CBO PAPERS

BALANCE AND AFFORDABILITY OF THE FIGHTER AND ATTACK AIRCRAFT FLEETS OF THE DEPARTMENT OF DEFENSE

April 1992

CONGRESSIONAL BUDGET OFFICE
SECOND AND D STREETS, S.W.
WASHINGTON, D.C. 20515

Administration plans for modernizing the Air Force and Navy fighter and attack aircraft fleets are the subject of this Congressional Budget Office (CBO) analysis, performed at the request of the chairmen of two subcommittees of the House Armed Services Committee: the Chairman of the Subcommittee on Procurement and Military Nuclear Systems and the Chairman of the Subcommittee on Research and Development. Major findings and conclusions of the analysis were presented in testimony before a joint meeting of the subcommittees on April 29, 1992. Because the issues involved in the analysis are complex, CBO is also releasing this paper, which discusses our analysis in more detail. In keeping with CBO's charter to provide objective and nonpartisan analyses, the paper makes no recommendations.

Lane Pierrot prepared both the paper and the testimony under the general supervision of Robert F. Hale and R. William Thomas. William P. Myers performed the cost analysis. Steve Glazerman and Karen Watkins provided extensive analytical assistance. Michael Berger assisted in the analysis of naval aircraft and, with Marc Shachtman, in the latter stages of preparation. Paul Houts edited the testimony and the paper. Judith Cromwell prepared the testimony. Cynthia Cleveland prepared the paper for publication.

Robert D. Reischauer
Director

April 1992

CONTENTS

TABLES

FIGURES

SUMMARY AND INTRODUCTION

Air Force and Navy tactical aircraft are designed to destroy enemy aircraft in the air (the fighter mission) and to attack enemy targets on the ground (the attack mission). To carry out these key missions, the Air Force and the Navy today maintain about 5,300 tactical aircraft of nine different types. The Administration plans to create four new or modified types of aircraft over the next decade or so that would replace existing models.

This paper assesses likely future trends in the numbers, age, and cost of tactical aircraft in the Navy and Air Force. Trends under the Administration's plans for tactical aircraft are the focus of the analysis. The paper also notes some alternative approaches to the Administration's plan that are designed to hold down costs and restructure priorities.

Because the Administration has not always publicly stated its detailed plans, the paper makes assumptions about those plans. Wherever possible, those assumptions--referred to as the base case--reflect current Administration statements regarding the number of forces, how many new planes are to be bought, and when older aircraft are to be retired. The analysis examines the period from the present through the year 2010. The year 2010, while chosen arbitrarily, is far enough in the future to capture the effects of current plans for developing tactical aircraft.

Key Conclusions

Under the base-case assumptions for the Administration's plan, the number of tactical air units would decline, as announced by the Administration. Both the Air Force and the Navy should be able to meet their numerical requirements for aircraft for this smaller force. Aircraft fleets would, however, become older. By the year 2010, the average age of tactical fighter/attack aircraft in the Air Force would rise to 18.6 years compared with 8.5 years today. The average age of the Navy fleet would increase to 16.0 years compared with 10.3 years today.

Even though fleets would be smaller and older, the United States would enjoy overwhelming superiority in tactical aircraft over selected regional powers. U.S. forces would, for example, be about 17 times more capable than those of pre-war Iraq. These estimates are based on a scoring system that reflects the quantity and quality of U.S. and foreign weapons. The system does not, however, capture differences in training, logistics, tactics, and other factors that would influence the outcome of a battle.

Despite this good news, some important concerns arise from the Administration's plan. The plan will be affordable only under optimistic

assumptions about the future cost of new aircraft and the funds that are likely to be available to buy them between now and the year 2010. Under plausible though less optimistic assumptions, funding requirements for tactical aircraft could fall billions of dollars short of the funds that are likely to be available.

Also, a mismatch exists between the age of the aircraft performing various missions and the order in which the Administration plans to buy new types of aircraft for each mission. Indeed, the Administration is modernizing first the two categories of missions that are currently fulfilled by the youngest planes, and it is modernizing last the category that has the oldest planes. There are, of course, many criteria for assessing when aircraft need to be replaced. Age may, however, be an increasingly important criterion in a period when physical deterioration rather than enemy threats may be the most important factor in determining when new planes are bought. By the criterion of age, the Administration should reorder the sequence in which it buy its four new and modified aircraft.

These concerns suggest that some changes in the Administration's plan may be considered. This paper discusses general alternatives but does not analyze them in detail. Among the potential alternative approaches:

- Defer or stretch out aircraft programs;
- Accept a cheaper mix of aircraft;
- Reduce the number of tactical air units; and
- Realign procurement schedules to mesh with aircraft age.

KEY TYPES OF AIRCRAFT

Today, the Navy and the Air Force have approximately 5,300 tactical aircraft in their fleets. Included are nine different types of aircraft. The various types of planes can be divided into five broad categories, based on their primary missions:

- Fighter aircraft, which are designed to attack enemy planes;
- Medium-attack aircraft, which are designed primarily to bomb enemy targets on the ground at relatively long ranges;
- Short-range attack aircraft, which conduct short-range bombing;
- Close air-support aircraft, which are designed to attack enemy targets on the ground that are close to friendly forces; and

- Multirole aircraft, which include planes that can perform both fighter and attack missions.[1]

Existing fighter aircraft include the F-14 and the F-15 (Models A to D). Medium-attack planes include the A-6, F-111, F-15E, and F-117. The AV-8 provides short-range attack capability, while the A-10 aircraft is designed for close air support. Multirole aircraft include the F-16 and the F/A-18. Table 1 lists these various aircraft for reference; each one is described in more detail in Appendix A.

To replace the planes in today's inventories, the Administration also plans to buy or modify four aircraft: the F-22 fighter, the E/F version of the F/A-18, the AX or advanced attack aircraft, and the MRF or Multirole Fighter. These planes are particularly important in this paper because the aircraft will determine the size of future procurement budgets.

F-22 Fighter

Under current Administration plans, the F-22 aircraft and the E/F version of the F/A-18 will be the first of the four new aircraft to enter production. The F-22 is intended to be a highly capable fighter aircraft that will eventually replace the F-15 aircraft (A to D models) as the Air Force's top-of-the-line fighter. The plane was called the Advanced Tactical Fighter until April 23, 1991. On that day the Air Force announced the selection of the YF-22 prototype (built by a consortium of Lockheed, General Dynamics, and Boeing) as the winning entry in the competition to build the new fighter.[2]

F-22 aircraft are designed to have stealth--that is, they are designed to be difficult to detect using a variety of sensors including radar and infrared or heat detectors. F-22s are also expected to have the ability to accelerate to, and cruise at, supersonic speeds without having to rely on the extra power of an afterburner. This capability, which the Air Force terms "supercruise," greatly increases the time the aircraft can fly at supersonic speeds by minimizing the reliance on afterburners, which make inefficient use of fuel. The supercruise technology would also help increase the F-22's range and might enable the plane to carry more weapons. Finally, compared with

---

1. Aircraft are typically categorized by their primary missions. But most fighters have some bombing capacity, and bombers with cannons may be able to attack targets in the air.

2. The YF-22 prototype won out over the YF-23 prototype developed by Northrop and McDonnell Douglas.

TABLE 1. SELECTED FIGHTER/ATTACK AIRCRAFT IN THE AIR FORCE, NAVY, AND MARINE CORPS

Type of Aircraft	Major Mission/ Service	Comments/ Major Mission	Replacement/ Replaces
		Aircraft Currently Fielded	
		Air Force	
A-10	Close air support	Short-range bomber	Variation of the F-16 (in part)
F-15A-D	Fighter	Current premier fighter	F-22
F-15E	Deep interdiction[a]	F-15 medium-range bomber	AX
F-16	Multirole	Lower-capability fighter/bomber	Multirole fighter (MRF)
F-111	Deep interdiction	Longest-range AF tactical bomber	AX
F-117	Interdiction	Short- to medium-range stealth bomber	Possibly AX
		Navy/Marine Corps	
A-6	Medium attack[a]	Navy's longest-range tactical bomber	AX
AV-8	Close air support	Marine Corps' vertical take-off bomber	Uncertain
F-14A	Fighter	Navy's premier fighter	F/A-18E/F
F/A-18A-D	Multirole	Navy's lower-capability fighter/bomber	F/A-18E/F
		Future Aircraft	
F/A-18E/F	Navy	Multirole	F/A-18s and F-14s
F-22	Air Force	Fighter	F-15A-D
AX	Navy/Air Force	Medium attack/interdiction	A-6, F-15E, F-111, F-117
MRF	Air Force	Multirole	F-16

SOURCE: Congressional Budget Office.

a. The Navy designates the mission of bombing targets at relatively long-range as "medium attack." The Air Force calls a similar mission "deep interdiction."

previous generations of aircraft, the F-22 will have more highly integrated avionics, thus providing more information while also reducing the pilot's workload.

The first F-22s are scheduled to be bought in 1996 and fielded around 2000. The Air Force plans to buy 650 F-22s through 2012 at a rate of about 48 per year.

The F-22 program will be costly. According to current estimates, funding for development will total about $20 billion. If the Air Force buys 650 planes, procurement costs for the fighter will total more than $50 billion and each F-

22 will cost about $80 million on average. This figure of 650 is a reduction from last year's plan, which envisioned production of about 750 F-22s for the Air Force.

Until last year the Navy planned to buy a version of the F-22, called the Navy Advanced Tactical Fighter or NATF, to replace F-14s and provide fighter capability on aircraft carriers. But the Navy canceled the NATF program and announced that the E/F version of the F/A-18 would perform this role on carriers after the existing F-14s retire.

F/A-18E/F Multirole Aircraft

The E/F version of the F/A-18 aircraft will still be a multirole aircraft, but it is expected to be heavier and more sophisticated than the current C/D version. As older F-14 and F/A-18 aircraft retire, the E/F version will fulfill an increasing share of the Navy's fighter and attack missions.

Compared with the C/D version, the Navy wants the E/F version of the F/A-18 to have substantially increased capability. It is to be bigger than the current C/D version and about 25 percent heavier. The extra size will permit the E/F version to carry a given load of weapons for a longer distance, which is important in some naval missions. The longer range will also allow aircraft carriers to operate farther from shore, which reduces threats posed by enemy forces ashore. The E/F version will feature a more powerful engine. The engine will maintain the speed and maneuverability of the heavier aircraft and so permit the modified plane to engage enemy aircraft even at long distances from an aircraft carrier.

Press reports suggest that the Navy is considering adding to the sophistication of the E/F version. Additional requirements could include improved stealth and enhanced avionics. Because the E/F versions may be in the fleet for 30 years or more, the Navy also wants the plane to be designed so that it has substantial space built in for improvements that might have to be made later in its long service life.

In part because of these prospective changes, the Navy's plans for the F/A-18 are less well-defined than are the Air Force's plans for the F-22. The Navy plans to begin procurement of the E/F model in 1997. The service plans to buy about 1,000 E/F models, both to replace the F-14s (about 400 to 500 planes) and to replace earlier model F/A-18s. Estimates of the program's costs are uncertain. But the E/F version might cost about $5 billion to develop and $55 billion to $75 billion to buy the planes the Navy wants.

AX Medium-Attack Aircraft

The Navy's AX will be a medium-attack aircraft that is expected to replace the aging A-6 aircraft in that mission. The AX is expected to have substantial stealth capability and to be able to carry a large number of a variety of weapons over relatively long distances. The AX is also expected to have some capability to destroy enemy aircraft, though its fighter capability may be modest. The AX is being developed as a replacement for the A-12 aircraft, which was canceled by Defense Secretary Dick Cheney in January 1991 because of uncertainty about costs and schedules.

Plans for the AX aircraft are less well-defined than those for the E/F version of the F/A-18. Nevertheless, some information is available. Last fall the Navy released a request to industry to provide proposals for the design of the AX aircraft.

The Air Force may also buy the AX, but its plans are even less well-developed than the Navy's. The Air Force might buy about 400 of the planes to replace its medium-attack planes, which include the aging F-111 aircraft as well as the newer F-117 and F-15E planes. This plan appears to be a change from last year, when the Air Force apparently intended to buy a version of the F-22 to replace its medium-attack aircraft. Even if the Air Force selects the AX, procurement of an Air Force version of the plane would probably not begin until 2010 or beyond.

