

GAO

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

April 2007

TACTICAL AIRCRAFT

DOD Needs a Joint and Integrated Investment Strategy





Highlights of [GAO-07-415](#), a report to the Chairman, Subcommittee on Air and Land Forces, Committee on Armed Services, House of Representatives

Why GAO Did This Study

The Department of Defense (DOD) plans to invest \$109 billion in its tactical air forces between 2007 and 2013. Long term, DOD plans to replace aging legacy aircraft with fewer, more expensive but more capable and stealthy aircraft.

Recapitalizing and modernizing tactical air forces within today's constrained budget environment is a formidable challenge. DOD has already incurred substantial cost and schedule overruns in its acquisition of new systems, and further delays could require billions of dollars in additional investments to keep legacy aircraft capable and sustainable.

Because of the large investments and risk, GAO was asked to review investment planning for tactical aircraft. This report describes the current status of DOD's new tactical aircraft acquisition programs; identifies current impacts on legacy aircraft modernization programs and retirement schedules; and assesses DOD's overall investment plan for tactical aircraft.

What GAO Recommends

To achieve better outcomes in acquisition programs and investment planning, GAO recommends that DOD (1) take decisive actions to shorten cycle times in developing and delivering new weapon systems and (2) develop an integrated and affordable enterprise-level investment strategy for tactical air forces.

www.gao.gov/cgi-bin/getrpt?GAO-07-415.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Michael J. Sullivan at (202) 512-4841 or sullivanm@gao.gov.

TACTICAL AIRCRAFT

DOD Needs a Joint and Integrated Investment Strategy

What GAO Found

DOD's efforts to recapitalize and modernize its tactical air forces have been blunted by cost and schedule overruns in its new tactical aircraft acquisition programs: the Joint Strike Fighter (JSF), the Air Force F-22A, and the Navy F/A-18E/F. Collectively, these programs are expected to cost about \$400 billion—with about three-fourths still to be invested. The JSF program, which is expected to make up the largest percentage of the new fleet, has more than 90 percent of its investments still in the future. Increased costs and extended development times have reduced DOD's buying power, and DOD now expects to replace legacy aircraft with about one-third fewer new aircraft compared to original plans at each program's inception.

The outcomes of these acquisition programs directly impact existing tactical aircraft systems. Until new systems are acquired in sufficient quantities to replace legacy fleets, legacy systems must be sustained and kept operationally relevant. Continual schedule slips and reduced buys of new aircraft—particularly in the F-22A and JSF programs—make it difficult for program managers to allocate funds for modifying legacy aircraft to meet new requirements or to set retirement dates for legacy aircraft. Lengthening the life of legacy systems also impacts DOD's new tactical aircraft acquisition programs. DOD has become increasingly concerned that the high cost of keeping aging weapon systems relevant and able to meet required readiness levels is a growing challenge in the face of forecast threats and reduces the department's flexibility to invest in new weapons.

DOD's tactical aircraft investments are driven by the services' separate acquisition planning. Moving forward, these plans are likely unexecutable given competing demands from future defense and non defense budgets. The EA-6B—providing tactical radar jamming capabilities for all services and one of the few examples of a joint asset—is also expected to be replaced by separate and unique aircraft for each of the services. Without a joint, DOD-wide strategy for tactical aircraft investments, it is difficult to identify potential areas where efficiencies might be achieved or where capability gaps might occur in DOD's tactical aircraft acquisitions.

Planned Changes in Tactical Aircraft Inventories

	Inventory 2006	Inventory 2025	Inventory reduction	Percent reduction
Air Force	2,500	1,800	700	28%
Navy & Marine Corps	1,200	900	300	25%
Total	3,700	2,700	1,000	27%

Source: DOD data, GAO analysis.

Note: These numbers are approximate to show relative changes in amounts.

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Abbreviations

DOD	Department of Defense
ICAP III	Improved Capability electronic suite modification
IOC	initial operational capability
JCIDS	Joint Capabilities, Integration, and Development System
JSF	Joint Strike Fighter
OSD	Office of Secretary of Defense
QDR	Quadrennial Defense Review
RDT&E	Research, Development, Test and Evaluation
STOVL	short field take-off and vertical landing

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United States Government Accountability Office
Washington, DC 20548

April 2, 2007

The Honorable Neil Abercrombie
Chairman, Subcommittee on Air and Land Forces
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

Over the past three decades, the Department of Defense (DOD) has spent \$534 billion to develop, procure, and modify its tactical air forces. Tactical air forces are critical to achieving and maintaining air dominance during combat operations and account for a significant share of the defense dollar. After procuring large numbers of fighter and attack aircraft in the 1970s and 1980s, DOD shifted its emphasis to procuring bombers, airlifters, and other systems. DOD now seeks to recapitalize and modernize its tactical air forces to ensure the total force has sufficient capabilities and capacity to meet operational requirements today and in the future. Over the next 20 years, DOD plans to replace several thousand aging tactical aircraft with a substantially smaller number of more expensive but more capable and stealthy new aircraft, while continuing to modify and sustain its current fleets in order to keep them operationally viable until sufficient numbers of the new systems are fielded.

Recapitalizing and modernizing tactical air forces to meet the warfighter's needs within today's constrained budget environment is a formidable challenge. Our work in this area has shown that DOD has incurred substantial cost increases and delays in its acquisition of new systems. Further delays in delivering these aircraft, cost increases, and cuts in quantity could easily occur, meaning billions of dollars in additional investments could be needed to keep current (legacy) aircraft both capable and sustainable for longer periods of time than currently planned.

Because of the costs, complexities, and interrelationships of the tactical air forces, and the need for greater insight, the Chairman of the Air and Land Forces Subcommittee, House Committee on Armed Services, asked GAO to look at DOD's investment planning for recapitalizing and modernizing its tactical fighter and attack aircraft force portfolio. This report addresses (1) current risks for DOD's new tactical aircraft acquisition programs; (2) impacts on legacy aircraft modernization programs and retirement schedules; and (3) the extent to which DOD has

developed an overall investment plan for future tactical aircraft that addresses capability gaps, limits redundancies, and considers the timing and affordability of planned actions. To conduct our work, we evaluated new acquisition and legacy modification plans, budgets, retirement and delivery schedules, and results to date for recapitalizing and modernizing tactical air forces. We analyzed Air Force, Navy, and Marine Corps plans and processes for establishing force and capability requirements and reviewed joint efforts and initiatives to look at integrated DOD-wide solutions. We also drew extensively on work conducted under other GAO engagements concerning weapon systems and force structure. We performed our work from June 2006 through March 2007 in accordance with generally accepted government auditing standards. Appendix I further discusses this report's scope and methodology.

Results in Brief

During the next 7 years, the military services plan to spend about \$109.3 billion to acquire about 570 new tactical aircraft and to modernize hundreds of operational aircraft. Substantial cost increases, schedule delays, and changes in requirements have significantly reduced procurement quantities of new aircraft. For example, since its start, the development period for the F-22A doubled, threat conditions changed, new ground attack and intelligence-gathering requirements were added, and its unit costs more than doubled, resulting in a steady decline in the number of aircraft the Air Force can now procure. Similar conditions and risk of poor outcomes seem to be emerging for the Joint Strike Fighter (JSF). The JSF is the linchpin for future modernization efforts because of its sheer size and plans to replace hundreds of operational systems in all three services. However, its development costs have increased by \$31.6 billion since 2004, and procurement and delivery schedules are slipping.

Funding needs and plans for new and legacy aircraft are by nature interdependent. Legacy systems must be sustained and kept operationally relevant until new systems complete development and are ready to replace them. If quantities of new aircraft are reduced and/or deliveries slip further into future years, significantly more as yet unplanned money will be required to sustain, modernize, and extend the life of legacy systems to ensure that the total force is both capable and sufficient in numbers. Uncertainty about new systems costs and deliveries makes it challenging to effectively plan and efficiently implement modernization efforts and legacy retirement schedules. Over the next seven years, the services are investing an average of about \$1.7 billion per year on legacy modifications, but there are large pent up demands—billions more—for unfunded

requirements and potential life extension programs identified by program officials. Officials said the time is approaching when hard decisions on retiring or extending the life of legacy aircraft must be made.

Looking forward, DOD does not have a single, comprehensive, and integrated investment plan for recapitalizing and modernizing fighter and attack aircraft. Lacking an integrated DOD-wide view of requirements, it is difficult to determine the extent of capability gaps and shortfalls, or, alternatively, duplication of capability. Rather, each military service operates largely within its own stovepipe to plan and acquire the resources needed to fill its individual force structure construct. In the Air Force's case, it is the forces deemed necessary to fill its air and space expeditionary wings; for the Navy, its carrier strike forces; and for the Marines, its expeditionary forces. Collectively, the services have underperformed to date in terms of delivering aircraft within desired costs and quantities, and future plans are likely unaffordable within projected funding levels. Individual service plans are largely dependent on favorable assumptions about the cost, quantity, and delivery schedules for new acquisitions and the ability to increase and sustain future funding levels substantially above current levels. These favorable assumptions are not realistic when juxtaposed with projected decline in future federal discretionary spending (including defense investment accounts), continued operational support requirements for the global war on terror, and looming start-ups of other big-ticket defense items, such as a strategic tanker aircraft and next generation long-range strike systems, competing for the same funds. Recent efforts to examine joint requirements on an integrated, DOD-wide basis have not significantly affected service plans and investments.

In order to recapitalize and sustain capable and sufficient tactical air forces that reflect what is needed and affordable from a joint service perspective and that has high confidence of being executed as planned, GAO is recommending that DOD (1) take decisive actions to shorten cycle times in developing and delivering new tactical aircraft and (2) develop an integrated enterprise-level investment strategy for tactical air forces.

Background

Tactical air forces are critical to achieving and maintaining air dominance during combat operations. These forces include Air Force, Navy, and Marine Corps fixed-wing fighters and attack aircraft with air-to-air combat,

air-to-ground attack, and defense suppression¹ missions, and related equipment and support activities. These forces operate in the first days of a conflict to penetrate enemy air space, defeat air defenses, and achieve air dominance. This allows follow-on ground, air, and naval forces freedom to maneuver and attack in the battle space. Once air dominance is established, tactical aircraft continue to vigorously and persistently strike ground targets for the remainder of the conflict. Some tactical aircraft are also essential to protect the homeland by defending against incoming missiles or enemy aircraft.

Current operational tactical aircraft (referred to as legacy systems) are the Air Force's F-15, F-16, F-117A, and A-10 systems and the Navy and Marine Corps F/A-18, EA-6B, and AV-8B. Most of these aircraft were purchased in the 1970s and 1980s and are considerably aged as measured by the number of flying hours accumulated by an aircraft compared to its estimated life expectancy. Weapon systems also tend to cost more to operate and maintain as they age. To meet national defense security requirements, DOD sustains its legacy fleets and also modernizes some with new capabilities and enhanced structures to keep aircraft operationally viable until new systems can be delivered in sufficient quantities and the legacies can be retired.

DOD is continuing efforts to recapitalize its tactical air forces (replace legacy with new) by acquiring and fielding the Air Force's F-22A, the Navy's F/A-18E/F and EA-18G, and the joint service F-35 Joint Strike Fighter (JSF) weapon systems. Recapitalization plans began 20 years ago with the start-up of the F-22A program and are now expected to take another 20 years or more to fulfill culminating with the final JSF procurements. The JSF is being developed in three variants for the U.S. and allied forces.² The Air Force's version, a conventional take-off and landing aircraft, is intended to replace the F-16 and A-10 and complement the F-22A. The Navy's carrier-capable version is intended to replace F/A-18C/D aircraft and complement the F/A-18E/F. The Marines Corps is acquiring a short field take-off and vertical landing (STOVL) variant to

¹Defense suppression is the neutralization, destruction, or temporary degradation of enemy air defenses, either by physical attack with munitions or by electronic means to jam and confuse enemy radar.

²JSF is being developed jointly with eight other nations: United Kingdom, Italy, the Netherlands, Turkey, Canada, Australia, Denmark, and Norway.

replace its AV-8B and F/A-18D fleets. Table 1 shows the new aircraft with the legacy systems they are expected to replace.

Table 1: New Aircraft Replacing Legacy Fleets

New tactical aircraft	Legacy aircraft to be replaced
Joint Strike Fighter	F-16 & A-10 (Air Force) F/A-18C/D (Navy) F/A-18D & AV-8B (Marine Corps)
F-22A	F-15C/D (Air Force)
F/A-18E/F	F/A-18A/B/C (Navy)
EA-18G	EA-6B (Navy)

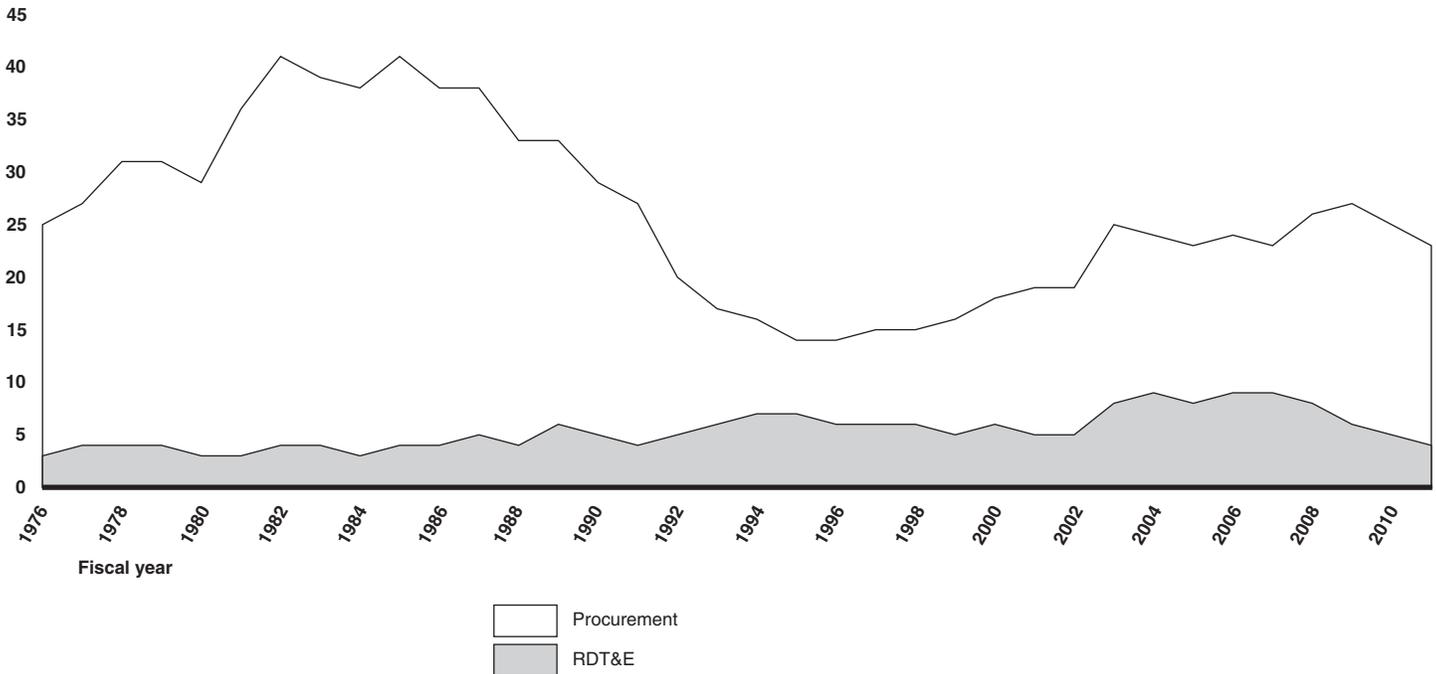
Source: DOD.

Tactical Air Forces Costs

Tactical air forces account for a significant share of the defense budget. DOD spends billions of dollars every year to develop, procure, and modernize its tactical air forces. Figure 1 shows the trend in actual and projected investment over the 36-year period from fiscal year 1976 to 2011. To reflect the trend in relative buying power, we normalized the data to express costs in fiscal year 2007 dollars. The total investment for research, development, test and evaluation (RDT&E) and procurement during this time period approaches \$1 trillion in constant dollars. The figure illustrates the large investments throughout the 1980s when most of the legacy fleets were acquired and the subsequent decrease in investment during the 1990s as DOD focused on other procurement priorities. The rise in investment starting in the mid-1990s reflects the build up and acquisition of the new systems. This data does not include another \$3.3 billion requested by DOD for tactical aircraft in the fiscal year 2007 supplemental and fiscal year 2008 budget request for the Global War on Terror.

Figure 1: DOD Investment in Tactical Air Forces

In billions of fiscal year 2007 constant dollars



Source: DOD historical budget data.

In addition to the large expenditures for development and procurement, the services spend billions more annually to operate, support, maintain, and man the tactical air forces. Over the past decade, the tactical air forces share of the total defense budget has stayed remarkably consistent, annually receiving about 11 to 12 percent of the total DOD budget and about 15 to 16 percent of the investment appropriations. DOD programmed a total of \$331.6 billion for personnel, operations and maintenance, military construction, and acquisition costs for the tactical air forces for fiscal years 2006 to 2011, an annual average of \$55.3 billion. Appendix III shows the breakdown by military service and by appropriation.

