement[b]	72.7	0.0	258.3	58.9			**$389.9**
Supplemental	223.9						**$223.9**
Total	**$304.5**	**$8.2**	**$266.2**	**$67.0**	**$9.1**		**$655.0**

Sources: DOD fiscal year 2009 budget and Army Shadow program office.

Note: This includes Army funding only.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $12.2 million and a fiscal year 2010 RDT&E budget request of $70.8 million for Shadow, of which $29.5 million is for overseas contingency operations.

[b]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 procurement funding amount of $87.9 million and a fiscal year 2010 procurement budget request of $609.4 million for Shadow, of which $326 million is for overseas contingency operations.

Figure 5: MQ-1C Extended Range Multi-Purpose UAS (Sky Warrior)

Source: General Atomics Aeronautical Systems, Inc.

Mission

The Extended Range Multi-Purpose unmanned aircraft system (Sky Warrior) is intended to perform reconnaissance, surveillance, and target acquisition missions at the Army division level. Additionally, Sky Warrior is equipped with four missiles. One Sky Warrior system consists of 12 MQ-1C air vehicles along with associated ground equipment, including five ground control stations.

Operating at 25,000 feet in a near all-weather environment, Sky Warrior will be equipped with automatic takeoff and landing capability. Communications with the Sky Warrior system will be via the TCDL. The air vehicle will be equipped with electro-optical/infrared and synthetic aperture radar capabilities, as well as a signals intelligence payload.

Program Status

The Under Secretary of Defense for Acquisition, Technology and Logistics elevated the Sky Warrior program to an acquisition category I program in a May 2008 memorandum. This directive supported the OSD decision that the Army Sky Warrior and Air Force Predator unmanned aircraft system programs migrate to a single contract for airframe procurement. Currently, Predator is built on an airframe designated the MQ-1B, but OSD is pushing the Air Force to transition its Predators to the same airframe the Army is using for the Sky Warrior, designated the MQ-1C. While the Air Force is planning to procure 5 MQ-1C airframes—in response to recent OSD direction—it is in the process of assessing how many additional airframes, if any, it needs to purchase.

According to program officials, the demand for intelligence, surveillance, and reconnaissance capabilities to meet current operational needs has resulted in concurrent development and production of the Sky Warrior system. The Army has purchased 40 interim Sky Warrior air vehicles, 21 of which are built on the existing Predator airframes. Although the remaining 19 air vehicles are built on the new MQ-1C airframe they do not provide full Sky Warrior capability. According to the Army, these interim air vehicles are intended to provide some capability to the warfighter until the full Sky Warrior system is fielded. A February 2009 memorandum from OSD authorizes the Army to procure four production-ready MQ-1C air vehicles to begin initial testing for the full Sky Warrior system.

GAO Observations

The Sky Warrior program has experienced both cost growth and schedule delays, which, according to program officials, can be explained by the need to deliver systems to the warfighter as quickly as possible. Production quantities have increased from 4 systems at program start to 11 systems; total program costs have increased over 138 percent. Milestone C—the point at which a system is approved to begin production—has been delayed by 2 years; therefore, the full Sky Warrior system will not enter low-rate production until November 2009. Furthermore, because the systems being fielded early do not possess all of the intended capabilities of a full system, costs will likely increase as other capabilities are integrated into the existing systems. Additionally, Sky Warrior has been designated an acquisition category I program and is currently undergoing a program rebaseline. This new baseline, once completed, may incorporate further schedule delays and cost increases.

OSD approved the Sky Warrior program's acquisition strategy in January 2009, despite the fact that the synthetic aperture radar the Army planned to use on the system had proven to be unreliable. The radar's poor performance forced the Army to select a new radar entirely. However, according to the program office, given the Army's acquisition strategy, the new radar will not be ready until after Sky Warrior finishes initial operational testing in 2011 and a full-rate production decision has been made. This approach greatly increases the risk in the program.

During the most recent GAO annual assessment of DOD major weapon programs, the Sky Warrior program office indicated that all four of the system's critical technologies were mature. However, a recent independent Army test concluded that three of the four technologies are not yet mature, including the automatic takeoff and landing system and the TCDL. As of May 2009, Army officials recognized that the automatic takeoff and landing system was still an immature technology. As a result, the Army will deploy each of its early Sky Warrior systems this summer with two ground control stations, an Army One Ground Control Station and a legacy ground control station—with stick and rudder controls—as a backup system in case the auto takeoff and land capability fails. Much of our prior work in DOD weapon systems acquisition and commercial best practices has shown that conducting technology development concurrent with product development greatly increases cost, schedule, and performance risks.

Table 11: DOD Planned Investment for Sky Warrior, Fiscal Years 2008-2013

Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$48.7	$12.7	$3.9	$4.1	$6.4	$6.6	**$82.4**
Procurement[b]	137.8	189.7	339.0	316.2	123.8	128.9	**$1,235.4**
Total	**$186.5**	**$202.4**	**$342.9**	**$320.3**	**$130.2**	**$135.5**	**$1,317.8**

Sources: DOD fiscal year 2009 budget and Sky Warrior program office.

Note: RDT&E and Procurement include funding for weaponizing the Sky Warrior air vehicle.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $61.767 million and a fiscal year 2010 RDT&E budget request of $83.571million for Sky Warrior.

[b]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 procurement funding amount of $239 million and a fiscal year 2010 procurement budget request of $666.2 million for Sky Warrior, of which $250 million is for overseas contingency operations.

Figure 6: MQ-1 Predator

Source: DOD.

Mission

The Air Force's MQ-1 Predator is a single-engine, propeller-driven, remotely piloted aircraft designed to operate at medium altitudes for long-endurance missions. The program began in 1994 as an advanced concept technology demonstration, and the aircraft proved its military utility with a successful operational deployment in Bosnia. Its original mission was to provide continuous ISR coverage to the theater commander/joint warfighter. In 2001, the Air Force added weapons to Predator, thus expanding its role to include a limited strike capability. Predator provides full-motion video of the battlefield with high-resolution sensors in near real time. Each Predator system includes four aircraft, a ground control station, and a satellite communications suite.