Multirole Fighter

Last year, the Air Force announced its plan to develop a new Multirole Fighter as an eventual replacement for the F-16 aircraft. Of the four planes that are definitely being developed, this one would probably enter production last, presumably sometime early in the next century. This schedule would be consistent with charts provided by the Air Force in testimony before the Congress in last year's budget debate. Those charts showed funding for the MRF increasing sharply toward the middle of the next decade. This timing for the MRF would also would be consistent with the period when a number of F-16 aircraft will reach the end of their service lives.

Because it is a new program, much less is known about the cost and design of the MRF than the F-22. Presumably, the MRF will be relatively less capable and less expensive than the F-22. But the Air Force is still debating fundamental issues, such as whether the plane should be a totally new aircraft or a variation of an existing plane. Press reports suggest that a

two-phase MRF program is being considered. During the earlier phase, the Air Force would buy a modified version of an existing plane, such as the F-16. In the meanwhile, the service would develop a new plane, which would enter production after purchase of the F-22 is complete. The MRF is to go through its initial program review this summer. Thus, Air Force plans on the MRF may be clearer by the time of next year's budget debate.

The Air Force has stated that it wants to hold down the cost of the MRF aircraft so the plane can eventually be purchased in substantial numbers. A number of service spokesmen have suggested that a price much in excess of $25 million to $35 million apiece would be unaffordable. If these goals are to be achieved, the Air Force will probably have to modify an existing aircraft. At least in the past, new aircraft designs have led to substantial cost increases that would push the cost of a brand new MRF well above the Air Force's goals.

Other Future Aircraft

At least one other aircraft program may be included in the Administration's long-range plans for fighter and attack aircraft. As of two years ago, the Navy had plans for a new Short Take Off/Vertical Landing (STOVL) aircraft, which would replace the AV-8 Harrier. The Navy suggested that the STOVL would be a long-term replacement not only for the Harrier but also for some of the F/A-18s, perhaps those the Marine Corps currently operates.

Plans for the STOVL apparently exist. On March 25, 1992, the Defense Advanced Research Projects Agency released a request for a proposal to evaluate the technology involved in this development effort. The Congressional Budget Office (CBO) has not, however, included the STOVL in this paper's detailed analyses because service goals are even less clear for this plane.

DEFINING A BASE CASE

Will current Administration plans for these various aircraft meet projected requirements? How old will U.S. inventories become? How much will tactical aircraft cost to buy under the Administration's plan? The answers to these questions depend on the number and types of aircraft that the Administration will buy. The answers also depend on other factors, such as the specific year when procurement of new aircraft begins and the number of forces that are to be maintained.

As the preceding discussion suggests, Navy and Air Force plans are often unclear, which may be understandable in a period when U.S. national security requirements are being redefined. Nevertheless, enough information is available to characterize, at least broadly, the likely effects of current Administration plans.

In order to assess probable trends, this paper creates a base case that makes specific assumptions about the size of forces and the size and timing of future procurements. Wherever possible, these assumptions are based on statements the Administration has made about its current plans.

Forces

This paper assumes that the number and types of tactical air units will gradually decrease to the level in the Administration's plan for 1995--a level the Administration terms its "base force"--and then will remain at the base-force level through 2010. This assumption is consistent with statements by Defense Secretary Cheney and General Colin Powell, the Chairman of the Joint Chiefs of Staff. Both leaders have stated that the units in the base force represent the minimum level of military forces necessary to meet future U.S. security requirements.

Under the base force, the Air Force maintains 26 wings of tactical fighter aircraft. Of these 26 wings, 15 will be manned by active-duty personnel and 11 will be manned by part-time personnel in the selected reserves. In addition, the Air Force will maintain several more wings of planes dedicated to the mission of intercepting bomber threats to the Continental United States.

Tactical air forces in the Navy are assumed to include 13 wings based on aircraft carriers. Of these, 11 wings are in the active forces and two in the reserves. In addition, Marine Corps forces are assumed to include four wings, three manned by active personnel and one by reserves.

The analysis in this paper also assumes that the services will pursue their current goals regarding the composition of their fleets. The Navy, for example, plans to eliminate from its carrier-based air wings the F-14 aircraft that are dedicated primarily to the fighter mission. Instead, the wings will include multirole F/A-18 aircraft that can carry out both attack and fighter missions.

Procurement

The base case in this paper also makes specific assumptions about future procurement plans for the four new tactical aircraft that are envisioned under the Administration's plan. In the case of the Air Force's new F-22 fighter, the assumptions are based on detailed plans the Air Force provided to CBO. These plans call for procurement of the F-22 to begin in 1996, with annual procurement reaching 48 planes a year in 2001 (see Tables 2 and 3). Detailed plans were not provided for the Multirole Fighter. The plan assumed in Table 3 is based on Air Force briefings given to CBO last year and on informal discussions with Air Force personnel. According to that information, the MRF would begin procurement in 2002 and would increase to a rate of 48 aircraft a year by 2005. One recent press report suggested that the Air Force is considering buying only 24 aircraft a year, but such a small buy would not be adequate to sustain the planned base force. Indeed, even the annual buy of 48 aircraft assumed in this paper is substantially lower than what would be required to replace all the F-16s retiring from the fleet.

The Navy has provided CBO with its plans regarding purchases of the F/A-18 aircraft. The Navy plans to buy between 48 and 72 of these aircraft a year in future years, with procurement beginning in 1997. The assumptions are reflected in Tables 2 and 3. The Navy also produced tentative plans for procuring the AX attack aircraft. These plans suggest the service expects to begin AX procurement in 2001, to buy about 18 of the planes per year at least

TABLE 2. NEW AND MODIFIED AIRCRAFT PURCHASED UNDER BASE-CASE ASSUMPTIONS ABOUT ADMINISTRATION'S PLAN DURING THE 1993-1997 PERIOD

Type of Aircraft	1993	1994	1995	1996	1997
F-22	0	0	0	4	4
Multirole Fighter	0	0	0	0	0
F/A-18 E/F	0	0	0	0	12
AX	0	0	0	0	0

SOURCE: Congressional Budget Office estimates from Department of Defense and Navy data.

through 2010, and to buy about 1,000 of the planes to replace its A-6 aircraft and the Air Force's medium-attack aircraft. These estimates represent changes from last year's plans. Last fall the Navy issued a request to potential contractors to provide concept proposals that instructed contractors to assume that about 575 AX aircraft would be bought beginning in 2001. The contractors were directed to assume production rates would be no higher than 36 planes a year.

Effects of Changes in Assumptions

As U.S. security requirements are redefined during the post-Cold War period, some of these base-case assumptions about the Administration's plans will no doubt change. Small deviations from the base-case assumptions will not, however, fundamentally alter the prospects and problems outlined in this paper. If, for example, the Air Force or Navy modestly reduces the size of a planned purchase of aircraft, or delays by a year or so the beginning of procurement, the basic conclusions will not change. Similar modest changes in planned retirement ages, which the services regularly impose during their detailed planning process, will not significantly alter the trends. In a period of rapidly changing requirements, it is important to be roughly right, even at the risk of being exactly wrong. The base-case assumptions in this paper should permit conclusions about the current Administration's plan that are roughly right.

TABLE 3. NEW AND MODIFIED AIRCRAFT PURCHASED UNDER BASE CASE FOR THE PERIOD BEYOND 1997

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total 1998-2010
F-22	12	24	36	48	48	48	48	48	48	48	48	48	48	552
Multirole Fighter	0	0	0	0	12	24	36	48	48	48	48	48	48	360
F/A-18E/F	12	18	30	48	48	48	48	48	48	72	72	72	72	636
AX	0	0	0	6	12	18	18	18	18	18	18	18	18	162

SOURCE: Congressional Budget Office from Air Force and Navy data.

MEETING NUMERICAL REQUIREMENTS

Under the assumptions of this base case, CBO's analysis suggests that both the Air Force and the Navy should be able to meet most of their numerical requirements for fighter and attack aircraft. (The services have a number of tactical planes that perform other missions, such as planes that attack enemy submarines, which are not included in this analysis.) Meeting numerical requirements will, however, result in substantial aging of the aircraft fleets in both services.

Air Force Aircraft

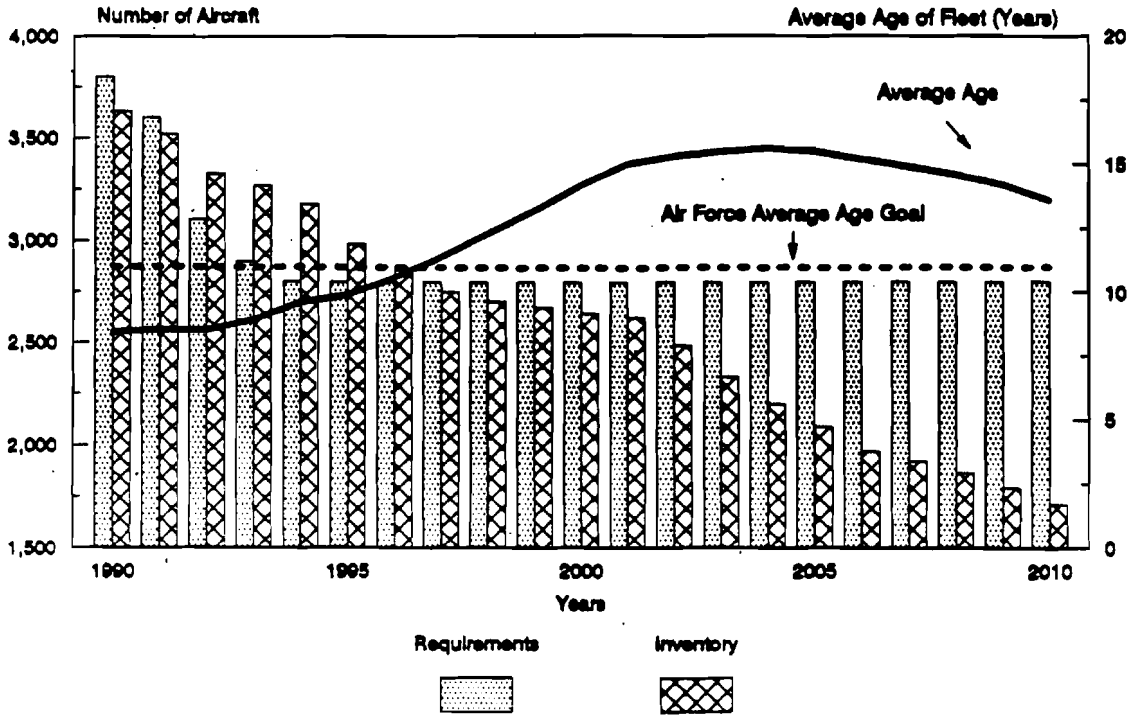
The ability to meet numerical requirements depends both on the size of the requirements and on projections of the size of the likely inventory of fighter and attack aircraft.

Requirements. CBO estimates that Air Force requirements for fighter and attack aircraft will decline from about 3,800 planes in 1990 to about 2,800 planes by 1995 (see Figures 1 and 2). After 1995, requirements should remain at this level through 2010, the last year analyzed in this paper.

The decline in requirements through 1995 reflects the drop from the 1990 level of about 35 air wings to about 26 wings by 1995. This decline will occur as the Air Force moves toward the Administration's planned base force. In addition to the 26 wings, CBO assumes that the Air Force, as it has in the past, will maintain several wings of aircraft to defend the Continental United States against attack by bombers. The Air Force has not announced plans to eliminate its interceptor wings, and CBO's projections assume that the interceptor wings are maintained. In the past, the Air Force has also had requirements for aircraft used for reconnaissance and electronic warfare. Over the long term, the service apparently intends to eliminate planes with a dedicated reconnaissance or electronic warfare mission in favor of equipping combat aircraft with specialized gear (contained in pods) that permit them to perform these missions. Thus, CBO's projections assume no separate requirements for those types of aircraft.