New Acquisition Programs Are Spending Significantly More Dollars and Delivering Fewer Tactical Aircraft Later Than Originally Planned

Midway through a 40-year effort to recapitalize and modernize its tactical air forces, DOD's efforts have been blunted by relatively poor outcomes in its cornerstone new acquisition programs. Increased costs, extended development times, requirement changes, and budget pressures have reduced DOD's buying power, and DOD now expects to replace legacy aircraft with about 1,500 fewer new tactical aircraft than it had originally planned—a reduction of one-third. Additionally, delivery of these new systems has lagged far behind original plans, not only delaying the fielding of capabilities to the warfighter, but also increasing operating and modernization costs to keep legacy aircraft relevant and in the inventory longer than expected.

DOD Plans for New Aircraft and Their Implications for the Total Force

DOD's recapitalization plans center on the acquisitions of the JSF, F-22A, F/A-18E/F, and its electronic attack variant, the EA-18G. Collectively, these programs are expected to cost about \$400 billion—with almost three-fourths still to be invested—to acquire about 3,200 aircraft (see table 2). Through the end of fiscal year 2006, Congress has appropriated about \$111 billion, and the services have taken delivery on 480 new aircraft. Table 2 also shows that about 72 percent of the expected investment and 85 percent of the planned procurement quantity is in the future. The F-22 and the F-18 series acquisition programs are expected to be mostly completed over the next five years, but the JSF program is only halfway through development with procurement starting in 2007 and continuing until 2034. With most of its program still ahead, its sheer size, and its tri-service impact, the JSF is, in many ways, the linchpin of DOD's tactical aircraft future.

Table 2: New Systems Acquisition Costs and Quantities

(In millions of current year dollars)

		Prior years	Investments FY07-11	To complete	Totals
JSF	Costs	\$24,796.7	\$41,688.1	\$209,974.1	\$276,458.9
	Qty	1	202	2,255	2,458
F-22A	Costs	\$50,224.7	\$12,375.3	\$0.0	\$62,600.0
	Qty	123	60	0	183
F/A-18E/F	Costs	\$34,891.8	\$9,592.8	\$0.0	\$44,484.6
	Qty	352	110	0	462
EA-18G	Costs	\$1,429.2	\$7,177.0	\$564.6	\$9,170.8
	Qty	4	82	4	90
Totals	Costs	\$111,342.4	\$70,833.2	\$210,538.7	\$392,714.3
	Qty	480	454	2,259	3,193
Percent	Costs	28%	18%	54%	
	Qty	15%	14%	71%	

Source: Selected Acquisition Reports, Dec. 31, 2005.

Note: F/A-18E/F and EA-18G costs include prorated shares of development costs for the Active Electronically Scanned Array Radar, funded in its own Navy program.

Increased costs, schedule delays, and budget pressures have combined to decrease procurement quantities of new tactical aircraft. Total quantities have been reduced by one-third compared to original plans at each program's inception (see table 3).

Table 3: Changes in Acquisition Quantities for New Tactical Aircraft Systems

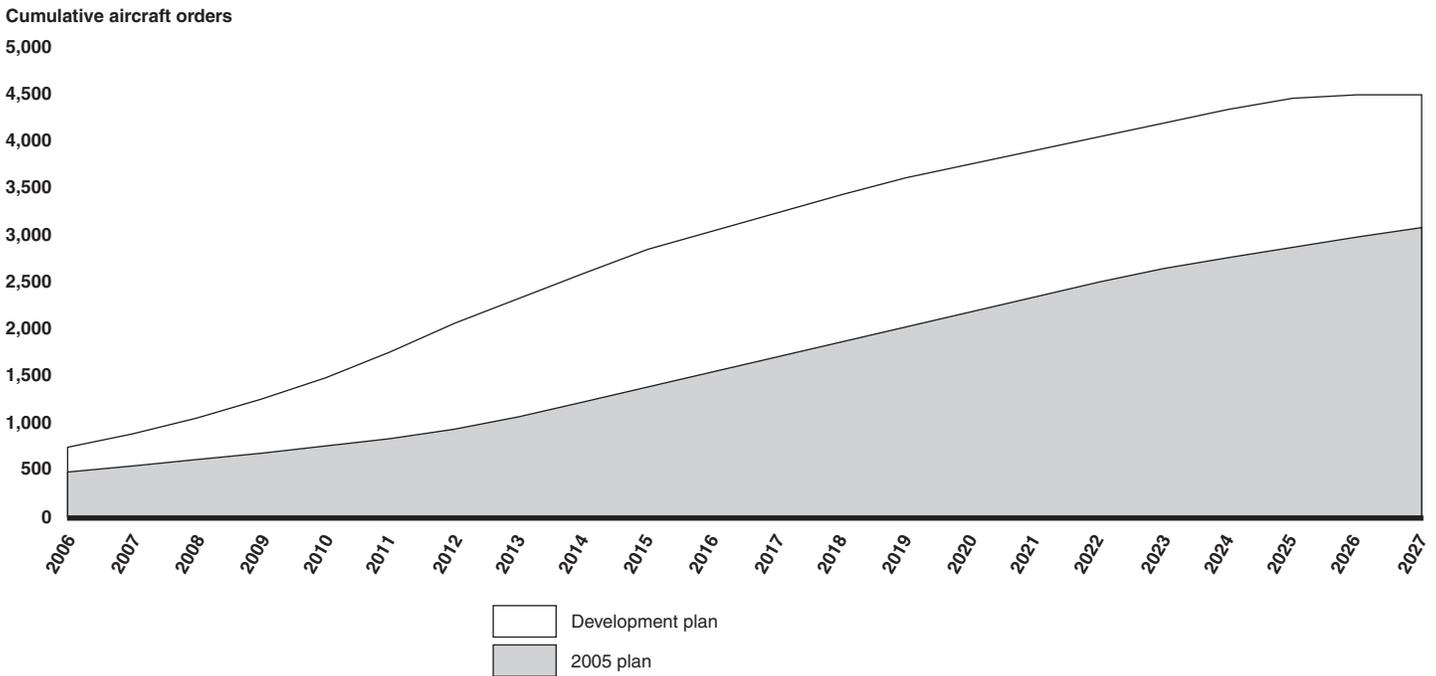
Aircraft	Original Qty	Current Qty	Decreased Qty	Percent decrease
JSF	2,988	2,458	530	-18%
F-18	1,000	552	448	-45%
F-22	750	183	567	-76%
Totals	4,738	3,193	1,545	-33%

Source: DOD data, GAO analysis.

Note: Current F-18 quantities include 462 F/A-18E/Fs and 90 EA-18G electronic attack variant.

The cumulative impacts of delayed deliveries and reduced quantities on the total force (see fig. 2) have slowed the recapitalization of the legacy force and made it more expensive to modernize, operate, and maintain. Collectively, this means that the warfighters will have fewer of the newest and most capable aircraft throughout the recapitalization period. With fewer buys of new systems, legacy aircraft will make up a larger proportion of the future force and for a longer period of time than originally envisioned. Although legacy aircraft are still very capable—and will be expected to remain so through upgrades and life extension efforts—they are becoming increasingly more expensive to operate and maintain. Service officials are confident that new systems will provide improved capabilities compared to legacy systems they replace, but worry whether the numbers of aircraft acquired are sufficient to meet national security requirements at an acceptable level of risk. They are also concerned with managing risks using legacy systems in the near- and mid-terms.

Figure 2: Original Planned and Current Procurement Quantities for New Tactical Aircraft



Source: GAO analysis of DOD data.

Cost, Schedule, and Performance Issues for New Acquisition Programs

Over the years, our extensive reviews of DOD’s major weapon system acquisitions have usually found positive outcomes when programs follow the evolutionary, knowledge-based strategy espoused by the best practices of leading commercial firms and now established in DOD policy. This includes establishing a solid business case that accurately and realistically matches available resources (technologies, money, expertise, and time) to warfighter needs. The Defense Acquisition Performance Assessment report in January 2006 also found that a disciplined business approach was needed to improve DOD’s weapon system acquisition process. One particular and key practice recommended was for time-certain development programs—delivery of the first unit to operational forces within about six years from the Milestone A decision point.³ We have usually found poorer outcomes—significant cost increases, reduced

³A project enters technology development at Milestone A. The purpose of this phase of development is to reduce technology risk and to determine the appropriate set of technologies to be integrated into a full system.

procurement quantities, and schedule delays—in programs not following these practices. For example, immature technologies, design problems, and changes in threats and requirements underpinning the original business case, contributed to major cost increases for the F-22A program, a doubling of its years spent in development, and a sharp reduction in quantities deemed affordable. We are concerned that the JSF is on a similar risky path with highly concurrent plans to begin production while still early in development and with little testing completed. On the other hand, the F/A-18E/F program is employing a more evolutionary approach and is experiencing better cost and schedule outcomes. We have some concerns that its new electronic attack variant, the EA-18G, is pursuing a too-aggressive and more concurrent strategy, increasing its risks of poor program outcomes in the future. Table 4 summarizes outcomes to date on these four tactical aircraft programs.

Table 4: Changes in Key Outcomes of New Tactical Systems

	Development cost changes	Quantity reductions	Program unit cost increases	Cycle time delays
F-22A	47%	465	186%	27 mo.
JSF	29%	408	33%	23 mo.
F-18E/F	(5)%	538	36%	12 mo.
EA-18G	8%	0	4%	0 mo.

Source: DOD data, GAO analysis.

Notes: Outcome measures compare costs and plans established at the start of system development with current costs and plans.

Cycle time delays show added months required to reach initial operational capability.

An overview of key observations on each new system follows. More details on each system’s mission, program status, major work activities, and funding are provided in appendix IV.

- The F-22A “Raptor” needs a new business case that more accurately and realistically supports the changed conditions and the program of record, including justification for additional investments of \$6.3 billion to incorporate more robust ground attack and intelligence-gathering capabilities. There is a 198 aircraft difference between the Air Force’s stated need for 381 aircraft and the 183 aircraft the Office of Secretary of Defense (OSD) says is affordable. We have previously recommended that DOD develop a new business case for the F-22A program before further investments in new aircraft or modernization are made. DOD has not concurred with this recommendation, stating that an internal

study of tactical aircraft has justified the current quantities planned for the F-22A. Because of the frequently changing OSD-approved requirements for the F-22A, repeated cost overruns, significant remaining investments, and delays in the program we continue to believe a new business case is required and that the assumptions used in the internal OSD study be validated by an independent source.

- The JSF “Lightning II” acquisition strategy’s high degree of concurrent development and production weakens its business case and poses substantial risks for cost overruns, schedule slips, and late delivery of promised capabilities to the warfighter. The program has contracted to deliver full capabilities for the three different variants in a single-step, 12-year development program and plans to begin production in 2007 with immature technologies, incomplete designs, undemonstrated system integration, and little knowledge about performance and producibility. Costs have increased another \$31.6 billion from the fiscal year 2004 rebaselined amount. Due to affordability pressures, DOD is beginning to reduce annual procurement quantities; recent plans indicate a 28 percent decrease in maximum annual buy quantities compared to last year’s program of record.
- The F/A-18E/F “Super Hornet” program adopted a more evolutionary and less risky approach, having substantial commonality with its predecessor C/D models and leveraging previous technology. Planned upgrades incrementally add new capabilities, some of which are having performance problems and delays according to OSD testers. Over half of the planned fleet has been delivered, and some have been used in combat. The mature and stable production program is on its second multiyear contract and is delivering aircraft ahead of the contract schedule and within cost targets.
- The EA-18G “Growler” is the newest program and shares the same F/A-18F platform, but incorporates airborne electronic attack capabilities. Its acquisition schedule is very aggressive and concurrent. Only two of its five critical technologies are fully mature to best practice standards even though the program is well into development and plans to start producing electronic attack-capable aircraft this year. OSD’s Director of Operational Test and Evaluation also cites its aggressive schedule to achieve an initial operational capability and special risks in integrating the electronic attack capabilities onto the F/A-18F platform.

New Acquisition Costs and Delays Have Made Resourcing Decisions for Legacy Systems Reactive and Less Efficient

The problems and delays encountered by the new tactical aircraft acquisition programs have direct and significant impacts on legacy systems plans and costs. Funding needs and plans for new and legacy aircraft are by nature interdependent, and decisions to sustain, modernize, or retire legacy systems are largely reactive to the outcomes of new systems. The military services accord new systems higher funding priority, and the legacy systems tend to get whatever funding is remaining after the new systems' budget needs are met. If new aircraft consume more of the investment dollars than planned, the buying power and budgets for legacy systems are further reduced to remain within DOD budget limits. However, as quantities of new systems have been cut and deliveries to the warfighter delayed, more legacy aircraft are required to stay in the inventory and for longer periods of time than planned, requiring more dollars to modernize and maintain aging aircraft. Table 5 summarizes budgeted investments (development and procurement funding) for new and legacy systems. Over the next 7 years, DOD plans to invest about \$109.3 billion in tactical aircraft to acquire about 570 new systems and modernize hundreds of legacy systems.

Table 5: Total Investments in New and Legacy Tactical Aircraft from Fiscal Years 2007 to 2013

(In millions of dollars)

New systems	Investments FY 2007-2013	Legacy systems Air Force	Investments FY 2007-2013	Legacy systems Navy/Marines	Investments FY 2007-2013
JSF	\$60,418.6	A-10	\$2,026.8	F/A-18A-D	\$3,527.9
F-22A	\$16,665.2	F-15A-D	\$2,667.8	E/A-6B	\$634.1
F/A-18E/F	\$13,083.6	F-16	\$2,400.1	AV-8B	\$403.1
EA-18G	\$7,466.1	F-117A	\$16.0		
Total new systems	\$97,633.5	Total legacy Air Force	\$7,110.7	Total legacy Navy/Marines	\$4,565.1

Source: DOD data, GAO analysis.

Notes: The Navy consolidates budgets for the F-18 series aircraft; accordingly, investment amount shown above for the new E/F models includes some development funding for the legacy A-D models, and the investment amount for the legacy models includes some modification funding for the new models.

Total investments also include \$3,320.0 million for tactical aircraft funding requested in the pending Fiscal Year 2007 Global War on Terrorism supplemental and the Fiscal Year 2008 Global War on Terror budget requests.

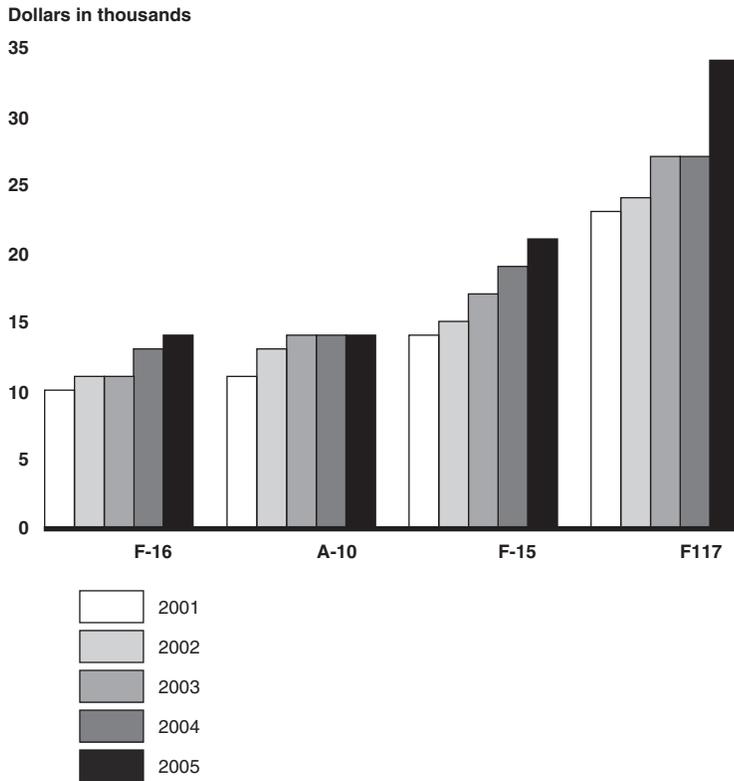
Uncertainty about new systems costs and deliveries makes it difficult to effectively plan and efficiently implement modernization efforts and legacy retirement schedules. With unpredictable quantities and delivery schedules of the new systems, program managers for legacy aircraft are

challenged to balance reduced funds for modifications with requirements to keep legacy systems operational and relevant longer than they had planned. Stable retirement plans are critical to effective management and efficient resource use, but in this environment retirement plans keep changing. Program managers are hard-pressed to allocate funds or set sunset schedules⁴ for legacy fleets until the outcomes of new acquisitions are known. Furthermore, the longer the services retain legacy systems in their inventories, the more money they will need for operation and maintenance costs in order to keep legacy aircraft operational and relevant. DOD has become increasingly concerned that the high cost of keeping aging weapon systems relevant and able to meet required readiness levels is a growing challenge in the face of forecast threat capabilities and is depleting modernization accounts, reducing the department's flexibility to invest in new weapons.

Operating costs per flying hour for Air Force legacy systems are shown in figure 3. It illustrates that operation and maintenance costs typically increase as weapons systems age. It also shows the relatively high operating costs for the F-117A, a factor in the decision to retire that fleet early. Some officials believe that operating costs for new systems will be less expensive than the legacy systems they replace, but others challenge that notion, citing such factors as the higher technology, stealth characteristics, and private sector support arrangements.

⁴Sunset schedules can be impacted by a statutory prohibition (10 U.S.C. 2244a) on making modifications to a weapon system within five years of its planned retirement.