Program Status

Future procurement of the Predator is uncertain. After more than a decade of operational use, it is now considered a legacy program. The Army is procuring a more modern, capable variant of Predator—Sky Warrior. In

2007, OSD directed the services to merge these two programs, using the newer Army platform as the baseline configuration. However, because of differences in service requirements and operations, the Army and Air Force have made limited progress. For example, the Army needs a tactical capability that operates with existing Army platforms like the Apache helicopter. In contrast, the Air Force needs a strategic capability that satisfies the needs of the joint warfighter. The Air Force has not completed testing of the newer Sky Warrior aircraft, and in fact is planning to purchase another variant—Reaper—as a replacement for Predator.

GAO Observations

Because Predator transitioned directly from a technology demonstrator into production, it did not follow a typical acquisition process. Its performance and quantity requirements have changed significantly since inception. For example, Predator was initially designed to provide the warfighter continuous ISR and targeting information. The user subsequently required that it carry missiles, giving it a limited strike capability. In addition, Predator's quantity requirements have more than doubled since it began. The Air Force originally planned to procure 12 systems (48 aircraft), but because of the increasing demand for its capability, the total quantity has been increased to 26 systems.

With the addition of MQ-9 Reaper and the Army's Sky Warrior, the contractor's business base has significantly expanded. This expansion raised concerns about the contractor's capacity, particularly given its history of late aircraft deliveries. Last year, however, the contractor delivered 10 Predator aircraft ahead of schedule. According to program officials, these aircraft were completed early to provide time for the contractor to move its equipment into newly expanded facilities. Despite these deliveries, the contractor's more recent aircraft deliveries have once again been late. Although the Air Force was directed to begin purchasing the newer MQ-1C aircraft—the Sky Warrior configuration—it plans to buy Reapers in lieu of Predators. Given the lingering uncertainty about how many of which configurations will be purchased, program officials are concerned that future aircraft deliveries will be affected.

Early Predator cost data are limited. Once Predator became an acquisition program, the Air Force projected an acquisition cost of $910 million (base year 2009 dollars) for 12 systems. Since that time, the number of operational systems has more than doubled, the performance and payload requirements have changed, and the flying hours and attrition rates have increased. This hampers a direct comparison. The total program cost is about $3.61 billion (base year 2009 dollars).

Table 12: DOD Planned Investment for Predator, Fiscal Years 2008-2013

Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$33.8	$24.8	$21.0	$20.7	$21.1	$21.5	**$142.9**
Procurement[b]	276.1	378.7	247.7	149.1	131.8	109.9	**$1,293.3**
Modifications	74.2	148.5	138.9	137.5	101.3	100.1	**$700.5**
Total	**$384.1**	**$552.0**	**$407.6**	**$307.3**	**$254.2**	**$231.5**	**$2,136.7**

Source: DOD fiscal year 2009 budget.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $36.906 million and a fiscal year 2010 RDT&E budget request of $18.101 million for Predator.

[b]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 procurement funding amount of $377.674 million and no procurement funding in fiscal year 2010 for Predator.

Figure 7: Vertical Take-off and Landing Tactical Unmanned Air Vehicle (Navy Fire Scout)

Source: DOD.

Mission

The U.S. Navy Vertical Take-off and Landing Tactical Unmanned Air Vehicle (VTUAV) will provide local commanders real-time imagery and data to support ISR requirements. A VTUAV system is composed of up to three air vehicles with associated electro-optical/infrared/laser designator-rangefinder sensors, two ground control stations, one recovery system, and associated spares and support equipment. The air vehicle launches and recovers vertically and operates from ships and land. Interoperability is achieved through use of a common data link and standard communications.

VTUAV is being designed as a modular, reconfigurable system to support various operations, including potential surface, antisubmarine, and mine warfare missions. Future capabilities currently under consideration include surface search radar, signal intelligence, enhanced data and communications relay, and integration of weapons.

Program Status

The Navy expects the VTUAV to achieve initial operational capability in late fiscal year 2009. The program began in fiscal year 2000, after market research and a competitive ship-based vertical takeoff and landing demonstration were conducted. A competitive contract was awarded to Northrop Grumman for delivery of system development air vehicles and the first lot of low-rate initial production (LRIP) systems. During fiscal year 2002, the program was de-scoped to a technology demonstration effort, and two LRIP options were not exercised.

In fiscal year 2003, the VTUAV program was restructured to support the Littoral Combat Ship (LCS), and received increased funding from Congress in fiscal year 2004 toward that goal. The restructured program was expected to cost about $2.3 billion, and as a result in August 2006 it was designated as an acquisition category IC program. The program received Milestone C approval in May 2007 to procure up to 4 air vehicles in the first lot of LRIP. The Navy plans to procure a total of 168 air vehicles, plus 9 developmental LRIP vehicles. VTUAV is currently undergoing test and evaluation.

GAO Observations

The VTUAV program was restructured in 2004 to support the LCS. At the time of the restructuring, Congress authorized funding for an upgraded VTUAV variant, the MQ-8B, which addressed requirement shortfalls—including time on station—of an earlier version, the RQ-8A. In February 2008, after being advised of at least a 2-year delay in the LCS program, the Navy decided to continue VTUAV development using an alternate ship—a frigate. Navy officials estimated that the move to the alternate ship would require $42.6 million of additional funding and result in a 9-month schedule delay.

VTUAV efforts are funded under cost-type contracts for system development and firm-fixed price for production. The program uses common, mature technologies as much as possible. The air vehicles are based on a commercial manned helicopter that has been in service for over 20 years. The MQ-8B is undergoing developmental and operational testing and has landed successfully aboard ship.

The Army, in September 2003, chose VTUAV to meet Future Combat System (FCS) unmanned aerial requirements. According to contractor officials, the two services were able to achieve about 97 percent commonality for the airframe. However, service-specific payloads will hinder further collaboration.