FIGURE 1. AIR FORCE INVENTORY, REQUIREMENTS, AND AVERAGE AGE

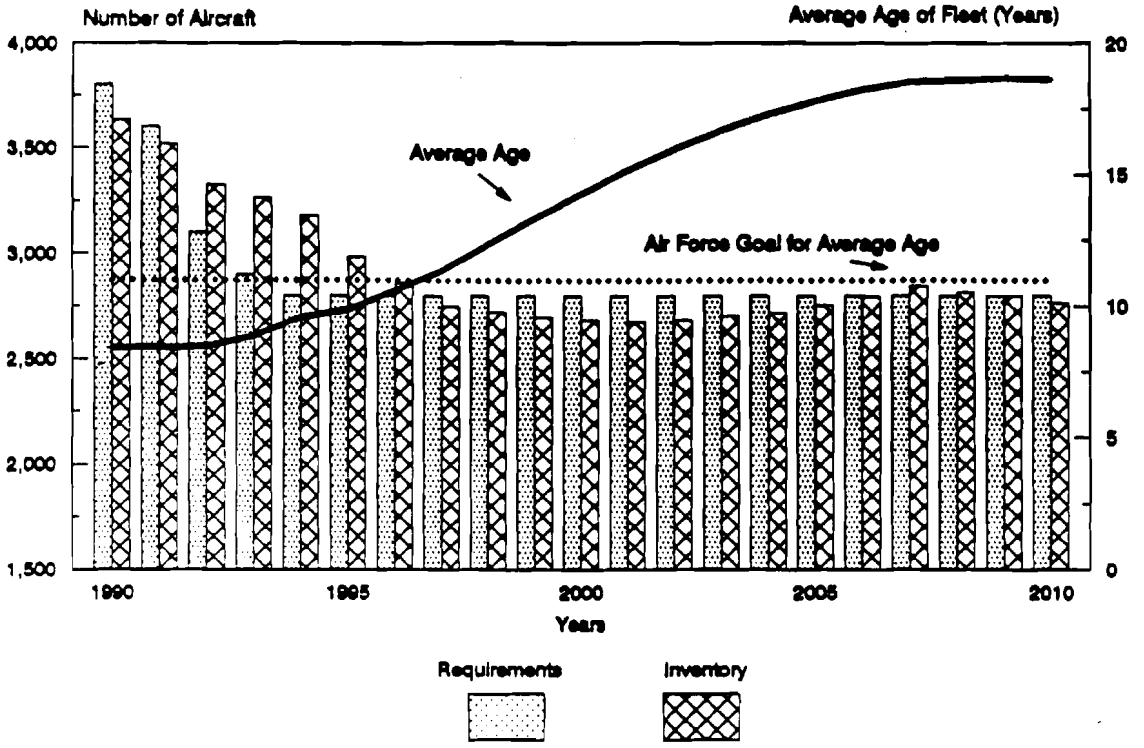
(Assumes Aircraft Are Retired After 22 Years)



SOURCE: Congressional Budget Office estimates from Department of Defense and Air Force data.

FIGURE 2. AIR FORCE INVENTORY, REQUIREMENTS, AND AVERAGE AGE

(Assumes Aircraft Are Retained to Meet Requirements – About 28 Years)



SOURCE: Congressional Budget Office estimates from Department of Defense and Air Force data.

CBO's estimates of requirements are also based on Air Force assumptions about the number of planes in each wing. The Air Force estimates that it needs about 100 planes in inventory for each wing: 72 combat aircraft plus 28 additional planes to provide combat trainers and to permit some aircraft to undergo periodic maintenance.[3]

Meeting Requirements. Whether the Air Force meets these requirements depends on trends in the inventory of its fighter and attack aircraft. CBO assumed that Air Force inventories would decline sharply through 1997 as more than 1,000 planes are retired to reflect reduced requirements.

After 1997, the size of the inventory depends in part on how many new planes are bought. The analysis in this section assumes that new procurement reflects the base-case assumptions in Tables 2 and 3. The size of the Air Force inventory also depends critically on how long the Air Force keeps planes in the fleet.

The Air Force could decide to continue its past policy, which called for retiring most fighter and attack aircraft after 22 years of service. This assumed age would be consistent with most of the service's recent testimony before the Congress. In that testimony, the Air Force suggested that it wants its fleet of fighter and attack fleet to have an average age of about 11 years. That goal implies that, if planes are evenly distributed by age, the service should retire its planes after 22 years of service.

If it retires aircraft after 22 years of service, the Air Force will fall short of its requirements for planes. Shortfalls would begin around 1997 and would grow sharply thereafter. By 2005, the Air Force could meet only 75 percent of its requirements. By 2010, it could meet only 60 percent. Looked at another way, unless many more planes are bought, the Air Force could maintain a fleet of only about 15 tactical fighter wings by 2010 if it chooses to retire its planes after 22 years of service.

These shortfalls could all be avoided, without buying more aircraft, if the Air Force elects to retain planes longer. CBO estimates that the service could meet almost all of its requirements if it maintains its planes in the inventory until they have about 28 years of service rather than retiring them after 22 years.

---

3. The Air Force is planning on establishing some wings that it calls composite wings that would contain a number of different types of aircraft, resembling Navy wings described below. When these wings are established, the service's fighter/attack requirements will depend on the composition of the wings in addition to their number. The Air Force plans for these wings are apparently not sufficiently well-developed to be provided to the Congress.

Keeping planes longer would lead to a significantly older fleet. Today, the Air Force fleet of fighter and attack aircraft has an average age of about eight years. By 1997, the fleet will reach and begin to exceed the Air Force goal of 11 years. Even if the service retired planes at 22 years of service, thereby accepting a considerably smaller fleet, average age would continue to grow and would reach a peak of almost 16 years around 2004. If the Air Force decides to meet its numerical requirements by retiring aircraft after 28 years of service, then the average age of its fleet will eventually exceed 18 years, about 60 percent above the service's goal of 11 years.

Effects of an Older Fleet. A sharply older fleet could lead to problems. For example, maintenance costs could rise as aircraft age. There is little evidence of this phenomenon in connection with the current fleet, but the Air Force has never operated a fleet with an average age anywhere near 18 years. Also, aircraft in a much older fleet would have been designed decades earlier. Thus, technological obsolescence--that is, the possibility that other countries will develop or buy aircraft that will exceed ours in capability--would be a concern.

The Air Force may, however, find an older fleet acceptable. Through periodic maintenance and modifications, the services can and do keep planes flying for longer than 22 or even 28 years. For example, B-52G bombers averaged about 31 years of age in 1991. Some transport planes are even older. Even certain types of fighter and attack aircraft, such as F-111 planes, have been operated into their twenties. For these aircraft, the Air Force has apparently overcome maintenance problems associated with aging.

Moreover, maintenance problems associated with aging should be more closely linked to the number of hours flown than to chronological age. Thus, the problems should be lessened if the reduction in threats to U.S. security permits the services to fly their aircraft for fewer hours each year. For example, the Air Force might be able to reduce hours flown if it retains some of the relatively young aircraft, which would otherwise be retired during the next few years as the number of wings is reduced, and then flies each plane in the larger fleet for fewer hours. The Air Force might also be able to store some of the excess planes in today's inventory and bring them out later when inventories are tight. Both these approaches could add to operating costs. The changes might, however, permit the Air Force to maintain acceptable levels of capability with an older fleet and so hold down procurement costs.

Trends in world events may also reduce concerns about technological obsolescence that, in the past, may have accompanied an aging fleet. Given the breakup of the Soviet Union, and the paucity of other countries with the capacity to develop aircraft that are more capable than current U.S. planes,

the Air Force may be less concerned about this aspect of aging. Moreover, as the next major section in this paper shows, the United States currently enjoys overwhelming superiority over selected regional powers in terms of the capability of its tactical aircraft. Thus, the United States is not in immediate jeopardy of losing its edge over potential adversaries.

Navy Aircraft

Like the Air Force, the Navy should be able to meet most of its requirements for fighter and attack aircraft.

Requirements. The Navy's requirements for fighter and attack aircraft should fall from about 2,000 aircraft in 1990 to about 1,700 aircraft in 1993 (see Figure 3). After 1993, requirements will increase slightly as a result of changes in the composition of reserve wings. By 1995, requirements will have reached a level of about 1,750 planes. They should remain at that level throughout the period of this analysis.

Requirements depend in part on the number of wings to be maintained. Under the Administration's base-force plan, the number of wings will decline from 15 wings in 1990 (13 active and two reserve wings) to 13 wings (11 active and two reserve wings) in 1995. In addition, the Marine Corps will maintain four wings of aircraft.

The composition of these wings also determines the number of the Navy's requirements. The Navy's carrier-based wings are assumed to contain 56 to 60 fighter and attack aircraft. The Marine Corps requires about 130 fighter and attack aircraft in each of its wings. Included in this figure are the F/A-18 aircraft that would be transported to war on the decks of aircraft carriers as well as AV-8s that are typically transported on the amphibious ships the Navy uses to lift Marines and their equipment to combat.[4]

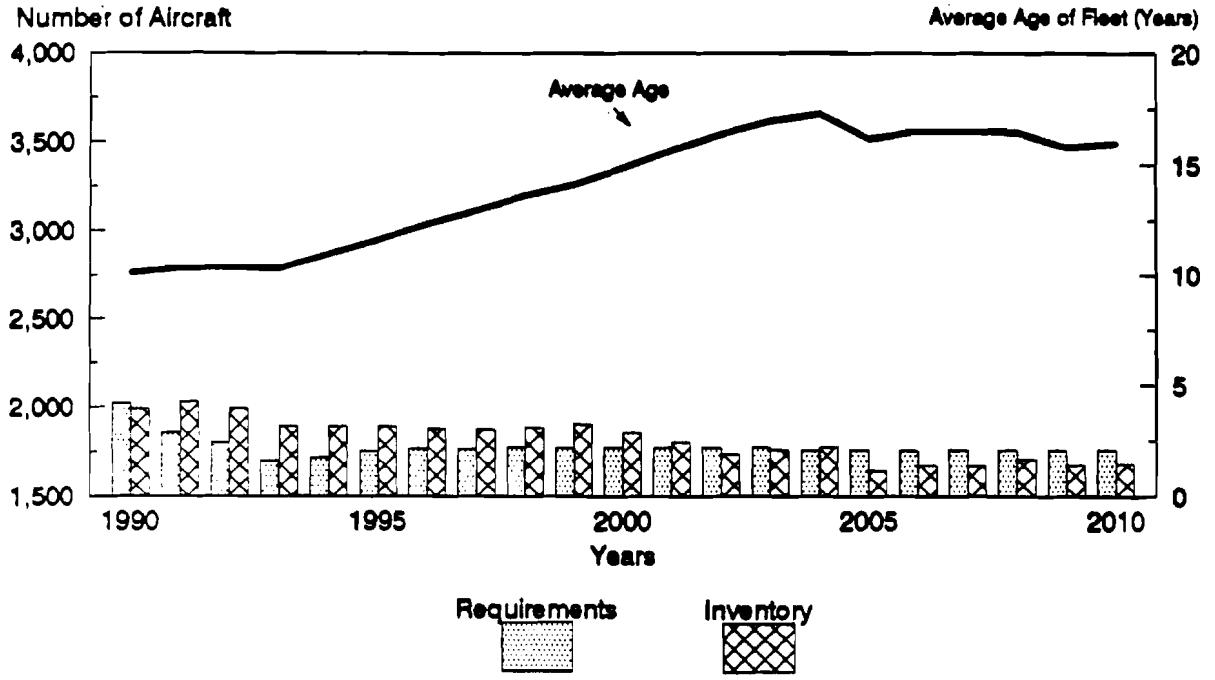
Meeting Requirements. If the Navy buys aircraft in the numbers associated with the base-case assumptions in this paper, the service should be able to meet its requirements for aircraft throughout this decade and for most of the

---

4. This figure for the number of fighter and attack aircraft in Marine Corps wings was taken from Secretary of Defense Dick Cheney, *Annual Report to the President and the Congress* (February 1992). It includes 10 A-6 aircraft in each Marine Corps wing. The Marines apparently plan to use F/A-18s instead of A-6s in future forces. CBO's assumption reflects this change.

FIGURE 3. NAVY INVENTORY, REQUIREMENTS, AND AVERAGE AGE

(Assumes Aircraft Are Retained to Meet Requirements)



SOURCE: Congressional Budget Office estimates from Department of Defense and Navy data.

next decade (see Figure 3).[5] In contrast to the Air Force, the Navy has not specified a particular age at which it plans to retire its planes. These projections assume that the Navy maintains older aircraft in the fleet until they are replaced by a new plane. Thus, by assumption, inventories match requirements in most years. Only in a few years during the latter part of the next decade are there shortfalls. Those shortfalls occur because peacetime accidents will reduce the inventories of certain types of aircraft (principally the AV-8) for which no replacements are being bought.