Figure 3: Operating Costs per Flying Hour for Air Force Tactical Aircraft



Source: GAO analysis of DOD data.

Since legacy programs typically receive less funding than requested, program managers must prioritize and fund first those modifications that are absolutely necessary—ones that are related to safety of flight or that will cause the aircraft to be grounded. As a result, there are large pent up demands of unfunded requirements the warfighters report as necessary to meet their mission requirements. Current estimates for unfunded modernization and sustainment requirements on legacy systems total several billions of dollars. The services are considering substantial service life extension programs and additional modernization enhancements for several of the legacy fleets, but many of these costs are not reflected in current programmed budgets or have yet to be estimated.

Some of these issues and concerns about legacy systems are not new, but perhaps have gained more immediacy because of their interdependency with the large scale new systems recapitalization efforts. GAO has

previously reported on the condition, program strategies, and funding for key existing DOD weapon systems, including tactical aircraft. Our 2005 report⁵ found that the military services had incomplete long-term strategies and funding plans for some systems, in that future requirements are not identified, studies are not completed, funding for maintenance and upgrades was limited, or replacement systems were delayed or not yet identified. We recommended that DOD reassess and report annually on its near- and long-term programs for key systems until replacements are fielded. DOD partially concurred to reassess programs stating that it already does this in its planning, programming, budgeting, and execution process. It did not concur that additional annually reporting to Congress of this information was necessary as they stated the annual budget submission already includes a balanced overall program within available resources.

The Air Force Is Increasing Investments in Legacy Systems to Keep Them Relevant and Capable

The Air Force plans to invest more than \$7.1 billion from fiscal year 2007 to 2013 to modernize legacy aircraft (table 6). These investments are heavily influenced by the ability of the Air Force to complete its recapitalization strategy for the F-22A and the JSF aircraft as currently planned. Further reductions in quantities and delays in delivering these new aircraft will impact the number of legacy aircraft retained and the amount of time they must remain in service. Future investments beyond those shown, including service life extension efforts costing billions of dollars, may be required to keep legacy fleets relevant and operational longer. Officials said the time is approaching when hard decisions on retiring or extending the life of legacy aircraft must be made.

⁵GAO, *Military Readiness: DOD Needs to Identify and Address Gaps and Potential Risks in Program Strategies and Funding Priorities for Selected Equipment*, [GAO-06-141](#) (Washington, D.C.: Oct. 25, 2005).

Table 6: Air Force Legacy Aircraft Modernization Costs

(In millions of current year dollars)

	Prior Two Years	Investments FY07-13	Totals
A-10	\$225.4	\$2,026.8	\$2,252.2
F-15 (all series)	\$630.5	\$2,667.8	\$3,298.3
F-16 (all series)	\$985.4	\$2,400.1	\$3,385.5
F-117A	\$59.0	\$16.0	\$75.0
	\$1,900.3	\$7,110.7	\$9,011.0

Source: DOD data, GAO analysis.

The following provides an overview of key observations on the Air Force legacy systems. Additional details on these systems are in appendix IV.

- The Air Force will retain the A-10 “Warthog” fleet in its inventory much longer than planned because of its relevant combat capabilities—demonstrated first during Desert Storm and now in the ongoing Global War on Terror. However, because of post-Cold War plans to retire the fleet in the early 1990s, the Air Force had spent little money on major upgrades and depot maintenance for at least 10 years. As a result, the Air Force faces a large backlog of structural repairs and modifications—much of it unfunded—and will likely identify more unplanned work as older aircraft are inspected and opened up for maintenance. Major efforts to upgrade avionics, modernize cockpit controls, and replace wings are funded and underway. Program officials identified a current unfunded requirement of \$2.7 billion, including \$2.1 billion for engine upgrades, which some Air Force officials say is not needed. A comprehensive service life extension program (if required) could cost billions more.
- F-15 “Eagles” will not be fully or as quickly replaced by F-22As as planned. For years, the Air Force modification efforts and funds have been concentrated on about half the fleet—the number projected as required to complement the new F-22A aircraft. With the F-22A quantities now reduced, more F-15s need to be modernized and retained for longer periods of time. Officials identified near-term unfunded requirements of \$2.3 billion and much more if life extension efforts are needed. The newest F-15E aircraft with enhanced strike capabilities will be retained even longer. The Air Force deferred the start up of a major radar upgrade effort costing \$2.3 billion, and program officials identified another \$1.7 billion in unfunded

requirements to address avionics, structural, and engine concerns among other efforts proposed for the F-15E.

- Newer F-16 “Falcon” aircraft may be needed to stay viable and operational longer due to JSF schedule delays and deferrals. The F-16 fleet consists of several different configurations that were acquired in a long and successful evolutionary program. The Air Force has invested billions over the years to upgrade capabilities, engines, and structural enhancements needed to achieve its original life expectancy of 8,000 hours. The program office estimated \$3.2 billion in unfunded requirements, including radar upgrades to the aircraft capable of suppressing enemy air defenses, the Air Force’s only platform for that mission. Significant unknowns exist about extending the life beyond 8,000 hours should that be necessary. This makes any additional JSF schedule delays, deferrals, and cost growth very problematic for the overall Air Force fighter structure.
- The Air Force plans to retire the F-117A “Nighthawk” stealth fighter in fiscal years 2007 and 2008, stating that there are other more capable assets that can provide low observable, precision penetrating weapons capability. Program Budget Decision 720, dated December 2005, directed the Air Force to develop a strategy to gain congressional support for this plan. Program officials estimate that the drawdown of the fleet and the shutdown of government and contractor offices and facilities would cost approximately \$283 million. There is currently no funding allocated for these retirement costs of the F-117A. This cost does not include storage and maintenance of the fleet after such a retirement.

Plans for Navy and Marine Corps Legacy Systems Are Evolving and Likely to Require More Funding

The Navy plans to invest about \$4.6 billion in its legacy tactical aircraft over the next seven years (table 7). Officials are relying heavily on the acquisition of the F/A-18E/F Super Hornet and the JSF as planned to complete its recapitalization strategy. Delays in the JSF program could require additional modifications beyond those already budgeted for the F/A-18C/D and AV-8B aircraft. Work on EA-6B aircraft is dependent on the timely delivery of the EA-18G Growler, its naval replacement, and on evolving Marine Corps plans for its future electronic attack capability.

Table 7: Navy Legacy Aircraft Modernization Costs

(In millions of current year dollars)

	Prior Two Years	Investments FY07-13	Totals
F/A-18 (all series)	\$1,106.6	\$3,527.9	\$4,634.5
EA-6B	\$254.4	\$634.1	\$888.5
AV-8B	\$119.9	\$403.1	\$523.0
	\$1,480.9	\$4,565.1	\$6,046.0

Source: DOD data, GAO analysis.

Note: The Navy consolidates budgets for the F/A-18 series; funding above includes some procurement modification funding for the new F/A-18E/F as well as the legacy F/A-18A/B/C/D aircraft.

The following provides an overview of key observations on the Navy and Marine Corps legacy systems. Additional details on these systems are in appendix IV.

- The F/A-18C/D “Hornet” fleet may be given extra life to ameliorate a fighter shortfall projected by Navy officials. Service officials are considering efforts to extend the life of the legacy aircraft until replaced by the JSF. A service life assessment effort to be completed in December 2007 will determine the feasibility, scope of work, and total costs for extending the life of the system. A preliminary estimate, including the costs of the assessment, is about \$2 billion, but officials said that number could very well increase substantially as the assessment progresses and cost estimates mature. Also included in the above estimate is the Center Barrel Replacement to eliminate structural limitations caused by cracking in the central fuselage. This effort is about half completed and will cost about \$970 million. A Naval Air Systems Command official said they could very well identify additional modifications and structural work required beyond what is funded. Further delays in JSF could exacerbate problems.
- The Navy will retire its EA-6B “Prowler” aircraft by 2013 and replace them with the new EA-18G, but the Marine Corps’s future plans are still evolving. The Navy will transition its most capable aircraft to the Marines who will operate and maintain them until retirement. The Marine Corps had planned to retire its EA-6B fleet starting in 2015, but officials said plans could change depending on the transition of aircraft from the Navy and that they may need to keep these aircraft in the inventory longer depending on the JSF delivery schedule. The Marine Corps has not yet made firm plans as to its future electronic attack capability and is considering employment of the JSF and other assets.

The Marine Corps has requested a total of \$379 million in the fiscal year 2007 global war on terrorism supplemental and the fiscal year 2008 global war on terror request to upgrade an additional 18 EA-6Bs with the Improved Capability III electronic attack suite and for other modernization enhancements.

- The Marine Corps wants to replace its entire AV-8B “Harrier” fleet with the JSF STOVL aircraft as expeditiously as possible. The Harrier—the original STOVL aircraft—is costly to maintain, and has a relatively high attrition rate. Program officials have budgeted very little future funds for Harrier modifications, but delays in JSF deliveries and possible cutbacks in quantity may require some redirection. Harriers may need to be retained in inventory longer than expected, but officials have not determined the extent of work required, nor the potential cost. Between 1994 and 2001, the majority of AV-8Bs were remanufactured with new fuselages to add structural life and to accommodate night attack modifications and a higher performance engine. Currently, five day attack aircraft are being upgraded to night attack capability, and two training aircraft are being refurbished.

A Joint Enterprise-Level Investment Strategy for Tactical Aircraft Is Lacking As Services Plan Independently

DOD does not have a single, integrated investment plan for recapitalizing and modernizing its tactical air forces. Rather, each service independently develops its requirements and programs its resources to size and shape its individual force structure. These plans to date have underperformed in terms of higher acquisition costs and fewer quantities delivered, and officials from each service forecast near-term and future shortfalls in the capabilities and numbers of aircraft. Moving forward, projected plans are likely unaffordable given competing demands from future defense and nondefense budgets.

Efforts to build a more joint position continue with some promise, but recent studies did not significantly impact service acquisition plans. Without a joint, integrated investment strategy for tactical aircraft that plans and addresses requirements on a DOD enterprise-wide basis, it is difficult to evaluate the efficacy and severity of capability gaps or, alternatively, areas of redundancy. Also, it is difficult to fully account for and assess real and potential contributions from other current and future non-tactical systems providing similar capabilities, including bombers, missiles, and unmanned aircraft.

Services Plan Tactical Aircraft Investments Independently

The national defense strategy, which comes from an enterprise level in DOD, requires the services to be able to successfully and simultaneously defend the homeland, win two overlapping major contingencies, operate in forward locations around the world to deter aggression, and handle lesser operations as needed such as humanitarian and peace-keeping missions. Defense strategy continues to evolve with an increased emphasis on the “long war”—the Global War on Terror—and other asymmetric operations and a reduced emphasis on major theater combat and conventional adversaries.

While OSD and the joint staff provide oversight and may make adjustments, each military service is primarily responsible for assessing tactical aircraft requirements, sizing its force structure, developing investment plans, and programming resources to meet its individual assignments within the total national defense policy requirements.⁶ The future forces planned by the military services will be smaller than today’s force, but more capable and stealthier, according to officials (see table 8). Even so, Service officials are forecasting shortfalls in force structure capabilities and numbers throughout this period.

Table 8: Changes in Tactical Aircraft Inventories Fiscal Years 2006 to 2025

	Inventory 2006	Inventory 2025	Inventory reduction	Percent reduction
Air Force	2500	1800	700	28%
Navy & Marine Corps	1200	900	300	25%
Total	3700	2700	1000	27%

Source: DOD data, GAO analysis.

Note: These numbers are approximate to show relative changes.

Two important factors in sizing and shaping forces are the types of forces and systems needed (capabilities) and the overall size of the force to meet operational demands (capacity). This means maintaining a force structure that not only has modern systems with advanced capabilities to meet projected threats, but also has enough assets to cover assigned targets, threats, and territories. Each Service also wants to size their force

⁶While aircraft investment budgets are consolidated at the Department of the Navy level, the Navy and Marine Corps largely plan independently to fill individual force structure requirements.

structure to enable them to employ rotational plans that cycle force packages through sequential phases of active deployment, return from deployment to reconstitute, and preparation for the next deployment.

Department of the Navy Future
Tactical Aircraft Plans

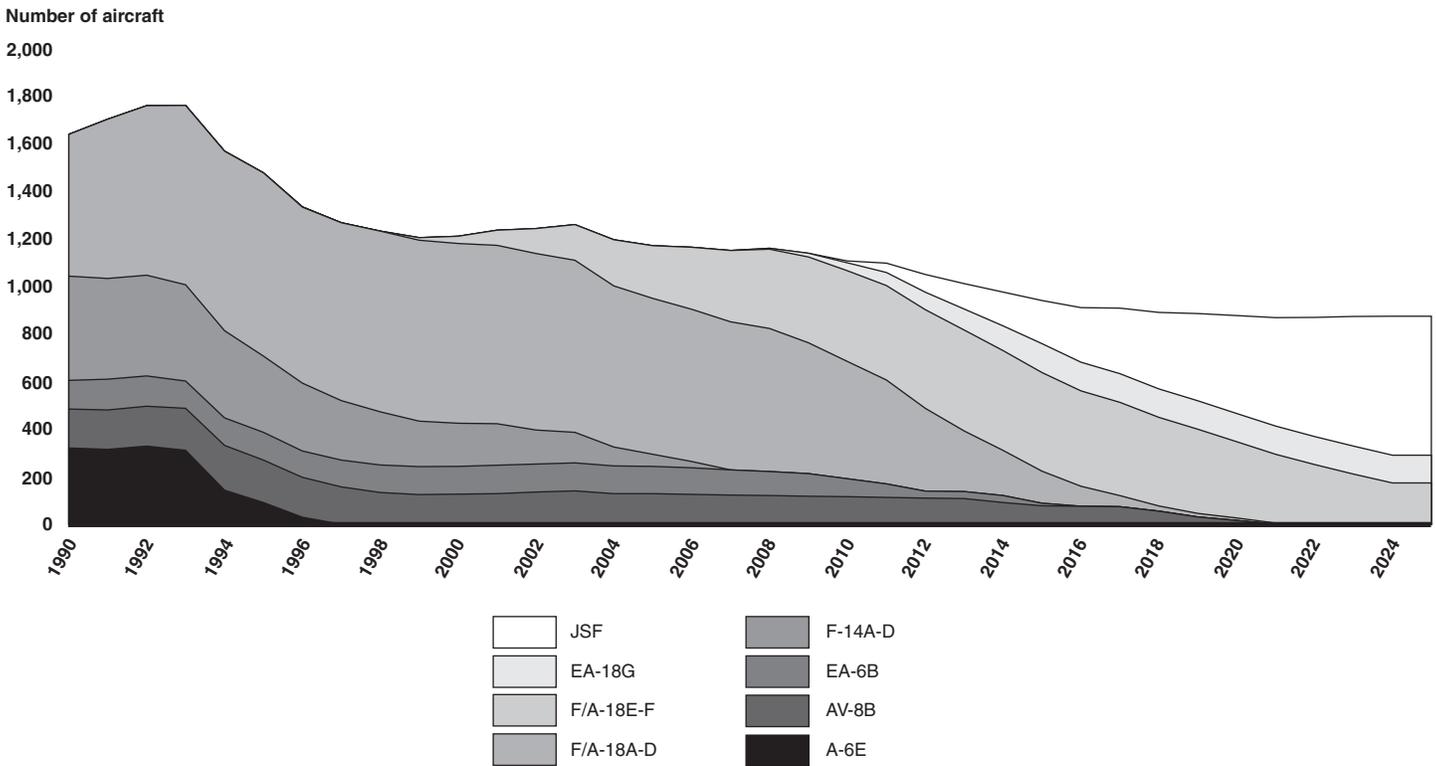
The Navy sizes and shapes its tactical fighter requirements to fill 10 carrier strike forces. Each future force would comprise 44 aircraft—24 F/A-18 E/Fs and 20 carrier capable Joint Strike Fighters—with equivalent capabilities and a mix of stealthy and non stealthy aircraft. EA-18Gs will also be assigned to carriers to provide tactical jamming support for the strike force.

Marine Corps fighter squadrons are attached to Marine expeditionary units and are sized and positioned to provide direct fire support and protection to front-line forces and reinforcements. The future Marine Corps combat air force is tied to success of the JSF acquisition program as officials plan to have an all-JSF force in the future. The future force will also have 40 percent fewer aircraft assigned to each infantry battalion.

In 2003, the Department of the Navy began implementing a tactical air integration plan to address affordability concerns. The plan was aimed at more closely integrating Navy and Marine Corps strike fighter inventories, in effect managing tactical air assets as a common pool. The Navy projected net savings of \$18.5 billion through fiscal year 2021 by reducing the number of operational legacy fighters required and, in turn, the number of new aircraft needed for recapitalization. This reduced future procurement plans by 409 JSFs and 88 F/A-18E/F aircraft. At the same time, it was recognized that integration would increase operating and maintenance costs because the smaller number of aircraft would need to be maintained at higher rates of readiness in order to meet emergency surge deployments.

