MATCHING RESOURCES WITH REQUIREMENTS: OPTIONS FOR MODERNIZING THE US AIR FORCE

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Center for Strategic and Budgetary Assessments

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by

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The Center for Strategic and Budgetary Assessments is an independent, nonprofit, public policy research institute established to make clear the inextricable link between near-term and long-range military planning and defense investment strategies. The Center is directed by Dr. Andrew F. Krepinevich and funded by foundations, corporations, government, and individual grants and contributions.

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The analysis and findings presented here are solely the responsibility of the Center for Strategic and the Budgetary Assessments and the author.

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Executive Summary

The US Air Force, like the Department of Defense (DoD) more generally, appears to face a significant mismatch between the cost of its plans and the level of funding likely to be available to pay for those plans over the long run. This mismatch is one of the central national security issues that policymakers will have to confront, manage and resolve in coming years. Fortunately, there are a range of alternative options for the Air Force that would be significantly more affordable than the current plan and might still meet US national security requirements.

AIR FORCE PLANS FOR 2005-22

Over the next two decades, the Air Force plans to retain essentially the same force structure it has today and to continue to keep its forces at high states of readiness—measured in terms of personnel quality, training, and equipment maintenance and repair. Under current plans, the area of greatest change will be in the development and production of new aircraft and other weapon systems. The Air Force's long-term plans are in some respects unclear and, in others, unsettled. However, the following list provides a reasonable estimate of the quantities and types of major weapons platforms the Air Force would like to acquire between 2005 and 2022:

- 1,575 next-generation F/A-22 and F-35 fighters, and some 200 new "regional" bombers;

- 300 unmanned combat air systems (UCAS);

- 84 C-17 strategic transports and 145 tactical transport aircraft;

- 280 new tanker aircraft;

- 48 CV-22 tilt-rotor aircraft for Air Force special operations forces; and

- 200 new intercontinental ballistic missiles (ICBMs).

While Air Force plans call for buying over 2,000 new next-generation manned combat aircraft and UCAS over the next two decades, under current plans the Air Force appears unlikely to buy any new long-range bombers or alternative long-range strike systems until after 2022.

Although most of the detailed discussion in this report focuses on major weapons platforms, it is important to note that, over the next two decades, the Air Force also plans to modernize extensively its intelligence, communications, sensor, and space capabilities, and buy a variety of different trainer, reconnaissance and other support aircraft, as well precision-guided munitions (PGMs).

COST AND AFFORDABILITY OF THE CURRENT PLAN

There is considerable uncertainty concerning how much it would cost to implement the Air Force's current force structure, readiness and modernization plans, and whether those plans are affordable within the budgets likely to be made available to the Air Force over the long run.

- The administration's fiscal year (FY) 2005 request includes $120 billion (unless otherwise noted, all funding and cost figures cited in this report are expressed in 2005 dollars) for the Department of the Air Force. Including a proportionate share of Defense Health Program (DHP) funding, brings the amount in the 2005 request attributable to the Air Force to some $125 billion. Under current plans, this budget would reach about $135 billion by 2009.

- Assuming the Air Force can meet its cost goals for developing and producing new weapon systems and that cost growth in operations and support (O&S) activities can be minimized, implementing the current Air Force plan would require average annual budgets of about $133 billion over the next two decades. This includes roughly $38 billion for procurement, $17 billion for research and development (R&D) and $78 billion for O&S activities.

- Assuming, in line with historical experience, that the new weapon systems in the Air Force's plans end up costing substantially more to acquire than projected and that O&S costs continue to rise as they have historically, implementing the Air Force's plan would require average budgets of about $148 billion a year over the next two decades. This includes roughly $44 billion for procurement, $21 billion for research and development (R&D) and $82 billion for O&S activities.

- Thus, based on low-end cost assumptions the Air Force's current plan would be roughly affordable if the level of funding projected for the Air Force in 2009 can be achieved and sustained over the next two decades, but would fall some $8 billion a year short if, instead, Air Force funding were to

remain at today's level through 2022. On the other hand, assuming the high-end cost estimate is correct, the Air Force faces a shortfall averaging some $13 billion annually, even assuming its budgets are increased as projected in the current plan through 2009 and sustained at that level through 2022. If its budgets can be sustained only at today's level, the shortfall would amount to $23 billion a year.

- It may prove difficult to sustain the Air Force's budget even at today's level over the next two decades. Over the long term, the Air Force will face stiff competition for budget dollars both from non-defense federal programs and priorities, and from other components and programs within DoD.

- If the increases in the Air Force's budget needed to pay for its current modernization, force structure and other plans cannot be achieved, or sustained over the long-term, the Air Force will have to reassess it plans. Those plans will have to be changed in a way that makes them less costly, but also leaves the Air Force with the capabilities it needs to effectively address the serious future challenges it faces.

TRENDS IN AIR FORCE CAPABILITIES

In deciding how to adjust its plans to make them more affordable the Air Force could choose from a range of substantially different options, with the options differing in the extent to which they focus on protecting current modernization plans, at the expense of force structure, or visa versa, as well as in their approaches to transformation. A number of issues and trends are likely to influence one's views about which of these options is most appropriate.

- **Growing Force Lethality Provided by PGMs:** The use of PGMs can increase the effectiveness of combat aircraft by an order of magnitude or more. The number and variety of PGMs, as well as the number of PGM-capable aircraft in the

Air Force has grown enormously over the past decade-and-a-half. During Operation Iraqi Freedom (OIF), virtually all of the Air Force's strike aircraft—including all of its bombers—were capable of delivering PGMs, including some relatively inexpensive weapons like the Joint Direct Attack Munition. The Air Force is also developing and acquiring improved next-generation PGMs, such as the Small Diameter Bomb and the stealthy Joint Air-to-Surface Standoff Missile.

- **Progress in Computers, Sensors and Communications Systems:** PGMs require timely, precise targeting information to be effective. Some of the most important advances in military capabilities likely to be made in future years will involve improvements in the ability to provide such information to strike aircraft on elusive, moving, and time-sensitive targets. Some observers have suggested that advances in these areas could eventually increase force lethality by as much as two orders of magnitude. However, significant technological hurdles remain, and programs designed to achieve dramatic improvements in these areas, such as the Space-Based Radar, are likely to prove fairly costly.

- **The Need for Advanced Aircraft Platforms:** Some observers argue that the acquisition of next-generation aircraft is relatively unimportant, since the most critical advances in combat capabilities are likely to involve computers, sensors and related technologies incorporated into satellites and support aircraft, as well as electronics and PGMs that can be fitted onto existing combat aircraft. Others argue that next-generation aircraft like the F/A-22 and the F-35 fighters incorporate improvements in their designs, such as robust, easily maintained stealth, that vastly increase their survivability and air-to-air effectiveness. Proponents of the F/A-22, for example, argue that the aircraft is needed to ensure American air dominance in coming decades and dissuade potential opponents from even trying to compete head-to-head with the US military in this mission area.

- **The Pace of Military Transformation:** It is widely believed that we are in the midst of a revolution in military affairs (RMA). There is, however, considerable disagreement about the nature, scope and implications of this RMA for future warfare. The Air Force claims that its current plans are consistent with the general contours of the RMA. Conversely, critics argue, among other things, that the current plan pays inadequate attention to the challenge posed to US power projection capabilities by the proliferation of cruise and ballistic missiles, and other threats. In particular, some argue that the current plan over-invests in short-range combat aircraft and under-invests in long-range precision strike capabilities. Some critics also argue that the Air Force is not moving ahead with the acquisition of unmanned aerial vehicles (UAVs) as rapidly as it could, given the current state of technology.

ALTERNATIVE OPTIONS FOR THE AIR FORCE

If the Air Force were constrained to keep the average annual cost of its long-term plan within roughly today's budget level—of about $125 billion—it could do so by adopting any one of a number of different options. Four illustrative options that would meet this requirement are discussed in this report. As noted earlier, judgments about the trends and issues outlined above are likely to influence one's views concerning which of these options would best meet US security requirements over the long run.

- **Protect Modernization Plans and Cut Force Structure:** Under this option, the Air Force would move ahead with all of its current modernization plans. It would pay for these plans and hold the Air Force's overall funding requirements to today's levels by making offsetting cuts in the size of the Air Force. The reductions would be made primarily in Air Force's fighter and bomber fleets, both of which would be cut by 50 percent.

- **Protect Force Structure and Cut Modernization Plans:** In this option, the Air Force would try to make its long-term plans more affordable primarily by cutting its modernization plans, rather than its force structure. Among other things, the F/A-22 program would be substantially scaled back, while the F-35 program and plans for a new regional bomber would be cancelled. Instead, the Air Force would buy new F-15E and F-16 fighters (which could be upgraded to incorporate some F-35 avionics). Air Force fighter and bomber forces would be cut by only about 15 percent in this option.

- **Accept Modest Cuts in Modernization Plans and Force Structure:** In this case, both the Air Force's modernization and force structure plans would be cut, but force structure would be cut less deeply than in the first option, while the Air Force's modernization plans would be cut less deeply than in the second. Under this option, the F/A-22 and F-35 programs would be scaled back, but neither would be cancelled, while the size of the fighter and bomber fleets would be reduced by about 25 percent.

- **Accelerate Transformation Efforts and Better Address the Anti-Access Challenge:** This option differs from the other options in a four main ways. First, because it takes the anti-access challenge more seriously, under this option no reductions would be made in the existing bomber force and current plans for fielding a new bomber would be accelerated by five years. Second, the UCAS would be deployed in substantially greater numbers. Third, modernization plans for Air Force special operations forces would be accelerated. Fourth, the Air Force would initiate a new program involving the use of commercial aircraft to augment its tanker forces in wartime. In addition, the regional bomber program would be cancelled and the F/A-22 and F-35 programs would be scaled back, while the size of the fighter fleet would be cut by 40 percent.

Determining which of these options would support the most capable and effective Air Force for the United States, or whether any of these options, or the current plan, would result in an Air Force that would be sufficiently capable to meet US

security requirements today and in the future, is beyond the scope of this report. Nevertheless, a preliminary review suggests that, under any of these four options, the Air Force would remain a highly capable force over the next two decades.

Introduction

The US Air Force is embarked on a very expansive and costly plan to modernize and sustain its forces. Over the next two decades, the Air Force plans to develop and procure a broad range of new aircraft and other weapon systems. Under current plans, the Air Force is projected to buy a total of some 2,600 new combat, airlift and tanker aircraft between fiscal years 2005 and 2022.[1] Production costs alone for these new weapon systems are likely to reach $195-245 billion. (Unless otherwise noted, all funding and cost figures cited in this report are expressed in 2005 dollars).

To pay for this effort, current plans call for increasing the Air Force's budget from some $125 billion in 2005 to $135 billion by 2009 (these figures include the Air Force's estimated share of Defense Health Program funding). This level of funding might be adequate to support the Air Force's long-term plan, assuming budgets of this magnitude can be sustained over the 2005-22 period, and that the Air Force can meet its cost goals for developing and producing new weapon systems and supporting its forces. But neither of these assumptions may be realistic.

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[1] The federal government's fiscal year begins on October 1 and ends on September 30. In this report, years cited generally refer to fiscal years.

Historically, new aircraft and other weapon systems have typically cost two-or-three times more to acquire than the systems they are intended to replace, while operations and support (O&S) activities have experienced consistent and persistent cost growth. Although next-generation aircraft are frequently projected to have lower O&S costs than the aircraft they are intended to replace, such savings have seldom materialized. If these patterns continue to hold in the future, the level of funding needed to implement the current plan could increase to an average of $148 billion a year over the 2005-22 period.

Moreover, it is far from clear that it will prove possible to sustain the Air Force's budget even at today's level over the next two decades, let alone at the higher levels projected for 2009 in the current plan. Over the long term, the Air Force will face stiff competition for budget dollars both from non-defense federal programs and priorities (especially as the baby boomer generation begins to retire towards the end of this decade), and from other components and programs within the Department of Defense (DoD).

The goal of this report is to describe the magnitude of the plans-funding mismatch confronting the Air Force today and to discuss a range of different options from which US policymakers might choose to make the Air Force's plans more affordable. Specifically, this report considers four different options, all of which would be affordable within budgets averaging $125 billion a year, the amount requested for the Air Force for 2005. It focuses on the 2005-22 period because such a horizon looks out far enough into the future to capture the magnitude of the problem facing the Air Force, but does not extend so far into the future as to become overly speculative. It is possible that more funding will be provided for the Air Force over this period than assumed in these options. On the other hand, given historical trends and various budget pressures, it is probably at least as likely that less funding will be provided.

This report focuses primarily on major force structure elements and major weapons platforms. Air Force plans for intelligence, communications and sensor capabilities, and trainer, reconnaissance, and other support aircraft, as well as

PGMs, are discussed only briefly. However, these programs and activities are included in the cost estimates of the current plan and various options provided in this report.

This report is organized into four chapters. Chapter One provides an overview of the Air Force's current plan through 2022. Since the Air Force projects few changes in readiness levels or force structure, this discussion focuses largely on the Service's modernization plans.

Chapter Two provides two different estimates of the potential cost of the Air Force's current plan—one based on relatively optimistic assumptions about modernization and O&S costs, and another based on more pessimistic (and almost certainly more realistic) assumptions about these costs. It also briefly discusses some of the pressures from both non-defense federal programs and priorities, and other components and programs within DoD, that may make it difficult to sustain the levels of funding that would be required to fully execute the Air Force's current plan.

Chapter Three discusses several issues and trends that are likely to influence one's views about how the Air Force's current long-term plan might best be changed to make it more affordable. These topics include advances in precision-guided munitions (PGMs), command, control, communication, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities, aircraft platforms, and military transformation.

Chapter Four describes four alternative long-term plans for the Air Force, each of which—in contrast to the current plan—is designed to be affordable through 2022 at roughly today's budget levels. These options differ in the extent to which they focus on protecting current modernization plans, at the expense of force structure, or visa versa, as well as in their approaches to transformation.

I. Air Force Plans for 2005-2022

This chapter provides an overview of the Air Force's plans through 2022. It provides a description of the major force elements in the Air Force, as well as the Service's plans for modernizing those forces. The Air Force, like the other Services, provides detailed information on its plans through 2009, the last year of DoD's Future Years Defense Program (FYDP). After that, the plans become less detailed and definite, and become especially vague or uncertain in some areas. The descriptions set forth in this chapter represent the author's best estimate of what constitutes the Air Force's long-term plan. In instances where the Air Force's current plans are unsettled, as used in this report, the term "current plan" refers to the author's best guess as to the Air Force's intentions.

In attempting to discern the details of the Air Force's long-term plans, a wide variety of sources were drawn upon. In addition to Air Force budget justification and other documents, however, the most important source was the Congressional Budget Office (CBO) publication, *The Long-Term Implications*

of Current Defense Plans: Detailed Update for Fiscal Year 2004, released in February 2004.[2]

At the most general level, as with the other Services, Air Force planning involves making decisions about force structure (i.e., the size and shape of its forces), readiness (e.g., personnel quality, training and equipment availability) and modernization (e.g., what new weapon systems and other equipment to buy, and how quickly to buy them). When combined with changes in operational concepts and organization, these decisions can also affect the transformation of military forces.

The focus of the discussion below is largely on the Air Force's modernization plans. This is because the Air Force has extensive plans for modernizing its forces. By contrast, the Air Force's long-term plans, with a few exceptions, do not envision major changes in force structure or readiness levels. Under current plans, the Air Force is projected to retain the same basic force structure it has today (and has had since the end of the Cold War) through 2022. That force structure consists of the following major elements:

- Tactical Combat Forces
- Bomber Forces
- Airlift Forces
- Tanker Forces
- Special Operations Forces (SOF)
- Intercontinental Ballistic Missile (ICBM) Forces

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[2] This publication updates information provided in two earlier CBO publications, Lane Pierrot and Gregory T. Kiley, *The Long-Term Implications of Current Defense Plans* (Washington, DC: CBO, January 2003) and *The Long-Term Implications of Current Defense Plans: Summary Update for Fiscal Year 2004* (Washington, DC: CBO, July 2003).

Moreover, the Air Force plans to continue to maintain these forces at high states of readiness. The main missions of these different force structure elements and their current equipment inventories are described below. But the focus of the discussion is on the Air Force's modernization plans for each of those elements.