Furthermore, FCS delays could affect Fire Scout production efficiency. According to Northrop Grumman officials, they need to produce a minimum number of airframes per year to break even; they are currently producing three airframes per year for the Navy to support system development. If FCS continues to delay the Army portion of the Fire Scout program (or other potential buyers do not make a purchase), airframe production will be difficult to sustain.

Table 13: DOD Planned Investment for VTUAV, Fiscal Years 2008-2013

Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$32.8	$9.7	$26.2	$5.0	$1.3	$1.4	**$76.4**
Procurement[b]	38.6	62.3	73.8	76.1	97.1	103.6	**$451.5**
Total	**$71.4**	**$72.0**	**$100.0**	**$81.1**	**$98.4**	**$105.0**	**$527.9**

Source: DOD fiscal year 2009 budget.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $9.6 million and a fiscal year 2010 RDT&E budget request of $25.6 million for VTUAV.

[b]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 procurement funding amount of $57.1 million and a fiscal year 2010 procurement budget request of $80.0 million for VTUAV.

Figure 8: FCS XM157 Class IV Unmanned Aircraft System (Army Fire Scout)

Source: DOD.

Mission

The XM157 Class IV unmanned aircraft system (UAS) will provide reconnaissance, surveillance, targeting, mine detection, communications relay, wide area surveillance, chemical detection, and meteorological survey capabilities for the FCS Brigade Combat Team (BCT). The Class IV UAS will operate in conjunction with manned aircraft. The air vehicle will vertically take off and land from unprepared surfaces, and will be controlled by light tactical vehicles equipped with launch control units and by command and control manned ground vehicles within the FCS BCT over the FCS network.

The Class IV UAS is part of the FCS family of systems made up of integrated, advanced, networked combat and sustainment systems; unmanned ground and air vehicles; and unattended sensors and munitions. Complementary programs external to FCS development provide many of the major Class IV UAS subsystems and payloads, including communications equipment such as the Warfighter Information Network-Tactical (WIN-T) and the Joint Tactical Radio System (JTRS).

Program Status

The Army is pursuing a joint acquisition strategy with the Navy. The Army, in September 2003, chose the Navy Fire Scout for its Class IV UAS. Program officials indicated that the Navy is the lead service for system development. The Army purchases common airframes under a separate line item in the Navy contract, and then provides the airframes to the FCS lead system integrator as government-furnished equipment. The Army is leveraging Navy testing to mitigate risk and provide early test data; its own first developmental flight testing is not scheduled to begin until the second quarter of fiscal year 2011.

The Army plans to support 15 BCTs, each equipped with 32 Class IV air vehicles, and will procure 500 air vehicles overall, including 20 for development and low-rate initial production. The Army has taken delivery of eight airframes.

The Class IV UAS schedule depends on complementary programs—specifically WIN-T and JTRS—and the overall FCS schedule, which has slipped. The fiscal year 2011 first flight date represents a 42-month delay from the Army's original baseline estimate.

GAO Observations

According to contractor officials, the Army and Navy achieved about 97 percent commonality for the airframe. A Defense Contract Management Agency official estimated about $125 million in development cost savings attributable to commonality. Contractor representatives maintain that operations and maintenance would provide greater opportunity for cost savings from commonality.

However, the Army's requirements for FCS-based, mission-specific subsystems and payloads are hindering further collaboration. According to both program and contractor officials, the delivered airframes were intended for testing, but they cannot be tested without WIN-T and JTRS, which are not currently available. WIN-T will be the data link that allows control of the Class IV UAS from mobile ground stations, and JTRS will provide a communication relay capability. Neither program nor contractor officials seemed confident that these subsystems would be available soon. Furthermore, DOD's recent proposal to terminate the FCS ground segment raises additional uncertainty over the Army's plans.

While the Navy identified an alternate ship to continue Fire Scout development when it learned that the projected host platform was delayed, the Army seems to be holding to FCS standards. Contractor representatives believe the Army is forgoing providing capability to the warfighter as a result. They envision the Class IV UAS not being available to the warfighter until 2015. In their opinion, however, were the Army to install an existing data link and payload into the aircraft, they would be useful, for example, in detecting improvised explosive devices in Iraq or Afghanistan.

Because it is a part of the FCS program, the Class IV UAS is funded through the FCS reconnaissance platforms budget, which also includes the Class I UAS. Therefore, we are unable to provide details on the Class IV UAS budget projections using the fiscal year 2009 budget. However, DOD's fiscal year 2010 budget, released in May 2009, contains an RDT&E budget request of $44.005 million in fiscal year 2010 specifically for the Class IV UAS.

Figure 9: Broad Area Maritime Surveillance Unmanned Aircraft System

Source: DOD.

Mission

The Broad Area Maritime Surveillance (BAMS) unmanned aircraft system will give DOD a unique persistent capability to detect, classify, and identify targets over a wide area of maritime battlespace. Operating both independently and cooperatively with other assets, it will provide a more effective and supportable ISR capability than currently exists. Along with future systems—the P-8A Multi-mission Maritime Aircraft and the EP-X electronic surveillance aircraft—BAMS will be part of a maritime patrol and reconnaissance force family of systems integral to the Navy's recapitalization of its airborne ISR. The Navy intends to position BAMS mission crews with maritime patrol and reconnaissance personnel to closely coordinate missions and use a common support infrastructure. To meet its objectives, the BAMS program is modifying a version of the Air Force Global Hawk air vehicle.

Program Status

DOD approved the start of system development for BAMS in April 2008, but the source selection was subject to a bid protest that delayed system development to August 2008. The program briefed the Joint Requirements Oversight Council on the source selection results, joint efficiencies being pursued, and potential future synergies in December 2008 and conducted the System Requirements Review in January 2009. The LRIP contract award is planned for fiscal year 2013, and the Navy expects to purchase 70 total aircraft—2 in development, 3 in low-rate production, and 65 in production.