Actual and planned inventory levels for combined Navy and Marine Corps tactical aircraft from fiscal year 1990 through fiscal year 2025 are shown in figure 4. The Department of the Navy tactical aviation forces peaked in the early 1990s at about 1,800 aircraft and shrunk to about 1,200 by 2006, principally through retirement of the A-6 fleet and beginning draw downs on the F-14 fleet. By 2025, the total tactical inventory is slated to decrease another 300 aircraft, or 25 percent (refer back to table 8). Therefore, the total inventory in 2025 is projected to be one-half the inventory in the early 1990s. Legacy aircraft would be virtually replaced by the more capable new systems.

Figure 4: Navy and Marine Corps Tactical Aircraft Force Structure



Source: GAO analysis of DOD data.

Shortfalls Forecast by Navy and Marine Corps Officials

Navy officials are projecting persistent future shortfalls in both legacy and new FA-18 aircraft. The amounts of the shortfall vary depending on two key variables—the rate of procurement on the Joint Strike Fighter and service life estimates for F/A-18s. Navy and Marine Corps officials told us that buying the JSF at the current planned rate—requiring a ramp-up to 50 aircraft per year by fiscal year 2015—will be difficult to achieve and to afford, particularly if costs continue to increase and schedules slip. According to one study, a likely scenario assumes acquiring fewer JSFs annually and achieving a modest increase in flying hour life for legacy F/A-18C/Ds; this scenario would project shortfalls starting in 2010 and peaking at 167 legacy strike fighters by 2017. Navy officials also project a shortfall of 131 F/A-18E/Fs by 2024 based on estimated usage, attrition, and assuming an increase in flying hour life from 6,000 to 9,000 hours. Options to erase these shortfalls include buying more new aircraft and extending the life of legacy aircraft.

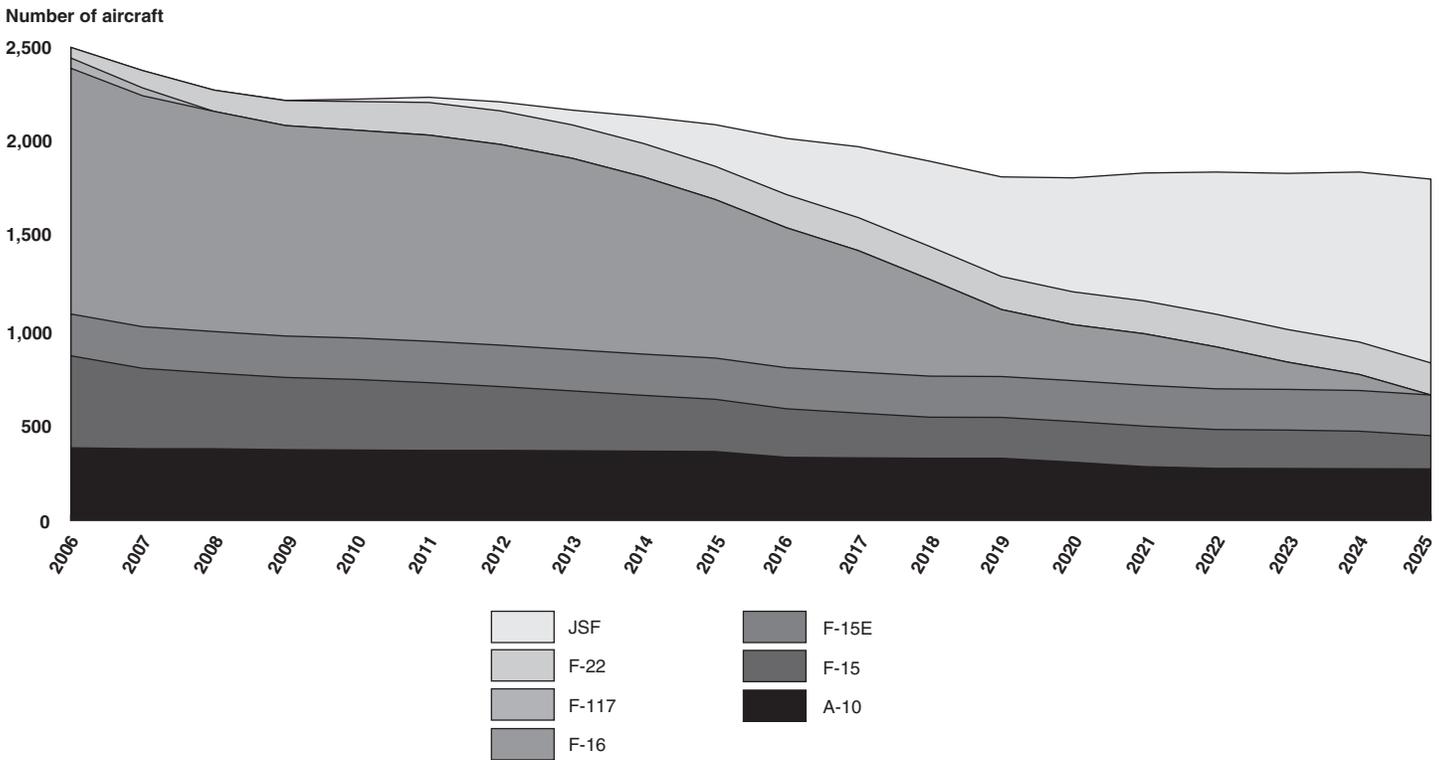
Department of the Air Force
Future Tactical Aircraft Plans

Marine Corps officials project a near-term shortfall in the AV-8B fleet ranging from 8 to 14 aircraft between fiscal years 2006 to 2011. Erasing this shortfall after 2011 depends upon acquiring the JSF STOVL in the numbers and time frames currently planned. According to officials, a one-year slide in the JSF schedule increases the shortfall by approximately three aircraft per year. As a result, the fleet would need to examine squadron structure and additional reductions to aircraft would be expected to negatively impact deployment capabilities.

The Air Force sizes its tactical air forces to meet warfighting requirements. In order to fill peacetime defense needs, the Air Force schedules ten air and space expeditionary forces, the planned organizations of Air Force aircraft, personnel, and support for operations and deployments. These individual force constructs are applied against rotational national security requirements. The Air Force's future plan for combat aircraft that is believed affordable is termed the programming force and is shown in figure 5.

This plan assumes buying the 183 F-22As deemed affordable by OSD and the current program of record for the JSF, but with a slowdown in fielding. The programming plan projects the total number of tactical aircraft decreasing by about 700 aircraft--from 2,500 currently to about 1,800 in 2025 (refer back to table 8). This plan continues the overall decline in inventory since 1990 when the Air Force fielded about 4,000 tactical aircraft. The programming force shows significant quantities of A-10 and F-15C/D/E aircraft remaining in the force by 2025 with phased drawdown of all F-16s. The 2025 force is now projected to be roughly 60 percent new systems and 40 percent legacy systems. This is a significant shift from earlier projections which had planned on an almost all new force. This shift reflects changes due to the cuts in total F-22A purchases and the reduced annual buys of JSF with consequent slowdown in fielding.

Figure 5: Air Force Tactical Aircraft Force Structure



Source: DOD data, GAO analysis.

Shortfalls Forecast by Air Force Officials

Officials at Air Combat Command—the requirement-setting command that supports the warfighter—told us that the programming (funded) force is not sufficient to meet national security requirements at acceptable levels of risk. According to these officials, the funded program would support only 100 combat aircraft (tactical fighters and bombers) in each air and expeditionary force compared to 150 aircraft today. While the new systems are expected to provide improved capabilities compared to the legacy systems they replace, officials do not think the force would have sufficient capacity to cover future security needs with acceptable risks.

Air Combat Command develops another force plan known as the vision force (later reworked into a planning force by Air Force headquarters) that the requiring command believes provides the right mix and numbers to meet future needs at an acceptable level of risk. This plan would procure the full complement of JSFs and the Air Force’s stated requirement for

381 F-22As, which would allow a full operational squadron to be assigned to each of the 10 air and space expeditionary forces. Under this plan, almost all legacy aircraft would be retired by 2025 with the exception of the F-15E, the latest model in the F-15 series that has an enhanced strike capability. This plan is not constrained by resources, and command officials estimated it would cost more than \$100 billion over the funding levels currently expected through 2025.

Affordability of Long-Range Plans Is Questionable

Looking forward over the next 20 years, DOD's collective tactical aircraft recapitalization plans are likely not affordable as currently planned. Acquisition strategies and plans assume favorable assumptions about cost and schedule and the ability to sustain funding at high levels over a considerable period of time. Historically, however, costs increase; quantities are reduced; and delivery schedules are delayed. The JSF program represents 90 percent of the investments to go for new tactical aircraft and projected plans are likely unaffordable given projected future budget constraints and competing demands.

First, plans for new systems are based on conservative estimates of future cost growth to complete the programs but optimistic estimates on the availability of future funding, production rates, and quantities of new aircraft delivered to the warfighter on time. While it is understandable to project that programs will execute to cost and quantity targets as planned, the prevailing and historical evidence suggests otherwise. In 1997 we reported⁷ that the historical average cost growth of major acquisition systems was at least 20 percent. Our annual assessment of weapon systems⁸ continue to show today that many programs cost more, take longer to develop, and deliver fewer assets than planned. While the F/A-18E/F program has generally executed to schedule, the F-22A did not, and we believe the recent cost escalation and potential delays in production indicate that the JSF is on a similar path. Air Force and Marine Corps officials told us that the planned maximum procurement rates for the JSF will be very difficult to sustain and there are already pressures to reduce or delay procurement before it even begins. The fiscal year 2008 budget has reduced near-term quantities and current planning projections

⁷GAO, *Aircraft Acquisition: Affordability of DOD's Investment Strategy*, GAO/NSIAD-97-88, (Washington, D.C.: Sept. 8, 1997).

⁸GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, GAO-07-406SP (Washington, D.C.: Mar. 30, 2007).

suggest that the Air Force will significantly reduce annual procurement quantities midterm in the program and defer these aircraft to later years, extending the procurement period by 7 years.

Second, the tactical aircraft plans do not consider billions in potential added costs for legacy systems. As discussed earlier in this report, substantial service life extension programs and additional modernization enhancements are under serious consideration for many of the legacy fleets. Some of these costs are not reflected in current programmed budgets or have yet to be estimated. For example, the Navy is considering options to extend the life of its F/A-18 fleets, but has not yet developed comprehensive cost estimates. An initial estimate is for \$2 billion, but an official told us the cost will likely be much larger. The Air Force is now planning to keep the A-10 in inventory for a longer period of time, but the full costs to extend the life are not known, and some other potential costs, including \$2.1 billion to improve the engines, are not funded. One estimate for extending the A-10's life in total was \$4.4 billion. We also learned that \$283 million to retire the F-117A during fiscal years 2007 and 2008 has not yet been funded, and given officials' comments about unstable divestiture schedules and changing retirement dates, it may be the case that other programs have also not factored in retirement costs to close contractor facilities and government programs. Furthermore, as legacies remain in the operational force longer, substantial funding for additional sustainment costs and annual operating and maintenance costs will be necessary, particularly if plans to defer JSF procurements are implemented.

Third, tactical aircraft plans will face increasing competition for the defense dollar from other new procurements and from continuing costs for the Global War on Terror. DOD is planning the start-up of several big-ticket items including a new strategic tanker aircraft, a next generation strike aircraft, unmanned aircraft, and other more transformational programs. Projected costs for ongoing military operations in the Global War on Terror will continue to put pressure on defense investment accounts and are also expected to increase the share of the total budget going to ground forces which could decrease the share for aviation programs. Flat or lower funding levels and future systems that can perform the same or similar tactical air missions may substantially alter the ultimate mix, timing, and rate at which combat aircraft are acquired.

Fourth, any questions on affordability must be viewed in a larger context relative to federal spending, demographic trends, and impacts on discretionary funding. The Comptroller General testified⁹ last year on the nation's unsustainable fiscal path and its large and growing structural deficit due primarily to known demographic trends, rising health care costs, and lower federal revenues as a percentage of the economy. Federal discretionary programs, including defense spending, will face serious budget pressures. Even so, defense programs are commanding larger budgets. Over the past 5 years, the department has doubled its planned investments in new weapon systems from about \$700 billion in 2001 to nearly \$1.4 trillion in 2006.

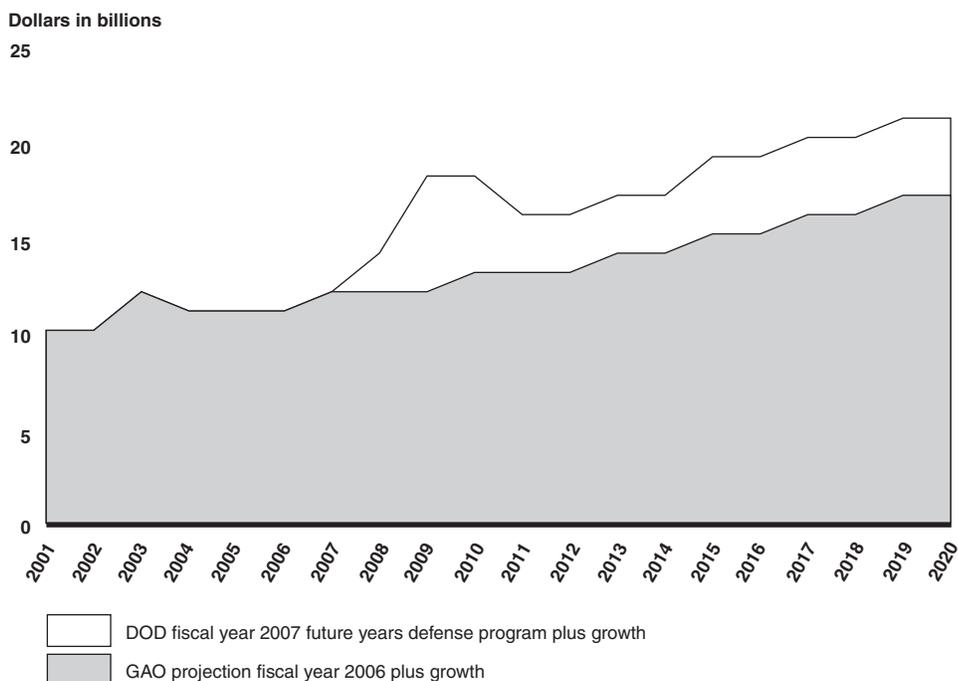
The Congressional Budget Office evaluated the long-term implications of defense plans and determined that current investment plans would require sustained funding levels at higher real (inflation-adjusted) amounts than since mid-1980s, due to sustained purchase of new equipment, increased costs for new capabilities, increased operations and maintenance costs for aging legacy systems, and costlier new systems. At the same time, the Congressional Budget Office notes that increased medical and operating support costs competing for the defense dollar and national demographic trends will continue to put pressure on federal discretionary spending.

Figure 6 illustrates the affordability challenge. It contrasts DOD's optimistic future-funding plans with a more conservative estimate. DOD's plan (top-line in figure 6) assumes funding levels well above historical amounts. The spike in funding required starting in 2008, clearly shows the typical bow wave effect in which weapon system budget requirements tend to move to the right (delayed to future years) as programs fail to receive full funding or do not execute as planned. DOD's projections show an optimistic bent that tactical aircraft procurement will be able to significantly increase its share of defense funding, exceeding historical levels when many project flat or falling funding levels. The lower line (shaded portion of fig. 6) assumes funding at the same level as fiscal year 2006 carried forward with annual inflationary increases. This more conservative projection is in line with historical experience. Our analysis of future-year defense plans indicates that the military services in total and the tactical aircraft procurement in particular have received similar shares of the defense dollar over time, a finding that argues against a strategy that

⁹GAO, *Defense Acquisitions: Actions Needed to Get Better Results on Weapons Systems Investments*, GAO-06-585T (Washington, D.C.: Apr. 5, 2006).

requires a substantial increase in order to succeed. The gap between the lines thus represents DOD plans that are likely unaffordable.

Figure 6: Projected Budgets for Tactical Aircraft



Source: GAO analysis of DOD data.

Efforts to Build Forces from a Joint Perspective Continue, but Recent Studies Have Not Had Substantial Impacts on Acquisition Plans

DOD continues broad efforts to improve jointness and bring a more integrated cross-service perspective to its plans and programs. There are promising, but still rather new efforts to enhance capabilities-based planning and portfolio management that could be used to better integrate and hone joint tactical aircraft requirements. However, recent efforts to apply jointness to tactical aircraft have not had much direct impact on service investment plans and strategies. We also note that one of the few mission capabilities that have been provided jointly, the tactical airborne electronic attack mission carried out by the EA-6B, is now expected to be replaced in the future by separate and unique aircraft for each of the services.

New Planning Efforts Show Promise

DOD has several promising efforts to enhance jointness and bring a capabilities-based approach to defense investments. The Joint Capabilities, Integration, and Development System (JCIDS), portfolio

management, and other initiatives are evolving mechanisms designed to bring top commanders' needs up-front and take a more joint, enterprise-wide view of requirements and funding decisions. Continuing efforts to develop joint capabilities-based assessment and planning methodologies will be essential to understand contributions to the warfighter, develop DOD-wide priorities, and craft investment strategies to mitigate shortfalls or eliminate duplication.