It is also important to note that several critical Air Force capabilities are *not* discussed in this report. Air Force command, control, communications, and intelligence (C3I) activities and space programs, as well as elements of the National Foreign Intelligence Program (NFIP)—which includes the Central Intelligence Agency (CIA), the National Reconnaissance Office (NRO), and related agencies and activities—that are funded through the Air Force's budget, are excluded from this discussion. They are excluded, among other things, because the highly classified nature of these activities makes it extremely difficult to discern existing capabilities, let alone future plans, in these areas. In an effort to limit the scope of this report to manageable proportions, this analysis also excludes any discussion of Air Force plans for intelligence, surveillance and reconnaissance aircraft, and some other specialized forces and activities.

TACTICAL COMBAT FORCES

The Air Force currently has a total inventory of about 2,400 fighter and attack aircraft. This inventory supports a primary aircraft authorization (PAA) of approximately 1,530 tactical combat aircraft.[3] This is essentially the same size force the Air

[3] PAA numbers include only those aircraft that units are authorized to operate in order to perform their assigned missions. The total active inventory (TAI) includes, in addition to PAA aircraft, training, maintenance pipeline and attrition reserve aircraft. This estimate of PAA strength is taken from Department of the Air Force, *FY 2005 Budget Estimates, Operations and Maintenance, Vol. 1*, February 2004, p. 62 and *Vol. 2*, pp. 25-26. Some other Air Force documents and other sources show considerably higher PAA figures.

Force adopted under the Clinton Administration's 1993 Bottom-Up Review (BUR), when the number of tactical fighter wing equivalents[4] was reduced to 20 (compared to 36 at the end of the Cold War and 26 under the first Bush Administration's Base Force plan). Current plans call for maintaining a fleet of fighter and attack aircraft of roughly this size through the next several decades.

Tactical combat aircraft are designed to carry out a wide variety of missions. These missions include countering enemy air forces and air defenses, attacking enemy ground forces (sometimes in direct support of US ground forces) and striking military bases, communications centers and other targets located inside enemy territory. Since the terrorist attacks of September 11, 2001, the protection of the US homeland (e.g., flying combat air patrols over US cities) has also emerged as an important mission for Air Force tactical combat aircraft. Currently, some 100 Air Force fighter aircraft are assigned to the continental air defense mission.[5]

Though the Air Force has a potentially important role to play in homeland security, the task of projecting power into distant regions of the world remains its core mission. The combat radius of tactical combat aircraft varies considerably, depending on the specific type of aircraft, the flight profile, the mission, the payload (e.g., number of munitions carried), and other factors. In most cases, however, these aircraft have unrefueled combat radii of 400-600 miles. Assuming unlimited aerial refueling, the combat radius for tactical combat aircraft can be extended, on a sustained basis, to perhaps 1,500-2,000 miles. If the aircraft must penetrate several hundred miles beyond the adversary's borders to carry out their missions, this suggests that fighter aircraft need to be based within 1,000-1,500

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[4] A tactical fighter wing equivalent includes a PAA strength of 72 aircraft.

[5] Christopher Bolkcom, *Homeland Security: Defending US Airspace*, Congressional Research Service (CRS), January 22, 2004, p. 1.

miles of enemy territory.[6] Thus, to be effective in wartime, tactical combat aircraft generally need to be operated from bases located within the region of conflict.

The US Air Force currently operates five different types of tactical combat aircraft. Under current plans, two of these aircraft will be fully retired from service prior to 2022. In three other cases, some aircraft will remain in the fleet through at least 2022, but in diminished numbers. These current-generation aircraft are scheduled to be replaced by two new next-generation manned aircraft, the F/A-22 and F-35 fighters, and an unmanned combat air system (UCAS). In addition, the Air Force is considering purchasing a third manned next-generation tactical combat aircraft—a "regional bomber" that would have greater range than other tactical combat aircraft, but would lack the intercontinental range of existing bombers.[7] In this report, it is assumed that under the current plan the Air Force would acquire a regional bomber—identified in this analysis as the FB-X.

EXISTING AIRCRAFT INVENTORY

A-10: The A-10 was designed specifically to attack enemy ground forces and to work closely in support of US ground combat units. Consistent with this mission, the A-10 is heavily armored (e.g., the cockpit is surrounded by a titanium "bathtub") and equipped with a 30mm Gatling gun. Like other US ground-attack aircraft, it is also equipped to carry a wide variety of PGMs. The Air Force has about 245 A-10s in its inventory. The

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[6] Where unlimited aerial refueling is available, the limiting constraint on range is the amount of time the pilot can remain strapped in the cockpit and remain effective. See Barry Watts, "Prospective US Air Force Failure Points," in Andrew Krepinevich, Barry Watts and Bob Work, *Meeting the Anti-Access and Area-Denial Challenge* (Washington, DC: CSBA, 2003), p. 16.

[7] This proposed aircraft is also sometimes referred to as an "interim bomber" that could serve as a bridge between the current bomber force and a follow-on long-range strike capability to be fielded beyond the 2005-22 timeframe.

first A-10s were fielded in 1977 and the last of these aircraft were delivered in 1984. The average age of the A-10 fleet is about 23 years. The Air Force plans to upgrade a portion of the A-10 fleet, extending the aircraft's service life from about 8,000 hours (roughly 25-30 years) to 16,000 hours, among other things, through various structural enhancements. Plans also call for providing the A-10 with an improved precision weapons capability.[8] Under current plans, in 2022 the Air Force is projected to have about 100 A-10s in service.[9]

F-15A-D: This is the Air Force's primary air superiority fighter. Equipped with a sophisticated radar and the Advanced Medium Range Air-to-Air Missile (AMRAAM), the F-15 is tasked with destroying any enemy aircraft that might try to contest US control of the air in wartime. The Air Force currently has a total of about 535 F-15C/Ds and earlier model F-15s in its inventory. The first F-15s were deployed in the mid-1970s. The last F-15C/Ds were delivered to the Air Force in 1986. According to the Air Force, the F-15C/D is expected to have a service life of about 8,000 hours.[10] Thus, it is assumed in this analysis that, under current plans, all of the Air Force's F-15A-Ds would be retired by 2016 or soon thereafter.[11]

F-15E: The F-15E is a version of the F-15 specially designed to attack ground targets located deep behind enemy lines. Although capable of all-weather, night-attack, deep-penetration missions against ground targets, the F-15E also retains the air-to-air capability of the F-15C/D. The Air Force spent about $2 billion

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[8] John A. Tirpak, "Warthog Wars, the Army Leadership Makeover, Global Shift in US Forces . . . .," *Air Force Magazine*, August 2003, www.afa.org/magazine/aug2003/083watch.asp, p. 2.

[9] Derived from Figure 3-21 in CBO, *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, February 2004, p. 27.

[10] "F-15E, Service Life," GlobalSecurity.Org, www.globalsecurity.org/military/systems/aircraft/f-15-life.htm.

[11] Although it is assumed in this analysis that all the F-15A-Ds would be retired by around 2016, the Air Force also appears to be considering extending the service lives of 100-150 F-15Cs to perform homeland security-related air defense missions through 2022 and possibly beyond.

designing the F-15E (on top of the $7.5 billion it spent developing earlier models of the F-15). The Air Force currently has about 220 F-15Es. A total of 236 of these aircraft were delivered to the Air Force between 1988 and 2004. The F-15E airframe is rated at as much as 16,000 hours, double the anticipated service life of the F-15C/D.[12] Under current plans, the Air Force is projected to have some 170 F-15Es in its fleet in 2022,[13] at which point almost all of the aircraft will be over 30 years old.

F-16. The F-16 is the mainstay of the US Air Force. It is a multi-role fighter capable of performing both air-to-air and air-to-ground missions. However, it is used primarily to attack ground targets. Altogether, the Air Force has a total of about 1,360 F-16s of various models. The first F-16s were delivered in 1978. Production of the aircraft for the US Air Force continued until 2002, when the last F-16 was delivered. The average age of F-16s in the US Air Force today is about 14 years. The latest models of the F-16 are far more capable than earlier versions of the aircraft. Although the US Air Force is no longer purchasing the aircraft, new F-16s are still being produced for export. Through the Falcon STAR (Structural Augmentation Roadmap) program, the Air Force is currently upgrading some 1,200 F-16s to extend their service lives. Under this $1 billion effort, the Air Force will replace or repair life-limited airframe components and structures. According to the Air Force, some F-16s have exhibited fatigue damage after as few as 3,500 flight hours. The Air Force expects the Falcon STAR program to extend the life of the F-16 to about 8,000 hours and also reduce the aircraft's time in depot

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[12]"F-15E, Service Life," GlobalSecurity.Org, www.globalsecurity.org/military/systems/aircraft/f-15-life.htm.

[13] Derived from Figure 3-21 in *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004,* p. 27.

maintenance.[14] Under current plans, the number of F-16s in the Air Force would drop to about 250 by 2022.[15]

F-117: This aircraft was specially designed to minimize its vulnerability to detection from enemy radars. The F-117 is one of only two stealthy combat aircraft currently in the Air Force's inventory (the other, the B-2 bomber, is discussed later in this chapter). The Air Force today has 55 F-117s. A total of 59 F-117s were delivered to the Air Force between 1982 and 1990. Like the F-15E, the F-117 is capable of attacking targets located well behind enemy lines. Because of its unique design and capabilities, and small numbers, F-117s are typically used to attack only very high value targets and in cases where achieving surprise is critical. The Air Force is currently modifying and upgrading its F-117 fleet to improve its safety, reliability and supportability. Improvements include upgrades to the F-117's mission planning computer, the replacement of obsolete avionics, and enhanced PGM capabilities.[16] The Air Force expects to keep some F-117s in its force through 2018, when the newest F-117s would be 28 years old.[17]

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[14] Air Force Material Command (AFMC) News, "Ogden ALC Delivers First Falcon STAR F-16," February 11, 2004, www.afmc.wpafb.af.mil/HQ-AFMC/PA/news/archive/2004/Feb/0215-04.htm.

[15] Derived from Figure 3-21 *in The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004,* p. 27.

[16] United States Air Force, *Committee Staff Procurement Backup Book, FY 2005 Budget Estimates, Aircraft Procurement, Air Force, Vol. 1,* p. 1303.

[17] Ibid.

MODERNIZATION PLANS

Under current plans the size of the Air Force's fleet of tactical combat aircraft would remain roughly the same size it is today (or only slightly smaller) through 2022.[18] However, under those plans, the composition of this fleet would change dramatically. As noted earlier, it is assumed in this report that the Air Force would buy three new types of manned tactical combat aircraft over the next two decades, the F/A-22, the F-35 and the FB-X, regional bomber. Altogether, a total of some 1,775 new manned aircraft of these types would be procured between 2005 and 2022. And by 2022, these models would account for two-thirds of the Air Force's inventory of tactical combat aircraft. In addition, it is assumed that the Air Force would buy 300 UCAS over the next two decades. Under this modernization plan, the average age of the Air Force's fleet of tactical combat aircraft would increase from 17 years at the end of 2004 to about 20 years in 2012 and then drop back down to about 12 years in 2022.

F/A-22: The F/A-22 is intended to replace the F-15C/D as the Service's premier air superiority fighter. It will mark a significant improvement over the F-15C/D because it is designed to be stealthy, and because it will have the ability to cruise at supersonic speeds. Since 2002, when the Air Force changed the aircraft's designation from the F-22 to the F/A-22, the Air Force has also claimed that the aircraft would have a significant ground attack capability.[19] The Air Force plans to procure a total of some 210-271 F/A-22 fighters,[20] with the precise number dependent on how successfully the Air Force can keep program costs within

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[18] See Figure 3-21 in *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, p. 27.

[19] Modifying the F-22 to give it a ground-attack capability is projected to add as much as $11.7 billion to the cost of the program. Statement of Allen Li, Director, Acquisition and Sourcing Management, "Tactical Aircraft: Status of the F/A-22 and Joint Strike Fighter Programs," General Accounting Office, GAO 04-597T, March 25, 2004, p. 5. Moreover, at least the first 65 F-22s will be constructed without these upgrades. Watts, "Prospective US Air Force Failure Points", p. 15.

[20] An additional six F/A-22s were acquired with R&D funds.

the congressionally-imposed cost cap.[21] Production of the F/A-22 was begun in 1999 and, through 2004, funding had already been approved for 68 aircraft. It is assumed in this report that under the current plan the Air Force would buy 203 additional F/A-22s, for a total of 271 aircraft—with production completed around 2011. In this case, in 2022 the Air Force would have some 260 F/A-22s in service, and these aircraft would account for roughly 11 percent of the Service's fleet of tactical combat aircraft.[22]

F-35 Joint Strike Fighter: Three different versions of the F-35 are currently under development, including conventional take-off and landing versions for the Air Force and the Navy, and a short takeoff and vertical landing (STOVL) version for the Marine Corps.[23] In the case of the Air Force, the F-35 is intended to replace the F-16 in the multi-role fighter role and the A-10 in the close air support role. Altogether, the Air Force plans to buy a total of 1,763 F-35s through 2026, including some 1,370 F-35s through 2022. Like the F/A-22, the F-35 is designed to be highly stealthy. However, unlike the F/A-22, it will not have a supercruise capability. On the other hand, the F-35 will have a much greater payload capacity than the F/A-22 and be substantially less costly to produce. Under Air Force plans, by 2022, about 1,120 F-35s will be in service, and the aircraft will account for nearly half of the Service's tactical combat fleet.[24]

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[21] After the end of the Cold War, the number of F-22 aircraft to be procured was cut from 750 to about 440. The number has been further reduced primarily due to cost considerations. Some Air Force officials continue to believe that 300-400 of these aircraft should be procured.

[22] It is assumed in this analysis that new aircraft would be delivered two years after funding was appropriated to procure the aircraft. This, plus that fact that some aircraft would be lost through normal attrition (e.g., peacetime training accidents), explains the difference between the number of aircraft projected to be procured over the 2005-22 period and the number assumed to be in the Air Force's inventory in 2022.

[23] The Air Force has also expressed interest in buying some STOVL versions of the F-35.

[24] Derived from Figure 3-21 in *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, p. 27.

Regional Bomber (FB-X): Air Force officials have expressed interest in buying an aircraft that would have a range in between that of other tactical combat aircraft and existing bombers. There are a number of possible options the Air Force could pursue to acquire such an aircraft. The most widely discussed option would be to procure a specially modified version of the F/A-22 called the FB-22. Other options include buying a version of the YF-23, a prototype aircraft that competed with (and lost out to) the F-22 more than a decade ago in the Air Force's Advanced Tactical Fighter (ATF) program "flyoff."[25] The FB-22 would have both a greater range and a better ground-attack capability (including a larger payload) than the current-design F/A-22. Such an aircraft would be capable of attacking the kind of targets now allocated in Air Force plans to the F-117 and the F-15E. Indeed, with a projected range of as much as 1,200-1,800 miles, the FB-22 would give the Air Force a medium-range strike capability that it currently lacks. On the other hand, some critics have questioned the feasibility of modifying the F/A-22 and providing it with these capabilities, and whether such capabilities would, in any case, be worth the cost of such an effort.[26] In contrast to the F/A-22 and the F-35, the Air Force is not yet committed to buying the FB-22 or any other aircraft for the regional bomber mission. However, as noted earlier, it is assumed in this report that under the current plan the Air Force would decide to buy such an aircraft. Specifically, it is assumed that the Air Force would buy 200 regional bombers through 2022.[27] Reflecting uncertainty over the specific aircraft that might be selected for this role, in this report the aircraft is identified as the FB-X.

Unmanned Combat Air System: Under the Joint Unmanned Combat Air System (J-UCAS) program, the Defense Advanced

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[25] The team that designed the YF-23 was led by the Northrop Corporation and McDonnell Douglas Corporation. McDonnell Douglas was subsequently acquired by the Boeing Corporation.

[26] For a discussion of the FB-22 program, see Christopher Bolkcom, *Air Force FB-22 Bomber Concept*, CRS, May 26, 2004.

[27] This is consistent with CBO's assumption about FB-22 procurement over this period. See Figure 3-20 in *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, p. 26.