Keeping planes until they are replaced means that the Navy could be retiring its older planes at quite venerable ages. Those ages might range from about 25 years for the F/A-18 aircraft to more than 40 years for the A-6 aircraft. Those ages are older, in some cases much older, than the retirement ages provided to CBO by the Navy as background for an earlier study. For example, in that earlier study, the Navy estimated that A-6 aircraft would leave the fleet after about 30 years of service.

Because the Navy would be retaining aircraft longer, the average age of its fleet would rise under these assumptions about retirements, from about 10 years today to more than 17 years by the middle of the next decade. Average age will then begin to fall as the AX aircraft begin to enter the fleet and will equal about 16 years by 2010.

The Navy would probably have many of the same concerns about this increasing average age that were discussed above in connection with the Air Force, including concerns about rising maintenance costs and technological obsolescence. The Navy may also have some unique problems. Age may be of particular concern for those Navy aircraft that regularly undergo the stress of taking off and landing on aircraft carriers. It may be particularly difficult for the Navy to retain the A-6 aircraft for the 40 years of age or more they would attain if they remain in the fleet until replacements are available. It is not at all clear that the Navy could operate carrier-based aircraft for that long a period. Thus, for certain types of planes, the Navy may either have to accept shortfalls or find the funds to buy replacements more rapidly than is assumed in the base-case assumptions for the Administration's plan.

For many types of aircraft, however, the Navy may be able to tolerate increases in average age. In the past, the service has frequently extended the

---

5. These results are contrary to some presented in past years by CBO and other analysts. Those earlier results showed that the Navy would be short of aircraft needed to meet its requirements. Several factors have led to this change in outlook. The Navy has reduced the planned size of its force (from 15 wings in past years to 13 wings under the base force). Also, compared with past plans, the current Navy plan anticipates the purchase of a larger of number of relatively less expensive F/A-18 aircraft. But the primary change is that CBO assumes that the Navy will retain aircraft longer to keep inventories in line with requirements.

planned service lives of its aircraft and may be able to do so again. Also, in a period of reduced threats to U.S. security, the Navy may be able to fly its aircraft for fewer hours each year, thereby permitting them to remain in service for more years. Finally, the technological obsolescence that is associated with aging may not be of as much concern now as it was in the past.

TACTICAL AIRCRAFT AND THREATS TO U.S. SECURITY

Even with reduced numbers of units, and despite the aging of its aircraft, the U.S. fleet of tactical aircraft will enjoy overwhelming superiority over most potential adversaries. (In this paper, the term tactical aircraft and the terms fighter and attack aircraft are used synonymously, though typically a number of aircraft that perform other missions are included in the category of tactical aircraft.) That conclusion is based on an analysis of capability that takes into account both the quantity and the quality of aircraft.

A Method for Analyzing Capability

CBO's estimates of capability are based on a Technique for Assessing Comparative Force Modernization (TASCFORM), a methodology for analyzing the capability of military forces that was developed by The Analytic Sciences Corporation for the Office of Net Assessment in the Department of Defense (DoD).[6] TASCFORM provides a quantitative estimate of the relative capabilities of different weapons systems and military forces and projects how those relative capabilities will change over time. TASCFORM scores change because the methodology assumes that as weapons age they lose capability compared with more modern weapons.

TASCFORM assigns a quantitative score for types of weapons based on the characteristics of those weapons. The scores are based on the assessments of military officers as well as assessments by intelligence analysts and other military analysts. The scores take into account how well weapons perform different missions, such as air-to-air and air-to-ground combat for aircraft. Characteristics of the weapons themselves, such as the reliability of the planes' mechanical systems, are also taken into account. Relative capabilities for entire forces are obtained by totaling the scores of all the weapons in those forces. TASCFORM measures for an entire air force can be derived by

6. *The TASCFORM Methodology: A Technique for Assessing Comparative Force Modernization* (Arlington, Va.: The Analytic Sciences Corporation, July 1991).

multiplying the number of a particular type of aircraft by its appropriate TASCFORM score and summing the scores for all types of planes.

The scores in this section are based on numbers of U.S. aircraft that will be available in 1997, after all of the reductions planned by the Administration have been carried out. Except where noted, scores for foreign countries are based on forces currently available.

The TASCFORM scores are best viewed as an indicator of the combat potential of weapons in the various forces. The scores cannot predict the outcomes of battles because a number of factors that are crucial to success in combat are not reflected in the scores. These factors include the quality and training of pilots who operate the aircraft, the capabilities of communications equipment, appropriate war-fighting strategy and tactics, and the ability of logistics forces to support personnel and maintain weapons.[7] The scores also cannot predict a number of other factors that determine combat outcomes such as luck, leadership, and morale.

Capability Compared with Selected Regional Powers

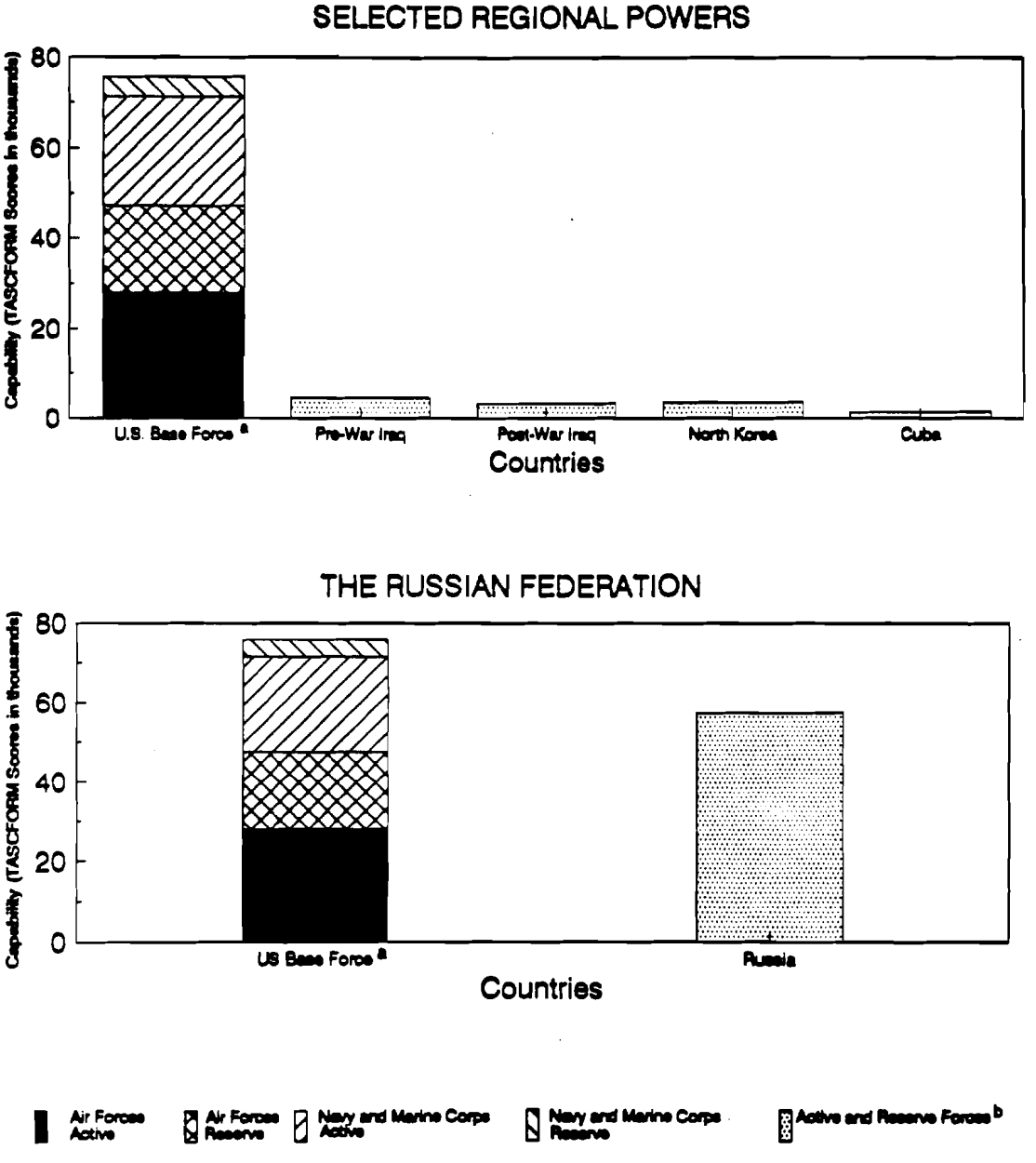
CBO has compared the total capability of all the tactical aircraft in the U.S. Air Force and Navy with the tactical fleets of three countries: post-war Iraq, North Korea, and Cuba. These countries illustrate the capability of countries that might become involved in future regional conflicts. U.S. capability is also compared with that of pre-war Iraq, which serves as a proxy for a major Middle Eastern power that could emerge in future years.

The TASCFORM scores suggest that U.S. fighter and attack forces would enjoy overwhelming superiority over these selected regional powers (see Figure 4). The tactical air capability of the United States would be about 10 times as large as the capability of pre-war Iraq. U.S. forces would be about 22 times more capable than the forces of North Korea, 24 times more capable than those of post-war Iraq, and 56 times more capable than the forces of Cuba's tactical air fleet.

The Air Force accounts for about two-thirds of the total U.S. capability that is reflected in these comparisons. Tactical aircraft in the Navy (including

7. The Analytic Sciences Corporation has developed models that attempt to quantify some of these factors, but CBO has not used them in this analysis because they entail more subjective judgements.

FIGURE 4. COMPARISON OF THE CAPABILITY OF U.S. TACTICAL AIRCRAFT TO THE TACTICAL AIRCRAFT CAPABILITIES OF OTHER COUNTRIES



SOURCE: Congressional Budget Office estimates from data from The Military Balance, (London: International Institute for Strategic Studies, various years); The Analytic Sciences Corporation; U.S. Air Force; U.S. Navy.

a. U.S. Base Force estimated from 1997 inventories and 1997 TASCFORM scores.
b. Sources provide insufficient detail to break out active and reserve forces.

those in the Marine Corps) account for the remaining third. As was noted above, these scores assume that all the planned reductions associated with the base force have been carried out.

These comparisons are based on several assumptions that may understate U.S. capability. The comparisons do not assume the participation of any U.S. allies because of the difficulty in determining which allied forces to include. Especially against North Korea, this assumption no doubt understates the total allied capability. Moreover, the TASCFORM scores used to arrive at these comparisons do not account for training and tactics. Most analysts believe that, compared with the forces of potential regional adversaries, U.S. units would be better supplied and would have pilots that are much better trained. These factors, particularly the superior training, could add substantially to the U.S. advantage.

Capability Against an Illustrative Larger Threat

How would this country's forces fare if some large country eventually built up a military capability? One way to shed light on that question is to compare the capability of the planned U.S. base force with the capability of the Russian republic. That comparison might be relevant if the Russian republic emerged as a major military power. Both the United States and Russia have expressed a strong desire to improve relations. Nevertheless, the Russian republic still possesses many weapons. A dictatorial government could conceivably seize power and gain control of these weapons. Any such attempt would entail obvious actions that would give the United States and its allies substantial warning. Moreover, such a step might also lead to civil war, which could destroy some or even most of the weapons. Until the weapons are destroyed or disabled, however, it seems prudent to consider their capabilities.

U.S. forces would be about 30 percent more capable than the tactical air forces the Russian republic might retain. The score for the Russian republic assumes that Russia acquires the planes owned by the former Soviet Union that were located in Germany and Poland. The Russian score also assumes that the republic receives all planes that were under central strategic control in the strategic interceptor mission and all the planes associated with naval aviation. Russia and the Ukraine are currently arguing about ownership of naval forces in the Black Sea fleet, presumably including some naval aircraft as well as ships. The outcome of this dispute will determine whether the assumption about Russia's receiving all Navy planes is reasonable.

Implications for the Administration's Base Force

The U.S. advantage against regional powers, and against larger threats with the capability of the Russian republic, does not necessarily mean that the Administration's planned air forces are too large. Nor does it necessarily mean that the Administration's planned program of modernization is unnecessary. Factors other than these balances may argue for the Administration's plan.