JCIDS is a major, but relatively new initiative to shift from a service-centric focus on individual acquisition programs to a more top-down and joint view of warfighting capabilities and effects. JCIDS is intended to involve a wide range of stakeholders, including combatant commanders, in identifying capability needs and alternative solutions. JCIDS introduces new methodologies intended to foster jointness and groups warfighting needs into eight functional areas based on warfighting capabilities—such as, force application, battle-space awareness, and focused logistics¹⁰—that cut across the military services and defense agencies. JCIDS process emphasizes early attention to the fiscal implications of newly identified needs, including identifying ways to pay for new capabilities by divesting the department of lower priority or redundant capabilities. Our recent report¹¹ discusses JCIDS and other steps DOD is taking to better identify and prioritize joint warfighting needs, but finds that DOD's service-centric structure and fragmented decision-making processes hinder successful implementation.

Another promising and related initiative is joint capability portfolio management. The intent is to manage groups of like capabilities across the enterprise to improve interoperability, minimize capability redundancies and gaps, and maximize capability effectiveness. This would help build budgets around a set of capabilities instead of traditional military accounts. The idea is to take a more joint look at what capabilities combatant commanders and warfighters need, as opposed to the current more service-centric way in which the services independently buy and field capabilities they deem important. By shifting the focus from service-specific programs to joint capabilities, DOD should be better positioned to

¹⁰The other capability areas are command and control, net centric warfare, force management, force protection, and joint training.

¹¹GAO, *Best Practices: An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes*, [GAO-07-388](#) (Washington, D.C.: Mar. 30, 2007).

understand the implications of investment and resource trade-offs among competing priorities. In September 2006, DOD management selected four test cases for experimentation with the joint capability portfolio management concept. Depending on this outcome, tactical aviation would appear to be an excellent candidate for portfolio management by cross-decking similar capabilities in each service. Although the implementation of these portfolio management initiatives seems to have the potential for improving interoperability and minimizing capability redundancies and gaps, DOD still has a long way to go before the effectiveness of this capability-based planning and management effort can be determined.

The Air Force is also implementing a new “associate wing” concept that is similar in its aims as the Navy-Marine Corps integration effort. Associate wings would pair up active and reserve component units to share the same aircraft and facilities, while retaining separate chains of command. Rather than each unit’s operating and maintaining its own wings, the two would now operate and maintain just one wing in common. While still very new, the expected outcomes would be reduced inventories, reduced operating costs, and fewer future replacements needed.

Joint Studies Have Not Been Very Directive

Despite the Quadrennial Defense Reviews (QDR) and other studies, there are many unanswered questions about whether services can achieve overarching goals for modernizing aging tactical aircraft fleets. In testimony on the results of the department’s 2006 QDR, the Secretary of Defense stated that continued U.S. air dominance depends on a recapitalized fleet. Surprisingly, however, DOD’s 2006 QDR report, issued in February 2006, did not present a coherent joint investment strategy for tactical aircraft systems that addressed needs, capability gaps, alternatives, and affordability. The Joint Strike Fighter, the largest aircraft acquisition program, was not mentioned and the F-22A only in relation to multi-year contracting. The QDR report did include some non prescriptive direction for joint air capabilities, emphasizing systems with greater range and persistence, larger and more flexible payloads, and the ability to penetrate and sustain operations in denied areas.

In a 2005 testimony,¹² we suggested that the QDR would provide an opportunity for DOD to assess its tactical aircraft recapitalization plans and weigh options for accomplishing its specific and overarching goals. By

¹²GAO, *Tactical Aircraft: F/A-22 and JSF Acquisition Plans and Implications for Tactical Aircraft Modernization*, GAO-05-519T (Washington, D.C.: Apr. 6, 2005).

not specifically addressing these issues, the DOD missed an opportunity. With limited information contained in the QDR report, many questions are still unanswered about the future of DOD's tactical aircraft modernization efforts.

In addition, DOD conducted a joint air dominance study that looked at current acquisition plans and capabilities. While it validated the need for three JSF variants, the study did not receive wide services support. Air Force officials said they submitted their own recommendations that were not adopted. Another consultant study, directed by the Deputy Secretary of Defense and intended to replicate the Navy-Marine Corps integration effort on a DOD-wide basis, also appears not to have had much direct impact on altering service acquisition plans going forward.

Joint Tactical Radar Jamming Mission May End

In conducting military operations, U.S. and allied aircraft can be at great risk from enemy air defenses, such as surface to air missile systems. The airborne electronic attack mission employs specialized aircraft to suppress, destroy, or temporarily degrade enemy radars and communications and is a critical enabler to successful tactical air operations. Because these specialized aircraft protect aircraft of all services in hostile airspace, the electronic attack mission crosses individual service lines. DOD considers airborne electronic attack to be a key capability for many contingencies and predicts increasing roles and missions for aircraft with these capabilities. Since 1995, the EA-6B has been DOD's only tactical standoff radar jammer aircraft and has provided support to all services during numerous joint and allied operations against both traditional and nontraditional threats.

This capability—one of the few examples of a truly joint asset shared by the military services—is now expected to diminish, to be replaced by separate and unique aircraft for each of the services. Concerned about a gap in defense suppression capabilities as a consequence of increasing modernization of enemy air defenses and aging of the EA-6B, DOD conducted an analysis of alternatives for airborne electronic attack. The May 2002 report concluded that the EA-6B inventory would be insufficient to meet DOD's future needs and identified many potential platform combinations to address capability shortfalls. DOD adopted a system-of-systems approach in which a multitude of systems are needed to provide required capabilities across the electronic spectrum. The report stated that before a service can begin a formal acquisition program, services decisions should consider whether one service will provide DOD's core capability and whether it would reside in a single platform.

Subsequent to the report, the Navy, Air Force, and Marine Corps each decided to develop individual and unique electronic attack capabilities to replace the EA-6B in the stand-off tactical jamming role. The Navy is developing the EA-18G, but plans to procure only enough to support its carrier strike forces. The Air Force initially proposed a modified B-52 for the standoff radar jamming role. With OSD concurrence, the Air Force cancelled this program because of its high estimated costs, and is now considering other options. In the near-term, the Marine Corps will continue to use upgraded EA-6B aircraft, but anticipates using in the future an electronic attack-capable Joint Strike Fighter integrated with unmanned aerial systems. There is an OSD directed study underway to validate the services' requirements.

While DOD continues to tout joint capabilities, it is a concern that one area of success is being curtailed. A September 2004 memorandum of understanding between the military services and joint staff stated that the Navy expeditionary EA-6B squadrons will decommission between fiscal years 2009 and 2012 to be replaced by indigenous Navy, Air Force, and Marine Corps electronic attack capability. DOD continues to assess requirements and options.

Conclusions

Tactical air recapitalization and modernization is a costly and very challenging enterprise, requiring a delicate and dynamic balancing of funding, fielding schedules, and retirement plans between new system acquisitions and legacy aircraft to ensure that current and future forces can meet national security requirements at reasonable levels of risk. New tactical aircraft programs, for the most part, have not adequately employed evolutionary, knowledge-based acquisition strategies—resulting in escalating costs that undercut DOD's buying power, reduces aircraft purchases, and delays delivering needed capabilities to the warfighter. Because funding needs and plans for new and legacy aircraft programs are interdependent, cost, schedule, or performance problems experienced in acquiring new systems cause perturbations in modernization costs and retirement schedules throughout the operational fleets. Dependent largely on the future course of the Joint Strike Fighter, legacy programs are placed in reactive modes with uncertain and changeable future requirements, unstable retirement plans, and potential unfunded requirements in the billions of dollars. While the services strive to reduce war-fighting risks by fielding new systems and limiting investment in legacy systems, they are faced with increased prices and schedule risks for new aircraft while maintaining aging, capability-limited legacy aircraft. In the past, we have recommended the department use an evolutionary

acquisition approach to develop weapon system programs coupled with a process that ensures at the start of development that requirements have been reduced to match mature technologies, a feasible design, and a reasonable expectation of available funding. While the department's acquisition policy has included such practices, DOD has not fully embraced the use of these practices as it executes current acquisition programs.

Despite DOD's repeated declaration that recapitalizing its aging tactical aircraft fleet is a top priority, the department does not have a single, comprehensive, and integrated investment plan to adequately craft joint priorities, identify critical capability gaps, and allocate scarce funds. Instead, planning has been separately done by the services. Each military service independently plans and resources individual programs that, collectively, are likely unaffordable and that make it difficult to identify and quantify DOD-wide capability gaps or duplication. DOD needs to bring overall tactical aircraft investments into line with more realistic, long-term projections of overall defense funding and the amount of procurement funding expected to be available for aircraft purchases, and then establish and adhere to a plan that is militarily justified and can be executed within that amount. Efforts to improve joint capabilities-based planning and to manage tactical air assets as a portfolio should be encouraged.

Recommendations for Executive Action

In order to recapitalize and sustain capable and sufficient tactical air forces that reflect what is needed and affordable from a joint service perspective and that has high confidence of being executed as planned, we are making two recommendations to the Secretary of Defense. The Secretary should

- take decisive actions to shorten cycle times in delivering needed combat capabilities to the warfighter including
 - adopting a time-certain development cycle that can deliver an increment of new capability within 5 to 6 years after the start of system design and development; and
 - reassessing requirements for ongoing weapon system acquisition programs to identify ways to reduce requirements and speed up delivery of initial capabilities; and
- develop an integrated enterprise-level investment strategy that
 - is based on a joint assessment of warfighting needs and a full set of potential and viable alternative solutions, considering not only new

-
- acquisitions but also modifications to legacy aircraft to achieve this balance within realistic and affordable budget projections for DOD;
- strikes a balance between maintaining near-term readiness and addressing long-term needs; and
 - considers the contributions of bombers, long range strike aircraft, unmanned aircraft, missiles, and other weapons currently in the inventory and those planned that can be employed to attack the same type targets as the tactical aircraft.

Agency Comments and Our Response

DOD concurred with both recommendations in written comments on a draft of this report. These comments appear in appendix II. They also provided technical comments that we incorporated in the final report as appropriate.

Regarding our first recommendation that DOD take decisive actions to shorten cycle times in developing and delivering weapon systems, DOD stated that this is consistent with a major initiative of the Under Secretary of Defense for Acquisition, Technology, and Logistics intended to put military capability into the hands of the warfighters faster and more affordably. The Department is also pursuing other efforts supporting such actions, including acquisition personnel pay incentives, acquisition policy changes, focused research and engineering investments in technology, and revised, earlier in-process reviews of requirements and proposed solutions by OSD and Joint Staff. At the same time, however, DOD stated that aircraft development is a highly complex engineering challenge and that it would be unreasonable to uniformly apply a six year cycle time to complex programs like the JSF.

We think that it is precisely *because* of complexity that programs like the JSF could stand to benefit most from adopting a more evolutionary acquisition process to develop and evolve weapon systems through small, time-phased development increments. DOD's history of substantial cost growth and extended development times for major weapon systems acquisitions were factors driving recent policy changes to require a more knowledge-based evolutionary process with time-phased development increments—key recommendations also in the Defense Acquisition Performance Assessment report. We note that the JSF's predecessor, the F-16 fighter program, delivered an initial increment of capability to the warfighter within about 4 years after development began and then successfully delivered 2,200 aircraft with incremental improvements as technology became available over the span of about 30 years. We believe this alternative, less risky and more evolutionary approach is feasible and

still available to the JSF as it seeks to develop multiple variants to recapitalize aging tactical fleets involving three services and international partners.

Regarding our recommendation that DOD develop an integrated and affordable enterprise-level investment strategy for tactical aviation, DOD concurred but stated it already had elements of such a strategy. Officials cited key decisions to invest in fifth generation systems such as the JSF and F-22, prudent life extension programs for selected legacy aircraft, the *Joint Air Dominance* study conducted during the 2006 QDR, and new processes—the Joint Capabilities Integration and Development System and portfolio management—as bringing integrated capabilities-based approaches in formulating a tactical aircraft investment strategy. We agree that the Department is making strides toward an integrated enterprise-wide investment strategy but that key processes are still in their beginning stages and that annual budget decisions are still primarily driven on a service-centric, weapon system-specific basis. The new Joint capability portfolio management initiative is a reaction to the current environment in which the services independently budget, buy, and field capabilities. It has the potential to bring a joint warfighter, cross-service view and disciplined budgeting over sets of mission area capabilities, but test cases for experimenting and proving the concept are just beginning. The 2006 QDR had the potential, but did not present a coherent joint investment strategy that addressed needs, capability gaps, alternatives, and affordability. These are critical, but now largely missing, elements to the comprehensive and integrated investment strategy we are recommending.

We are sending copies of this report to the Secretary of Defense, the Secretary of the Air Force, the Secretary of the Navy, the Commandant of the Marine Corps, and the Director, Office of Management and Budget. Copies will also be made available to others upon request. In addition, the report will be available at no charge on the GAO web site at <http://www.gao.gov>.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Major contributors to this report are listed in appendix V.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Michael J. Sullivan". The signature is fluid and cursive, with a long horizontal stroke at the end.

Michael J. Sullivan
Director, Acquisition and Sourcing Management

Appendix I: Scope and Methodology

To determine current risks and future plans for DOD's new tactical aircraft acquisition programs, we evaluated plans, budgets, delivery schedules, and results to date on the JSF, F-22A, F/A-18E/F, and EA-18G. We compared cost, schedule, and performance data to prior estimates to identify significant changes and their causes. We discussed concerns and emerging issues with officials from the program offices, the requiring commands, and service headquarters. To limit impacts on the services and leverage our work, we drew extensively upon prior and ongoing GAO engagements on the JSF, F-22A, and EA-18G.

To determine impacts on legacy systems and retirement schedules, we reviewed work content and funding requirements for ongoing and projected modernization and sustainment projects for tactical aircraft. We discussed future plans for legacy systems, retirement schedules, and the degree they have been affected by cost, schedule, and performance outcomes for new acquisition systems. We compiled lists of unfunded requirements and estimates of costs for service life extension programs.

To determine the extent to which DOD has developed an integrated investment plan for future tactical aircraft, we analyzed Air Force, Navy, and Marine Corps plans and processes for establishing force and capability requirements, the factors used to size and shape future force structure to meet national security requirements, and how capability gaps or redundancies are addressed. We reviewed OSD and joint staff responsibilities and processes for exercising program management and oversight of service programs and new initiatives intended to improve enterprise planning and look for integrated DOD-wide solutions.

In performing our work, we obtained information and interviewed officials from the F-22A System Program Office, Wright-Patterson Air Force Base, Ohio; F/A-18 System Program Office, Patuxent River, MD; program offices for Air Force legacy systems, Wright-Patterson Air Force Base, Ohio; program offices for Navy and Marine Corps legacy systems, Patuxent River, MD.; Air Combat Command, Langley Air Force Base, VA; Naval Air Systems Command, Patuxent River, MD; Navy, Marine Corps, and Air Force headquarters offices, OSD, and Joint Chiefs of Staff offices, Washington, D.C. We performed our work from June 2006 through March 2007 in accordance with generally accepted government auditing standards.

Appendix II: Comments from the Department of Defense



ACQUISITION,
TECHNOLOGY
AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

MAR 28 2007

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:

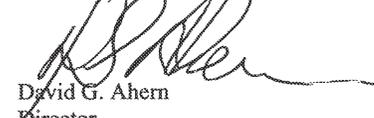
This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-07-415, "TACTICAL AIRCRAFT: DoD Needs a Joint and Integrated Investment Strategy," dated February 23, 2007 (GAO Code 120564).

The report recommends DoD take decisive actions to shorten cycle times in developing and delivering new weapon systems and develop an integrated and affordable enterprise-level investment strategy for tactical air forces.

The DoD concurs with both of the GAO recommendations, but disagrees with the GAO's supposition that we do not have an enterprise level investment strategy for tactical aviation. The Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) established seven major acquisition related goals for the Department. Three of those goals directly pertain to shortening of acquisition cycle time. These goals flow down directly from the National and Defense Strategic Guidance. Three of the USD(AT&L) goals also pertain to improvement of how we invest our scarce resources. The enclosures provide additional comments on how the Department is addressing the GAO's recommendations and technical comments.

The Department appreciates the opportunity to comment on the draft report. My point of contact for this effort is Mr. David Hersh, (703) 697-3619, David.Hersh@osd.mil.

Sincerely,



David G. Ahern
Director
Portfolio Systems Acquisition

Enclosures:
As stated



GAO DRAFT REPORT OF FEBRUARY 23, 2007
GAO-07-415 (GAO CODE 120564)

“TACTICAL AIRCRAFT: DoD Needs a Joint and
Integrated Investment Strategy”

DEPARTMENT OF DEFENSE COMMENTS TO GAO RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the DoD take decisive actions to shorten cycle times in developing and delivering needed combat capabilities to the warfighter including:

- Adopting a time-certain development cycle that can deliver an increment of new capability within five to six years after the start of system design and development, and
- Reassessing requirements for ongoing weapon system acquisition programs to identify ways to reduce requirements and speed up delivery of initial capabilities.

DOD RESPONSE: Concur. Acquisition cycle time reduction is a major Under Secretary of Defense, Acquisition, Technology and Logistics (USD(AT&L)) initiative intended to put military capability into the hands of the warfighters faster and more affordably. The GAO recommendation is consistent with that initiative. Improving cycle time is a daunting challenge, and is a focus area in three of the USD(AT&L) goals. The USD(AT&L) goals have been communicated to all members of the acquisition community and are being codified in the Department’s acquisition management policy. Under the National Security Personnel System, implemented by the Department, acquisition community personnel pay is tied directly to employee performance towards achievement of those goals. The acquisition policies being put into place brings together the requirements, acquisition, programming, and budgeting communities to improve affordability, and cycle time. The Department’s investments in research and engineering are focused towards technologies to take advantage of opportunities to affordably and rapidly improve military capability. This includes actions to ensure the technology readiness levels of the systems selected for development are sufficient to minimize risk and accelerate procurement. The EA-18G program is an example of a program that does this well, providing an incremental new capability that uses the proven F/A-18F platform and integrates the proven EA-6B ALQ-218 receiver system. The EA-18G is on track to deliver this capability on time, less than five years from program start.