Research Projects Agency (DARPA) is currently working with the Air Force and the Navy to develop a UCAS capable of carrying out a range of different tactical missions for the two Services. Today, the US military operates a wide variety of different unmanned aerial vehicles (UAVs). But these are used almost exclusively for reconnaissance, intelligence gathering and related missions. The UCAS would be the first UAV designed specifically to carry out strike missions. The design of the Air Force version of the UCAS is being optimized, at least initially, to counter enemy air defenses. According to the Air Force, its UCAS could perform the suppression of enemy air defense (SEAD) mission both through hard kills (e.g., by launching PGMs) and by electronic means. The Air Force believes that the UCAS would also be useful for striking other ground targets, as well as enforcing "no-fly zones" and carrying out other missions requiring long endurance. It is unclear how many UCAS will ultimately be acquired by the Air Force and the schedule on which they will be produced. Obviously, much depends on how successful the ongoing development effort is. CBO estimates that, under current plans, the Air Force would begin procuring UCAS in 2006, and would procure some 300 UCAS through 2022.[28] At that point, UCAS would account for about 11 percent of the Air Force's tactical combat fleet.

BOMBER FORCES

In addition to some 2,400 relatively short-range tactical combat aircraft, the Air Force has a fleet of about 171 intercontinental (3,000 mile-plus combat radius) bomber aircraft. This total aircraft inventory supports a PAA strength of 131 aircraft. Because of their much greater range, unlike tactical combat aircraft, bombers can strike targets deep inside hostile territory and can be based well outside the region of conflict. Indeed, bombers can and have been used to attack bases in distant regions of the world, while operating from bases in the United

[28] Derived from Figure 3-20 in *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, p. 26.

States. Bombers also have a much greater payload capacity than fighter and attack aircraft, typically 5-10 times greater.[29] The Air Force's bomber fleet includes three different kinds of bombers, the B-2, the B-1B and the B-52. Under current plans, the Air Force is projected to eventually reduce the size of its bomber force to a total of 157 bombers (96 PAA) and sustain a force of essentially this size over the next 30-plus years. According to Air Force projections, all three bombers should be structurally sound for the next four or five decades.[30]

B-2: The B-2 bomber is the Air Force's newest and most capable bomber. Like the F-117, the B-2 bomber is a stealthy aircraft, but it has a much greater range and payload capacity. The B-2 bomber is generally equipped with precision-guided conventional bombs. However, it can also be armed with nuclear weapons. Because of its stealthy design, the B-2 is capable of penetrating even heavily defended enemy air space. The Air Force has 21 or these aircraft, and a PAA strength of 16. The first B-2s were delivered in the 1993 and the last in 1997. The average age of the B-2 bomber fleet is currently about 10 years. The Air Force plans to extensively upgrade the B-2s to improve their survivability, lethality and supportability. Current plans call for spending some $928 million on modifications and upgrades over the next five years alone.

B-1B: The Air Force purchased 100 B-1B bombers in the 1980s. It currently has 58 B-1B bombers in its active inventory, and some additional B-1Bs in inactive status. The average age of the B-1B bomber fleet is about 17 years. The Air Force's B-1B fleet has a PAA strength of 54 aircraft. Unlike the B-2 and the B-52 bombers, the B-1B is presently tasked only with conducting strikes with conventional weapons. Like the B-2, it can carry a variety of different PGMs, as well as unguided gravity bombs. Over the long run, the Air Force plans to maintain a total inventory of about 60 B-1Bs and support a PAA strength of 36 B-

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[29] Christopher J. Bowie, *The Anti-Access Threat and Theater Air Bases* (Washington, DC: CSBA, 2002), p. 14.

[30] US Air Force, *US Air Force Long-Range Strike Aircraft White Paper*, November 2001, p. 27.

1Bs.[31] The Air Force's ongoing upgrade program for the B-1B includes enhancements to the bomber's PGM delivery and electronic countermeasure capabilities, as well as other avionics and maintainability improvements.

B-52: The B-52 bomber is the Air Force's oldest combat aircraft. The Air Force currently has a total inventory of 91 B-52 bombers, supporting a PAA strength of 61 aircraft. Under Air Force plans, the total inventory of B-52s will drop to 76 aircraft, supporting a PAA of 44 B-52 bombers. Notwithstanding the B-52's 40-plus years of service, it remains a very effective bomber. Over the past four decades the B-52 fleet has been extensively modernized to extend its service life and increase its capabilities. Like the B-2, the B-52 fleet is assigned both conventional and nuclear strike missions. However, in contrast to the B-2, the B-52 is limited to using standoff weapons (e.g., cruise missiles), when operating in high threat environments.

Modernization Plans

Air Force plans for a replacement bomber remain somewhat unsettled. According to recent Air Force statements, the Service plans to begin development of a new Long-Range Strike Platform (LRSP) in the next few years, leading to a full-scale development decision in the 2012-15 timeframe, a production decision between 2020 and 2025, and subsequent fielding in the 2025-30 timeframe.[32] This marks an acceleration of previous Air Force bomber acquisition plans. Under the 2001 bomber roadmap, the Air Force was not projected to begin fielding a new bomber until around 2037.[33] The Air Force has indicated that the LRSP might be either manned or unmanned. For the purposes of this

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[31] The B-1B number will be increased by reactivating a number of B-1Bs currently in storage.

[32] General T. Michael Moseley, USAF Vice Chief of Staff, prepared statement before the House Armed Services Committee, March 2, 2004, p. 2.

[33] "Long-Range Strike Aircraft," GlobalSecurity.Org, www.globalsecurity.org/military/systems/aircraft/lrsa.htm.

analysis, it is assumed that procurement of the new bomber would begin just after the period covered in this report (e.g., 2023-25). Although, it is assumed that no new bombers would be procured over the 2005-22 period, as noted above, existing plans call for all three types of bombers to be significantly modified and upgraded over the next several decades. Because it is assumed that no new bombers would be purchased between now and 2022, the average age of the Air Force's bomber force is projected to increase from about 29 years to 47 years over this period.

AIRLIFT FORCES

A robust airlift capacity is critical to maintaining the US military's ability to project power into distant regions of the world. Measured by tonnage, the vast majority of US equipment and supplies used to support US forces and combat operations in past conflicts has been supplied by sealift or through prepositioning, rather than airlift. However, airlift provides a critical means of rapidly delivering military personnel and, for lighter military forces, equipment and supplies. It also provides a means of quickly transporting forces and cargo to locations that do not have access to ports, major roads or railroads. In addition, airlift is needed to carry out some specialized military missions, including airdrop operations.

The Air Force's airlift fleet consists of both strategic and tactical capabilities. The former includes aircraft capable of transporting personnel and cargo from the United States to distant regions of the world. The later includes aircraft designed to transport forces and supplies within regions where US forces are engaged.

Currently, the Air Force has a strategic (or inter-theater) airlift fleet with a lift capacity equivalent to about 45 million ton miles per day (MTMD). The Air Force has four main types of strategic airlift aircraft, the C-17, the C-5, the C-141, and the KC-10A. In addition, during times of national emergency, the US military can draw upon commercial passenger airliners and cargo aircraft that participate in the Civil Reserve Air Fleet

(CRAF) program. Presently, some 674 international long-range aircraft, owned by two dozen different companies, are enrolled in CRAF.[34] For planning purposes, the Air Force assumes that CRAF aircraft could provide about 20.5 MTMD if needed. However, the actual capacity of the CRAF fleet, if fully mobilized, is substantially greater.[35] The Air Force also has a number of different types of tactical (or intra-theater) airlift aircraft, the most important of which is the C-130.

C-17: The C-17 is the Air Force's newest and most numerous strategic airlift aircraft. A single C-17 can carry an average load of about 45 tons[36] of cargo to distances of 4,400-5,100 miles,[37] or much further with in-flight refueling. The C-17 has a smaller cargo capacity than the C-5, the Air Force's other main strategic airlifter. However, like the C-5, the C-17 is capable of carrying "out size" (i.e., especially large or bulky) cargo. The C-17 also has several important advantages over the C-5 and most commercial transport planes. Among other things, the C-17 can operate from shorter and narrower runways and is more maneuverable on the ground. The first C-17 was delivered in 1993. The Air Force currently has about 110 C-17s in its inventory. The average age of the C-17 fleet is about six years. As discussed below, the Air Force plans to continue procuring additional C-17s through at least 2007.

C-5: Measured by carrying capacity, the C-5 is the Air Force's most capable strategic airlifter. The C-5 fleet consists of two different versions of the aircraft. The Air Force has 76 C-5As and 50 C-5Bs. Each of these aircraft has an average cargo capacity of

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[34] Office of Emergency Transportation, "Civil Reserve Air Fleet, Monthly Allocations," www.rspa.dot.gov/oet/craf/CR000404.xls.

[35] GAO, *Military Readiness: Civil Reserve Air Fleet Can Respond as Planned, but Incentives May Need Revamping*, December 2002, pp. 4-7.

[36] Average payload figures for the C-17 and other strategic airlift aircraft are taken from Rachel Schmidt, *Moving US Forces: Options for Strategic Mobility* (Washington, DC: CBO, February 1997), p. 13.

[37] The first 70 C-17s produced have an unrefueled range of 4,400 miles, later models have an unrefueled range of about 5,100 miles. Christopher Bolkcom, *Military Airlift: C-17 Aircraft Program*, p.5.

about 65 tons. The C-5As were delivered between 1969 and 1973. The C-5Bs were delivered in the 1980s. The average age of the C-5 fleet is about 27 years. The C-5As, in particular, suffer from low mission-capable rates.

KC-10A: The KC-10A is a military version of the McDonnell Douglas DC-10. It was designed primarily as a tanker. However, the KC-10A can also be used to transport cargo. It has an average payload capacity of about 40 tons. The Air Force has a total of 59 KC-10As, which were delivered between 1981 and 1990. The average age of the aircraft fleet is about 20 years.

C-141: The C-141 is the oldest and smallest of the Air Force's strategic airlifters. Delivered between 1964 and 1982, today the C-141 aircraft fleet has an average age of about 38 years. Each C-141 can carry an average cargo load of some 23 tons. Since the early 1990s, the C-17 has been replacing the C-141, and there are now only about 60 C-141 airlifters left in the Air Force. The Air Force expects the last C-141s to be retired in 2006.

C-130: By comparison to the strategic airlifters discussed above, the C-130 is a much smaller and shorter-range airlifter. The latest model of the aircraft, the C-130J, can carry a payload of about 18 tons over a distance of 2,000 miles.[38] While the Air Force's fleet of strategic airlifters is intended primarily to deliver personnel, equipment and supplies from the United States to distant regions of the world, the C-130 is intended primarily to transport troops and supplies *within* these forward regions. Altogether, the Air Force has a total of about 510 C-130s. First delivered to the Air Force in 1956, the average age of the C-130 aircraft fleet is now about 26 years. As discussed below, the Air Force plans to keep the C-130J in production through the middle of the next decade.

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[38] This is the aircraft's maximum normal payload and range. US Air Force, "C-130 Fact Sheet," www.af.mil/factsheets_print.asp?fsID=92&page=1.

Modernization Plans

The focus of the Air Forces airlift modernization plans is on completing planned purchases of C-17 and C-130 aircraft. The Air Force would also like to begin procuring a next-generation replacement for the C-130, the AMC-X, sometime around 2020.

C-17: The current FYDP calls for the Air Force to purchase a total of 180 C-17 aircraft. Through 2004, a total of 138 of these aircraft have already been procured. The remaining 42 C-17s are scheduled to be purchased over the next three years. However, the Air Force officials have indicated that they would like to buy an additional 42 C-17s, bringing the total number to 222 aircraft. It is assumed in this analysis that under the current plan the Air Force would, indeed, procure a total of 222 C-17s, including 84 of the aircraft over the 2005-22 period. These additional purchases would allow the Air Force to retire about 30 C5-As, without reducing their overall strategic airlift capacity.

C-130: Under current plans, the Air Force is projected to buy an additional 126 C-130Js over the 2005-16 period. To date, the Air Force has procured 42 C-130Js, including 27 for airlift and 15 for other specialized support missions, such as electronic warfare and weather reconnaissance.

AMC-X: The Air Force eventually plans to acquire a replacement for the C-130. Although current plans are unsettled, it is expected that this new aircraft would become operational around 2020.[39] This suggests that procurement would begin in 2018. In this report, it is assumed that the Air Force would procure a total of 20 AMC-X between 2018 and 2022.

[39] Andrew Koch, "US Wants Next-Generation Stealth Aircraft," *Jane's Defence Weekly*, October 29, 2003.

TANKER FORCES

The Air Force currently has an inventory of about 600 tanker aircraft. The effective operating range of combat, airlift and other aircraft can be greatly extended through aerial refueling. As noted earlier, without aerial refueling, tactical combat aircraft are generally limited to combat radii of 400-600 miles. By contrast, where aerial refueling is available sustained operations by tactical combat aircraft can be carried out over ranges of as much as 1,500-2,000 miles. In the case of bombers, tanker support can increase an aircraft's combat radius from 3,000 miles to 8,000 miles or more, literally global distances. Thus, the Air Force's tanker fleet is a critical force multiplier. Moreover, the Air Force's tanker fleet supports not only other Air Force aircraft, but Navy and Marine Corps aircraft, as well aircraft from allied countries.

The critical importance of the Air Force's tanker fleet to US power projection capabilities can be clearly seen in the recent war in Iraq. During that conflict, Air Force tanker aircraft flew 6,193 sorties—accounting for over 25 percent of all Air Force sorties—and offloaded some 376 million pounds of fuel.[40] No other country in the world has an aerial refueling capability even vaguely comparable to that possessed by the US Air Force. The mainstay of the Air Force's tanker fleet is the venerable KC-135. The Air Force has about 540 KC-135s, as well as 59 KC-10As.

KC-135: The KC-135 can carry about 200,000 pounds of fuel. Each aircraft can also carry some 35,000 pounds of cargo. The KC-135 is the oldest aircraft in the Air Force's inventory. The Air Force's KC-135 tankers were delivered between 1957 and 1964. The average age of the KC-135 aircraft fleet is about 44 years. The fleet includes about 130 KC-135Es and 410 KC-135R/Ts. Each of these versions are reengined upgrades of the original KC-135A tanker. The KC-135R/Ts are the most modern versions, having been retrofitted with new, more fuel efficient and reliable turbofan engines beginning in 1984. The KC-130Es are, on average, about 2.5 years older than the KC-135R/Ts.

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[40] "Operation Iraqi Freedom—By the Numbers," USCENTAF, Assessment and Analysis Division, April 20, 2003, pp. 7-8.

KC-10A: The KC-10A is a much newer, larger and more capable tanker than the KC-135. As noted earlier, the KC-10As were delivered in the 1980s, and the aircraft have an average age of some 20 years. Each KC-10A can carry about 365,000 pounds of fuel, making it by far the Air Force's largest tanker. It is also a truly dual-capable aircraft. As noted earlier, the KC-10A has an average cargo capacity of about 40 tons.

Modernization Plans

The focus of the Air Force's tanker modernization efforts is its plan to acquire 100 new Boeing 767 aircraft, modified for the tanker mission. The plan is controversial, among other reasons, because the Air Force plans to acquire the first 20 of these aircraft through a lease-purchase arrangement, rather than purchase them directly. Air Force officials argue that this approach will allow the Air Force to acquire the aircraft more quickly than would be possible through the traditional approach (i.e., direct purchase of all 100 aircraft). However, analyses conducted by CBO, the General Accounting Office (GAO), the Congressional Research Service (CRS), and others, indicates that this arrangement will end up costing the Air Force more, over the long run, than would direct purchase.[41] Nor is it clear that directly purchasing the aircraft would necessarily take longer.[42]

Presently, the program is on hold subject to several internal investigations of possible ethics violations, and the completion of two studies—the Air Force Analysis of Alternatives (AoA) and the Mobility Capabilities Study (MCS) being conducted by DoD's

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[41] See, for example, Christopher Bolkcom, *The Air Force KC-767 Lease Proposal: Key Issues for Congress*, CRS, August 28, 2003; Douglas Holz-Eakin, CBO Director, Letter to the Honorable John McCain, Chairman, Committee on Commerce, Science and Technology, November 13, 2003; and Steven M. Kosiak, "Air Force Plan to Lease Tankers Likely to Cost More than Buying, Set Harmful Precedent," CSBA, June 12, 2003.

[42] Christopher Bolkom and Ronald O'Rourke, "Observations on DoD KC-767 Lease vs Buy Scenarios," CRS Memorandum to the Senate Commerce Committee, October 1, 2003, p. 2.

office of Program, Analysis and Evaluation (PA&E). These studies will take a comprehensive look at tanker recapitalization requirements, and various options for meeting overall tanker requirements in the future. Both of these reports are scheduled to be completed by November 2004.[43] Thus, the Air Force's tanker force structure and modernization plans are currently unsettled.