BAMS is being developed using the Global Hawk airframe; however, the Navy plans to make upgrades, such as a wing de-icing technology, to accommodate the maritime operations. It also plans to use different subsystems, such as sensors and communications equipment. Program officials explained that the BAMS air vehicle is about 78 percent common with Global Hawk and uses sensor components or entire subsystems from other existing platforms. The BAMS program is leveraging lessons learned from the Global Hawk program to avoid similar cost, testing, and technology problems, and the two programs have established a memorandum of agreement.

Northrop Grumman is currently considering whether to assemble BAMS in two locations: Palmdale, California, where the Global Hawk is being assembled, and a new facility in St. Augustine, Florida. Though the Palmdale facility has the capacity to assemble BAMS, contractor officials told us that the decision will be based on both economic and program risk-level assessments. They were not able to provide quantitative analysis associated with their pending decision to assemble BAMS in two locations and told us that the calculations will not be made until the 2011-2012 time frame.

GAO Observations

In February 2008, before initiating development, DOD and the Navy concluded that all BAMS technologies were approaching maturity—that is, they had been demonstrated in a relevant environment. Therefore, the

Navy insists that the BAMS program has no critical technologies. Despite repeated requests, Navy officials did not provide us with the list of technologies that were assessed for maturity. Nevertheless, the program office has identified six subsystems, such as radar software, that could cause cost, schedule, or performance issues during development. Program officials indicated that they are monitoring development risks for these subsystems. The Under Secretary of Defense for Acquisition, Technology and Logistics' decision allowing the program to begin development also required that an independent technology readiness assessment be conducted at the completion of preliminary design review and that the results be submitted for DOD review.

While there is a benefit to using an existing airframe, the Navy plans to make changes to Global Hawk that introduce additional risk to the program. Already the initial operational capability has been delayed from August 2014 to December 2015, but program officials are planning to achieve full operational capability by 2019—in time to avoid a capability gap that otherwise would be created by the retirement of the P-3C Orion aircraft.

Table 14: DOD Planned Investment for BAMS, Fiscal Years 2008-2013

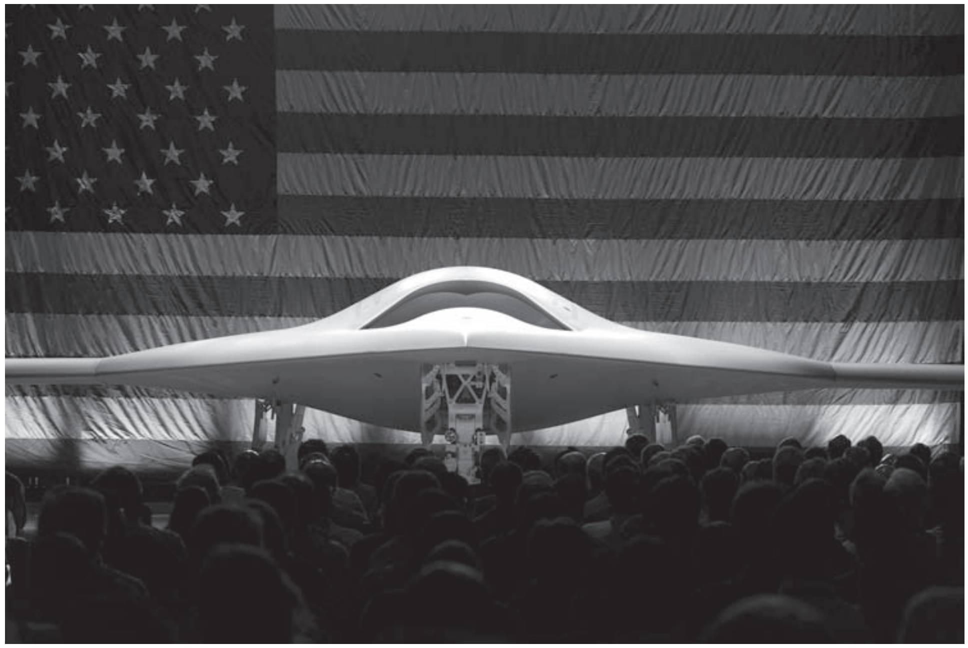
Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$115.9	$480.1	$557.0	$462.8	$383.7	$279.2	**$2,278.8**
Procurement							
Total	**$115.9**	**$480.1**	**$557.0**	**$462.8**	**$383.7**	**$279.2**	**$2,278.8**

Source: DOD fiscal year 2009 budget.

[a]OSD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $432.5 million and a fiscal year 2010 RDT&E budget request of $465.8 million for BAMS.

Figure 10: Navy Unmanned Combat Air System Demonstration



Source: DOD.

Mission

The Navy Unmanned Combat Air System Demonstration (UCAS-D) program will demonstrate critical technologies for operating a low observable unmanned aerial system from aircraft carriers. The first capabilities to be proven are launch and recovery and deck surface operations. The demonstration will inform a follow-on acquisition decision at Milestone A or B.

In the 2020-2025 time frame, the Navy plans to change program focus to a strike-fighter aircraft possibly to replace F/A-18 aircraft in a future Carrier Air Wings mix with the Joint Strike Fighter. The Navy wants a carrier-based, air-refueled, very long-endurance aircraft capable of operating at greater distances from the carrier battle group, defeating heavily defended targets, expanding payload options, and providing continuous maneuvers.

Program Status

The Navy conducted a limited source selection between two contractors that had been involved in prior UCAS-related efforts, and in August 2007 awarded Northrop Grumman a $635.9 million contract to design, develop, integrate, test, and demonstrate two unmanned combat air systems. The contract includes cost, technical, and schedule incentives. The first flight is planned for November 2009 at Edwards Air Force Base, and the first landing on an aircraft carrier is expected to occur at the end of 2011.

Navy UCAS-D is only a demonstration effort; no acquisition program has been approved, and no milestone events have been scheduled. However, the program is trying to mitigate risks through modeling and simulation, surrogate flight testing, and shore-based testing before conducting sea trials. Additionally, the demonstration aircraft will use various systems already in use on other aircraft, such as F-18 landing systems and F-16 engines, according to officials.