Modernizing U.S. forces may be necessary to maintain the overwhelming superiority over potential adversaries. The balance of forces, as shown in Figure 4, reflects the current capability of regional powers. During the next decade or so, however, those nations may purchase new weapons, perhaps from the republics that were part of the former Soviet Union. These new weapons could permit them to modernize their tactical air forces and improve their capability. If the United States is to maintain its superiority, it might have to respond with a modernization program of its own.

The Administration might also argue that it needs to maintain the overwhelming military superiority suggested in Figure 4 in order to minimize the loss of American lives in any future conflict. With heavy superiority, the United States can avoid engaging in slow attrition warfare that risks the loss of American lives and instead devastate an opponent quickly, as it did during Operation Desert Storm.

The Administration's plans for deterring or prosecuting future regional conflicts may also require a large number of tactical air units. The United States might elect not to deploy all of its air and ground forces in regional conflicts, but rather to withhold some substantial portion in case other contingencies arise simultaneously. General Colin Powell has also argued that the United States needs all the units inherent in the planned base force in order to sustain a substantial overseas presence without requiring that U.S. personnel spend an inordinate amount of time overseas.

These arguments notwithstanding, the U.S. tactical air forces do have a substantial margin of superiority over potential foes, both in terms of number and modernization. For example, in the Persian Gulf War, the United States deployed the equivalent of about eight Air Force wings. (In this calculation, each wing is assumed to have 72 combat-ready aircraft.) Even after reductions reach the level of the base force, the total number of Air Force wings will be about three times that size. Even excluding reserve forces, which might not all be called to active duty, the number available under the base force would still be about twice the level deployed during Operation

Desert Storm. U.S. forces are also obviously better equipped and much better trained than are the forces of most or all regional powers.

These arguments suggest that the United States currently enjoys a substantial margin of superiority in the capability of its tactical aircraft. Thus, if it chooses, the United States can take time to assess carefully its needs for modernizing tactical air forces.

AFFORDABILITY OF THE ADMINISTRATION'S PLAN

One factor that will enter that assessment is cost. The procurement costs for the Administration's plan could be substantial. CBO's analysis suggests that those costs would be affordable only under optimistic assumptions about trends in costs and available funds. Under plausible though more pessimistic assumptions, the Administration's program would not be affordable.

Cost and affordability depend, of course, on many factors. Procurement costs obviously depend on how many planes are bought. This paper's analysis assumes that purchases follow the base-case pattern shown in Tables 2 and 3. Cost and affordability also depend on how much each plane costs and how much money is available to buy it. Each of these factors entails substantial uncertainty.

How Much Will New Planes Cost?

The unit costs of aircraft are important in estimating whether procurement costs under the base case will be affordable. CBO used a lower and a higher estimate of unit costs to reflect uncertainty regarding this key factor. All of the estimates in this paper are presented in terms of unit procurement costs, which are calculated by dividing total procurement costs by the total size of the planned purchase.

Lower Estimate. In the lower estimate, CBO used service projections of unit costs if they were available. For the Air Force's F-22 aircraft, the lower estimate assumed a unit procurement cost that would average about $80 million, which is consistent with the Air Force's current assumptions about the fighter's cost. (See Table 4. All costs are expressed in 1993 dollars.) The Navy provided estimates of the cost of the "E/F" version of the F/A-18 and of the AX. Those estimates suggest an average unit procurement cost of about $55 million for the F/A-18E/F and about $120 million for the AX.

TABLE 4. ASSUMPTIONS ABOUT THE UNIT COST OF AIRCRAFT

Type of Aircraft	Procurement Cost per Plane (Millions of 1993 dollars) Lower	Higher	Total RDT&E for Program (Billions of 1993 dollars)
F-22	80	115	19.0
MRF	35	50	n.a.
AX	120	165	11.7
F/A-18E/F	55	75	4.9

SOURCE: Congressional Budget Office estimates from Department of Defense and Navy data.

NOTES: Numbers are rounded to the nearest $5 million; n.a. = not available; RDT&E = Research, Development, Test, and Evaluation.

Service estimates for the MRF aircraft were not available. CBO estimated the cost based on costs of other aircraft. CBO assumed that the Multirole Fighters would cost about $35 million each. CBO arrived at this &estimate by increasing the current unit cost of the F-16 aircraft by 80 percent, the least amount of real growth experienced at any time since 1950 when moving from one generation of aircraft to the next.

That estimate of $35 million seems roughly consistent with Air Force statements, which have noted that the plane would cost about $25 million. The Air Force estimate, however, is expressed in terms of flyaway costs, which are lower than the unit procurement costs used in this paper. Flyaway costs do not include a number of items that must be bought to field planes, such as test equipment and ground-support equipment. These costs are included in the unit procurement costs estimated by CBO. As a rule of thumb, fly-away costs amount to only about two-thirds of the money that is included in unit procurement costs. If the Air Force's $25 million estimate is increased to reflect a comparable level of aggregation to CBO's estimates, the price of the plane would be roughly equal to CBO's estimate of $35 million.

Higher Estimate. The unit costs of DoD weapons often increase above planned levels. In part, this growth reflects optimism in making the initial estimates. Much of the growth, however, reflects changes in plans--for example, reductions in the size of the purchase or changes in the design of the weapon--that occur after the initial cost estimates are made.

CBO's higher estimate of unit costs reflects the potential for growth in costs. In its higher estimate, CBO assumed that the F-22 aircraft would cost about $115 million apiece, an increase of roughly 40 percent above the unit costs in the lower estimate. The estimate of $115 million is consistent with the large growth in units costs that fighter and attack aircraft have experienced when going from one generation of planes to the next generation. Should this pattern continue with the F-22 aircraft, which will represent a new generation of planes, unit costs could be substantially higher than those now estimated. If, for example, the F-22 experienced growth in costs consistent with the growth in costs experienced between the A/B version of the F-15 aircraft and its predecessor (the F-4), then the F-22 could cost $100 million. If growth in the cost of the F-22 matches the growth in cost between the average version of the F-15 aircraft and the F-4, then the F-22 would cost about $135 million. This paper's higher estimate of $115 million is in the middle of that range.

The estimate of $115 million for the F-22 is also consistent with past analyses of the growth in the cost of DoD weapons. Those analyses show that real increases of about 25 percent are common among systems that are already well into development--that is, for weapons that are in the stage referred to as full-scale development. Growth of roughly 50 percent would not be unexpected in systems that have not yet reached full-scale development, and the F-22 has just entered that phase of its development.

Under the higher estimate, the unit cost of the AX aircraft is assumed to grow by roughly 40 percent above currently planned estimates to $165 million. This amount represents roughly the same percentage increase that CBO assumed for the F-22 over the current Air Force estimate. Although this sum may seem large, it could be plausible since the AX is in the early development stages, and programs have experienced growth of 50 percent by the time they reach procurement.

In addition, the estimate of $165 million is only about 50 percent higher than the Navy's estimates of the cost of the canceled A-12. Yet the Navy may make changes in what the AX aircraft is required to do, which could increase its cost above that of the A-12. The Navy has, for example, indicated that the AX may need the capability to attack enemy planes in the air. This air-to-air capability was not a part of the A-12 design. The Navy may be reducing some of its other requirements for the AX--for example, the required degree of stealth and the distance the plane must be able to fly. Nevertheless, the addition of a capability to attack enemy aircraft in the air could add substantially to the costs of the AX aircraft.

Under the higher estimate, the unit cost of the MRF is assumed to be about $50 million. According to press reports, the Air Force's estimate of MRF costs ranges from $25 million to $35 million. But the service estimate is expressed in terms of the flyaway cost, which is smaller than the unit procurement costs used in this paper. An estimate of $50 million for unit procurement cost could be consistent with the upper end of the Air Force's range in costs. The Air Force itself has indicated that it may be difficult to hold the cost of the MRF to the lower end of the Air Force's range. General John Loh, Commander of Tactical Air Command, suggested the difficulty of getting substantial improvements in capability at low cost when he said that the MRF would be a "breakthrough in how to manufacture an affordable airplane or an upgrade to an existing airframe."[8] The higher estimate assumes that the Air Force does not achieve a breakthrough.

As with the other planes, the E/F version of the F/A-18 was assumed to grow in cost by about 40 percent to about $75 million each. Although the E/F version is well into development, growth in procurement costs may still occur. Development costs for the E/F program have grown substantially over the last year and, though these increases are not necessarily a harbinger of growth in procurement costs, they do indicate that changes may be going on in the program. Those changes could lead to a growth in costs. Press reports have also suggested concerns about the range or distance that the E/F version of the F/A-18 will be able to fly. If these concerns are valid, then changes could be made in the design of the aircraft that could add to costs.

Available Funding

It is impossible to know for certain how much funding will be available to buy tactical aircraft in the next century. Available funding depends on total budgets and also on the share of those budgets that is allocated to tactical aircraft.

To illustrate a possible level of funding consistent with past history, CBO assumed that tactical aircraft would receive the same average share of total Air Force and Navy funding (5.6 percent and 4.0 percent, respectively) that they received between 1974 and 1992. Those years include periods of peak funding for tactical aircraft as well as periods of lower funding. CBO then applied that share to the planned funding in the Air Force and Navy budgets in 1997, the last year of the Administration's Future Years' Defense Plan (FYDP). In the years beyond 1997, total Air Force and Navy budgets are assumed to remain constant in real terms. The resulting level of available

---

8. Tony Capaccio, "Mixed Air Force Signals on New Fighter Effort," *Defense Week* (February 18, 1992), p. 2.

funding amounts to about $4.0 billion for the Air Force and $3.1 billion for the Navy (see Figure 5). Total funding for tactical aircraft in both services would equal about $7.1 billion (see Figure 6).

Affordability of the Administration's Plan

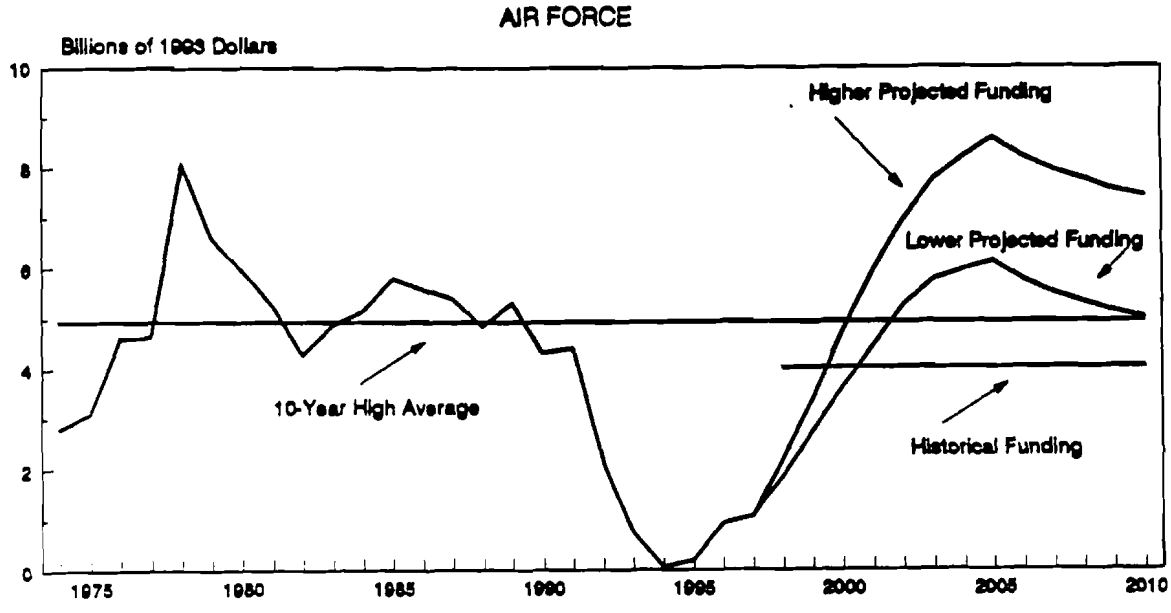
Under the initial assumptions in this paper, the procurement costs associated with the Administration's plan would not be affordable. Between 1998 and 2010, the average of the funding required under the lower estimate for the Air Force and Navy amounts to about $9.6 billion (see Figure 6). Assuming that tactical aircraft receive their historical shares of each service's budget, the total available funds would average $7.1 billion during this period. Thus, there would be a shortfall of about $2.5 billion, or roughly 25 percent.