For purposes of this report, it is assumed that the Air Force will ultimately decide to buy a mixture of new medium and small tankers—in both cases, selecting a derivative of a commercial aircraft—and that, over the long-term, it would maintain essentially the same refueling capacity and numbers of tankers that has today. Specifically, it is assumed that the Air Force would procure a total of about 280 tankers over the 2007-22 period, including 140 medium tankers, such as the KC-767, the A-330 or an equivalent aircraft, and 140 small (and less costly) tanker aircraft. The small tanker would be a derivative of the Boeing 737, the A-321 or an equivalent commercial aircraft. Each medium tanker would have a fuel capacity of about 200,000 pounds (comparable to the KC-135 and the KC-767), while the capacity of each small tanker would be about 100,000 pounds. Under this plan, it is assumed that the Air Force would retire its entire fleet of 135 KC-135E tankers and about 150 KC-135R/Ts tankers.

By 2022, the Air Force's tanker fleet would (like today's fleet) consist of some 600 aircraft, including 140 new medium tankers, 140 new small tankers, 260 KC-135R/Ts and 59 large KC-10A tankers. Such a fleet would have a modestly lower "theoretical" fuel capacity compared to the current tanker fleet. However, because the new tankers would have much higher reliability and availability rates than the older KC-135s they would be replacing, the "real world" functional capacity of the Air Force's tanker force in 2022 would be equivalent or superior to today's fleet. Additionally, each of these new tankers would be air refuelable and would be able to refuel all types of receivers, using

[43] DoD, "Department of Defense Defers Tanker Lease Decision," Press Release, May 25, 2004.

either a boom or hose and drogue unit (HDU), thereby increasing the operational flexibility of the tanker force.[44]

These force structure and modernization plans seem consistent with DoD's and Air Force's stated requirements, and previous plans for the tanker force. However, as noted earlier, this is an area where the Air Force's plans are presently very much in flux, and it is possible that the tanker plan announced in the fall of 2004 will differ considerably from the "current plan" described here.

SPECIAL OPERATIONS FORCES

Air Force special operations forces account for only a small fraction of the Services' overall force structure. Air Force Special Operations Command (AFSOC) oversees a force of only about 9,400 active duty personnel. This is equivalent to about 2.5 percent of the Air Force's total active duty end strength, and 4-5 percent of those troops assigned to mission (vice infrastructure) functions. Notwithstanding the relatively small size of AFSOC, its forces provide the US military with critical combat capabilities. The importance of the Air Force's and the other Services' special operations forces has been demonstrated most clearly in the war in Afghanistan, where US special operations forces played a decisive role in toppling the Taliban government, and where they continue to play a critical role in supporting operations against both Taliban and al Qaida forces. Air Force special operations forces have also been heavily used in Iraq.[45]

The core of the Air Force's special operations force structure is organized around four major weapons platforms (including about 120 aircraft).

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[44] Air Force aircraft refuel through the use of a boom, while most US allies and Navy and Marine Corps aircraft use the hose and drogue method.

[45] Air Force SOF aircraft deployed in the initial phase of OIF included eight AC-130s and 26 MC-130s. "Operation Iraqi Freedom—by the Numbers," p. 7.

AC-130: The Air Force currently has 21 AC-130 gunships. These modified versions of the C-130 tactical transport aircraft were acquired by the Air Force between 1968 and 1995. Equipped with side-firing guns and sophisticated sensors, the AC-130 is capable of providing precision fire and area saturation against ground targets for extended periods.

MC-130E/H: The MC-130E/H Combat Talon is designed to provide a global, adverse weather air drop capability, and to transport troops, equipment and personnel in support of SOF operations. The Air Force presently has 14 E models and 22 H models, for a total of 36 aircraft. These C-130 variants were delivered to the Air Force between 1965 and 1980.

MC-130P: This version of the C-130 tactical transport was modified to provide air refueling support to other SOF aircraft operating in high threat areas. The Air Force currently has 26 MC-130 aircraft.

MH-53: The MH-53 is a heavy-lift, deep-penetration helicopter designed to support SOF operations by, among other things, providing an infiltration and exfiltration capability in areas where fixed-wing aircraft are unable to operate effectively. The MH-53 is also used to support combat search and rescue missions. The Air Force has a total of 36 MH-53 helicopters. The helicopters have an average age of about 34 years.

Modernization Plans

The Air Force's long-range plans for its special operations forces are—as in many other areas—somewhat unclear and unsettled. It is assumed in this analysis that, under the current plan, Air Force special operations forces would remain essentially the same size they are today, measured in terms of personnel and aircraft. However, those forces would be modernized. In the case of major weapons platforms, the Air Force's efforts and resources are projected to focus primarily on *procurement* of the CV-22 and *development* of a number of other SOF aircraft.

CV-22: Under current plans, the Air Force is projected to buy 50 CV-22s, a version of the Marine Corps MV-22 Osprey tilt-rotor aircraft, to be used to support special operations missions. The CV-22 is intended to replace the MH-53 helicopter. The administration requested funding for the first two of these aircraft in 2004. Under current plans, the remaining 48 aircraft would be purchased between 2005 and the middle of the next decade.

Other SOF aircraft: The Air Force expects to eventually replace the AC-130, the MC-130E/H and the MC-130P with next-generation aircraft. These replacements have tentatively being designated the AC-X, also known as the NGG (next-generation gunship), the M-X (a stealthy transport) and the K-X (a stealthy penetrating tanker). One option being considered by the Air Force is to procure variants of the AMC-X, the planned replacement for the C-130, to replace these different aircraft. As noted earlier, the AMC-X is projected to be deployed beginning around 2020. It is assumed in this analysis that the AC-X, M-X and K-X aircraft, being variants of the AMC-X, would take several years longer to develop and field. Specifically, it is assumed that development of these aircraft would be largely completed by 2022, the last year covered in this analysis, but that procurement of these aircraft would not begin until after 2022.

INTERCONTINENTAL BALLISTIC MISSILE FORCES

Today, the Air Force fields a force of about 520 ICBMs, including 500 Minuteman IIIs and some 20 Peacekeeper missiles. Under current plans, all remaining Peacekeeper ICBMs are to be retired by the end of 2005, while the Minuteman force is to be kept in service for the foreseeable future.

Modernization Plans

Air Force officials have indicated they plan to start deploying a replacement for the Minuteman III missile sometime around 2018.[46] This suggests that they will need to begin procurement of a new ICBM around 2016, at the latest. Although it is unclear from Air Force statements, it is assumed in this analysis that under current plans the Minuteman ICBMs would be replaced on a one-for-one basis. It is assumed that the Air Force would procure a total of 200 new ICBMs over the 2016-22 period, and additional missiles thereafter.

[46] Robert S. Norris and Hans M. Kristensen, "NRDC Nuclear Notebook: US Nuclear Forces, 2004," *Bulletin of Atomic Scientists*, May/June 2004, p. 68.

II. Funding Requirements and Affordability of the Air Force's Plan

The cost of implementing the Air Force's force structure, readiness and modernization plans over the 2005-22 period can be only roughly estimated. One reason for this imprecision is that, as noted in the previous section, the Air Force, along with the rest of DoD, does not always provide detailed data concerning its long-term plans. But even if the Air Force's force structure, readiness and modernization plans were precisely known, it would not be possible to estimate precisely the cost of implementing those plans. This is because there is considerable uncertainty concerning how much it will cost, over the long run, to support various elements of the Air Force at high readiness levels, as well as how much it will cost to buy many of the new weapon systems projected in current plans.

Reflecting this uncertainty, this analysis includes two different estimates of the cost of the Air Force's current plan: a *low-end* estimate, based on relatively optimistic assumptions about future procurement and O&S costs, and a *high-end* estimate based on relatively pessimistic assumptions more consistent with historical experience. Since it is based on historical experience, the latter estimate probably serves as a better basis for planning. The former, more optimistic, estimate is provided for purposes of comparison and because it illustrates perhaps the best that could be hoped for if all of

the various acquisition and infrastructure reforms instituted or proposed over the past few years were successfully implemented.

The administration's 2005 request includes about $120 billion for the Department of the Air Force. Including a proportionate share of Defense Health Program (DHP) funding (which is a defense agency appropriation in the DoD budget) brings the amount of the 2005 request attributable to the Air Force to $125 billion. Under current plans, the Air Force's budget, adjusted to include a share of DHP funding, would reach about $135 billion by 2009 (hereafter, references to the overall Air Force's budget in this report include this DHP adjustment). These funding levels are intended to cover the Air Force's peacetime O&S and modernization costs. These projections exclude any additional emergency funding that might be provided to the Air Force to cover its share of costs associated with ongoing military operations in Afghanistan, Iraq or elsewhere.[47]

Based on low-end cost assumptions, implementing the Air Force's current long-term plan would be projected to cost an average of $133 billion a year over the 2005-22 period. Thus, if cost growth in modernization programs and O&S activities can be held substantially below historical rates, the current plan would be roughly affordable at the level of funding currently projected for the Air Force in 2009. On the other hand, using high-end estimates of modernization and O&S costs would increase funding requirements for the Air Force to an average of some $148 billion annually over the 2005-22 period. This is not only some $23 billion more than the administration has requested for 2005, but some $13 billion more than would be provided in 2009 under the current plan. Given competing budgetary pressures from within DoD, as well as pressures on the DoD topline caused by the worsening deficit outlook and the impending retirement of the "baby

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[47] In May 2004, the Bush Administration amended its 2005 request for DoD to include an additional $25 billion to cover incremental costs likely to be incurred in 2005 as a result of the ongoing military operations in Afghanistan and Iraq. Most of this funding will be allocated to the Army. However, some portion of the funding will be allocated to the Air Force and the other Services. The 2005 costs associated with these operations are almost certain to exceed $25 billion. The administration expects to submit a request for a supplemental appropriation to cover these additional costs sometime next year.

boomer" generation, it is unclear whether such historically high levels of funding for the Air Force are achievable and sustainable.

This discussion of the cost and affordability of the Air Force's current long-term plan is broken down into three different sections. The first part provides high- and low-end cost estimates of the Air Force's modernization plans, while the second part provides high-and low-end estimates of future Air Force O&S costs. Modernization plans include both weapons procurement (i.e., production) and research and development (R&D) activities. Operations and support funding is used to cover military personnel, operations and maintenance (O&M) and other costs associated with manning, operating and supporting US bases and military forces. The third part of this chapter briefly discusses some of the broader budgetary issues and concerns that may raise questions about the long-term affordability of the current Air Force plan.

MODERNIZATION PLANS

Assuming the Air Force is able to meet its cost goals for new weapon systems, this analysis concludes that executing the modernization plans described in Chapter 1 would require average annual funding over the 2005-22 period of about $38 billion for procurement and $17 billion for R&D. On the other hand, assuming the cost of acquiring new weapons system grows as it has historically, this analysis concludes that implementing these plans would require average annual funding of $44 billion for procurement and $21 billion for R&D.

Procurement Costs

The methodology used in this analysis to estimate the procurement funding requirements associated with the Air Force's long-term plans involved a two step process. First, the cost of Air Force's plans for the purchase of *major* weapon systems over the 2005-22 period was estimated. As used in this analysis, major weapon systems refer to all of the tactical combat aircraft, bombers, special operations, airlift and tanker aircraft, as well as ICBMs, discussed in Chapter 1 (and only

those systems). Second, using a different, simplified, methodology an estimate was made of the cost of procuring other types of Air Force equipment.

Funding requirements for the Air Force's major weapons programs were estimated by multiplying the expected unit procurement costs of each of these weapon systems by the number of systems projected to be procured over the 2005-22 period. The number of systems assumed to be procured was the same in the low- and high-end estimates, and was based on the program descriptions provided in Chapter 1. Where the two estimates differ is in their assumptions about unit procurement costs.

For the low-end estimate, the Air Force's current unit cost estimates were assumed to be accurate and, where official estimates were not available, new systems were generally assumed to cost about the same as similar current-generation systems.[48] By contrast, the high-end estimate assumes that, consistent with historical experience, new weapon systems will end up costing substantially more to procure than DoD expects. Historically, each new generation of weapon system has typically cost two-to-three times more per copy to procure than the system it is intended to replace. Moreover, actual acquisition costs for major weapon systems have typically exceeded projected costs by 20 percent.[49] Table 1 shows the author's estimates of the Air Force's plans for major weapon systems over the 2005-22 period, in terms of both procurement quantities and unit costs. Under the low-end estimate, procurement funding requirements for major weapon systems would average about $11 billion annually over these years.

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[48] As in the case of quantity estimates, CSBA made use of a wide variety of sources to derive unit cost estimates. In particular, in addition to DoD, a number of CBO publications were used to derive unit procurement cost estimates under both the low-end and high-end methodologies. See, for example, Lane Pierrot, *A Look at Tomorrow's Tactical Air Forces*, (Washington, DC: CBO, January 1997) and *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, February 2004.

[49] Specifically, new weapon systems have typically ended up costing about 20 percent more than they were projected to cost at the time a decision was made to move the system into full-scale development.

This would rise to nearly $14 billion annually under the high-end cost estimate.

Table 1: Estimated Unit Procurement Costs and Quantities of Air Force Major Weapon Systems, 2005-2022 (cost estimates in millions of 2005 dollars)

System	Low-End Cost Estimate	High-End Cost Estimate	Quantity
F/A-22	$125	$135	203
FB-X	$150	$165	200
F-35	$45	$70	1370
UCAS	$20	$30	300
C-17	$250	$250	84
C-130J	$90	$90	126
AMC-X	$100	$150	20
Medium Tanker	$150	$150	140
Small Tanker	$75	$75	140
ICBMs	$40	$60	200

Source: CSBA. Based on DoD, CBO and other data

Although major weapon systems, as defined above, generally represent the Air Force's most visible acquisitions, historically they have accounted for an average only about 30 percent of the Air Force's total procurement budget. Of the remaining procurement funding, typically a little less than half has been allocated to NFIP and Air Force space programs. The 2005 request includes at total of about $14 billion for these programs and activities. As noted earlier, these are both highly classified areas. Thus, no attempt was made to describe current plans for NFIP and space programs in Chapter 1. Reflecting this lack of information, a simplified approach was used in this analysis to estimate future funding requirements for these programs. Specifically, it was assumed, in both the low-end and high-end cost estimates, that funding for NFIP and Air Force space programs would remain at about $14 billion a year through 2022. This may understate future funding requirements. NFIP funding, in particular, appears to have grown significantly over the past several years, since the terrorist attacks of September 11, 2001, and it is possible that it will continue to

grow in the future. On the other hand, viewed from a longer-term perspective, the current level of funding appears to be very high.[50]

The remainder of the Air Force's procurement budget, which typically accounts for slightly more than half of all Air Force procurement funding not allocated to major weapons programs, is used to purchase a wide variety of other equipment, including everything from forklifts and trucks to munitions, tactical guided missiles and training aircraft, as well as to pay for modifications and upgrades of deployed systems. It is also used to cover the cost of purchasing specialized aircraft—such as intelligence, surveillance and reconnaissance aircraft—that are not among those categorized as major for purposes of this analysis. Historically, for every dollar the Air Force has spent on the procurement of major weapon systems, it has spent about $1.20 on these other "minor" procurement programs. It is assumed in this analysis that this ratio will continue to hold in the future, resulting in average annual minor procurement funding requirements over the 2005-22 period of about $13 billion in the low-end estimate and $17 billion in high-end estimate.

R&D Costs

Compared to the methodology used to estimate future Air Force procurement funding requirements, this analysis takes a simpler approach to estimating future Air Force R&D funding requirements. Under the low-end estimate, it is assumed that the Air Force would spend an average of about $17 billion a year on R&D over the FY 2005-22 period. This is the same level of funding that has been provided for Air Force R&D on average over the past 20 years. It is possible that R&D costs could be even lower, since the Air Force has already nearly completed the development of many of the new weapon systems projected to be procured over this period—such as the F/A-22, the C-17 and the C-130J. Furthermore, annual Air Force R&D budgets of $17 billion would still be relatively high by historical standards. Between 1965 and 2004, the Air Force spent an average of only $15

[50] Funding for these programs and activities averaged about $10 billion a year over the 1985-2004 period.

billion on R&D. And over the past ten years, the Air Force has been provided an average of about $16 billion annually for R&D.