The Joint Staff now reviews technical maturity levels before validating Service requirements documents. Our intent is to avoid requiring technical solutions at the cutting edge in favor of those that can be developed incrementally and more rapidly. The department is also reviewing potential materiel and non-materiel solutions far earlier in the process than ever before. This initiative, called “Concept Decision,” is intended to stabilize requirements and improve funding stability critical to reducing risk, accelerating cycle time, and ensuring predictable outcomes. Stability of requirements is another area we are addressing. Requirements growth increases risk, adds cost, and slows

development. Another major factor we are attempting to address is funding stability. Funding cuts, whether internally by the Department or by the Congress, can also add risk, increase cost, and slow development.

It is important to recognize that aircraft development, even when not pushing the cutting edge of technology, is a highly complex engineering challenge that can easily take longer than five or six years. It would be unreasonable to uniformly apply a six year cycle time to complex programs like the Joint Strike Fighter (JSF) which has multiple variants and involves multiple services and international partners. Simply conducting the developmental and operational testing necessary for such programs can consume two years or more. If we were to await successful completion of that testing before beginning procurement, we would add an additional two years or more. It is necessary to intelligently accept some risk in concurrency to minimize the cycle time. Future improvements to tactical aircraft will follow the incremental approach described in the GAO's report, keeping the F-22 and JSF as viable in service weapon systems for many decades, much like we have achieved with the B-52, F/A-18, F-15, F-16, EA-6, AV-8 and A-10.

RECOMMENDATION 2: The GAO recommended that the DoD develop an integrated and affordable enterprise-level investment strategy that:

- Is based on a joint assessment of warfighting needs and a full set of potential and viable alternative solutions, considering not only new acquisitions, but also modifications to legacy aircraft to achieve this balance within realistic and affordable budget projections for DoD.
- Strikes a balance between maintaining near-term readiness and addressing long-term needs; and considers the contribution of bombers, long-range strike aircraft, missiles, and other weapons currently in the inventory and those planned that can be employed to attack the same type targets as the tactical aircraft.

DOD RESPONSE: Concur. The DoD has developed and implemented an investment strategy for tactical air forces as reflected in the President's Fiscal Year 2008 Budget submission. The first key element of the Budget is to buy Joint Strike Fighter aircraft (JSF). Investing in fifth generation platforms such as the F-22 and JSF, instead of legacy aircraft, for the Air Force, Navy, and Marines will reduce attrition losses in high-threat environments. The second key element incorporates a planned buy of 183 F-22 aircraft to field air dominance capabilities and hedge risk. For the third key element, as DoD modernizes with stealth platforms, the services will maintain needed capabilities and force structure via prudent life extension programs for selected aircraft such as the F/A-18C/D.

This investment strategy was formulated based on high-level guidance, such as the National and Defense strategies, and key studies such as the Joint Air Dominance study conducted during the 2005 Quadrennial Defense Review. In addition, the Joint Capabilities Integration and Development System (JCIDS) and portfolio management are key processes which bring a capabilities-based approach to the tactical aircraft investment strategy. The Joint Requirements Oversight Council takes a joint enterprise-

**Appendix II: Comments from the Department
of Defense**

wide view of requirements, vice a Service-centric approach to tactical aircraft investment. The Service chiefs, in carrying out their responsibilities to train and equip their respective Services, develop force structure plans which they believe best serve their Service mission requirements. The individual Service plans are vetted through the joint process which results in a unified fiscally-constrained Department position on force structure.

Appendix III: Tactical Air Forces Funding Fiscal Years 2006 to 2011

Dollars in thousands

Air Force	2006	2007	2008	2009	2010	2011	2006-2011
Military construction	\$380,760	\$296,077	\$533,027	\$913,709	\$754,934	\$358,505	\$3,237,012
Military personnel	\$9,355,951	\$9,570,892	\$9,594,455	\$9,788,140	\$10,017,144	\$10,345,118	\$58,671,700
Operations and maintenance	\$12,776,725	\$13,019,158	\$13,640,801	\$13,698,510	\$14,196,380	\$14,428,658	\$81,760,232
Procurement	\$7,587,576	\$7,321,053	\$9,841,779	\$10,671,089	\$10,104,223	\$10,379,510	\$55,905,230
Research, development, test, and evaluation	\$5,909,282	\$6,170,332	\$5,840,288	\$5,288,475	\$4,624,294	\$3,588,672	\$31,421,343
Navy							
Military construction	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Military personnel	\$1,157,408	\$1,181,013	\$1,197,863	\$1,234,087	\$1,273,850	\$1,302,516	\$7,346,737
Operations and maintenance	\$2,027,062	\$1,922,443	\$1,945,247	\$1,901,132	\$1,941,628	\$1,922,958	\$11,660,470
Procurement	\$5,990,828	\$5,977,071	\$7,820,351	\$11,419,657	\$11,461,509	\$10,081,260	\$52,750,676
Research, development, test, and evaluation	\$2,871,719	\$2,626,234	\$2,147,384	\$1,480,793	\$1,231,906	\$893,068	\$11,251,104
Marine Corps							
Military construction	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Military personnel	\$1,543,652	\$1,571,905	\$1,637,699	\$1,701,146	\$1,755,634	\$1,816,020	\$10,026,056
Operations and maintenance	\$906,053	\$820,374	\$849,582	\$884,860	\$880,779	\$882,676	\$5,224,324
Procurement	\$709,064	\$508,526	\$441,031	\$220,030	\$239,761	\$245,740	\$2,364,152
Research, development, test, and evaluation	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total DOD							
Military construction	\$380,760	\$296,077	\$533,027	\$913,709	\$754,934	\$358,505	\$3,237,012
Military personnel	\$12,057,011	\$12,323,810	\$12,430,017	\$12,723,373	\$13,046,628	\$13,463,654	\$76,044,493
Operations and maintenance	\$15,709,840	\$15,761,975	\$16,435,630	\$16,484,502	\$17,018,787	\$17,234,292	\$98,645,026
Procurement	\$14,287,468	\$13,806,650	\$18,103,161	\$22,310,776	\$21,805,493	\$20,706,510	\$111,020,058
Research, development, test, and evaluation	\$8,781,001	\$8,796,566	\$7,987,672	\$6,769,268	\$5,856,200	\$4,481,740	\$42,672,447
Grand Total	\$51,216,080	\$50,985,078	\$55,489,507	\$59,201,628	\$58,482,042	\$56,244,701	\$331,619,036

Source: DOD's 2007 Future Years Defense Program.

Appendix IV: A Summary of Tactical Aircraft Systems Ongoing and Future Efforts

This appendix provides more details on new and legacy tactical aircraft to expand upon summary information provided in the body of this report. We include a brief description of each aircraft's mission, program status, and our observations on program execution and outcomes. Where applicable, we also highlight recent GAO work on some systems. The appendix also includes a funding table for each aircraft that consolidates the budget requests in the Fiscal Year 2008 Defense Budget, the Fiscal Year 2007 Global War on Terrorism Supplemental, and the Fiscal Year 2008 Global War on Terror request. The budget information in these tables is expressed in current (then year) dollars and the totals may not add exactly because of rounding. The fiscal year 2007 funding shown in these tables has been appropriated by Congress except for the supplemental requests.

Figure 7: F-22A Raptor



Source: DOD.

Initial operational capability: December 2005

Total quantity to be procured: 183

Current inventory: 78

Mission

The F-22A is the Air Force's next generation air superiority fighter and incorporates a stealthy and highly maneuverable airframe, advanced integrated avionics, and a supercruise engine. It will replace or complement the F-15 as the Air Force's primary air-to-air fighter and was originally intended to counter threats posed by the Soviet Union. The Air Force has decided to add more robust air-to-ground and intelligence-gathering capabilities not previously envisioned at program start, but now considered necessary to increase its utility.

Program Status

Demonstration and validation began in October 1986 and system development in June 1991. Low-rate initial production was approved in August 2001 and full-rate production in March 2005. The first production aircraft was delivered in June 2003 and, as of October 2006, 78 aircraft had been delivered to the operational forces. The program of record is to acquire a total of 183 aircraft at a total cost of \$62.6 billion. The Air Force plans to complete procurement in 2010 under a multiyear contract.

Initial operational capability was declared in December 2005. In its December 2006 annual report, DOD's Director of Operational Test and Evaluation has determined that the F-22A is operationally effective in the air-to-air mission role and in the air-to-ground mission against fixed targets using the Joint Direct Attack Munition. The aircraft is not yet operationally

suitable due to reliability and maintainability deficiencies. Operational users report that the aircraft has performed excellently in military exercises against representative threats and represents a large advantage over the F-15.

The Air Force is implementing a modernization and reliability improvement program and plans to invest another \$6.3 billion to develop and integrate more robust ground attack, intelligence-gathering, and other new capabilities. Formally established in 2003, the F-22A's modernization program is currently being planned for three increments of increasing capability to be developed and delivered over time, from fiscal year 2007 to 2013. Additional modernization is expected, but the content and costs have not been determined or included in projected budgets beyond 2013.

GAO Observations

The Air Force's current stated need is for 381 F-22As. However, because of past cost overruns and current budget constraints, OSD states that 183 are all that is needed and affordable. This leaves a 198-aircraft gap with the Air Force's stated need. We have reported on F-22A issues for many years and have recommended that a new and executable business case be prepared that more accurately and realistically supports the current program of record and which resolves a capability gap between what the Air Force requires and what DOD can afford.¹ During the more than 20 years the aircraft has been in development, the conditions underpinning the original business case substantively changed—threat and employment plans changed, costs increased, the development period doubled, and new mission requirements were added. Without a new relevant business case—on the appropriate number of F-22As for our national defense—it is uncertain whether additional investments in the modernization program are advisable.

The Air Force is working with the contractor to fix structural deficiencies on the F-22A. Fatigue testing identified cracks in the aircraft near the horizontal section tail of the aircraft. The Air Force is planning modifications to strengthen the structure to get the 8,000-hour service life. The Air Force estimates the costs to modify 72 F-22As will be approximately \$124 million. These modifications will not be fully implemented until 2010.

¹The latest report is GAO, *Tactical Aircraft: DOD Should Present a New F-22A Business Case before Making Further Investments*, [GAO-06-455R](#) (Washington, D.C.: June 20, 2006).

**Appendix IV: A Summary of Tactical Aircraft
Systems Ongoing and Future Efforts**

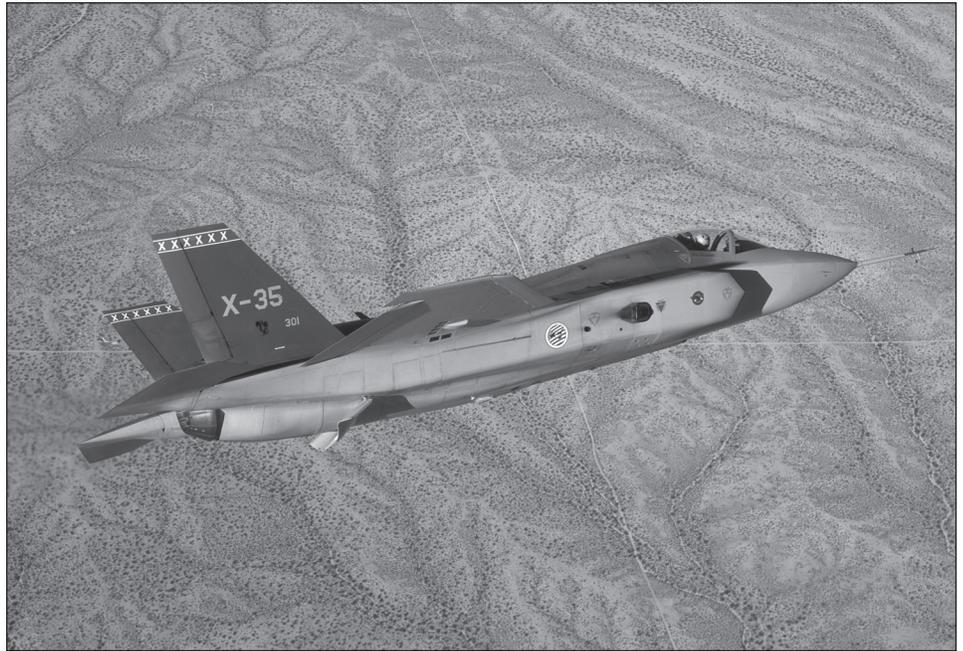
At the start of modernization, all three critical technologies essential to achieving capability requirements were considered mature by best practice standards. Since that time, however, the program added three additional critical technologies, all of which are immature. Immature and untested technologies, as the program pushes forward, significantly increase the risk of poor cost and schedule outcomes.

Table 9: F-22A Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$472.5	\$743.6	\$666.8	\$510.3	\$417.3	\$512.0	\$495.8	\$3,827.3
Procurement	3,385.4	3,579.4	3,673.0	45.9	46.9	0	0	10,730.6
Modifications	145.6	281.9	345.6	337.9	433.3	271.4	291.6	2,107.3
Supplemental								
RTD&E	0	0						0
Procurement	0	0						0
Modifications	0	0						0
Total	\$4,003.5	\$4,604.9	\$4,685.4	\$894.2	\$897.4	\$792.4	\$787.4	\$16,665.2

Source: DOD budget data.

Figure 8: F-35 Joint Strike Fighter (JSF)



Source: DOD.

Initial operational capability (planned): March 2012 (Marines), March 2013 (Air Force & Navy)

Total quantity to be procured: 2,458

Current inventory: 1 (test aircraft)

Mission

The JSF program goals are to develop and field an affordable, highly common family of stealthy, next-generation strike fighter aircraft for the Navy, Air Force, Marine Corps, and U.S. allies. The carrier suitable variant will provide the Navy a multirole, stealthy strike aircraft to complement the F/A-18E/F. The conventional take-off and landing variant will primarily be an air-to-ground replacement for the Air Force's F-16 and the A-10 aircraft, and will complement the F-22A. The short take-off and vertical landing (STOVL) variant will be a multi-role strike fighter to replace the Marine Corps' F/A-18 and AV-8B aircraft.

Program Status

The JSF program is DOD's most costly aircraft acquisition program. DOD estimates that the total cost to develop and procure its fleet of aircraft will be \$276 billion, with total costs to maintain and operate the JSF adding another \$347 billion over its life cycle. It is also DOD's largest cooperative development program. Eight partner countries are providing funding for

system development and demonstration: Australia, Canada, Denmark, Italy, the Netherlands, Norway, Turkey, and the United Kingdom.

Concept demonstration began in November 1996. The program entered system development and demonstration in October 2001 and is expected to run through fiscal year 2013. Manufacture and assembly of test aircraft is continuing, and first flight of the Air Force's variant occurred in December 2006. Overall, the cost estimate to develop the JSF has increased from \$34.4 billion in 2001 to \$44.5 billion in 2005—about 29 percent. Procurement costs have increased from \$196.6 billion in 2001 to \$231.7 billion in 2005—about 18 percent. Since program start, JSF quantities have been reduced by 530 aircraft. Current estimated program acquisition unit costs are about \$112 million, a 38 percent increase since 2001.

GAO Observations

We recently issued our third annual report on the JSF acquisition.² The development team has achieved first flight and has overcome major design problems found earlier in development. However, the current acquisition strategy still reflects very significant risk that both development and procurement costs will increase and that aircraft will take longer to deliver to the warfighter than currently planned. Even as the JSF program enters the midpoint of its development, it continues to encounter significant cost overruns and schedule delays. As a result of the program reporting a Nunn-McCurdy unit cost breach, a new baseline was established in 2004 with additional costs of \$19.4 billion; since then, estimated costs to complete the acquisition have increased another \$31.6 billion. OSD cost analysts are concerned about worsening cost performance and believe the cost to complete the program will further escalate. The program has also experienced delays in several key events, including the start of the flight test program, delivery of the first production representative development aircraft, and testing of critical missions systems.

Our past reports have found that the acquisition program is not following a knowledge-based evolutionary approach that places it at risk of continued poor program outcomes. The degree of concurrency between development and production in the JSF's acquisition strategy includes significant risks for cost and schedule overruns or late delivery of promised capabilities to

²GAO, *Joint Strike Fighter: Progress Made and Challenges Remain*, GAO-07-360 (Washington D.C.: Mar. 15, 2007).

the warfighter. For example, at the time of the low-rate initial production decision, only one aircraft will have flown; less than 1 percent of the flight test program will have been completed; and none of the three variants will have a production representative prototype built. The 7-year flight test program of more than 11,000 hours of testing just began in December 2006. It will not be until 2011 that a fully capable, integrated JSF is scheduled to begin flight testing. By that time, DOD expects to have committed to buy 103 production aircraft for \$20 billion. Therefore, almost all of critical flight testing remains to confirm the aircraft will indeed deliver the required performance. Manufacturing and technical problems can delay the completion of the flight test program, may necessitate design changes, increase the number of flight test hours needed to verify the system will work as intended, and affect when the capabilities are delivered to the warfighter.