The program appears generally to be on schedule and within budget. According to program officials, the program has the funding needed to complete the demonstration by fiscal year 2013 as planned, despite a funding reduction of almost $400 million in the 2009 President's budget.

GAO Observations

Navy UCAS-D can trace its origin to Defense Advanced Research Projects Agency (DARPA) unmanned combat air vehicle advanced technology demonstration programs started in the late 1990s. In 2003, OSD established a joint Navy and Air Force program, designated the Joint Unmanned Combat Air System (J-UCAS), to be managed by DARPA. In 2005, the joint program transitioned from DARPA to the Air Force. However, a late 2005 program decision memorandum recommended terminating the J-UCAS program and funding separate Navy and Air Force programs. As a result, the Navy initiated the Navy UCAS-D program in 2006.

Prior to holding a Milestone B decision, the program is leveraging DARPA's J-UCAS efforts in conjunction with current risk mitigation efforts, to evolve required technologies to the level at which DOD considers technology to be mature. While risk mitigation is a positive step, and the program seems to be on schedule, significant challenges remain. For example, development of an airborne data network radio that is critical to carrier landing and aerial refueling operations has been suspended indefinitely, according to program officials. While the program is proceeding with an earlier version of the radio, program officials note that the future is uncertain. Furthermore, the Defense Contract Management Agency expressed concern about the UCAS-D program entering system development; the program may use different technologies than are currently being demonstrated, likely resulting in significant additional development costs.

In addition to the $1.4 billion in funding detailed in table 1, we noted fiscal year 2007 funding of $97.1 million, and program officials identified $1.3 billion of known funding for either the Navy UCAS-D or DARPA J-UCAS programs before fiscal year 2007—yet acknowledged the amount may not represent total previous funding. DOD, assuming no future cost increases, will have spent at least $2.8 billion for two demonstration aircraft.

Table 15: DOD Planned Investment for UCAS-D, Fiscal Years 2008-2013

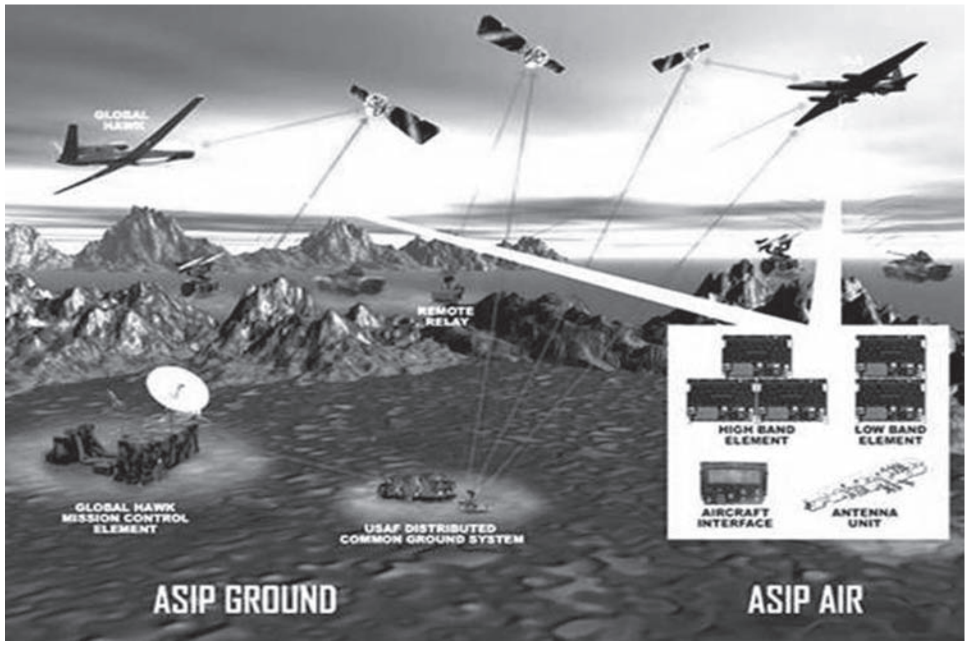
Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$158.2	$275.8	$315.8	$271.9	$222.1	$170.4	**$1,414.2**
Procurement							
Total	**$158.2**	**$275.8**	**$315.8**	**$271.9**	**$222.1**	**$170.4**	**$1,414.2**

Source: DOD fiscal year 2009 budget.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $274.7 million and a fiscal year 2010 RDT&E budget request of $311.2 million for UCAS-D.

Figure 11: Airborne Signals Intelligence Payload



Source: DOD.

Mission

The Air Force's Airborne Signals Intelligence Payload (ASIP) is a common, scalable family of sensors designed for medium- and high-altitude aircraft. ASIP is expected to provide the warfighter with automatic, real-time, battlefield surveillance, situational awareness, and intelligence information that may be composed of communications and electronic signals—commonly referred to as signals intelligence (SIGINT).

Within the ASIP program, the Air Force is developing three different sensor variants: (1) a baseline variant to be integrated onto the U-2 and unmanned Global Hawk aircraft; (2) a scaled-down variant, designated the ASIP 1C, to be integrated onto the unmanned Predator; and (3) a midsized variant, the ASIP 2C, to be integrated onto Reaper and potentially the Army's Sky Warrior, which are also unmanned aircraft. The ASIP program office is responsible for developing and testing the sensors, while the individual aircraft program offices will be responsible for sensor production and integration.

Program Status

The ASIP baseline sensor underwent an operational assessment in February 2008. The results of that assessment indicated that the program was on track to meet its effectiveness and suitability requirements. The program completed developmental testing in February 2009 and plans to begin operational testing using a U-2 aircraft in March 2009. Officials noted that the Air Force intends to use the operational testing on the U-2 to assess the baseline sensor's readiness for initial operational testing on Global Hawk. Depending on the results of the U-2 tests, the Air Force may leave the developmental unit on the U-2 for continuing operational use.