On the other hand, $17 billion a year for Air Force R&D might not be sufficient. As in the case of procurement costs, the cost of developing new weapon systems has grown dramatically over the past several decades. And, again as in the case of procurement, actual R&D costs have often substantially exceeded anticipated R&D costs for new weapon systems. In addition, while R&D activities associated with some new weapons programs are now complete or largely complete, in other cases—such as the F-35 and the UCAS—substantially more funding will need to be provided over the 2005-22 period. The Air Force will also have to begin providing R&D funding over this period for some new weapon systems, such as the next-generation bomber and a new ICBM. Reflecting the potential for cost growth, under the high-end estimate Air Force R&D funding is projected to average about $21 billion a year over the long term. This is based on the assumption that Air Force R&D funding would remain at the level requested for 2005, in the administration's most recent budget request, throughout the entire 2005-22 period.

OPERATIONS AND SUPPORT COSTS

Operations and support programs and activities include essentially all of those areas of the defense budget associated with manning, operating, maintaining and sustaining US military forces day-to-day, both in peacetime and in wartime. It includes funding provided through the military personnel and O&M accounts of each of the Services, as well as various defense agency O&M accounts. As defined in this analysis, the O&S budget also includes funding for military construction and family housing. O&S funding generally accounts for over half of the Air Force's budget. Including the Air Force's share of DHP funding, the 2005 request contains about $71 billion to cover Air Force O&S costs.

Historically, O&S activities have not only absorbed the largest share of the Air Force's budget, they have also experienced substantial and sustained cost growth. Under the low-end estimate, it is assumed that Air Force O&S costs (including associated DHP costs) would rise to an average of $78 billion a year over the 2005-22 period. Under the

high-end estimate, it is assumed that those costs would average $82 billion over these years. The reasons for these cost growth assumptions are discussed below.

On a per troop basis, O&S costs for the US military as a whole grew at an average annual rate of about 2 percent in real terms between 1980 and 2000.[51] Due to data limitations, it is difficult to ascertain precisely how much Air Force O&S costs, specifically, have grown over this period.[52] But they appear to have grown at a comparable rate. Data limitations also make it difficult to determine the precise cause of this cost growth. However, it is possible to identify some of the important contributors.

The steady rise in O&S spending has stemmed in part from the need to recruit and retain quality personnel. The 2005 request includes $28.5 billion for the Air Force's military personnel accounts. As the civilian economy has grown and pay and benefits have improved for civilian workers, it has similarly proven necessary to improve pay and benefits for military personnel. The impact of civilian wage growth has been especially significant since the military transitioned to an all volunteer force in the 1970s. Moreover, the US military has sought to recruit and retain increasingly capable and experienced personnel over the years.

In the case of the Air Force, the percentage of recruits scoring above average on the Armed Forces Qualification Test (AFQT) increased from some 55 percent in 1980 to 75 percent in 2001. Likewise, the percentage of Air Force recruits with high school diplomas rose from 84 percent to 99 percent over these same years. The US military has also become substantially more senior and experienced over time. For example, in 1980 the average service member was about 26.5 years old and had under 35 months of experience. By contrast, in 2000 the average service member was

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[51] It is difficult to discern meaningful O&S costs trends over the past few years because of the effects of the wars in Afghanistan and Iraq on O&S funding requirements.

[52] Among other things, accurately tracking trends in Air Force O&S costs over this period is made difficult by the fact that some health care costs that, in the 1980s, were covered through the Air Force's budget began, in the 1990s, to be paid for with defense agency (DHP) funds.

about 27.5 years old and had almost 85 months of experience.[53] As the force has grown older and more experienced, the share of the force with dependents has also increased. In addition, the US military, and the Air Force in particular, has come to require substantially more technically proficient personnel. Between 1945 and 1985, for instance, the share of white collar technical personnel in the US military increased from 13 percent to 29 percent.[54] Today, 73 percent of Air Force enlisted personnel have had at least some college, while half of the officers in Air Force hold a masters or higher level degree.

The need to recruit and retain quality personnel has not only affected military pay, but other benefits as well. The most costly of these other benefits is health care. Over the past several decades, military health care costs have grown dramatically. The US military as a whole is projected to spend about $28 billion on military health care in 2005, with most of that funding provided through the DHP. On a per troop basis, this is about three times more than DoD spent on military health care in 1988.[55] This cost growth has resulted from a variety of factors, including increased costs associated with improvements in medical technology, the fact that the overall beneficiary population (which includes not only active duty personnel, but also military retirees and dependents) has declined much more modestly than the number of active duty personnel, and the fact that benefits have been expanded for military retirees over 65 years of age.

Historically, the costliest, and generally the fastest growing, portion of the O&S budget has been accounted for by O&M programs and activities. The 2005 request includes $38.4 billion for the Air Force's O&M accounts. The O&M budget covers the costs of purchasing fuel, spare parts and many other items associated with carrying out training activities, as well as real world operations in Iraq, Afghanistan and elsewhere (although these latter cost are generally covered through supplemental appropriations). In addition to these areas, sometimes

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[53] Michael E. O'Hanlon, *Defense Policy Choices for the Bush Administration, 2001-05* (Washington, DC: The Brookings Institution, 2001), p. 27.

[54] Martin Binkin, *Military Technology and Defense Manpower* (Washington, DC: The Brookings Institution, 1986), p. 6.

[55] Allison Percy, *Growth in Medical Spending by the Department of Defense*, (Washington, DC: CBO), September 2003, p. i.

referred to as "mission"-related activities, the O&M budget covers the costs of many programs less immediately related to near-term readiness. Along with military health care, these "infrastructure" activities include installation support, headquarters and administration, individual (though not unit) training, and centralized logistics. Many of these functions are performed by Air Force civilian personnel (whose salaries are paid out of the Air Force's O&M budget). The Air Force currently employs about 161,000 civilian workers.

During the decade of the 1980s, DoD and Air Force officials generally argued that O&M increases were needed to improve the readiness of US forces (e.g., to improve aircraft mission-capable rates). In the 1990s, they argued that increases in operational tempo (OPTEMPO), equipment age and so-called "non-defense" defense programs were largely responsible for driving up O&M costs.

At least some of the O&M cost growth experienced during the 1980s does, indeed, appear to have been related to improving readiness levels. Between 1981 and 1989, mission-related O&M funding grew by about 25 percent in real terms,[56] while mission-capable rates for Air Force aircraft, for example, rose from 66 percent to nearly 80 percent.[57] But infrastructure-related O&M funding also increased by some 25 percent over these years. The explanations of DoD, Air Force and other Service officials for why O&M costs continued to grow substantially in the 1990s are less convincing.

Some "high demand/low density" capabilities (e.g., surveillance, reconnaissance and electronic warfare aircraft) were used more intensively in the 1990s than in the 1980s, at the end of the Cold War. However, prior to the terrorist attacks of September 11, 2001 (and the subsequent wars in Afghanistan and Iraq), the bulk of the aircraft, ships and other equipment operated by US forces appear to have been used

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[56] Amy Belasco, *Paying for Military Readiness and Upkeep: Trends in Operations and Maintenance Spending* (Washington, DC: CBO), September 1997), pp. 9-10.

[57] CBO, *Trends in Selected Military Readiness Indicators* (Washington, DC: CBO, March 1994), pp. 70-71.

only modestly, if at all, more intensely.[58] Likewise, increasing equipment age does not seem to have been a significant cost driver over the past few decades. Between 1980 and 2000, the average age of Air Force aircraft increased by about 11 years. Nevertheless, Air Force spending per flying hour and spending on depot maintenance did not grow substantially over this period.[59]

Table 2: Average Ages of Selected Air Force Aircraft Under the Current Plan

System	2004	2012	2022
Fighter/Attack Aircraft	17	20	12
Bombers	29	37	47
Airlift Aircraft	23	24	26
Tankers	40	38	33

Sources: CSBA based on CBO, DoD and other data

Rather than higher OPTEMPO or equipment aging, what appears to have caused most of the cost growth in O&M activities experienced in the 1990s were increases in infrastructure-related costs. Between 1980 and 2000, the share of DoD's O&S budget allocated to infrastructure activities increased from about 40 percent to 50 percent. Likewise, today, infrastructure-related programs and activities appear to absorb about half of the Air Force's total budget.[60] Some of this growth has been in so-called "non-defense" defense programs. But there has been little, if any, growth in these non-traditional areas, such as environmental cleanup, since the mid 1990s.

Most of the cost growth that has occurred in infrastructure-related activities since the end of the Cold War has, instead, clearly involved more traditional functions. Some sources of this cost growth are easy to identify, such as military health care and pay for civilian DoD personnel.

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[58] While overall equipment usage rates do not appear to have increased substantially, if at all, in the 1990s, personnel tempo (i.e., the percentage of the force typically operating away from their home bases) clearly did increase.

[59] Gregory T. Kiley, *The Effects of Aging on the Costs of Operating and Maintaining Military Equipment* (Washington, DC: CBO, August 2001), pp. 14-18.

[60] See Air Force Major Programs table in "Budgets: 2004 Air Force Almanac," *Air Force Magazine*, May 2004, p. 53.

But the source of much of this growth is unclear. As noted earlier, in addition to health care, infrastructure-related functions include installation support, headquarters and administration, centralized logistics, and individual training. Although, due to data limitations, the trends in any one of these particular activities are difficult to ascertain, taken as a whole, spending on these infrastructure-related functions appears to have increased substantially in the 1990s.

Given the difficulty of determining the cause of past cost growth in the Air Force's O&S budget, not surprisingly, it is difficult to project future funding requirements with much confidence. Overall, however, it is probably safe to assume that costs will continue to increase. Among the areas most likely to experience significant cost growth are the following.

- **Military Pay:** Assuming civilian incomes will continue to grow above the rate of inflation in the future, it will continue to be necessary to increase military pay in real terms as well. In addition, pressure to increase military pay and other benefits will likely grow as the Air Force acquires increasingly sophisticated aircraft systems and other equipment, creating a demand for better educated and skilled personnel. Continued involvement in military operations could also add to the pressure for higher pay.

- **Military Health Care:** As noted earlier, adjusted for changes in the size of the force, military health care costs have grown dramatically over the past several decades. Health care costs for the civilian population are projected to grow well above the rate of inflation over the next two decades, and there is little reason to believe that the military's health care costs will grow any more slowly. Failing to increase per capita spending on military health care sufficiently would undoubtedly lead to problems with recruitment and, especially, retention.

- **Civilian Personnel Costs:** Many of the same pressures that will likely drive up military personnel costs in coming years, are also likely to lead to increases in pay and other benefits for Air Force and other DoD civilian employees.

- **Equipment Maintenance and Repair:** As noted earlier, the increasing age of the Air Force's fleet of aircraft does not appear to

have been a major driver of O&S costs in the 1980s and 1990s. Even if the Air Force's current modernization plans are fully implemented, the average age of its aircraft fleet is projected to continue to increase. CBO estimates that for each additional year of average age, aircraft O&S costs are likely to increase by one percent.[61] According to CBO, such growth would cause annual O&S costs associated with Air Force and Navy aircraft to increase by a total of $4 billion by 2020.[62] Although the Air Force argues that the F/A-22 and F-35 will have comparable or lower O&S costs than the current-generation aircraft they are intended to replace, historically, next-generation aircraft have typically had higher O&S costs. Thus, the introduction of these new aircraft could also cause O&S costs to rise. CBO estimates that by 2020 the introduction of next-generation aircraft could cause Air Force and Navy O&S costs to rise by another $4 billion.[63]

- **Facilities Maintenance and Repair:** It is widely believed that DoD has spent too little over the past decade or more on maintaining, repairing and constructing military bases, housing and other facilities. According to the administration, at current spending levels DoD would be able to replace the average DoD facility only once every 192 years. DoD would like to reduce the replacement rate down to about 67 years, more in line with commercial standards. Although it is unclear precisely how much funding for facilities upkeep and construction will need to be increased in future years, some significant increase will almost certainly prove necessary.

If the Air Force, and DoD more generally, were able to manage various infrastructure-related functions more efficiently, it might be possible to reduce the rate of O&S cost growth in the future. Proposals aimed at reducing infrastructure-related O&S costs include making greater use of "outsourcing" (allowing private sector contractors to compete for maintenance, repair and other work currently performed

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[61] *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004*, p. 21.

[62] Ibid.

[63] Ibid.

at public sector facilities) and closing excess military bases. As a result of legislation enacted in 2003, DoD has also received authority to reform and reorganize the way it manages its civilian workforce. Although these initiatives may result in some savings, if history is any guide, the level of savings will probably be relatively modest. Indeed, the best that may be achievable is some slowing of the rate of cost growth in O&S activities, rather than actual reductions in funding requirements.

Given the consistency and persistence of the historical trend toward rising O&S costs and the existence of a wide variety of different potential candidates for cost growth in the future, it seems likely that Air Force O&S costs will continue to increase over the 2005-2022 period. Reflecting this conclusion, in the low-end estimate it is assumed that Air Force O&S funding per troop would increase at an average annual rate of 1.2 percent in real terms over these years. In the high-end estimate, it is assumed that those costs would increase at an average annual rate of 1.7 percent. These estimates are consistent with the rates of growth for the US military as a whole projected by CBO in its most recent analysis of DoD's long-term plans.[64] Since it is assumed in this analysis that the size of the Air Force would remain essentially unchanged under the current plan (measured by the number of personnel) through 2022, this means that the Air Force's overall O&S budget would grow at an average annual rate of 1.2 percent to 1.7 percent annually over this period.

This would yield average annual O&S funding requirements for the Air Force of $78 billion under the low-end cost estimate, and $82 billion under the high-end estimate. Altogether (including modernization and O&S requirements), based on low-end cost assumption, paying for the Air Force's current plan would require increasing the Service's total annual budget to about $133 billion and keeping it at roughly that level throughout the 2005-22 period. Based on high-end cost assumptions, the Air Force's overall annual budget would have to be sustained over these years at an average level of $148 billion.

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[64] See, *The Long-Term Implications of Current Defense Plans: Detailed Update for Fiscal Year 2004,* pp. 5-6.

AFFORDABILITY OF THE CURRENT PLAN

It is possible that the Air Force's current long-term plan will prove affordable at either the low-end or high-end budget levels projected above. However, there are also good reasons to believe that it may not. The Bush Administration's defense plan calls for the Air Force's budget (including associated DHP funding) to be increased from $125 billion in 2005 to $135 billion in 2009. Assuming the low-end costs estimate discussed above is correct, if these budget levels could be achieved and sustained through 2022, the Air Force's current plan would indeed be affordable. However, as noted at the outset of this chapter, the low-end estimate is almost certainly too optimistic. The high-end cost estimate, since it is far more consistent with historical experience, is much more likely to prove accurate. In that case, the Air Force faces a shortfall averaging some $13 billion annually over the next two decades, even assuming its budgets are increased as projected in the current plan through 2009 and sustained at that level through 2022. If it can be sustained only at today's level, the shortfall would amount to $23 billion a year. In fact, it may prove difficult to sustain the Air Force's budget even at today's level over the next two decades. Over the long term, the Air Force will face stiff competition for budget dollars both from non-defense federal programs and priorities, and from other components and programs within DoD.

Pressures on the DoD Topline

In the aftermath of the terrorist attacks of September 11, 2001, defense spending has become a higher priority for most Americans, but it is still far from the only priority. Over the long term, the defense mission will have to compete with other priorities of the American public and political leadership. These goals include cutting taxes, reducing the federal debt, ensuring the health and durability of Social Security and Medicare, and providing greater resources for education, health research and other domestic programs.

The long-term federal budget picture has dramatically worsened over the past three years. In early 2001, CBO projected a 10-year

surplus of about $5.6 trillion over the 2002-11 period.[65] By contrast, CBO's baseline estimate now projects *deficits* totaling $2.012 trillion over the next decade (2005-14).[66] The dramatic change in the government's fiscal outlook has resulted from the enactment of large tax cuts, as well as a weak economy, the cost of military operations in Afghanistan and Iraq, and other factors. Unfortunately, it is likely that the outlook will deteriorate still further in coming years. In its most recent budget request, the administration has proposed to extend the expiring provisions of the 2001 and 2003 tax cuts. At the same time it is also proposing further increases in funding for defense and homeland security. According to CBO, enactment of the President's proposed budget would push total federal deficits to some $2.75 trillion over the 2005-14 period, and keep the government in the red throughout the entire decade.[67]

Worse yet, this estimate almost certainly understates the actual cost of the administration's proposals. Among other things, the CBO estimate of the President's proposed budget does not include the cost of a war in Iraq and other military operations, or the full cost of extending relief from the Alternative Minimum Tax (AMT).[68] The administration's plan also assumes that spending on domestic discretionary programs (e.g., education, transportation and health research) will be cut. Making more realistic assumptions about these

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[65] CBO, *The Budget and Fiscal Outlook: Fiscal Years 2002-2011* (Washington, DC: CBO, January 2001), p. 2.