DOD appears to be taking some actions to lessen funding risk—the ability to sustain funding in times of austere budgets or against competing priorities. DOD’s plan in 2006 assumed extremely high annual funding rates averaging \$14 billion between 2012 and 2023. This is an extremely large annual funding commitment that carries a correspondingly high level of funding risk as the program moves forward and must annually compete with other programs for the defense dollar. Due to affordability pressures, DOD is beginning to reduce procurement budgets and annual quantities. The recently released fiscal year 2008 defense budget shows declining procurement quantities for the first years of production. To meet future constrained acquisition budgets, Air Force and Navy officials and planning documents suggest a decrease in maximum annual buy quantities from 160 shown in the current program of record to about 115 per year, a 28 percent decrease. While this will reduce annual funding requirements, it will also stretch the procurement program at least seven years to 2034, assuming buy quantities are deferred rather than eliminated.

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Table 10: Navy JSF Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$2,163.9	\$1,707.4	\$1,548.9	\$1,045.3	\$1,065.9	\$745.6	\$663.7	\$8,940.7
Procurement	124.5	1,317.1	1,809.0	3,608.0	3,422.7	5,675.7	5,647.2	21,604.2
Modifications	0	0	0	0	0	0	0	0
Supplemental								
RTD&E	0	0						0
Procurement	0	0						0
Modifications	0	0						0
Total	\$2,288.4	\$3,024.5	\$3,357.9	\$4,653.2	\$4,488.6	\$6,421.2	\$6,311.0	\$30,544.9

Source: DOD budget data.

Table 11: Air Force JSF Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$2,132.9	\$1,780.9	\$1,541.2	\$1,146.0	\$789.1	\$975.2	\$734.9	\$9,100.1
Procurement	648.5	1,461.7	1,906.3	2,457.3	3,544.1	4,914.1	5,222.6	20,154.6
Modifications	0	0	0	0	0	0	0	0
Supplemental								
RTD&E	0	0						
Procurement	389.0	230.0						
Modifications	0	0						
Total	\$3,170.4	\$3,472.6	\$3,447.5	\$3,603.3	\$4,333.2	\$5,889.3	\$5,957.5	\$29,873.7

Source: DOD budget data.

Figure 9: F/A-18E/F Super Hornet



Source: DOD.

Initial operational capability: September 2001

Total quantity to be procured: 462

Current inventory: 290

Mission

The F/A-18E/F Super Hornet program was approved as a major modification in the F-18 series in May 1992. It is a twin engine, single- and two-seat, multi-mission tactical aircraft designed to perform fighter escort, interdiction, fleet air defense, and close air support missions. The F/A-18E/F is replacing the F/A-18A/B/C, has improved range and payload, and is less detectable. In addition to the procurement quantity of 462 E/F aircraft, the Navy is also procuring 84-90 airframes for the EA-18G program (total acquisition up to 552 aircraft).

Program Status

Development began in 1992, procurement in 1996, and initial operational capability was declared in September 2001. Through fiscal year 2006, the Navy has taken delivery of 272 aircraft and has 210 aircraft on a 5-year

multiyear contract.³ The Navy has received an unsolicited draft proposal for a third multiyear contract that would complete the planned program. Navy officials believe this could reduce unit costs, but told us to be effective the contract would need a quantity higher than the 70 aircraft remaining to be bought. This would seemingly require an increase in Navy buys or the addition of potential foreign military sales.⁴

Super Hornet aircraft have flown over 340,000 hours by the end of December 2006 and have been employed in combat operations. The Navy originally planned to buy 1,000 aircraft, but the quantity was reduced to 548 by the 1997 Quadrennial Defense Review, expecting to transition more quickly to the JSF, but with provisions for additional procurement if the JSF is delayed. In 2003, the quantity was further reduced to 462 when a study showed closer integration of Navy and Marine Corps aviation fleets would provide greater efficiency for common assets.

GAO Observations

The F/A-18E/F acquisition program is mature and has had relatively good procurement cost and schedule outcomes. One substantive reason for good outcomes is the low risk, evolutionary acquisition strategy adopted. The E/F variant is part of the F/A-18's family of aircraft that has gradually upgraded capabilities since delivery of the original F-18 in the late 1970s. It has substantial commonality with its predecessor C/D models and leveraged previous technologies. For example, the initial release of the E/F models incorporated the avionics suite from the C/D models with provisions for upgrades to occur subsequent to the basic air vehicle development. Planned upgrades to the F/A-18E/F continue to incrementally add capabilities. Current production is phasing in block upgrades including the active electronically scanned array radar, advanced crew station, network-centric operation, and time-critical strike modifications. Navy program officials cited that, for the past three years, full rate production aircraft have been consistently delivered up to 3 months ahead of schedule, that the program is mature, and its current costs remain well-defined and within targets.

³This multiyear procurement contract, the program's second of this contract type, includes 154 F/A-18E/F and 56 EA-18G airframes for a total of 210.

⁴There are currently seven foreign countries that have F/A-18A/B/C/Ds in their fleets: Australia, Canada, Finland, Kuwait, Malaysia, Spain, and Switzerland.

While platform production and fielding has been successful, the December 2006 report of the Director of Operational Test and Evaluation identified ongoing tests and deficiencies in several of the aircraft's major systems, including radar, defensive countermeasures, and weapons. The report states it is paramount that all systems interoperate properly in order to allow for optimal operational effectiveness and suitability.

The program has reported two Nunn-McCurdy (10 U.S.C. 2433) breaches in unit cost since 1999, but these are attributable more to external factors than to system development, production, or management problems. The first breach occurred in 1999 when the procurement quantity was significantly reduced by the QDR. The second breach occurred in 2005 when the quantity was again reduced. Also, the OSD Comptroller decided to break out program reporting for the EA-18G aircraft separate from the E/F models. In doing so, common support costs for both programs were budgeted in the E/F program.

Prior to this review, we last reported on the E/F program specifically in our 2003 annual weapon systems' assessment.⁵ At that time program officials noted that the aircraft demonstrated two to three times the quality of the F/A-18C/D and have provided measurable improvements to squadron readiness. In addition, all F/A-18E/F preplanned upgrades continued to track to their program schedules. Program officials also stated that the active electronically scanned array radar program continues to execute as planned, and the program received the first engineering and manufacturing development unit in 2003.

⁵GAO, *Defense Acquisitions: Assessments of Major Weapon Programs*, GAO-03-476 (Washington, D.C.: May 15, 2003).

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Table 12: F/A-18 Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$39.3	\$44.9	\$66.3	\$66.3	\$61.0	\$52.1	\$35.4	\$365.3
Procurement	2,560.7	2,135.4	1,780.5	1,986.0	1,708.1	1,604.7	201.2	11,976.6
Modifications	424.7	441.9	460.2	480.4	510.6	521.9	529.6	3,369.3
Supplemental								
RTD&E	0	1.5						1.5
Procurement	16.0	725.7						741.7
Modifications	96.8	60.8						157.1
Total	\$3,137.4	\$3,409.7	\$2,307.0	\$2,532.7	\$2,279.7	\$2,178.7	\$766.3	\$16,611.5

Source: DOD budget data.

Note: This table includes all F/A-18 series budget data as the Navy consolidates investment funding for all models. Procurement funds requested are for the purchase of the new F/A-18E/F, while RDT&E and modification funds include amounts for both new and legacy F/A-18A/B/C/D aircraft.

Figure 10: EA-18G Growler



Source: DOD.

Initial operational capability: 2009 (planned)

Total quantity to be procured: 84-90

Total current inventory: 0

Mission

The EA-18G is the replacement for the Navy's EA-6B Prowler and will provide carrier strike forces with electronic attack and tactical jamming capabilities to defeat enemy air defenses and to protect strike fighters and the carrier group. Derived from the combat proven F/A-18F aircraft, the EA-18G incorporates advanced airborne electronic attack avionics for the suppression of enemy air defenses, including accurate emitter targeting for employment of onboard weapons such as the High-Speed Anti-Radiation Missile.

Program Status

The two-seater EA-18G airframe is about 90 percent common with the F/A-18F airframe and is procured under the same multiyear contract. The two models diverge at a point in the production line and airframes destined to be Growlers receive the electronic attack subsystems. System demonstration and design was about 70 percent complete by October 2006. Two test articles were delivered in 2006 and first flight was in August 2006. The low-rate initial production decision is scheduled for late April

2007 and initial operational capability is planned for the last quarter in 2009.

The Navy is proposing to reduce the total quantity of EA-18Gs from 90 to 84. The reduction is a result of re-evaluating inventory requirements in association with the Navy's fiscal year 2008 budget and the application of tiered readiness, as well as a reduction of four aircraft from the first low-rate production buy. The Navy expects to receive its first EA-18G in 2009.

GAO Observations

We reported in 2006 on the EA-18G's acquisition schedule for integrating the electronic attack subsystems.⁶ Our analysis showed that the program was not fully following the knowledge-based approach espoused in best practices and DOD's acquisition guidance, thus increasing the risk of cost growth, schedule delays, and performance problems. None of its five critical technologies were fully mature when system development started, and, at the time of our review, flight testing hadn't begun. The Navy proposed buying one-third of the total quantity as low-rate initial quantity aircraft based on limited demonstrated functionality. We recommended DOD consider outfitting additional EA-6Bs with the improved electronic suite for an interim capability, which would allow the restructuring of EA-18G production plans to begin procurement after full functionality was demonstrated.

This year, our follow on review as part of our annual assessments of major weapon systems determined that progress has been made but that three of the five critical technologies are still not fully mature to best practices standards with production slated to start in 2007.⁷ Flight testing is underway and, until full functionality is demonstrated, there are risks of redesign and retrofit. Fifty-six aircraft are already on the F-18 multiyear contract, most procured as low-rate initial production aircraft based on limited demonstrated functionality. A fully functioning Growler, one that meets or exceeds the upgraded EA-6B capability, will not complete operational testing until January 2009, 20 months after production starts and after more than one-third of the total fleet has already been bought.

⁶GAO, *Electronic Warfare: Option of Upgrading Additional EA-6Bs Could Reduce Risk in Development of EA-18G*, [GAO-06-446](#), (Washington, D.C.: Apr. 26, 2006).

⁷ [GAO-07-406SP](#).

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Navy officials agree that EA-18G’s schedule is aggressive, but disagreed with our overall assessment of the EA-18G. Officials reported that the program has been stable since its schedule was developed in 2003 and is meeting or exceeding all cost, schedule and performance parameters. Furthermore, officials stated that some technologies are evolutionary upgrades of systems previously tested on its EA-6B aircraft with demonstrated effectiveness. We note, however, that these technologies are in new environments with form and fit challenges, including space constraints, which could impact performance and ultimate design. The December 2006 annual report from the Director of Operational Test and Evaluation stated that the schedule remains aggressive with plans to fully assess risk areas to achieve initial operational capability in fiscal year 2009. The Director reported that the primary risks include the integration of multiple components of the electronic attack system onto the F/A-18E/F platform and the operator workload for the two-man crew in missions currently performed by the four-person EA-6B aircraft.

Table 13: EA-18G Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$372.1	\$272.7	\$135.2	\$72.3	\$45.2	\$36.7	\$28.3	\$962.5
Procurement	669.8	1,427.6	1,652.7	1,352.9	707.9	242.6	0	6,053.5
Modifications	0	0	0	0	0	0	0	0
Supplemental								
RDT&E	0	0						0
Procurement	450.0	0						450.0
Modifications	0	0						0
Total	\$1,492.0	\$1,700.3	\$1,788.0	\$1,425.1	\$753.1	\$279.3	\$28.3	\$7,466.1

Source: DOD budget data.

Figure 11: A-10 Warthog



Source: DOD.
Date first deployed: March 1976
Current inventory: 356
Average age: 25.3 years

Mission

The A-10 was the first Air Force aircraft specially designed for close air support of ground forces. It is a simple, effective and survivable twin-engine jet used against all ground targets, including tanks. Officials cite exceptional combat results during Desert Storm and the Global War on Terror. Some aircraft are specially equipped for airborne forward air control.

Program Status

Because of the A-10's relevant combat capabilities—demonstrated first during Desert Storm and recently in the Global War on Terror—the Air Force now plans to keep it in the inventory longer than anticipated. How long and with what upgrades is also dependent on whether the JSF aircraft are delivered on schedule. The Air Force is pursuing several major modifications to upgrade systems and structures on the A-10 fleet. A major re-winging effort is planned for 2007 through 2016 that will replace the “thin skin” wings on 242 aircraft at an estimated cost of \$1.3 billion. This effort will help to extend the A-10's service life to 16,000 hours. Precision

Engagement modernizes cockpit controls and upgrade avionics and weapons. All 356 aircraft in the force are slated to receive the Precision Engagement suite. Total cost to complete the modification is estimated to be \$420 million.

GAO Observations

Significant investments are underway and others planned or proposed to modernize 356 A-10s and to extend service life from 8,000 to 16,000 flying hours in order to achieve the goal of keeping the aircraft in service until 2025 or later. However, because of post-Cold War plans to retire the aircraft starting in the early 1990s, the A-10 fleet received no money for major modifications or programmed depot maintenance during the 1990s. As a result, the Air Force is now faced with a very large backlog of maintenance, structural repairs, and extensive modifications to modernize the A-10 fleet and keep it viable. Officials have begun major upgrades to modernize the cockpit and major subsystems and to replace the wings on most of the fleet. Officials are also finding that as older aircraft are inspected and opened up for modification, additional and more costly structural and sustainment work is being identified beyond initial plans.

Even with the higher priority accorded the aircraft, program officials identify at least another \$2.7 billion in unfunded requirements.⁸ Chief among these are an engine upgrade program estimated at \$2.1 billion. It is intended to provide the A-10 with significantly improved engine capabilities. However, the proposal was deferred by the requiring command because of limited funding and higher warfighter priorities. The Air Force's Fleet Viability Board, which assesses aging aircraft fleets and recommends to the Secretary and Chief of Staff of the Air Force whether aircraft should be retired or continued in service, recently determined that the A-10 is still viable and validated many of the modifications and repairs already underway. The Board recommended funding this engine upgrade in order to extend the A-10's service life until 2030. The Board's assessment identified mission limitations due to insufficient thrust to maximize survivability in the current threat environment with existing engines. Although agreeing that the engine upgrade would be desirable if funds were available, the requiring command continues to defer this program as a lower priority. We note that the Air Force has requested

⁸We obtained another preliminary estimate that suggests a service life extension program for the A-10 could cost \$4.4 billion, which may include some of these unfunded requirements.

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development funding of \$230 million for the engine upgrade program in the 2008 supplemental request.

Table 14: A-10 Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$31.9	\$2.0	\$0	\$3.0	\$0	\$0	\$0	\$36.9
Procurement	0	0	0	0	0	0	0	0
Modifications	106.9	161.7	145.6	306.0	274.5	268.9	268.9	1,532.5
Supplemental								
RTD&E	10.0	230.0						240.0
Procurement	0	0						0
Modifications	217.4	0						217.4
Total	\$366.2	\$393.7	145.6	309.0	\$274.5	\$268.9	\$268.9	\$2,026.8

Source: DOD budget data.

Figure 12: F-15A/B/C/D Eagle and F-15E Strike Eagle



Source: DOD.

Date first deployed: July 1972 (F-15A), April 1988 (F-15E)

Current inventory: 493 (F-15A/B/C/D), 224 (F-15E)

Average age: 23.4 years (F-15C/D), 14.5 years (F-15E)

Mission

The F-15A/B/C/D Eagle is a single- and two-seat, twin-engine, all-weather tactical fighter designed to gain and maintain air supremacy over the battlefield. The F-15E Strike Eagle is a two-seater dual-role fighter designed to perform air-to-air and air-to-ground missions. An array of avionics and electronics systems gives the F-15E the capability to strike targets at low altitude, day or night, and in all weather.

Program Status

The Air Force has a number of ongoing improvement efforts for the F-15 fleet, including

- helmet mounted cueing system,
- a new identification friend-or-foe system,
- various computer upgrades, and
- new radar for the F-15E

The Joint Helmet Mounted Cueing System is planned for several DOD systems and provides pilots the capability to aim weapons and sensors by looking at the intended target. The new friend-or-foe identification system will solve obsolescence issues, add capability, and be upgradeable for the future. Computer upgrades also resolve obsolescence issues, enhance on-

board computers, and improve avionics performance. The F-15E model will receive the improved active electronically scanned array radar.

GAO Observations

For years, modernization efforts and funding for the F-15C/D aircraft had been concentrated on about half the fleet—178 aircraft of its total inventory of 391. These were the number of aircraft the Air Force projected was needed to provide sufficient force structure to meet defense requirements and to complement the F-22A. That projected number was predicated upon the Air Force receiving its full F-22A stated requirement of 381 aircraft. However, due to affordability, the Air Force now faces a 198 aircraft shortfall in the quantity of F-22As it is slated to receive. As a result, officials expect more F-15C/Ds need to be modernized and retained for longer periods than planned. Originally planned for retirement by 2015, the Air Force now needs to keep substantial numbers of F-15C/D aircraft operational to 2025 and perhaps beyond.