Flight testing on Global Hawk began in September 2008, and initial operational testing is scheduled to begin in late fiscal year 2009. However, the Global Hawk program officials recently indicated that the program will not meet its planned starting date for operational testing, and according to the ASIP Program Manager, it will most likely not begin until early 2010. The Global Hawk program office plans to purchase a total of 25 ASIP sensors for its Block 30 aircraft beginning in fiscal year 2009. According to the program office, those ASIP-equipped aircraft will not be fielded, however, until 3 years later, because of sensor production and integration. In October 2008, DOD approved the purchase of 2 sensors and the program will seek approval for an additional 3 sensors in spring 2009, depending upon successful completion of developmental testing.

Integration and developmental testing of the ASIP 1C sensor will begin in summer 2009. According to the program office, the total number of ASIP 1C sensors to be produced is critically linked to the Air Force's Predator purchases and has not yet been finalized. Regardless, ASIP program officials are operating under the assumption that ASIP 1C production will begin in 2010.

Air Force officials noted that uncertainties about 1C and 2C production quantities are in large part the result of uncertainties about the number of Predators and Reapers the Air Force will ultimately purchase. In addition, officials stated that if the Air Force purchases the Army's Sky Warrior airframe to upgrade its Predators, it will have to purchase more 2C sensors and fewer 1Cs. However, according to DOD officials, the Air Force is planning to end Predator procurement and pursue an all-Reaper fleet.

ASIP program officials noted that developmental efforts on the 1C sensor will continue regardless of final production decisions because knowledge gained from the 1C sensor is an integral part of the 2C sensor's development. Because of the modular design of ASIP and the high level of commonality between the three ASIP variants, the program office plans to seek approval to bypass a formal 2C development program and enter directly into production.

Under DOD's direction, all three ASIP sensor efforts have been combined under one major defense acquisition program—recently designated Acquisition Category ID. However, officials stated that the Air Force will continue to manage the program as though it were three separate programs.

GAO Observations

According to the program office, the ASIP baseline sensor has experienced 110 percent cost growth from its original estimate, primarily because of capability enhancements, schedule impacts, and increased hardware deliveries. Program officials stated that although the baseline sensor's development is on schedule, the program is affected by fluctuations within Global Hawk. Since Global Hawk's schedule has continued to slip, ASIP program officials recently sought and received approval to begin ASIP operational testing on the U-2. The program office noted that the Air Force had not originally planned to conduct ASIP operational tests, but given the disconnect between ASIP developmental test completion and the beginning of Global Hawk initial operational testing, officials believe that additional operational testing on the U-2 would allow them to gain knowledge and further reduce risk before beginning Global Hawk testing.

In January 2009, DOD directed the Army and the Air Force to analyze ASIP and the Army's Tactical SIGINT Payload in an effort to move to a common SIGINT sensor. However, in response the services emphasized that after 15 months of collaboration, a joint program does not make sense and recommended that an independent organization conduct the analysis and provide further direction.

Table 16: DOD Planned Investment for ASIP, Fiscal Years 2008-2013

Then year dollars in millions

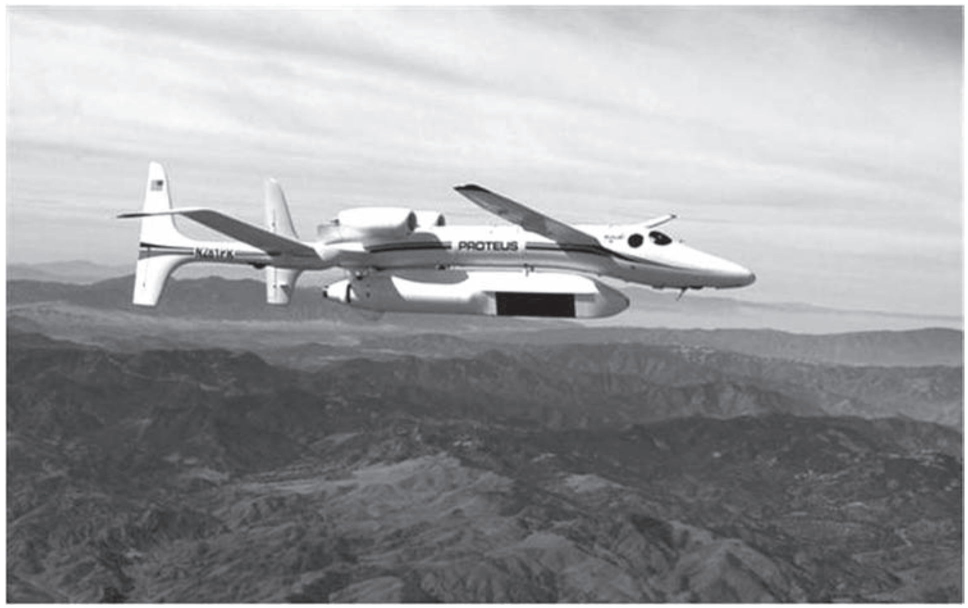
	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$66.197	$110.252	$106.963	$102.455	$99.846	$105.384	**$591.097**
Procurement							
Total	**$66.197**	**$110.252**	**$106.963**	**$102.455**	**$99.846**	**$105.384**	**$591.097**

Source: DOD fiscal year 2009 budget.

Note: Procurement funding for the sensors is included in the procurement budgets of the respective host platforms.

[a]Because they are part of the same program element, ASIP Baseline and 1C-2C efforts are reported together. DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $107.6 million and a fiscal year 2010 RDT&E budget request of $119.2 million for the ASIP program.

Figure 12: Multi-Platform Radar Technology Insertion Program



Source: DOD.

Mission

The Air Force's Multi-Platform Radar Technology Insertion Program (MP-RTIP) is being designed as a modular, scalable, two-dimensional active electronically scanned array radar. The Global Hawk MP-RTIP variant will provide persistent imaging on a long-endurance platform, with improved ground moving target indicator, limited air moving target indicators, and synthetic aperture radar imaging over current capability.