[66] Douglas Holtz-Eakin, Director, CBO, Letter to the Honorable Ted Stevens summarizing CBO's forthcoming analysis of the President's budget request, February 27, 2004, p.1.

[67] Ibid, table 1.

[68] Since, unlike the regular income tax code, the AMT is not indexed to inflation, unless relief is provided the number of taxpayers that would be subject to the AMT would grow from about two million today to some 39 million by 2012. The administration's proposal includes AMT relief, but only through FY 2006. In reality, it seems highly unlikely that either the president or the leadership of either party in Congress would allow the AMT to expand in this way.

factors could push likely deficit levels to some $5 trillion over the coming decade.[69]

As bad as the deficit picture appears to be for the coming decade, it is likely to worsen dramatically in the years after 2014. This is because members of the baby boomer generation will begin retiring around the end of this decade. This has enormous implications both for federal spending and revenue. Because of the retirement of the baby boomers, spending on Social Security and Medicare is projected to increase from about 6.9 percent of GDP in 2002 to 8.9 percent by 2020 and 12.1 percent by 2040.[70] Covering these costs will become ever more difficult as the ratio of working-to-retired Americans declines. Today, there are nearly five adult Americans 20-64 years of age for every American over 65. By 2020 the ratio will drop to less than four-to-one, and by 2030 it will fall to less that three-to-one.[71] As a result of these pressures, the Bush Administration's own budget documents project that the federal government will run deficits continuously over the next 50 years, and that the size of the deficit will grow from about 1 percent of gross domestic product (GDP) in 2014 to 1.7 percent in 2020, 5.0 percent in 2030, and 8.7 percent by 2040.[72] Others have projected that deficits could increase to as much as 6.2

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[69] See, for example, David Kamin and Richard Kogan, "Deficit Picture Grimmer than CBO's March Projections Suggest," Center for Budget and Policy Priorities (CBPP), June 4, 2004; Joint Statement issued by CBPP, the Committee for Economic Development, and the Concord Coalition, "Mid-Term and Long-Term Deficit Projections," CBPP, September 29, 2003; and Ed McKelvey, "The Federal Deficit: a $5.5 Trillion Red Elephant," Goldman Sachs, September 9, 2003.

[70] CBO, "Social Security and the Federal Budget: The Necessity of Maintaining a Comprehensive Long-Range Perspective," August 1, 2002, p. 4.

[71] CBO, "The Looming Budgetary Impact of Society's Aging," July 3, 2002, p. 6.

[72] Office of Management and Budget (OMB), *Fiscal Year 2005 Budget of the US Government, Analytical Perspectives* (Washington, DC: US Government Printing Office, 2004), p. 191.

percent of GDP by 2020, 12.3 percent by 2030 and 21.1 percent by 2040.[73]

The generally bleak fiscal outlook outlined above does not, of course, *prove* that the administration's proposed funding increases for defense are not sustainable over the long run. These projections do, however, suggest that sustaining these increases could be difficult, and will likely require making hard choices between defense and other important priorities over the coming decade and beyond. Boosting defense spending beyond even the levels projected under the current plan—to cover the cost growth for the Air Force projected in the high-end estimate—would be still more difficult.

Competing With Other DoD Components and Programs

If the DoD topline cannot be sustained at the levels projected in the administration's current plan, it might nonetheless be possible to provide the necessary increases in the Air Force's budget—by shifting funding to the Air Force from other DoD programs and the other Services. However, this too seems unlikely. Between 1974 and 2004, the share of Service funding (i.e., the DoD budget excluding defense agency funding) allocated to the Air Force averaged 35 percent. In its best year over this period the Air Force accounted for 37 percent of the funding provided to the Services. Assuming DoD's annual budget were to remain flat at $403 billion, the level requested for 2005 (exclusive of funding for military operations in Iraq and elsewhere), and defense agencies would continue to absorb about 15 percent of DoD's overall budget,[74] a 37 percent share of Service funding would yield a $127 billion annual budget. This would still fall $6 billion short of the Air Force's requirements under the low-end estimate cost, and $21 short of its requirements under the high-end estimate.

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[73] "Mid-Term and Long-term Deficit Projections," CBPP, p. 15.

[74] This is the share of DoD's budget accounted for by defense agencies over the past decade.

In any case, notwithstanding the success of the Air Force in the 2003 war in Iraq and other recent conflicts, there is little evidence to suggest that the Air Force will be provided a larger share of future DoD budgets. Historically, the share of DoD's budget allocated to the different Services has remained remarkably stable. Even the end of the Cold War and the geopolitical and other changes that have occurred over the past decade-and-a-half have done little to alter this historical pattern of spending on the Services.

Moreover, like the Air Force, each of the other Services have long-term plans that call for substantially modernizing their forces and keeping them at high states of readiness. And again as with the Air Force, implementing these plans will require significant and sustained budget increases for each of these Services. In addition, a number of members of Congress and others, including Democratic presidential nominee, Senator John Kerry, have called for increasing the size of the Army to help reduce the stress on that Service caused by its large deployments in Iraq and Afghanistan. The Air Force was unable to increase significantly its share of the DoD budget after either the 1991 Gulf War or Operation Allied Force (in Kosovo)—conflicts in which it was widely viewed as having played the dominant role. Given the critical role played by the Navy during the war in Afghanistan, and the Army in Iraq (especially in the country's occupation), it seems even less likely that the Air Force will now be successful in increasing its budget share. Indeed, it seems at least as likely that in light of recent experience in Afghanistan and Iraq, the Air Force might see its budget share reduced in the future.

It is assumed in this analysis that any extra costs incurred by the Air Force due to its involvement in military operations in Afghanistan, Iraq or elsewhere would be covered through emergency supplemental or other appropriations—rather than paid for out of the Air Force's own regular annual appropriations. This is how such costs have generally been managed since the mid 1990s. However, it is possible that at some point in the future, perhaps because of growing deficit pressures, the Air Force and other Services will be required to absorb at least some of these costs within their regular annual appropriations. In that case, the funding available to pay for the Air Force's current force structure, readiness and modernization plans would be reduced still further.

If the increases in the Air Force's budget needed to pay for its current modernization, force structure and other plans cannot be achieved, or sustained over the long-term—either by further raising the DoD topline, or by taking funding from one or more of the other Services—the Air Force will have to reassess it plans. Those plans will have to be changed in a way that makes them less costly, but also leaves the Air Force with the capabilities it needs to address effectively the serious future challenges it faces.

III. Trends in Air Force Capabilities

If the US Air Force were constrained to keep the cost of its long-terms plans within today's budget levels, it would have to modify and scale back those plans. In deciding how to adjust its plans to make them more affordable, however, the Air Force could choose from a range of substantially different options. In the next chapter (Chapter 4) four different options are described, each of which would be affordable through 2022 at roughly today's budget levels. These options differ in the extent to which they focus on protecting current modernization plans, at the expense of force structure, or visa versa, as well as in their approaches to transformation.

In this chapter, several issues and trends that are likely to influence one's views about which of these options is most appropriate are discussed—though not resolved. These topics include issues and trends related to precision-guided munitions (PGMs), command, control, communication, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities, aircraft platforms, and transformation. Developments in each of these areas have led to improvements in Air Force capabilities over the past several decades. And it is likely that trends in these areas will lead to further, perhaps dramatic, improvements in the Air Force's (as well as the other Services') capabilities over the next two decades. Improvements in these areas would be funded under the current plan, as well as each of the four options discussed in the next chapter.

ADVANCES IN PRECISION-GUIDED MUNITIONS

The use of PGMs can increase the effectiveness of aircraft by an order of magnitude or more. Unguided "dumb" bombs delivered from aircraft often land hundreds of feet from their intended aim points. For example, dive bomb attacks by F-105s against heavily defended targets in North Vietnam during the late 1960s provided average circular error probables (CEPs) of around 500 feet.[75] By contrast, laser-guided bombs (LGBs) have consistently achieved CEPs of 10 feet in combat, while the satellite-guided Joint Direct Attack Munition (JDAM) has generally been more accurate than its design CEP of between 20 feet (when delivered by the B-2) and 45 feet (when delivered from most other aircraft).[76] Moreover, both of these munitions have achieved reliability rates of over 90 percent in recent conflicts.

Due primarily to the modification of existing aircraft over the past 15 years, the number of aircraft capable of delivering PGMs has greatly increased, even as the overall size of the Air Force's fighter and bomber fleets has declined. By the time of Operation Iraqi Freedom in 2003, virtually all of the Air Force (as well as Navy and Marine Corps) attack aircraft—bombers as well as fighters—deployed were capable of the autonomous delivery of PGMs. And, whereas LGBs, which were first used in combat in 1968, could only be employed during clear weather, JDAMs provide US strike aircraft with an all-weather capability.

As table 3 shows, the use of PGMs by the US military has increased greatly over the past decade and a half. The vast majority of the more than 54,000 PGMs employed in these recent conflicts were delivered by Air Force aircraft. Over half of these weapons were laser-guided bombs, while satellite-guided munitions—predominately

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[75] Wayne Thompson, *To Hanoi and Back: The U.S. Air Force and North Vietnam, 1966-1973* (Washington, DC: Smithsonian Institution Press, 2000), pp. 45-6. CEP is the radius of a circle around the aim-point within which 50 percent of the bombs are expected to hit.

[76] The JDAM's accuracy is greater in the case of the B-2 because the bomber's on-board radar is used to eliminate target location error prior to release.

JDAMs—accounted for another 27 percent of the PGMs delivered in these campaigns.

Table 3. Precision-Guided Munitions Used by US Forces in Recent Conflicts[77]

Conflict	Unguided Bombs	PGMs	% PGMs
Iraq, 1991	**210,000**	**17,161**	**8**
Kosovo, 1999	**16,587**	**6,728**	**29**
Afghanistan, 2001-02	**11,201**	**12,001**	**52**
Iraq, 2003	**10,383**	**18,365**	**64**

The growing use of PGMs has not only greatly increased the effectiveness of US air attacks, it has also contributed—along with the use of special jamming, reconnaissance and other support aircraft, as well as a small number of stealth aircraft—to the extremely low casualty rate suffered by US air forces. During the 1991 Gulf War, allied air forces flew some 43,000 strike sorties against individual aim points and targets but suffered only 38 combat losses. This loss rate was several times lower than that suffered by US air forces flying missions over North Vietnam during the Vietnam War. Eight years later, in Kosovo, NATO air forces flew some 10,500 strike sorties and lost only two aircraft to Serbian air defenses. These trends have shown continued improvement in America's two most recent conflicts. US forces lost no airplanes during the war in Afghanistan and lost only one airplane due to enemy action in the 2003 Gulf War.

One of the reasons PGMs comprised only a relatively modest share of the munitions used in the 1991 Gulf War is that only a limited number of aircraft were capable of employing them at that time. LGBs were the most widely used, and perhaps the most effective, type of PGM employed by US air forces during that war. However, the US

[77] Sources include: GAO, Operation Desert Storm: Evaluation of the Air Campaign (Washington, DC GAO) June 1997, p.178; William Arkin "Weapons Total from Afghanistan Includes Large Amount of Cannon Fire," Defense Daily, Vol. 213, No. 42, March 5, 2002; and Lt. Gen. T. Michael Mosley, Operation Iraqi Freedom-By the Numbers (CENTAF-PSAB, Saudi Arabia: US Central Air Forces, April 30, 2003).

military had only some 200-300 aircraft equipped with laser designators at that time. By comparison, in large part because of the procurement of additional low-altitude navigation and targeting for night (LANTIRN) pods, the number of Air Force, Navy and Marine Corps aircraft equipped with laser designators had climbed to around 600 by 2000. Today, thanks to the growing number of laser designators and the advent of JDAMs, virtually all US ground-attack aircraft are capable of employing PGMs autonomously.

The United States currently possesses a large inventory of relatively modern PGMs. Over the past several decades, DoD has procured over 200,000 air-to-surface PGMs, most of which are relatively short-range weapons. DoD has also procured about 4,200 Tomahawk Land Attack Missiles (TLAMs) and 375 Tactical Tomahawks, both of which are sea-launched, long-range, surface-to-surface cruise missiles.

In order to improve US PGM capabilities and ensure that US forces are capable of effectively defeating the kinds of threats that might emerge in future years, current plans also call for the Services to buy large quantities of new PGMs. DoD ultimately plans to buy as many as 230,000 JDAMs,[78] a relatively inexpensive kit (under $25,000 per unit) that can be attached to existing "dumb" bombs, and 10,800 Joint Standoff Weapons (JSOWs), a more expensive unpowered glide bomb. Like JDAM, JSOW utilizes inertial guidance aided by information from DoD's Global Positioning System (GPS) satellite network. GPS-guided munitions can be delivered by almost any combat aircraft and (unlike LGBs) are true all-weather munitions. In addition to these relatively short-range systems, current Air Force plans call for acquiring 4,900 stealthy Joint Air-to-Surface Standoff Missiles (JASSMs), which have a range of 100 miles or more. Finally, the Air Force is developing a 250-pound class Small Diameter Bomb (SDB) that will enable aircraft to carry larger numbers of PGMs per sortie. In the case of the F/A-22, for example, the SDB will allow the aircraft to carry eight PGMs per mission rather than two 1,000-pound JDAMs. In the case of the B-2 bomber, the SDB would allow the bomber's payload to be increased from 16 2,000-pound or 80 500-

[78] Boeing Corporation, "Backgrounder: Joint Direct Attack Munition," April 23, 2004, p. 2.

pound JDAMs to as many as 192 PGMs.[79] Taken together, these various developments suggest that the effectiveness and lethality of Air Force strike platforms will continue to increase—in some instances dramatically—over the next two decades.

In general, short-range PGMs tend to be far less costly to procure than long-range systems. While the JDAM, for example, costs under $25,000 a copy, the unit cost of the TLAM was about $2 million. The Air Force's Conventional Air Launched Cruise Missile (CALCM), a conversion of the nuclear Air Launched Cruise Missile (ALCM) was even more costly per round. However, trends in electronics and other technologies have led to significant reductions in the cost of even long-range PGMs. The Navy hopes to reduce unit costs of the Tactical Tomahawk to under $600,000, and the JASSM is presently being procured for about $400,000 apiece.

Under current plans, the Air Force and the other Services will substantially increase their PGM-capabilities in coming years. Neither PGM accuracy nor reliability appears to pose any substantial problem for US precision-strike capabilities at this point in time—at least for fixed targets. Among the critical, as-yet-unanswered, questions is the degree to which the growing effectiveness of PGMs might permit some reductions in force structure or reduce the need to buy costly next-generation combat aircraft and other weapons platforms.

ADVANCES IN COMPUTERS, SENSORS AND COMMUNICATIONS SYSTEMS

Many observers believe that the most important advances in military capabilities likely to be made over the next several decades will involve

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[79] Christopher Bolkcom, Statement Before the House Armed Services Committee, Subcommittee on Projection Forces, Hearing on Conventional Long-Range Strike Operations, March 3, 2004, p. 8, and "US Air Force Long-Range Strike Aircraft White Paper," p. 12.

improvements in computers, sensors and communications systems.[80] These are the technologies that are most critical to the development of C4ISR systems. C4ISR systems include everything from dedicated satellites and support aircraft—such as Joint Surveillance Attack Radar System (JSTARS) and Airborne Warning and Control System (AWACS) aircraft—to target detection and targeting pods fitted onto combat aircraft, or incorporated into other weapons platforms. Some have suggested that advances in these areas could eventually increase force lethality by as much as two orders of magnitude.

PGMs incorporate many of these same technologies. More importantly, the effectiveness of PGMs is highly dependent on the existence of an effective supporting C4ISR architecture. At the tactical level, PGMs require "precision information" about aim points if they are to be effectively employed. Even a PGM with 100 percent accuracy and lethality would be of little use if, for example, through the use of deception, terrain cover or mobility, an adversary were able to keep his most valuable military assets hidden from view.