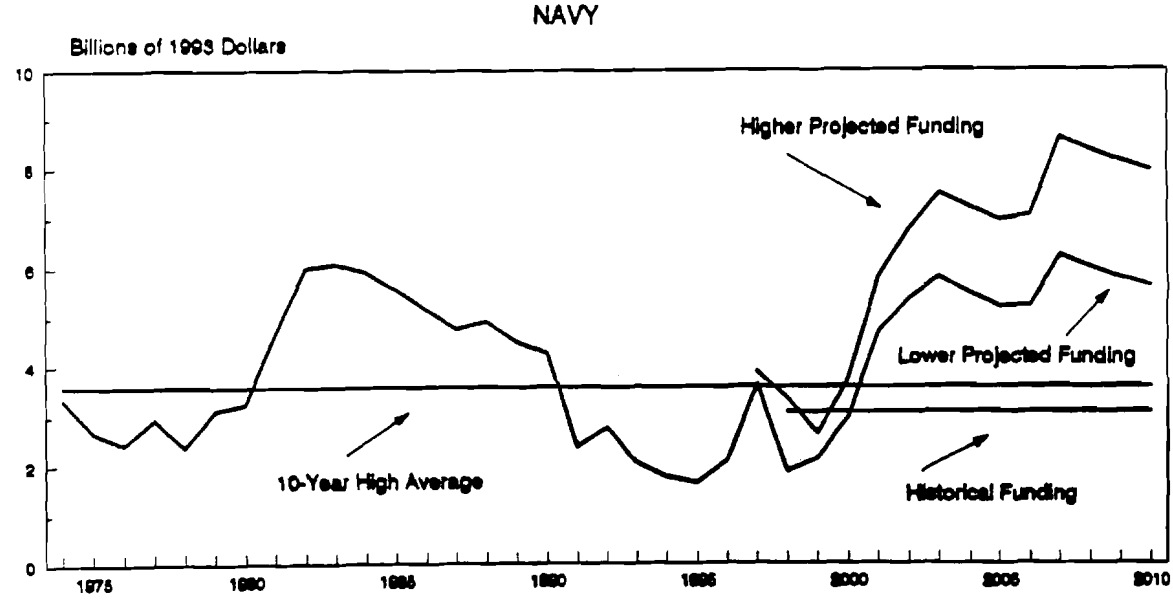
The Navy would experience the larger shortfall of funding during this period, an average of about $1.7 billion per year. The Air Force would only lack an average of about $0.8 billion in funds per year (see Figure 5).

Affordable Under Some Assumptions. Under some circumstances the Administration's plan would be affordable, however. The estimates of $7.1 billion in funding available under the historical share assume no real growth in the total defense budget in the years beyond 1997. Historically, however, defense budgets have grown. If budgets beyond 1997 grow enough to keep pace with increases in gross domestic product, which over a long period has grown in real terms by 2 percent or so a year, then the defense budget would be substantially higher in the next decade than its planned level for 1997. If tactical aircraft continue to receive their historical share, then the defense budget would receive an average of about $8.3 billion during the 1998-2010 period. The funds required to buy the planes assumed in this case exceed that funding by an average of about $1.4 billion per year. Therefore, growth in the budget would substantially reduce but not eliminate the shortfall.

Affordability problems are more likely to be resolved by according tactical fighters a higher share of service budgets than they have received in the past. Assume, for example, that the Air Force devoted about 6.6 percent of its total budget to tactical aircraft, compared with the historical average of 5.6 percent in 1974 to 1992, and that the Navy devoted 6.3 percent, compared with 4.0 percent historically. Assume also that the unit costs of aircraft do not rise above planned levels and that the total level of real defense spending remains at the planned 1997 level of spending through 2010. Under these assumptions, enough funding would be available to finance procurement costs under the Administration's plan.

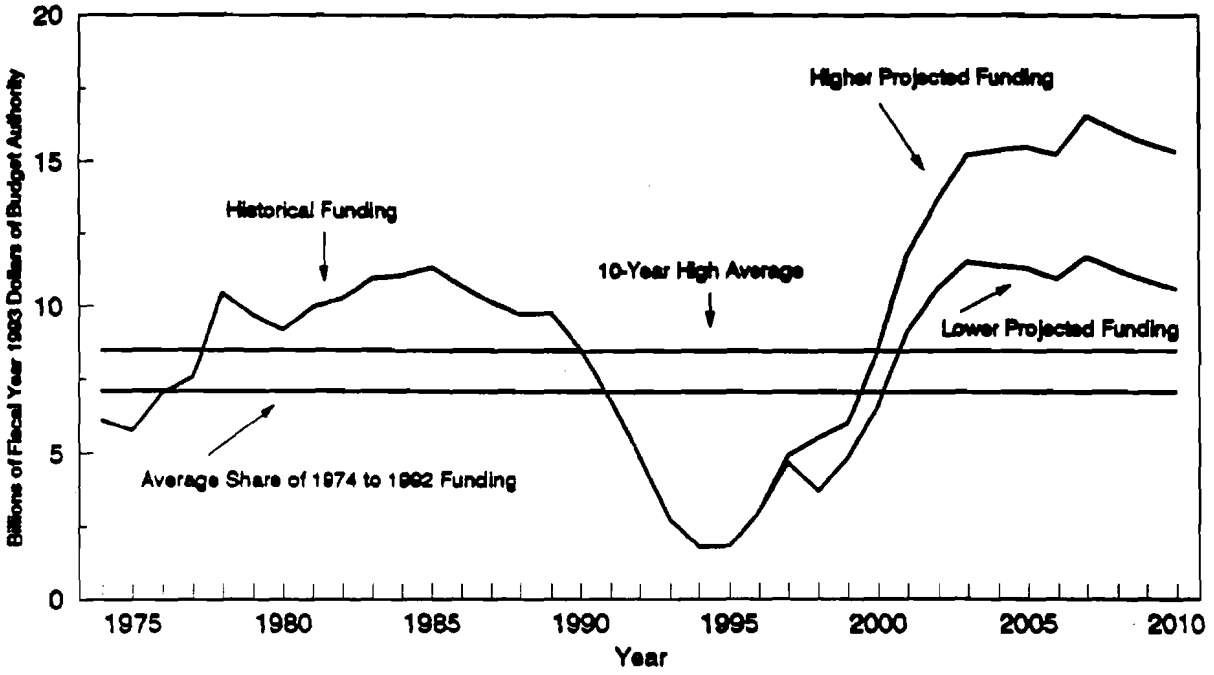
FIGURE 5. HISTORICAL AND PROJECTED FUNDING FOR FIGHTER AND ATTACK AIRCRAFT COMPARED WITH AVERAGE HISTORICAL FUNDING





SOURCE: Congressional Budget Office estimates from Air Force, Navy, and Department of Defense data.

FIGURE 6. HISTORICAL AND PROJECTED FUNDING FOR FIGHTER AND ATTACK AIRCRAFT FOR THE AIR FORCE AND NAVY COMPARED WITH AVERAGE HISTORICAL FUNDING



SOURCE: Congressional Budget Office estimates from Air Force, Navy and Department of Defense data.

Tactical aircraft might plausibly receive a larger share of service budgets in the future. That might occur if the Air Force does not need to invest in strategic bombers or missiles and instead can devote those funds to tactical aircraft. It could also occur if the Navy devotes funds to tactical aircraft that it has used in the past to replace many of the other types of aircraft, or allocates a larger share of its budgets for shipbuilding to aircraft procurement.

Unaffordable Under Many Other Assumptions. Unfortunately, for each assumption that suggests the Administration's plan is affordable, there are ones that suggest it is not. If the unit costs of aircraft rise, as has been common in the past, then sufficient funds may not be available to pay for the Administration's plan. Under CBO's higher estimate of costs, procurement requirements for tactical aircraft in the Air Force and Navy together average about $13.1 billion between 1998 and 2010. During that same period, the funds that would be available, assuming tactical aircraft receive their historical share of the total defense budget, would amount to $7.1 billion (see Figure 6). Hence, under these assumptions, there would be a shortfall of about $6 billion a year, or 45 percent.

Nor is it clear that, over the next decade, tactical aircraft will receive more than their historical share of service budgets. The higher shares needed to finance plans, even if unit costs do not rise, are above historical norms. In the Air Force, the required share of 6.6 percent would roughly equal the share accorded to tactical aircraft during those 10 of the 19 years from 1974 through 1992 when shares were highest. The required 6.3 percent of the Navy's budget is without precedent in the period from 1974 through 1992. Even though the Navy never devoted that large a share to tactical aircraft during any one year, it would have to do so for more than a decade to make its plan affordable.

Moreover, to acquire higher shares of services' budgets, tactical aircraft will have to beat out other major procurement programs that will be seeking increased funding in coming years. These programs include strategic defenses, attack submarines in the Navy, and Army helicopters. Stiff competition for scarce funds may also come from categories of defense spending other than procurement. Among the notable potential claimants are research and development costs, which could rise under the new acquisition strategy; military medical care costs, which would rise as the national costs of health care rise and as the number of older retirees grows; and the costs of environmental cleanup, which could increase in the Department of Defense and even more so in the Department of Energy.

If tactical aircraft not only do not receive their historical share of funding, but actually receive a smaller share, the effects on affordability would be

substantial. Assume, for the sake of illustration, that funds available for tactical aircraft are 10 percent less than those suggested by their historical share. Then, under the higher estimate of unit costs, the average shortfall in funding in the 1998-2010 period could grow to $6.7 billion a year.

Also, the overall defense budget could decline substantially more than the reductions that are envisioned in the Administration's current FYDP. Yet the estimates in Figure 6 assume no declines beyond those planned by the Administration. The Chairmen of the House and Senate Armed Services Committees have both recommended reductions, as have other Members of Congress. Some of those reductions may be achieved by reducing the number of tactical air units, which could reduce procurement requirements. But much of the cost of the Administration's plan is determined by a desire to procure new and more capable aircraft rather than by the need to replace retiring planes. Thus, the cost of the Administration's planned program of modernization may not decline markedly as forces are cut.

Other issues could also adversely affect affordability. The unit costs in the higher estimate in this paper are based on average growth that has been observed in the past. But the higher estimate is not an upper limit. Unit costs have grown by more than the average in the past, and they could grow by more in the future. Clearly, higher growth would worsen the outlook for affordability. As was noted earlier, the Administration may also be considering buying another aircraft--the Short Take Off/Vertical Landing aircraft, which would replace the AV-8--that is not included in the base-case assumptions in this paper. Buying another aircraft could add substantially to costs.

In sum, under this paper's base-case assumptions about the Administration's plan, the plan could be affordable but only under relatively optimistic assumptions. Under a number of plausible but more pessimistic assumptions, there could be a shortfall of many billions of dollars in the funds needed to pay for the costs of the Administration's plan.

MISMATCH BETWEEN AGE AND ORDER OF PROCUREMENT

Particularly if costs must be reduced, a decision will have to be made about the order of procurement for the Administration's four new or modified planes. The Administration plans on buying these planes in the following order:

- o F-22 (fighter mission);
- o F/A-18 E/F (multirole mission);

- o AX (medium-attack mission); and
- o MRF (multirole mission).

The order of purchase should depend on which plane is needed first to meet national security needs. Average age is one factor that can help guide decisions about which plane is needed first, since age is an indicator of technical obsolescence and deteriorating capability. Under the Administration's plan, however, there is a mismatch between age and order of procurement.