MP-RTIP was originally intended for multiple platforms, including the E-10A multisensor command and control aircraft, a large variant of the Boeing 767 aircraft. However, the E-10A program was canceled in 2007 and all current development efforts are directed to integrating the radar into the Block 40 configuration of the Air Force Global Hawk unmanned aerial vehicle. The weight and power restrictions of the Global Hawk platform require a smaller radar than the variant designed for the E-10A aircraft.

Program Status

In September 2006, flight testing began after installation of a Global Hawk MP-RTIP development unit on a Proteus, a surrogate test bed aircraft. Proteus flight testing is planned to be complete in March 2009, which is a delay from September 2007. According to program officials, radar antenna calibration issues caused significant delays in maturing software. By June 2009, the MP-RTIP program plans to deliver one MP-RTIP development unit to the Global Hawk program for developmental testing though officials told us that delivery could be delayed further if Global Hawk is not ready to receive the radar at that time. Thereafter, the MP-RTIP program office will support the Global Hawk program through completion of initial operational testing, which is planned to start no later than November 2010. The Air Force currently funds development of the radar through the MP-RTIP program, while production will be funded through the Global Hawk program. Furthermore, officials told us that the Air Force continues to investigate other platforms for the radar.

GAO Observations

According to program officials, the MP-RTIP program office coordinates with the Global Hawk program office to prepare to integrate the radar on the Global Hawk Block 40 configuration in June 2009. Officials also told us that the two offices coordinated the fit tests for the radar in fall 2008, and continue coordination as they conducted radar system performance-level verification through March 2009.

Development costs for MP-RTIP have decreased, largely because of the E-10A program cancellation, according to officials. In total, these costs have decreased by 23 percent, from $1.7 billion at the program's December 2003 start to $1.3 billion as of December 2007.

Table 17: DOD Planned Investment for MP-RTIP, Fiscal Years 2008-2013

Then year dollars in millions

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
RDT&E[a]	$38.664	$42.215	0	0	0	0	**$80.879**
Procurement							
Total	**$38.664**	**$42.215**	**0**	**0**	**0**	**0**	**$80.879**

Source: DOD fiscal year 2009 budget.

[a]DOD's fiscal year 2010 budget, released in May 2009, reflects a fiscal year 2009 RDT&E funding amount of $42.1 million and a fiscal year 2010 RDT&E budget request of $71.9 million for Global Hawk.

Appendix III: Comments from the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

JUL 2 3 2009

Mr. Michael J. Sullivan
Director, Acquisition and Sourcing Management
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Mr. Sullivan:

This is the Department of Defense (DoD) response to the GAO draft report GAO-09-520, "DEFENSE ACQUISITIONS: Opportunities Exist to Achieve Greater Commonality and Efficiencies among Unmanned Aircraft Systems," dated June 19, 2009 (GAO Code 120762).

The DoD partially concurs with the draft report's first recommendation and concurs with recommendations two through five. The rationale for the DoD's position is enclosed.

We appreciate the opportunity to comment on the draft report. Technical comments were provided separately for your consideration. Should you have any questions, please contact Mr. Edward Wolski, Unmanned Warfare Office, Edward.Wolski@osd.mil, 703-695-8778.

Sincerely,

David G. Ahern
Director
Portfolio Systems Acquisition

Enclosure:
As stated

GAO Draft Report Dated June 19, 2009
GAO-09-520 (GAO CODE 120762)

"DEFENSE ACQUISITIONS: OPPORTUNITIES EXIST TO ACHIEVE GREATER COMMONALITY AND EFFICIENCIES AMONG UNMANNED AIRCRAFT SYSTEMS"

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommends that the Secretary of Defense direct a rigorous and comprehensive analysis of the requirements for current unmanned aircraft programs, develop a strategy for making systems and subsystems among those programs more common, and report the findings of this analysis to Congress.

DOD RESPONSE: Partially concur. The Department does not agree that a separate comprehensive analysis needs to be conducted across all unmanned systems with the specific purpose of identifying opportunities for commonality. The Department agrees that there is significant cost benefit in leveraging commonality where appropriate in acquisition of weapons systems. Where commonality may not be achievable, the strategy has been to maintain interoperability at critical interfaces that support warfighting capability needs. Within the Department, the Unmanned Aircraft Systems (UAS) Task Force has been tasked to identify opportunities for increased commonality and interoperability across current and future UAS programs. In this role, the UAS Task Force has conducted robust analyses of requirements to identify specific opportunities to utilize commonality to reduce lifecycle costs. In unmanned aircraft programs, the most significant opportunities for commonality are those highlighted by the GAO in this report: MQ-1 Predator and MQ-1C Extended Range Multi-Purpose (ER/MP); RQ-4B Global Hawk and Navy Broad Area Maritime Surveillance (BAMS); MQ-8B Fire Scout; and RQ-7 Shadow. Of these systems, the UAS Task Force with support from the Joint Requirements Oversight Council (JROC) has completed a comprehensive analysis of the potential for commonality between the Predator and ER/MP programs and provided findings as recommendations to the Defense Acquisition Board (DAB). The resultant decisions were documented in Acquisition Decision Memoranda (ADMs) and provided in the DoD Report to Congress in response to Section 144 of the 2009 National Defense Authorization Act (NDAA). Additional commonality between Army and Navy Fire Scout configurations depends on the end-state sensor and network requirements for Army MQ-8B to be compatible with Future Combat System (FCS) as rightfully pointed out by the GAO in this report. Finally, the Marine Corps has adopted an identical configuration for Army Shadow.

The Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) and the JROC have also expressed a strong desire to maximize commonality between the Air Force Global Hawk and Navy BAMS programs in written memoranda. The UAS Task Force and OUSD(AT&L) in coordination with the Joint Staff are to conduct a rigorous review of the BAMS and Global Hawk programs in the fall of 2009 that will result in a strategy for increased commonality between the two programs. The findings from this review are expected by winter 2009 and will be reflected in the acquisition strategies for both programs. Both the USD(AT&L) and the JROC have expressed a clear desire for commonality in UAS programs where it enables warfighter requirements to be met more efficiently and at lower lifecycle costs.