In some instances, it may be necessary to buy new platforms to take full advantage of advances in computers, sensors or communications systems. However, in many cases advances in these areas can be incorporated into existing platforms through modifications and upgrades. The potential impact of such improvements is most easily measured in the case of computers. The maximum number of computer computations possible per second has increased by roughly an order of magnitude every five years.[81] At the same time, the cost of computing power has declined dramatically. For example, between 1985 and 1990, the cost of a given amount of

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[80] For an extensive discussion of the potential for developments in sensor, communications and computer technologies to improve military capabilities, see O'Hanlon, *Technological Change and the Future of Warfare*, pp. 32–67.

[81] Kenneth Flamm, "Controlling the Uncontrollable," *Brookings Review*, Winter 1996, pp. 22–25.

computing power dropped by a factor of ten.[82] These trends are projected to continue for the foreseeable future.

Significant advances are also likely to be made in sensors, communications and related technologies (in part as a byproduct of further advances in computing). For example, it has been estimated that as a result of improvements in their cooling elements and other advances, the range of some infrared sensors could be increased by 25–50 percent.[83] Likewise, improvements in radar technology appear likely, among other things, due to the miniaturization of electronic components. As with advances in computer technology, improved sensor capabilities can often be retrofitted onto existing platforms. One area where it is clear that the Services' sensor capabilities will greatly improve over the coming decade, primarily through modifications made to existing aircraft, is in night-attack capabilities. Under current plans, the number of Air Force, Navy and Marine Corps aircraft equipped with forward-looking infrared (FLIR) systems, or night vision goggles and modified cockpits, is projected to grow from roughly 1,100 in 2000 to 1,800 by 2010.

Advances in UAVs have also contributed to improvements in US intelligence, surveillance and reconnaissance capabilities. UAVs played only a very minor role in the 1991 Gulf War. At that time, the only reconnaissance UAV available was the Pioneer. But UAVs were used with increasing frequency in the Balkans in the 1990s, and then more aggressively in Afghanistan and Iraq. In Operation Iraqi Freedom (OIF), the US military employed ten different types of UAVs in unprecedented numbers. The ability of UAVs to stay aloft for long periods and provide persistent surveillance made it very difficult for Iraqi ground forces to move without being detected.

When used in combination with manned C4ISR assets, such as JSTARS aircraft, and other supporting technologies, these systems greatly compressed the time separating the identification and striking of enemy targets. A rapid engagement capability is critical in the case

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[82] Panel on the Future Design and Implementation of US National Security Export Controls, *Finding Common Ground*, p. 254.

[83] O'Hanlon, *Technological Change and the Future of Warfare*, p. 36.

of mobile targets, or where prompt fire support is needed. During the 1991 Gulf War, it typically took 72 hours to complete the Air Tasking Order (ATO), which (among other things) directed which targets would be struck. The cycle of target generation, attack execution and battle damage assessment often took several days to complete. By the time of the 1999 war in Kosovo, the average "sensor-to-shooter" cycle was down from three days to about three or four hours. This cycle time was reduced still further in Afghanistan and the 2003 war in Iraq.[84]

The mixture of dramatically improved C4ISR and PGM capabilities, has proven to be a highly lethal combination. Most recently, in OIF, all-weather, precision air strikes were largely responsible for the destruction of the Iraqi Republican Guard divisions.[85] Of the 800-plus tanks that the Republican Guard fielded at the beginning of the war, "all but a couple dozen" were reportedly destroyed by air strikes or abandoned by the third week of the war.[86]

ADVANCES IN AIRCRAFT PLATFORMS

At various periods in history, great advances have been made in the design and propulsion of aircraft and other weapons platforms. At other times, improvements have been more gradual and limited. Some observers argue that, with perhaps a few exceptions, over the next few decades dramatic improvements in platform design and propulsion are unlikely. Instead, they believe that the most critical advances are likely to involve C4ISR systems, such as satellites and various support aircraft, that can be used to locate, track and identify enemy targets, as well as electronics and PGMs that can be incorporated into existing weapons platforms. Such a precision-strike architecture might revolutionize the way wars are fought, but it would do so primarily because of improved C4ISR support capabilities and PGMs, rather than because of the acquisition of new weapons platforms. Indeed, some believe such a revolution has already occurred. Others argue that

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[84] Andrew F. Krepinevich, *Operation Iraqi Freedom: A First Blush Assessment* (Washington, DC: CSBA, 2003), pp. 15-17.

[85] Ibid.

[86] General Richard Meyers, *DoD News Briefing*, April 7, 2003.

substantial or even revolutionary improvements in platform design are in the offing, making it critical that the Services invest now in new generations of aircraft, ships and ground vehicles.

Nowhere is this debate sharper than in the case of combat aircraft. Everyone agrees that dramatic improvements were made in aircraft design and propulsion from the 1920s through the 1950s. Toward the end of this era, between the late 1940s and early 1950s, the US Air Force transitioned from prop- to jet-powered aircraft. The improvements in speed made possible by the move to jet propulsion were enormous. For example, the P-51 Mustang, the mainstay of the US Air Force at the end of World War II, had a cruising speed of 360 miles per hour. By comparison, the F-86 Sabre used in the Korean War had a cruising speed of 550 miles per hour. Great improvements in aircraft speed continued to be made throughout the 1950s. However, by the mid 1950s, improvements in cruising speed had pretty much come to an end. The F-4, first deployed in 1961, had a cruising speed of about 585 miles per hour. The F-15 and the F-16 fighters, introduced in the mid-to-late 1970s, have comparable cruising speeds.[87]

This maturing of platform capabilities is one reason why the Air Force began to slow the pace at which it introduced new aircraft designs, and to accept progressively longer service lives from the 1950s through the 1990s. Between 1945 and 1965, the Air Force deployed 12 new fighter designs. By comparison, between 1965 and 2004, the Air Force has deployed four new designs. Likewise, the average age of the Air Force's fighter inventory grew from about 2 years in 1955, to 7 years in 1975, to 11 years by 1990, and 17 years in 2004.

In terms of speed, the F/A-22 marks a departure from the incremental rates of change that have marked successive generations of fighters over the past several decades. It will have a "supercruise" capability, defined as the ability to cruise for sustained periods at Mach 1.5 or higher. The F/A-22 will also be designed to be far more stealthy than current-generation fighters. Among other things, this reduction in radar cross-section could greatly reduce the effective

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[87] To be sure, the F-15 and F-16 are far superior to the F-4 in terms of maneuverability and several other important performance criteria.

range of enemy surface-to-air missile (SAM) tracking radars. The F-35 will *not* have a supercruise capability, but like the F/A-22 it will be far more stealthy than existing aircraft.

On the other hand, the F/A-22 and the F-35 are likely to cost two-to-three times more to procure than the latest F-15 and F-16 aircraft. These higher costs may well be worth the price if supercruise and stealth are truly critical capabilities for the Air Force. But if fielding improved PGMs and C4ISR assets is the key to increasing combat effectiveness in the future, investing in such costly next-generation aircraft, at least in the numbers projected in current plans, may be a serious error. The wisdom or necessity of buying large numbers of next-generation aircraft like the F/A-22 and the F-35 also depends, in part, on how likely one views the prospect that the United States will find itself confronting a peer (or near-peer) competitor over the next two decades, that has both the resources and inclination to challenge US dominance in the air—through the acquisition of substantial numbers of modern fighters and highly advanced SAM systems.

In the end, determining whether or not the pace of technological advance projected for next-generation aircraft is significant enough to justify their very high costs is beyond the scope of this report. The point of this discussion is simply to note that the likely rate of change and progress in basic design is one of the factors that needs to be taken into account when deciding the appropriate service lives for existing aircraft, and whether such aircraft should be replaced by next-generation systems, or new-production current-generation aircraft.

MILITARY TRANSFORMATION

It is widely believed that we are in the midst of a revolution in military affairs (RMA) that will materially, and perhaps dramatically, change the way wars are fought in the future. The driving forces behind this RMA are advances in technology, especially information technology, combined with potential changes in military organization and concepts of operation. There is, however, little agreement concerning precisely how the RMA will change the way wars are fought, what the

implications are for the organization of the US military and its concepts of operation, or how major the changes in warfare will be.[88] The Air Force claims that its current plans not only continue to make sense in light of the RMA, but that those plans will effectively exploit the RMA.

A key area of disagreement concerns the Air Force's plans for maintaining its ability to project power into distant regions of the world. Currently, the Air Force is developing the Global Strike Task Force (GSTF) concept as a way of sustaining its power projection capability. Air Force officials have characterized the GSTF as the "next step" in Air Force transformation.[89] The F/A-22 is to play an especially pivotal role in this concept of operations. The Air Force expects the F/A-22 to take out enemy SAM systems and other time-critical targets. Moreover, by protecting the F-117 and B-2 against enemy fighters and SAMs, Air Force officials argue that the F/A-22 would allow 24-hour-a-day, seven-days-a-week operations by all of the Air Force's stealthy aircraft from the outset of hostilities. Once air dominance is established, the GSTF concept would enable precision-strike operations by non-stealthy aircraft, whether sea- or land-based. This view of the RMA focuses on the importance of improvements in stealth, precision and network-centric warfare, but continues to concentrate these capabilities primarily in relatively short-range systems.

Critics have argued that the GTSF concept and the Air Force's plans for implementing it may be seriously flawed. As Barry Watts has noted:

> ...the GTSF concept is critically dependent on the presumption that, for at least the next three decades, the Air Force will be able to deploy short-range fighters into theater bases located, at most, 1,500-2,000 nm [nautical miles] from enemy airspace, if not closer. The USAF's path remains that of betting that forward bases, which are almost certain to fall

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[88] For a discussion of different views concerning the RMA, *Technical Change and the Future of Warfare*, O'Hanlon, pp. 11-20.

[89] Watts, "Prospective US Air Force Failure Points," p. 11.

> increasingly within the reach of enemy ballistic missiles, cruise missiles and other A2 [anti-access] capabilities, can nonetheless be utilized by its expeditionary air units.[90]

Another related concern is that countries may not grant base access to US forces for political reasons. Experience in recent conflicts suggests that access to forward bases is, indeed, becoming more problematic. In both the 2001-02 war in Afghanistan and the 2003 war in Iraq, US access to forward bases was far more limited than it was in the 1991 Gulf War. During OIF, for example, Turkey and Saudi Arabia—both of which had hosted US combat aircraft in the first Gulf War—denied the US military permission to operate combat aircraft from bases on their territory.

Advocates of this view of the RMA do not argue that these trends will necessarily make it *impossible* for US tactical air forces (or US naval forces and ground forces) to be brought into threatened regions during a crisis or wartime. But they do believe that these developments are likely to increase substantially the difficulty and cost of such deployments, as well as greatly limit the effectiveness of those forces once they are deployed. If this is an accurate forecast of trends in warfare, it may make sense to adopt a different concept of operations, as well as new forms of organization and approaches to modernization. In particular, these trends might call into question the current plan's focus on the very costly modernization of the US military's already large and effective fleet of tactical combat aircraft. Instead, it might make more sense for the US military to increase its investments in long-range precision-strike capabilities.

This is not the only issue on which views differ concerning the RMA and military transformation, only perhaps the most salient. Other areas of disagreement and uncertainty include the relative merits of manned and unmanned systems, the importance of new aircraft and other platforms relative to improved PGMs and C4ISR capabilities, and the degree to which the combination of mass and precision now possible through the use of bombers equipped with PGMs is likely to change the way wars are fought. In addition, there

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[90] Watts, "Prospective US Air Force Failure Points," p. 20

are differing views concerning the pace and timing of the RMA and military transformation. Some observers believe that the path, shape and implications of the RMA are clear now, and that it is thus appropriate to move ahead with ambitious modernization plans and possibly force structure changes. Others argue that the implications and trajectory of the RMA remain somewhat opaque, and that therefore a slower approach should be taken to transformation.

IV. Air Force Options

This chapter describes four alternative long-term plans for the Air Force, each of which (in contrast to the current plan) is designed to be affordable through 2022 at roughly today's budget levels. In other words, each of these alternative plans could be sustained over the next two decades with annual budgets averaging some $125 billion, the amount requested for the Air Force for 2005. These options differ in the extent to which they focus on protecting current modernization plans, at the expense of force structure, or visa versa, as well as in their approaches to transformation.

All of these options were generated using the high-end modernization and O&S cost assumptions described in Chapter 2. As noted in that chapter, these high-end assumptions, which are based on historical cost trends, are far more likely to prove accurate than the much more optimistic low-end cost assumptions described in that chapter, which are based on Air Force cost goals. As was also noted in Chapter 2, the low-end cost estimate of the current Air Force plan was included primarily for purposes of comparison and to illustrate the best that could be hoped for if all of the acquisition and infrastructure reforms instituted or proposed over the past few years were to prove fully successful. It is worth noting, however, that to the extent the Air Force is successful in these efforts, it could make the task of fitting its plans within current budget levels significantly easier than is reflected in the options described below.

Before discussing the ways in which these alternative plans differ from the current plan, as well as from one another, it should be noted that in two respects all of the options remain consistent with the current plan. First, they all assume that the Air Force would retain its current goal for airlift capacity. Second, they all assume that funding for centralized C3I (including NFIP) activities and Air Force space programs would remain at the levels projected in the current plan. As discussed in Chapter 2, this analysis assumes that, under the current plan, NFIP and space funding provided through the Air Force's procurement budget would remain at their requested 2005 levels through 2022. In the case of O&S funding for centralized C3I activities and space programs, under the current plan and each of the alternative options, costs are assumed to grow through 2022 at the same rate projected for the Air Force's overall O&S budget. It should also be noted that three of the four options discussed in this chapter (the exception being Option 4) maintain the same force structure and modernization goals for special operations forces as the current plan.

OPTION 1: PROTECT AIR FORCE MODERNIZATION PLANS AND CUT FORCE STRUCTURE

Under this option, the Air Force would move ahead with all of its current modernization plans. It would pay for these plans and hold the Air Force's overall funding requirements to roughly today's budget levels by making offsetting cuts in the size of the Air Force. This option assumes that the new weapon systems called for in current plans will be so much more effective than either the systems they will be replacing or new (and less costly) current-generation systems, that it makes more sense to continue with these plans, and accept significant cuts in the size of the Air Force, than it does to scale back those modernization plans and avoid (or at least substantially limit) such cuts.

Overall, under this option the size of the Air Force (measured by troop levels) would be cut by about 23 percent. The number of active duty Air Force personnel would be reduced from about 360,000 today

to about 275,000 by the end of 2014, and would be kept at roughly that level through 2022.[91] Although in theory cuts could be made at the same level across all elements of the Air Force, such an approach would make little strategic sense, and would run counter to past experience. Instead, it is assumed in this option that the cuts would be focused primarily on combat forces, including tactical combat aircraft, bombers and ICBMs. Specifically, each of these force structure elements would be cut by 50 percent, with all of the reductions completed by 2014. By contrast, Air Force airlift forces, C3I activities and special operations forces would be kept at the levels projected in the current plan, while the size of the Air Force's fleet of tanker aircraft would be reduced by about 17 percent.

Focusing force structure cuts on the Air Force's combat elements and, conversely, protecting airlift capacity, C3I assets and tanker forces would be consistent with the approach taken at the end of the Cold War. During the course of the post-Cold War drawdown, the number of Air Force tactical fighter wing equivalents was cut from about 36 in 1990 to 20 by the mid-1990s, a reduction of about 45 percent. Over this same period, the Air Force's bomber fleet and ICBM force were cut by similar amounts. By comparison, the Air Force's airlift capacity was essentially untouched, and the tanker fleet was reduced only relatively modestly.

The main mission of the Air Force's airlift fleet is to support the rapid deployment of US forces to distant regions of the world during international crises or wartime. The Army, Air Force and Navy (primarily the Marine Corps) all depend in part on the Air Force's airlift fleet to transport equipment and personnel, especially in the early stages of conflicts. *Overall* lift requirements might decline over the long term, if the US military came to rely on smaller, but more capable combat forces. But such a change would do little, if anything, to reduce the requirement for those mobility assets, like airlift, that provide rapid lift in the early stages of conflicts. Thus, as noted above, in all of the options discussed in this chapter the capacity of the airlift fleet would be kept at roughly the levels projected in the current plan.

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[91] Under all of the options discussed in this chapter, it is assumed that the number of Air Force Reserve and National Guard personnel would be cut by roughly the same rate projected for Air Force active duty personnel.