Age by Mission

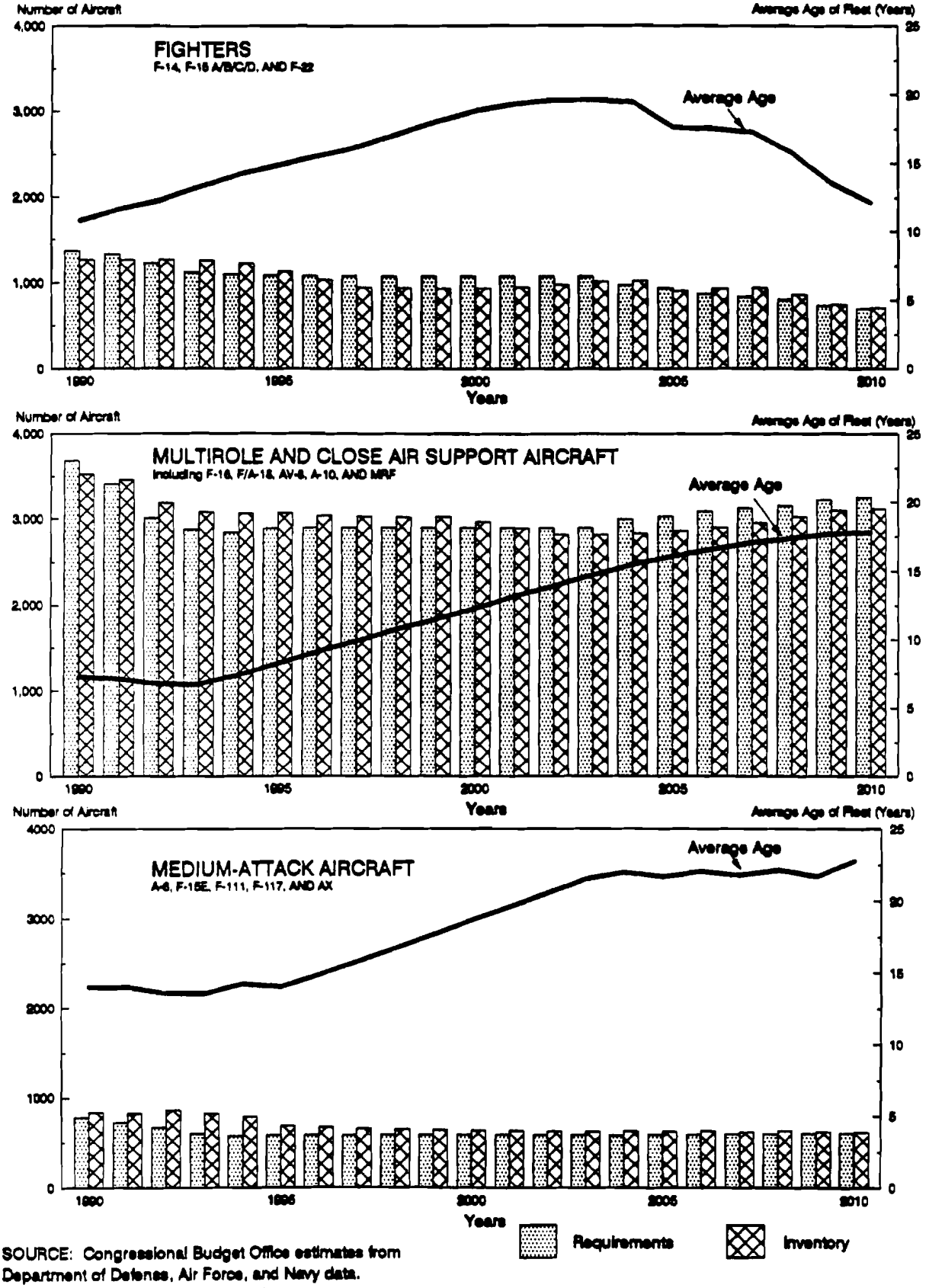
The oldest planes in the fleet are the planes that are designed primarily for the medium-attack mission. Today, these planes are about 14 years old on average (see Figure 7). The planes in this mission category will grow slightly younger through 1993, as the last of the F-15E model aircraft are delivered. After that no planes will be delivered for this mission until 2003, when the first AX aircraft are assumed to enter the fleet. Even then, AX aircraft are assumed to be bought at very low rates through 2010. Thus, medium-attack aircraft will increase in age through 2010, reaching an average age of about 23 years by that year.

Measures presenting the average age of aircraft may mask the full extent of the problem for some types of aircraft in the medium-attack fleet. With the fleet as a whole averaging 23 years of age by 2010, some medium-attack aircraft--the carrier-based A-6 aircraft, for example--will not retire until they have completed more than 40 years of service. If technical problems or shortages of funding were to delay the AX program significantly, and the Navy elected to hold on to the AX aircraft until a replacement became available, then retirement ages of the oldest of the A-6 aircraft could be pushed toward the half-century mark, an extraordinary level.

Multirole aircraft are currently the youngest planes in the fleet. Aircraft that are designed primarily for the multirole mission, as well as those that have as their primary mission close air support and short-range attack, currently average about seven years of age (see Figure 7). (For simplicity, this paper includes in the multirole mission the A-10 aircraft, which conducts close air support, and the AV-8B aircraft, which is a short-range attack aircraft. Treating these two aircraft separately would not significantly alter the results.)

Although the E/F version of the F/A-18 aircraft, and eventually the MRF aircraft, will help hold down the age of aircraft in the multirole mission,

FIGURE 7. INVENTORY, REQUIREMENTS, AND AVERAGE AGE OF AIRCRAFT BY MISSION CATEGORY



SOURCE: Congressional Budget Office estimates from Department of Defense, Air Force, and Navy data.

planes in this mission category will also increase in average age. By the end of the next decade, they will reach an average age of about 18 years. Nevertheless, throughout most of this period, planes in that category will be significantly younger than the aircraft designed primarily for medium attack.

In terms of age, fighter aircraft are currently between medium-attack aircraft and multirole planes. Fighter aircraft, which average about 12 years of age today, are younger than aircraft that pursue the medium-attack mission. But fighter aircraft are considerably older than multirole aircraft.

By the end of the next decade, however, fighter aircraft will be the youngest aircraft among those three mission areas, with an average age of about 12 years. That shift in relative age will occur in part because procurement of the F-22 fighter aircraft will help hold down the average age of fighter aircraft. The shift will also be influenced by the Navy's plans to eliminate dedicated fighters from the air wings based on aircraft carriers. As the older F-14 aircraft retire, their requirements will shift into the multirole category and will be met by F/A-18 aircraft.

Therefore, the Administration's plan would modernize first the two mission categories (fighter and multirole) that contain the youngest planes; the plan would modernize last the mission category (medium attack) that contains the oldest planes. Moreover, the age differences are substantial. By 2010, the first category to be modernized, fighter aircraft, will have an average age of 12 years. The last to be modernized, medium-attack aircraft, will have an average age of about 23 years, or about double that of fighter aircraft.

At least to some extent, the mismatch between age and the order of procurement was unplanned. Originally, the A-12 aircraft--a medium-attack plane--was expected to enter procurement before the F-22 fighter. Cancellation of the A-12 program, which was based on problems of cost and schedule rather than relative priorities among missions, led to the mismatch.

Importance of the Mismatch

By the criterion of age, the Administration's planned order ought to be reconsidered. Moreover, age as a criterion for modernization may be more compelling in future years than it has been in the past. In previous years, the services have argued that modernization must occur to keep up with improvements in the capabilities of the threats posed by the former Soviet Union. If the former Soviet Union modernized its fleets of aircraft, then it was deemed necessary for the United States to modernize its planes. In the aftermath of the dissolution of the Soviet Union, that arms race may

disappear. If so, planes may not need to be replaced until physical deterioration and maintenance problems demand their replacement. Age should be a reasonable measure of when physical deterioration and maintenance problems will require modernization.

It could also be argued that aging in the medium-attack fleet is less acceptable than in other types of aircraft. Some military leaders--including the Air Force Chief of Staff, General Merrill McPeak--contend that the Air Force's fleet of medium-attack aircraft is rapidly becoming obsolete. This obsolescence may be a problem because few of those planes have stealth characteristics and so are vulnerable to the defensive systems--such as ground-based radars and missiles--of regional powers. Many of these smaller, regional powers may find it easier to acquire these defensive systems than to acquire capable fighter aircraft, which are expensive to buy and difficult to operate effectively. Thus, according to General McPeak, medium-attack aircraft should be replaced sooner than the Administration's current plan would allow. In addition, some analysts feel that medium-attack aircraft perform a mission that is most likely to be useful in regional conflicts and therefore should be accorded higher priority in procurement plans.

Other criteria may justify the Administration's planned order of procurement. For example, it is arguable that fighters need to be younger and more modern. Indeed, both the Air Force and the Navy have contended that fighter aircraft need to be younger because they experience more stress during their operations, primarily because fighters fly at higher speeds and execute sharper turns than bombers.

Nevertheless, age is an important criterion, particularly in the era following the Cold War. According to that criterion, a reordering of the priorities in the Administration's plan would be appropriate, and that reordering may be particularly necessary if funding constraints cause procurement of the AX aircraft to be delayed.

POSSIBLE SOLUTIONS TO PROBLEMS OF AFFORDABILITY AND MIX

For various reasons, the Congress might want to examine alternatives to the Administration's current plan for procurement of tactical aircraft. These reasons include affordability, the mismatch between procurement plans and aircraft age, and trends in the threats to U.S. security posed by regional adversaries. CBO has not analyzed alternative procurement strategies in detail, but the remainder of this section discusses several conceptual approaches.

Delay or Stretch Out Programs

In the past, the Administration and the Congress have frequently solved problems of near-term affordability by deferring the time when procurement begins or by reducing the annual rate at which aircraft are bought, which stretches out the total procurement period. Because this has been a frequent approach, it might fairly be labeled "business as usual."

The business-as-usual approach could take several specific forms. In the late part of this decade and the early part of the next one, procurement costs for tactical aircraft would grow rapidly under the Administration's plan. That growth could be delayed by putting off the time when the AX and MRF aircraft are permitted to enter production. The annual buy of the E/F version of the F/A-18 and the F-22 could also be reduced, though the planned quantities under the base-case assumptions in this paper are already quite low.

These approaches create a number of serious problems. First, deferrals and stretchouts tend to create a "bow wave" of procurement requirements as all of the programs that are deferred and stretched pile up on top of other programs that are scheduled to begin later. Producing planes at a lower rate also increases their unit cost, while deferring the time when production begins often adds to development costs. Therefore, both deferrals and stretches are inefficient in that DoD eventually pays more for the same number of planes.

Those approaches do, however, help eliminate near-term budget problems. Moreover, delays in modernization may be more acceptable today because, after the dissolution of the Soviet Union, other countries may not improve the capability of their fleets of tactical aircraft. Delaying the purchase of new aircraft does lead to an older fleet. But, as was noted in an earlier section, the services might be able to offset the adverse effects of this aging by changes in policies regarding the use of existing aircraft.

Accept a Cheaper Mix of Aircraft

A more efficient approach to holding down costs, but one that involves tougher decisions, would involve accepting a cheaper but less capable mix of tactical aircraft. DoD has made great strides in reducing the number of aircraft in its fleet by developing and buying planes that perform a number of missions. These planes typically do not perform each mission as well as top-of-the-line aircraft dedicated solely to a particular mission. But they do provide substantial capability that, in view of today's reduced threats, may be sufficient. The Navy, for example, has apparently abandoned the idea of

deploying highly capable fighter aircraft in its carrier wings for the foreseeable future, choosing instead to buy the less capable F/A-18 aircraft.

The services might be able to apply this strategy even more extensively in the future. For example, the Air Force could abandon the idea of having a highly capable fighter and settle for developing, perhaps in concert with the Navy, the Multirole Fighter. The Navy could continue buying the C/D version of the F/A-18 rather than buying the more expensive E/F version.

The services could also achieve a cheaper mix of aircraft by pursuing a "silver bullet" strategy of the sort discussed in earlier CBO analyses. The silver bullet approach involves the purchase of a very small number of highly capable aircraft, such as the AX or F-22, along with a much larger number of less capable aircraft, perhaps including the MRF and the current C/D version of the F/A-18. The highly capable aircraft would be used only against the most formidable threats.

Yet another approach to achieving a cheaper mix of aircraft would be to instruct the services to buy the same planes. The Navy, for example, could buy a variation of the F-22 instead of the AX for its medium attack mission, as the Air Force planned to do last year for its F-111 replacement. Alternatively, the Air Force might consider buying the E/F version of the Navy's F/A-18 for its F-15 replacement instead of the F-22.

Joint programs would save on development funding. In the past, some joint programs (notably, the F-4) have achieved success. But joint programs can also result in sharply higher procurement programs as the services attempt to design one plane that meets all their needs. In this case, each service ends up paying for capabilities that it does not need.

In its most extreme form, a policy of accepting a cheaper mix of aircraft could lead to a delay in most or all programs of modernization. Instead, the United States would buy more of today's types of aircraft. Such a policy would be consistent with a world in which potential adversaries are not able to modernize their aircraft or choose not to modernize them.