RECOMMENDATION 2: The GAO recommends that the Secretary of Defense require the military services to identify and document in their acquisition plans and strategies specific areas where commonality can be achieved.

DOD RESPONSE: Concur. See response to recommendation 5.

RECOMMENDATION 3: The GAO recommends that the Secretary of Defense require the military services to take an open systems approach to product development.

DOD RESPONSE: Concur. The requirement for the military departments to take an open systems approach is already documented. The Department of Defense Instruction 5000.02 requires program managers to employ Modular Opens Systems Architecture (MOSA) to design for affordable change, enable evolutionary acquisition, and rapidly field affordable systems that are interoperable in the joint battle space.

RECOMMENDATION 4: The GAO recommends that the Secretary of Defense require the military services to conduct a quantitative analysis that examines the costs and benefits of various levels of commonality.

DOD RESPONSE: Concur. The quantitative analysis that examines cost benefit is required to be completed during the Analysis of Alternatives (AoA) where existing and proposed programs are examined. The results of the AoA inform the system's Capabilities Development Document (CDD) which is reviewed and approved by the JROC. In the new Department of Defense Instruction 5000.02, the AoA takes place in the Materiel Solutions Analysis phase which begins with the Materiel Development Decision (MDD). The MDD is a formal entry point into the acquisition process and is mandatory for all programs. By implementing the MDD, the new 5000.02 gives the Milestone Decision Authority the ability to ensure that the appropriate analytical rigor is instilled in the program at initiation and that the costs and benefits of viable alternatives are examined and allowed to shape the ultimate capability requirements documented in the CDD.

RECOMMENDATION 5: The GAO recommends that the Secretary of Defense require the military services to establish a collaborative approach and management framework to periodically assess and effectively manage commonality.

DOD RESPONSE: Concur. The Department has a process in place for identifying and managing commonality. The ability for the military departments to leverage commonality begins with the determination that compatible capability requirements exist between systems. Currently, the military departments are required to analyze and validate requirements utilizing the Joint Capabilities Integration and Development System (JCIDS). The JCIDS process was created to support the statutory responsibility of the JROC to validate joint warfighting requirements. The primary objective of the JCIDS process is to ensure the capabilities required by the joint warfighter are identified with their associated operational performance criteria in order to successfully execute the missions assigned. The JCIDS process also supports the acquisition process by identifying and assessing capability needs and associated performance criteria to be used as a basis for acquiring the right capabilities.

Once a program has been initiated and is in development, commonality between military department acquisition programs is identified in acquisition strategies and documented via signed Memoranda of Agreement (MOAs). In the case of the Navy Fire Scout and Army FCS Class IV programs, an Executive Steering Group (ESG), chaired by respective Flag-/General-officer level Program Executive Officers, has been established to monitor commonality of the Fire Scout airframe. An ESG has also been formally chartered to manage commonality between the Air Force Predator and Army ER/MP programs. In the fall of 2009, the Navy and Air Force will be requested to identify their proposed framework to collaboratively manage commonality between the BAMS and Global Hawk programs.

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Michael J. Sullivan (202) 512-4841 or sullivanm@gao.gov

Acknowledgments

In addition to the contact named above, principal contributors to this report were Bruce Fairbairn, Assistant Director; Travis Masters; Rae Ann Sapp; Karen Sloan; Leigh Ann Nally; Raffaele Roffo; Brian Smith; and Laura Jezewski.

Related GAO Products

Defense Acquisitions: Assessments of Selected Weapon Programs. GAO-09-326SP. Washington, D.C.: March 30, 2009.

Unmanned Aircraft Systems: Additional Actions Needed to Improve Management and Integration of DOD Efforts to Support Warfighter Needs. GAO-09-175. Washington, D.C.: November 14, 2008.

Defense Acquisitions: DOD's Requirements Determination Process Has Not Been Effective in Prioritizing Joint Capabilities. GAO-08-1060. Washington, D.C.: September 25, 2008.

Defense Acquisitions: A Knowledge-Based Funding Approach Could Improve Major Weapon System Program Outcomes. GAO-08-619. Washington, D.C.: July 2, 2008.

Intelligence, Surveillance, and Reconnaissance: DOD Can Better Assess and Integrate ISR Capabilities and Oversee Development of Future ISR Requirements. GAO-08-374. Washington, D.C.: March 24, 2008.

Defense Acquisitions: Greater Synergies Possible for DOD's Intelligence, Surveillance, and Reconnaissance Systems. GAO-07-578. Washington, D.C.: May 17, 2007.

Intelligence, Surveillance, and Reconnaissance: Preliminary Observations on DOD's Approach to Managing Requirements for New Systems, Existing Assets, and Systems Development. GAO-07-596T. Washington, D.C.: April 19, 2007.

Defense Acquisitions: Better Acquisition Strategy Needed for Successful Development of the Army's Warrior Unmanned Aircraft System. GAO-06-593. Washington, D.C.: May 19, 2006.

Unmanned Aircraft Systems: Improved Planning and Acquisition Strategies Can Help Address Operational Challenges. GAO-06-610T. Washington, D.C.: April 6, 2006.

Unmanned Aircraft Systems: New DOD Programs Can Learn from Past Efforts to Craft Better and Less Risky Acquisition Strategies. GAO-06-447. Washington, D.C.: March 15, 2006.

Unmanned Aircraft Systems: Global Hawk Cost Increase Understated in Nunn-McCurdy Report. GAO-06-222R. Washington, D.C.: December 15, 2005.

Unmanned Aircraft Systems: DOD Needs to More Effectively Promote Interoperability and Improve Performance Assessments. GAO-06-49. Washington, D.C.: December 13, 2005.

Unmanned Aerial Vehicles: Improved Strategic and Acquisition Planning Can Help Address Emerging Challenges. GAO-05-395T. Washington, D.C.: March 9, 2005.

Unmanned Aerial Vehicles: Changes in Global Hawk's Acquisition Strategy Are Needed to Reduce Program Risks. GAO-05-6. Washington, D.C.: November 5, 2004.

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