A multi-staged improvement program for the 178 aircraft, including recent upgrades of the engines and radar, is mostly complete. Officials identified near-term unfunded requirements on these aircraft totaling \$2.3 billion, including new radars and countermeasure sets. In addition, potential service life extension efforts on the fleet and backlogged unfunded requirements to modernize aircraft in addition to the 178 may be needed but the full costs have not been identified.

The Air Force also plans to keep 224 F-15Es in service beyond 2025. These are the newest F-15s with enhanced strike capabilities. The major upcoming upgrade effort on the F-15E is a radar modernization program to add active electronically scanned array radar. Estimated to cost \$2.3 billion, the Air Force has delayed funding for this effort and now plans to start procurement in 2010. Program officials identified unfunded requirements totaling about \$1.7 billion, including upgraded radar warning receivers, helmet mounted cueing system, and long-term sustainment efforts to address electrical, structural, and power plant concerns to keep the aircraft viable for another 25 or more years.

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Table 15: F-15 Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$137.5	\$101.3	\$186.4	\$165.6	\$120.0	\$120.8	\$123.2	\$954.8
Procurement	0	0	0	0	0	0	0	0
Modifications	164.3	19.2	58.2	256.6	336.6	287.2	148.5	1,270.6
Supplemental								
RTD&E	0	97.5						97.5
Procurement	0	0						0
Modifications	192.0	152.9						344.9
Total	\$493.8	\$370.9	\$244.6	\$422.2	\$456.6	\$408.0	\$271.7	\$2,667.8

Source: DOD budget data.

Figure 13: F-16 Fighting Falcon



Source: DOD.

Date first deployed: January 1979

Current inventory: 1317

Average age: 16.7 years

Mission

The F-16 Fighting Falcon is a single engine multi-role fighter with full air-to-air and air-to-ground combat capability. It provides a relatively low cost, high-performance weapon system for the United States and allied nations. The F-16 currently comprises more than half of the Air Force's fighter force. The fleet includes several different configurations or blocks. The newest blocks incorporate the high-speed anti-radiation missile targeting system, the Air Force's only platform specifically for the suppression of enemy air defenses.

Program Status

The Air Force is not currently purchasing any new F-16's, but the contractor is still producing them for foreign sale. The production is slated to continue past 2009 to accommodate recent sales. If the Air Force were to buy new aircraft, officials estimated that it would cost \$380 million for development and about \$50 million per aircraft procured.

The Air Force has a number of ongoing improvement efforts for the F-16, including

- structural airframe modifications,
- avionics and capabilities upgrades,
- engine service life extension program, and
- new engines for some F-16 models.

Falcon STAR is an effort to modify the airframe to allow the F-16 to reach the original 8,000 hours estimated for its flight life. Due to increased workload and weight that exceed the original specifications of the aircraft, the F-16 must be structurally modified to compensate for the increases. A number of common avionics and capabilities upgrades are necessary to provide increased processor speed and memories, color displays, and incorporate the Joint Helmet Mounted Cueing System. The F110 engine service life extension program addresses safety, reliability and maintainability concerns and new engines for the Block 42 aircraft will provide needed thrust improvements.

GAO Observations

With over 1,300 aircraft, the F-16 fleet comprises more than one-half the Air Force's fighter and attack forces. The fleet includes several different configurations that were acquired and upgraded in evolutionary fashion over a considerable period of time. Reduced annual buy quantities on the JSF and deferred deliveries to the warfighter means that F-16s slated to be replaced by the JSF and retired will need to remain operable and relevant for additional years. Already investing several billions of dollars to keep the fleet operable, improve capabilities, and sustain it to meet its original expected service life, a preliminary unfunded cost estimate to increase the life expectancy of the newer fighters is \$4.5 billion.

Without improvements, almost 90 percent of the fleet would exceed design limits on engines by 2010. High usage, increased stresses, and more weight than planned threatened to cut life expectancy in half. Significant unknowns exist about extending the life beyond 8,000 hours should that be necessary. This makes any additional JSF schedule delays, deferrals, and cost growth very problematic for the overall Air Force fighter structure.

If it becomes necessary to enable the newest F-16 aircraft to reach a 10,000 flying hour life, a program official estimated an additional cost of \$2.2 billion for structural enhancements. The program office also identified another \$3.2 billion in unfunded requirements, including radar

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upgrades to aircraft capable of suppressing enemy air defenses. The oldest F-16s are to be retired over the next few years, and the Air Force has halted modifications and funding for these aircraft.

Table 16: F-16 Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$152.0	\$90.6	\$113.8	\$117.6	\$108.6	\$110.7	\$112.9	\$806.2
Procurement	0	0	0	0	0	0	0	0
Modifications	366.4	329.3	292.4	234.4	202.6	72.3	41.2	1,538.6
Supplemental								
RTD&E	0	55.3						55.3
Procurement	0	0						0
Modifications	0	0						0
Total	\$518.4	\$475.2	\$406.2	\$352.0	\$311.2	\$183.0	\$154.1	\$2,400.1

Source: DOD budget data.

Figure 14: F-117A Nighthawk



Source: DOD.

Date first deployed: 1982
Total current inventory: 55

Mission

The F-117A Nighthawk is the world's first operational aircraft designed to exploit low observable stealth technology. This precision strike aircraft penetrates high-threat airspace and uses laser-guided weapons against critical targets.

Program Status

As part of its transformation plans, the Air Force proposed retiring the F-117A aircraft in 2007 and 2008, stating that there are other more capable assets that can provide low observable, precision penetrating weapons capability. Program Budget Decision 720, dated December 2005, directed the Air Force to develop a strategy to gain congressional support for this plan. Congress has agreed, with certain limitations, mandating that the Air Force retire F-117As in "pristine" storage in case the aircraft would need to be recalled into service.

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GAO Observations

Program officials estimate that the drawdown of the fleet and the shutdown of government and contractor offices and facilities would cost approximately \$283 million. However, there is currently no funding allocated for these retirement costs of the F-117A. This cost does not include long-term storage and maintenance of the fleet after such a retirement.

Table 17: F-117A Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$14.0	0	0	0	0	0	0	\$14.0
Procurement	0	0	0	0	0	0	0	0
Modifications	2.0	0	0	0	0	0	0	2.0
Supplemental								
RDT&E								0
Procurement								0
Modifications								0
Total	\$16.0	0	0	0	0	0	0	\$16.0

Source: DOD budget data.

Figure 15: F/A-18A/B/C/D Hornet



Source: DOD.

Date first deployed: November 1978

Current inventory: 662

Average age: 20.8 years (A), 22.5 years (B), 15.0 years (C), 14.4 years (D)

Mission

The F/A-18A/B/C/D is an all-weather fighter and attack aircraft also known as the Hornet. It is a single- and two-seat, twin engine, multi-mission fighter/attack aircraft that can operate from either aircraft carriers or land bases. The F/A-18 fills a variety of roles: air superiority, fighter escort, suppression of enemy air defenses, reconnaissance, forward air control, close and deep air support, and day and night strike missions.

Program Status

The major modification effort ongoing is the Center Barrel Replacement to eliminate structural limitations caused by cracking in the central fuselage. This effort is expected to cost about \$970 million. During scheduled inspections of the aircraft, the Navy also identified cracks in the wing structure in about 40 percent of the aircraft. These could cause safety of flight issues in the future but are not thought to be serious enough at this time to ground the aircraft or to require immediate repair.

GAO Observations

The F/A-18s are the backbone of the naval tactical aircraft fleet, but are quickly running out of service life. The Navy plans to soon retire the A and B models, and the Marine Corps plans to transition entirely to the JSF for its future strike force. The Navy's modernization efforts are focused on the remaining 421 F/A-18C/D aircraft. The Navy has an ongoing assessment of the service life of this aircraft that is expected to be completed in December 2007. At this time, it is not clear as to the need for or extent of future modifications, but a Naval Air Systems Command official said the assessment could very well identify additional modifications and structural work required beyond what is funded. Further delays in JSF could exacerbate funding shortfalls to sustain and modernize the operational fleet.

While the F/A-18C/D legacy aircraft are currently meeting both the Navy's and Marine Corps's force structure requirements and readiness levels, inventory reductions through the Navy-Marine Corps tactical aircraft integration plan, JSF delays, and better defined structural limits of the F/A-18C/D have created a shortfall starting in 2011 in the number of aircraft that Navy officials project as needed to support its war-fighting plans. One option the Navy is considering would be the purchase of additional F/A-18E/F models to resolve this shortage.

Another option under consideration is extending the life of its F/A-18C/D fleets to mitigate projected shortfalls. The full cost of the life extension program is not known at this time. The service life assessment effort to be completed in December 2007 will determine the feasibility, scope of work, and total costs for extending the life of the system. Current estimate for extending service life, including the costs of the assessment, is about \$2 billion, but officials said that number could very well increase substantially as the assessment progresses and cost estimates mature.

Concerned over the looming gap in the Navy's inventory, in May 2006, the Senate Committee on Armed Services recommended that the Navy consider buying more F/A-18E/Fs to mitigate any possible shortfall in aircraft until JSF aircraft are delivered.

Note: Budget information for the F/A-18A/B/C/D is included earlier in this appendix with the discussion of the F/A-18E/F (see table 12, p. 50). The Navy consolidates investment budgets for all models of the F-18.

Figure 16: EA-6B Prowler



Source: DOD.

Date first deployed: May 1968

Current inventory: 107

Average age: 24.3 years

Mission

The primary mission of the EA-6B Prowler is the suppression of enemy air defenses in support of strike aircraft and ground troops by interrupting enemy electronic activity and obtaining tactical electronic intelligence within the combat area. The Prowler is a long-range, all-weather aircraft with advanced electronic countermeasures capability, and enhances combat survivability of strike force aircraft and weapons by denying, delaying, and degrading the acquisition of friendly forces by enemy air defense systems. Both the Navy and Marines maintain Prowler assets.

Program Status

In 1995, the EA-6B was selected to become the sole tactical radar support jammer for all services after the Air Force decided to retire its fleet of EF-111 aircraft. This decision resulted in increased use of the EA-6B, as the Prowler provided airborne electronic attack capability during numerous joint and allied operations since 1995. The Navy plans to start

retiring its EA-6B in 2008 and replace it with the EA-18G as its core airborne electronic attack component. The Marine Corps had expected to retire their EA-6B assets in 2015, but that could change as future plans for its replacement are still evolving.

Three significant upgrades to the EA-6B are

- the Improved Capability electronic suite modification (ICAP III), which provides the EA-6B with greater jamming capability;
- an upgrade to the aircraft's current electronic pods, which improves frequency band capability; and
- replacement of the wing center sections of the entire fleet and outer wing panel replacement on portions of the fleet.

The ICAP-III modification includes the addition of software to allow the EA-6B to automatically pinpoint enemy signals and better receive and utilize data. Aircraft not receiving ICAP III are having the current electronic attack systems upgraded. Funding to replace the wing center sections was added by Congress. To date, 114 wings have been procured and 100 have been installed on aircraft. In addition forty-seven EA-6Bs are also in need of an outer wing panel replacement; Navy officials said that the first four pairs have already been delivered, and procurement will be ramped to 18 sets per year in order to receive deliveries through 2008.

GAO Observations

In 2006 GAO reported⁹ that, as a result of DOD's decision to move to an electronic attack system of systems, the EA-6B would be able to meet the defense suppression needs of the Navy until 2017 and those of the Marine Corps until 2025 if the aircraft were fitted with the ICAP-III electronic suite upgrade. Because the EA-18G's five critical technologies were not fully mature and posed a costly risk for design changes, GAO recommended that DOD consider outfitting additional EA-6Bs with the ICAP III suite, which would allow the Navy to slow EA-18G low rate production until its technologies become fully mature and functionality demonstrated.

The Navy and Marine Corps operate the EA-6B, which provides electronic attack support DOD-wide at this time. The EA-6B has been upgraded over time to increase its reactive jamming capability. The most important ongoing effort to the EA-6B is the ICAP-III electronic suite modification,

⁹[GAO-06-446](#).

which provides more rapid emitter detection, selective reactive jamming, and expanded coverage. The Navy has two squadrons currently deployed with ICAP-III and plans to equip a total of 15 of its EA-6Bs with the ICAP-III suite. The Navy plans to start decommissioning the EA-6B from its fleet starting in 2008 and retire all aircraft by 2013, replacing them with the new EA-18G that will provide electronic attack support to its carrier strike forces.

The Navy will start transferring aircraft to the Marine Corps in fiscal year 2010 and complete transfers in 2013 with delivery of the ICAP III aircraft. The Marines Corps planned to retire its EA-6Bs by 2015, but officials said plans could change depending on the transfer schedule and that they may need to keep these aircraft in the inventory longer depending on the JSF delivery schedule. The Marine Corps has not yet made firm plans for its future electronic attack capability and is considering employment of the JSF and unmanned aircraft systems. We note that the Marine Corps has requested a total of \$379 million in the fiscal year 2007 and 2008 global war on terror requests to upgrade an additional 18 EA-6Bs with the ICAP-III suite and for other modernization enhancements.

Table 18: EA-6B Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Procurement	0	0	0	0	0	0	0	0
Modifications	48.8	30.6	33.7	32.8	33.3	37.5	38.1	254.8
Supplemental								
RTD&E	0							0
Procurement	0							0
Modifications	178.6	200.7						379.3
Total	\$227.4	\$231.3	\$33.7	\$32.8	\$33.3	\$37.5	\$38.1	\$634.1

Source: DOD budget data.

Figure 17: AV-8B Harrier II



Source: DOD.

Date first deployed: January 1985

Current inventory: 134

Average age: 10.4 years

Mission

The AV-8B Harrier II is a short field take-off and vertical landing (STOVL) jet aircraft that deploys from naval ships, advanced bases, and expeditionary airfields. Its mission is to attack and destroy surface targets and escort friendly aircraft, day or night, under all weather conditions during expeditionary, joint or combined operations. The Harrier is responsible for conducting close air support, armed reconnaissance and air interdiction, offensive and defensive anti-air warfare, including combat air patrol, armed escort mission, and offensive missions against enemy ground-to-air defenses. The first Harrier squadron is expected to be replaced by the JSF starting in fiscal year 2011.

Program Status

The AV-8B, a more powerful and longer range model, than its predecessor the AV-8A, was introduced in 1985. The AV-8Bs were originally designed as day attack only aircraft, but some were later upgraded to add night attack and radar capabilities. The night attack and radar upgrades enhance the pilot's ability to locate and destroy targets under various weather

conditions and at night. Some of the AV-8Bs received an upgrade to enhance night attack with improved multimode radar in 1991-1992. Between 1994 and 2001, the majority of AV-8Bs were remanufactured with new fuselages to add structural life to the airframe and to accommodate the new radar upgrade.

Currently there are several on-going efforts to add capabilities and improve sustainment for the AV-8B until replaced by the JSF, including

- remanufacturing 5 old, day attack aircraft to receive the night attack capability and refurbishing 2 training aircraft;
- using a more accurate method to track the useful life of the aircraft; and
- continuing efforts to improve sustainment through a readiness management plan for the airframes and an engine life management plan.

The AV-8B was originally designed to last for 6,000 flying hours. This estimate was based on engineering fatigue projections on a 20 year service life, flying 300 hours per year, on very rigorous mission profiles. However, the aircraft have typically not been flown in such stressful flight envelopes and the Marines estimate they will be able to exceed the original 6,000 hour service life and maintain an additional 66 aircraft in service through 2015. In addition, the Marine Corps plans a set of modifications, largely unfunded, that would add important capabilities by 2012 or later to enable the Harriers to be more effective in future threat environments.

GAO Observations

The AV-8 aircraft was DOD's first STOVL system. The aircraft is costly to maintain and has a relatively high attrition rate. The Marine Corps has 134 AV-8Bs in its current fleet and plans to replace them all with STOVL JSFs by 2025. The new fuselages increased the estimated service for the AV-8Bs from 6,000 to 9,000 flight hours. Further, the AV-8Bs have not been used as vigorously as mission profiles used to project its useful life and officials believe that the fleet can remain in inventory well beyond the expected delivery dates of the JSF, if necessary.

Ongoing and planned modernization efforts are minimal. The Marines are upgrading five AV-8Bs that did not get previous upgrades so that they will now have the night attack capability, and refurbishing two training aircraft. In fiscal year 2007, the Marine Corps began repairs on four aircraft damaged during combat operations using supplemental funding. As another step to mitigate potential slips in JSF production, officials are also

**Appendix IV: A Summary of Tactical Aircraft
Systems Ongoing and Future Efforts**

increasing the amount of depot level maintenance on the AV-8B fleets to ensure sufficient numbers are available and capable. The Harrier is scheduled to remain in service until at least 2021, but its retirement is dependent upon the delivery of the JSF.

Table 19: AV-8B Fiscal Year 2008 Defense Budget (in millions of dollars)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
FY 2008 Budget								
RTD&E	\$21.7	\$17.4	\$26.3	\$14.8	\$12.5	\$12.7	\$12.9	\$118.1
Procurement	0	3.0	3.4	3.4	0	0	0	9.9
Modifications	57.5	37.5	51.7	37.3	29.2	23.0	22.6	258.8
Supplemental								
RTD&E	0	6.4						6.4
Procurement	0	0						0
Modifications	9.9	0						9.9
Total	\$89.9	\$64.3	\$81.4	\$55.5	\$41.7	\$35.7	\$35.5	\$403.1

Source: DOD budget data.

Appendix V: GAO Contacts and Staff Acknowledgements

GAO Contact

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