Accept Smaller Forces

Costs could also be held down if the Administration and the Congress agree to smaller forces than those now planned under the Administration's base force. Smaller forces might be acceptable given the overwhelming superiority that U.S. tactical air units enjoy compared with the forces of potential regional adversaries.

Forces could, for example, be reduced to the level recommended by Representative Les Aspin, the Chairman of the House Armed Services Committee. Under Mr. Aspin's Option C, tactical air wings would be reduced to 18 wings by 1997, compared with 26 wings under the Administration's base force. Carrier-based Navy wings would be reduced from 13 to 12, and fighter forces in the Marine Corps would be eliminated. Once fully in place, this reduction would lead to a cut of about $3.6 billion a year in the costs to operate tactical air units in the Air Force and Navy.

The smaller forces of Option C would reduce the requirements for procurement, thus cutting those costs. Also, if the annual operating savings of $3.6 billion under Option C were applied to the procurement of tactical aircraft, then the chances of being able to afford needed modernization would be greatly enhanced. Of course, if the operating savings were applied to procurement, there would be no net reduction in the defense budget.

In order to achieve smaller forces, the Administration might consider restructuring its tactical air forces. A number of political leaders and military analysts have discussed such restructuring. For example, restructuring has been recommended, at least in general terms, by Senator Sam Nunn, the Chairman of the Senate Armed Services Committee. Military analysts have suggested several examples of specific approaches to consolidating tactical air forces. The Administration could, for example, eliminate fixed-wing fighter aircraft from the forces of the Marine Corps. Existing naval aircraft operating from aircraft carriers would provide fighter protection for Marine ground forces. Mr. Aspin's recommended force posture (Option C) contains this approach.

The Administration could also eliminate all fixed-wing aircraft in the Air Force, Navy, and Marine Corps that are designed to perform close air support and the related mission of battlefield interdiction. Instead, the Army and Marine Corps could provide their own close air support using existing helicopters.

Finally, the Navy could eliminate all aircraft designed to perform the medium-attack mission. The Air Force would take over this mission, either using long-range bombers (B-1 and B-2 aircraft) based in the United States or using its current fleet of medium-attack aircraft. To sustain and modernize that fleet, the Air Force could buy a version of the F-22. Aircraft carriers would continue to conduct shorter-range bombing missions.

Those changes are certainly not the only restructuring options that might be considered. Also, the changes are far reaching and would have many pros and cons that are not discussed in this paper. The options do, however,

illustrate some of the kinds of changes that could be undertaken in an effort to reduce the size of U.S. forces.

Realign Development and Procurement to Mesh with Aircraft Age

As it considers changes in the Administration's plan for tactical aircraft, the Congress may wish to realign development and procurement to mesh with aircraft age. As was noted above, there are many criteria other than age that must enter the decision about which aircraft to purchase first. Age is, however, one of the key factors.

The AX medium-attack aircraft is the plane that is most needed based on fleet age because the medium-attack mission has the oldest aircraft. It might be unwise to attempt to initiate procurement of the AX much before 2001, which is the year procurement would begin under CBO's base-case assumptions about the Administration's plan. Undue acceleration could cause the sorts of problems that led to cancellation of the A-12 program, predecessor to AX.

If costs must be held down, however, the Congress could take action to ensure that funds for the AX program are not affected. That action might involve delaying or canceling the F-22 program, a program that would modernize the relatively younger fleet of fighter aircraft. Alternatively, the Congress could defer or cancel the development of the E/F version of the F/A-18 aircraft, continuing instead to buy the current C/D version. The new version of the F/A-18 aircraft would modernize the fleet of multirole aircraft, which is also relatively young.

Either of these actions would raise a number of questions. For example, during a period of a few years, either approach could leave the United States producing only one tactical aircraft. Having only one production line open would raise concerns about the industrial base. Specifically, would enough producers be available if the United States ever decided that it needed to produce a large number of tactical aircraft? A detailed discussion of this complex issue is beyond the scope of this paper. Industrial base problems are, however, probably less of a problem for tactical aircraft than for some other types of weapon systems. For example, under the Administration plan, the United States would cease purchasing all Army tanks for a number of years.

APPENDIX A. DESCRIPTION OF EXISTING AIRCRAFT

This appendix describes the nine types of existing tactical aircraft. The nine aircraft are categorized according to their primary mission.

Fighter Aircraft

Two types of existing aircraft have the fighter mission as their primary role.

F-15. The F-15 Eagle is currently the Air Force's top-of-the-line fighter. Developed in the late 1960s, it first entered production in 1973. A total of about 900 F-15 aircraft were purchased in four different models, designated F-15A through F-15D. Procurement of those F-15 aircraft that are primarily fighters ended in 1989 (but see discussion of the F-15E below).

The F-15 aircraft is a twin-engine, single-seat, supersonic fighter capable of attacking enemy aircraft that are outside of a pilot's visual range.[1] F-15s downed 33 of 38 Iraqi aircraft destroyed in the air in the Persian Gulf War.

F-14. First procured in 1971, the two-seat, twin-engine, F-14 Tomcat has been the Navy's primary fighter for many years. The ability to fire the long-range Phoenix missile allows it to fire at enemy aircraft from longer ranges than any other aircraft in the world. That capability to fire missiles at long ranges, combined with the F-14's high speed, were particularly important to the Navy when it was concerned about defending aircraft carriers against attacks from Soviet bombers. Those bombers could launch antiship missiles at relatively long ranges.

The Navy bought more than 600 F-14s over the 1971-1990 period. The Navy also planned to remanufacture a number of the planes to extend their service lives and improve their capabilities. The Administration canceled the remanufacturing program in last year's budget, apparently for reasons of affordability and perhaps also because the threat from the bombers of the former Soviet Union had diminished.

---

1. The Navy and Air Force typically also buy two-seat variations of planes that have single-seat combat versions for trainers. Model designations for planes are expressed using lettered pairs, for example the F-15a/b or F/A-18c/d. The first of the paired models ("a" and "c") are single seat, while the second ("b" and "d") have two seats. There are exceptions to this rule. For example, the "E" model of the F-15 has two seats. The Marine Corps uses the two-seat F/A-18s in combat units.

Medium-Attack Aircraft

Four types of planes--the A-6, F-111, F-15E, and F-117--are designed primarily to carry bombs and use them on targets on the ground. All can carry a substantial payload and still attack targets at relatively long distances.[2]

In this paper, those longer-range attack aircraft are referred to as "medium-attack" aircraft (in contrast to long-range attack planes such as the B-52, B-1, and B-2 bombers). Medium attack is a Navy term; the Air Force uses the term "deep interdiction."[3] [4]

A-6. Since the early 1960s, the A-6 has been deployed aboard aircraft carriers to carry out the medium-attack mission. The A-6 is a two-seat, twin-engine plane. All of the A-6s in the current Navy inventory are "E" model aircraft. Some of these planes were built in the 1970s and 1980s, and others were converted from earlier models to the E configuration.

The A-6 can fly long distances carrying substantial payloads. But the A-6 is an aging aircraft. The Navy has concerns about its ability to survive if flown into harm's way because the aircraft lacks stealth technology and so is visible to enemy sensors.

F-111. The Air Force's F-111 is another venerable aircraft that carries out the medium-attack mission (deep interdiction in the Air Force's terminology). The F-111 aircraft is a two-seat, twin-engine bomber whose wings can be positioned to optimize its aerodynamic performance. Developed in the 1960s, the F-111 was initially expected to perform both fighter and attack missions in both the Navy and Air Force. However, the F-111 was eventually bought only by the Air Force and was employed solely for bombing missions.

F-15E and F-117. The newest aircraft designed for the medium-attack mission are the Air Force's F-15E and the F-117. The F-15E Strike Eagle has sophisticated capabilities for attacking targets on the ground: advanced avionics, long flight ranges, and substantial capability to attack targets at night and in bad weather. The Air Force developed the F-15E as a "dual-role"

---

2. The F-15E also has an air-to-air capability.

3. The term medium is used by the Navy to distinguish between long-range strategic bombers. The service once carried nuclear-armed bombers with very long ranges on aircraft carriers. Strategic nuclear bombing from aircraft has been the province of the Air Force for a number of years, though most of the aircraft discussed in this paper can carry nuclear weapons.

4. The F-117 may not be able to perform the "deep interdiction" mission, except with modest payloads. Many details of the plane's performance are still classified.

fighter--that is, to perform both fighter and attack missions. Nevertheless, the aircraft is typically included in counts of attack aircraft.

The F-117 rounds out the current Air Force interdiction fleet. The F-117 is designed to have stealth--that is, it is designed to be difficult to detect with radars and other sensors. The single-seat, twin-engine plane received star billing for its performance in the war with Iraq, where, according to earlier Air Force estimates, it attacked 40 percent of the strategic Iraqi targets, though it flew only 2 percent of the combat sorties.[5]

Short-Range Attack

The AV-8 aircraft is an attack aircraft with a short range. The Marine Corps has a relatively small inventory of about 200 of the AV-8B Harrier aircraft, which were bought in the period from 1982 to 1992.[6] The AV-8 aircraft has the capability to land and take off vertically or in shorter distance than conventional aircraft. The Marine Corps prizes this capability because the plane can operate from amphibious ships that lack carrier-sized runways, and thus might be the most readily available aircraft to assist Marines who are engaged in amphibious operations. (If the Harrier has to execute a vertical takeoff, it uses so much fuel that its range is severely constrained.)

Close Air Support

The Air Force's A-10 Warthog was developed primarily for the close air-support mission, which provides air support to friendly ground forces who are engaged with the enemy. The aircraft is designed to destroy tanks and other armored vehicles close to an area of hostile fire. To carry out this mission, the A-10 is heavily armored to provide it with a chance of surviving while flying over battlefields. The plane was apparently a stellar performer in the war with Iraq, destroying 1,000 tanks, 2,000 other vehicles, 1,200 artillery pieces, and two helicopters (shot down with the A-10's cannon).

---

5. U.S. Air Force, "Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War" (September 1991). During press reports while the war was going on, jubilant military leaders described these strikes as 95 percent effective. But some of the polish may have rubbed off the F-117's stars, according to more recent press reports (Barton Gelman, *Washington Post*, April 10, 1992). A Department of Defense study substantially lowered estimates of effectiveness for the F-117 and several other systems. But even if the reported numbers for effectiveness are accurate--about 60 percent accuracy instead of earlier Air Force reports of 95 percent--the plane still performed well.

6. The Marines also bought an earlier model of the Harrier, the "A" model, but retired the planes rapidly because they were difficult for pilots to operate.

The Air Force bought about 700 A-10s from 1975 to 1982. During the next decade or so, the Air Force plans to replace the A-10 aircraft with a modified version of existing F-16 aircraft discussed below.

Multirole Aircraft

The remaining two major types of aircraft--the F-16 and the F/A-18--are designed to attack both enemy aircraft in the air and targets on the ground. Both planes were developed in the 1970s. They are less costly than top-of-the-line aircraft such as the F-15 and F-14 and, for that reason, make up a larger portion of the inventories of tactical aircraft.

F-16. The F-16 Falcon is an Air Force aircraft designed to carry out the fighter mission, though at ranges less than the F-15's in air-to-air combat. The Falcon is also designed to carry out bombing missions but has less complex avionics, and less sophisticated ground attack capabilities, than those of the F-15E Strike Eagle.

About 2,200 of the single-engine, single-seat F-16s will have been bought by 1993, when production of the plane is currently scheduled to end. This large amount has made the F-16 by far the most numerous aircraft in the Air Force inventory. In 1992, Air Force officials estimated that about 63 percent of the Air Force's inventory of fighter and attack aircraft consisted of F-16s.

F/A-18. Like the F-16, the Navy's F/A-18 is designed to carry out both fighter and attack missions. The twin-engine, single-seat F/A-18 makes up about 38 percent of the Navy's current inventory of fighter and attack aircraft (including aircraft operated by the Marine Corps). Under current Administration plans, procurement of an improved version of the F/A-18 will continue well into the next decade.

The F/A-18 is more sophisticated and costly than the F-16. But the current F/A-18 carries shorter-range missiles than the F-14, being unable to carry the F-14's long-range Phoenix missile, and it has shorter bombing ranges and carries a smaller payload than the A-6.