The Air Force's tanker fleet provides refueling capabilities for Air Force combat, airlift and support aircraft, as well as for Navy and Marine Corps combat and support aircraft. Under this option the total number of Air Force aircraft would decline significantly. It is also assumed that the Navy and Marine Corps would make some substantial cuts in their air forces in order to help finance their own modernization plans. As such, it seems reasonable to assume that tanker requirements would decline. Just how much of a reduction might be feasible without negatively impacting force projection and combat capabilities is difficult to gauge. However, it seems reasonable to assume that the tanker force could be safely cut by 17 percent. Such a reduction would be consistent with the US decision at the end of the Cold War to cut the size of the tanker fleet by about one-third as much as it cut the Air Force's tactical combat aircraft and bomber forces.

As noted earlier, under all of the options considered in this chapter US funding for centralized C3I activities and space programs is assumed to remain at the levels projected in this report for the current plan. The Air Force is responsible for the lion's share of DoD's centralized C3I and space functions. Assuming no change in these areas seems reasonable, since, in general, changing the size of the US military's combat force structure (either through expansion or reductions) would do little to change the requirements for these functions.

The assumption in this option—as well as in Options 2 and 3—that the Air Force's plans for special operations forces would be protected also seems reasonable, given the importance of unconventional warfare capabilities (e.g., for combating terrorism and counterinsurgency operations) in the post-9/11 world.

The savings generated by the force structure reductions included in this option would free up sufficient funding to allow the Air Force to continue with all of the major modernization programs included in current plans (discussed in Chapters 1 and 2) and still hold its budget topline to roughly today's level. Although in this option the Air Force would proceed with all of its modernization programs, in several cases the number of systems to be procured would be reduced—reflecting the fact that fewer systems would be needed to equip a smaller force structure.

Tactical Combat Aircraft

While the Air Force's fleet of tactical combat aircraft would be cut deeply under this option, it would be rapidly modernized. Although 50 percent smaller than the tactical combat force projected for 2022 under the current plan, it would be even more modern. By 2022, 85 percent of the Air Force's tactical fighter force would consistent of stealthy next-generation F/A-22s, FB-Xs, F-35s and UCAS, compared to 77 percent under the current plan. The only current-generation tactical combat aircraft remaining in the Air Force in 2022 would be 170 F-15Es, compared to 520 F-15Es, F-16s and A-10s under the current plan.

It is assumed, under this option, that the Air Force would give top priority to the F/A-22 and the regional bomber programs—specifically, that it would buy all 271 F/A-22s (including 203 aircraft between 2005 and 2022) and 200 FB-Xs projected in the current plan (see Table 4). By contrast, the number of F-35s procured through 2022 would fall from 1,370 in the current plan to 565. Likewise, the number of UCAS to be procured by the Air Force during these years would decline from 300 to 125. Although fewer than projected in the current plan, because of the smaller size of the Air Force's tactical combat fleet, these purchases would be sufficient to fully equip all of the Air Force's squadrons now operating F-16s and A-10s with F-35s or UCAS by 2022.

In order to minimize the near-term dangers associated with making large cuts in force structure, the reductions included in this option would be stretched out over a 10 year period. By the time they were completed in 2014, the Air Force would have its entire planned force of F/A-22s deployed, and would be starting to field F-35 and UCAS squadrons.

Bombers

The number of Air Force bombers would be cut by 50 percent, from 157, the goal under the current plan, to 79. As in the case of the Air Force's tactical combat forces, these reductions would be implemented over a ten-year period, with the cuts completed by 2014. In making these cuts, it is assumed that the Air Force would keep all of its B-2 bombers and reduce the size of both its B-1B and B-52 fleets by about

60 percent. This would leave the Air Force with a bomber inventory of 21 B-2s, 26 B-1Bs and 32 B-52s. As in the case of the current plan, in this option the Air Force would develop a new bomber or other long-range strike platform over the next two decades, but would not begin procurement of the new systems until after 2023 (just beyond the timeframe covered in this report).

Table 4: Procurement of Major Weapon Systems, 2005-2022

System	Current Plan	Option 1	Option 2	Option 3	Option 4
F/A-22	203	203	57	57	57
FB-X	200	200	0	0	0
F-35	1370	565	0	515	300
F-15E	0	0	210	145	100
F-16	0	0	1085	515	100
UCAS	300	125	255	225	500
LRSP	0	0	0	0	12
C-17	84	84	84	84	84
C-130J	126	126	126	126	126
AMC-X	20	20	20	20	20
Tankers	280	230	148	260	240
CV-22	48	48	48	48	48
SOF	0	0	0	0	45
ICBM	200	100	0	0	120

Source: CSBA

Airlift

No change from the current plan.

Tankers

As noted earlier, in this option the size of the tanker fleet would be cut by 17 percent. Since fewer tankers would have to be replaced, and the oldest tankers would be retired first, this change would reduce the number of new tankers the Air Force would need to procure.

Specifically, it is assumed that the number of medium and small tanker aircraft procured through 2022 would likewise decline by 17 percent, falling from 280 to 230. Thus, under this option, a total of 115 medium and 115 small tankers would be procured over the next two decades.

SOF

No change from the current plan.

ICBMs

Under this option, the number of operational ICBMs would be cut by 50 percent, from about 500 in the current plan to 250, with the cuts completed by 2007. Since fewer ICBMs would need to be replaced, the number of ICBMs procured under this option would also decline. Instead of procuring 200 ICBMs between 2016 and 2022, as projected in the current plan, a total of 100 missiles would be purchased.

Funding

Under this option, procurement funding for the Air Force would average $36 billion a year over the 2005-22 period. Reflecting the significantly smaller force structure that would need to be supported, funding requirements for O&S activities would decline to an average of $68 billion annually, compared to $82 billion in the current plan. Since no changes would be made to current plans for developing new weapon systems, under this option, Air Force R&D funding would remain at the same level projected in the current plan, about $21 billion a year. (See Table 5).

Table 5: Average Air Force Funding Requirements, 2005-2022 (in billions of 2005 dollars)

	Option 1	Option 2	Option 3	Option 4	Current Plan
Procurement	**36**	**29**	**32**	**33**	**44**
R&D	**21**	**19**	**20**	**22**	**21**
O&S	**68**	**77**	**72**	**71**	**82**
Total	**125**	**125**	**125**	**125**	**148**

Source: CSBA

OPTION 2: PROTECT FORCE STRUCTURE AND CUT MODERNIZATION PLANS

Under this option, the Air Force would try to make its long-term plans more affordable by cutting its modernization plans, rather than its force structure. As such, it is essentially the converse of Option 1. Under this option, the Air Force would take a much slower approach to modernization, especially the purchase of next-generation weapons platforms. This option assumes that current-generation aircraft equipped with the latest PGMs and avionics, and supported by advanced C4ISR capabilities, would prove sufficient to maintain US superiority over the long term. It also assumes that next-generation weapon systems are not so much more effective than current generation systems as to justify the deep cuts in force structure needed to pay for those programs and still live within today's Air Force budget levels.

Under this option, most of the major next-generation systems included in the current plan would be scaled back (e.g., the F/A-22), cancelled (e.g., the FB-X and the F-35), or deferred (the new ICBM). In place of many of these systems, new production models of current-generation systems (e.g., F-15Es and F-16s) would be procured. In other cases, steps would be taken to extend the service lives of existing systems (e.g., the KC-135 tankers).

Although this option attempts to protect force structure by making offsetting cuts in next-generation weapons programs, it does include some modest cuts in force structure as well. Overall, under this

option the number of active duty Air Force personnel would be cut by seven percent, declining to 335,000. Since the force structure cuts included in this option are much more modest than those included in Option 1, they would be completed much more quickly, in all cases by 2007. These reductions were necessary because the cuts in next-generation programs included in this option were not, by themselves, sufficient to keep Air Force funding requirements at today's level.

As in the case of Option 1, and for similar reasons, the force structure cuts included in this option are focused primarily on combat forces. In this case, the Air Force's tactical combat aircraft, bombers and ICBM forces would each be cut by 15 percent. As in Option 1 and the other options, Air Force airlift forces and C3I and space activities would be kept at the levels projected in current plans. Likewise, in this option—as in Options 1 and 3—Air Force special operations forces would be manned and modernized as projected in the current plan. In this option, the size of the Air Force's fleet of tanker aircraft would be reduced, but only very modestly (by 5 percent), reflecting the much smaller reductions in total aircraft numbers included in this option compared to Option 1.

Tactical Combat Aircraft

Under this option, the number of F/A-22's procured over the 2005-22 period would be cut from 203 to 57. Including the 68 F/A-22s already procured, this would bring total F/A-22 production to 125 aircraft, compared to the 271 aircraft called for in current plans. A buy of this size would be sufficient to maintain at least one fighter wing equivalent (i.e., 72 primary authorized aircraft) of F/A-22s. Under this option, the FB-X would be cancelled. To partially offset the cuts in the F/A-22 program and the cancellation of the FB-X, the Air Force would procure 210 new F-15E fighters.[92]

Similarly, under this option the Air Force would cancel the F-35 and buy new F-16s instead. Altogether, 1,084 F-16s would be procured

[92] It is assumed that new F-15E's would have unit procurement costs of about $60 million.

over the 2005-22 period.[93] This is somewhat less than the number of F-35s projected to be procured over these years under the current plan—reflecting the fact that the force structure to be equipped would be 15 percent smaller. The UCAS program is one of the few new major acquisition programs that would continue to be funded in this option. It would be continued because the UCAS program offers a potentially cost-effective approach to sustaining a relatively large force structure for the Air Force. The number of UCAS procured would nevertheless decline from 300 to 255. As in the case of the F-16, this smaller buy reflects the reduction in the size of the tactical combat forces that would need to be equipped under this option, compared to the current plan.

Bombers

As in the case of tactical aviation, the number of Air Force bombers would be cut by 15 percent in this option. This would bring the number of bombers down from 157 under the current plan to 133 aircraft. In implementing these cuts, it is assumed that the Air Force would keep all of its B-2 bombers and reduce the size of both its B-1B and B-52 fleets by about 18 percent. This would leave the Air Force with a bomber inventory consisting of 21 B-2s, 50 B-1Bs and 62 B-52s. In this Option, unlike the current plan or Option 1, the full-scale development of a new bomber would be deferred until after 2022. In this case, a new bomber would probably not be available to be fielded until around 2037, at the earliest. While fielding a new bomber in 2037 would represent a lengthy delay compared to the current plan or Option 1, it would be consistent with the plans included in the 2001 Bomber Roadmap.

Airlift

No change from the current plan.

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[93] It is assumed that new F-16's would have unit procurement costs of about $40 million.

Tankers

Under this option, the size of the tanker fleet would be cut by 5 percent. Such a reduction would be consistent with the reductions made by the Air Force at the end of the Cold War and assumed in Option 1. This option would also significantly slow down and restructure the Air Force's plans for modernizing its fleet of tanker aircraft. Specifically, the Air Force would defer production of any new tankers for eight years, pushing back production of the first new tankers to 2015. This would reduce the number of new tankers purchased over the 2005-22 period from 280 to 150, including 75 medium and 75 small tankers. As an interim measure, it is assumed under this option that about $4 billion would be spent to upgrade and extend the life of the KC-135E fleet.

SOF

No change from the current plan.

ICBMs

Under this option, the number of operational ICBMs would be cut by 15 percent to 425. As with all of the other force structure cuts included in this option, these cuts would be completed in 2007. In addition, reflecting the slower approach to modernization taken in this option, production of a new ICBM would be deferred until sometime after 2022.

Funding

Under this option, Air Force procurement funding would average $29 billion a year over the 2005-22 period, compared to $44 billion a year in the current plan. Likewise, average annual R&D funding requirements would decline by about $2 billion, to $19 billion a year. These R&D savings stem from the decisions in this option to cancel the FB-X regional bomber, and defer the acquisition of a new bomber and ICBM. Since the size of the Air Force would be cut only modestly, Air

Force O&S funding requirements would decline only modestly, to $77 billion a year, in this option.

OPTION 3: ACCEPT MODEST CUTS IN MODERNIZATION PLANS AND FORCE STRUCTURE

This option takes a middle path between the first two options. In this case, both the Air Force's modernization and force structure plans would be cut, but force structure would be cut less deeply than in Option 1, while the Air Force's modernization plans would be cut less deeply than in Option 2.

Under this option, the number of active duty Air Force personnel would be reduced by about 12 percent, to some 315,000 troops, by the end of 2009, and would be kept at roughly that level through 2022. As with the other options, the force structure cuts included in this option are focused primarily on combat forces. In this case, the Air Force's tactical combat aircraft, bombers and ICBM forces would each be cut by 25 percent, with all of the reductions completed in 2009. And, again, as in the other options, Air Force airlift forces, and centralized C3I and space activities, would be kept at the levels projected in the current plan. As in Options 1 and 2, plans for Air Force special operations forces would also be carried out consistent with the current plan. In this option, the size of the Air Force's fleet of tanker aircraft would be reduced by about 8 percent, somewhat less than in Option 1 and somewhat more than in Option 2.

Most of the major next-generation systems included in the current plan would, under this option, be scaled back, but only one of the systems (the FB-X) would be cancelled. In addition, as in Option 2, the production of the next-generation ICBM would be deferred beyond 2022. In the case of the tactical combat forces, modernization would be accomplished through a combination of next-generation and current-generation procurement.

Tactical Combat Aircraft

This option would take the same approach as Option 2 to the F/A-22 and the FB-X programs. That is, a total of 125 F/A-22s would be procured (including 57 over the 2005-22 period), while the FB-X would be canceled. To partially compensate for these cuts, 145 new F-15Es would be procured instead.

Under this option the Air Force would replace its existing force of F-16 fighters through a dual track approach involving the production of both the F-35 and new F-16s. The Air Force would buy a total of 515 F-35s and an equal number of new F-16 through 2022. The combined total of 1,030 aircraft is 25 percent below the number of F-35s projected to be procured over these years under current plans—reflecting the fact that the force structure to be equipped would be 25 percent smaller.

The Air Force would also proceed with the UCAS program. However production of the UCAS would be reduced from about 300 vehicles to 225 through 2022—again reflecting the somewhat smaller force structure the Air Force would need to equip.

Bombers

Under this option, the Air Force's inventory of bombers would be cut by 25 percent to 118 aircraft. As in the preceding two options, it is assumed that in implementing these reductions the Air Force would keep all of its B-2 bombers and take all of the cuts out of its B-1B and B-52 fleets. In this option, both of those fleets would be cut by about 30 percent. This would leave the Air Force with a bomber inventory in 2022 consisting of 21 B-2s, 43 B-1Bs and 54 B-52s. As in each of the earlier options, it is assumed that no new bombers would be purchased during the timeframe covered by this report.

ICBMs

The number of operational ICBMs would be cut by 25 percent in this option, from 500 in the current plan to 375. In addition, as in Option

2, production of a new ICBM would be deferred until sometime after 2022.

Airlift

No change from the current plan.

Tankers

Consistent with the approach taken after the end of the Cold War (and using the same methodology employed in the two preceding options), the Air Force's tanker fleet would be cut by 8 percent in this option. Since fewer tankers would have to be replaced, and the oldest tankers would be retired first, it is assumed that this change would also reduce the number of new tankers the Air Force would need to purchase by 8 percent. This would reduce the number of new medium and small tankers procured through 2022 to 130 tankers of each type, for a total of 260 aircraft.

SOF

No change from the current plan.

ICBMs

The number of operational ICBMs would be cut by 25 percent in this option, from 500 in the current plan to 375. In addition, as in Option 2, production of a new ICBM would be deferred until sometime after 2022.

Funding

Air Force procurement funding would average $32 billion a year over the 2005-22 period, under this option, while R&D funding would average $20 billion a year. The procurement savings of about $12

billion a year (compared to the current plan) included in this option, reflect both the slower approach taken to modernization and the fact that a significantly smaller force structure would need to be modernized. The R&D savings stem from the decisions, under this option, to cancel the FB-X regional bomber and defer acquisition of a new ICBM. Reflecting the moderately smaller force structure that would need to be supported, funding requirements for O&S activities would decline to an average of $72 billion annually, compared to $82 billion in the current plan.

Table 6: Air Force Combat Aircraft Inventories in 2022

Type	Option 1	Option 2	Option 3	Option 4	Current Plan	2004
Fighter / Attack						
A-10	0	100	75	60	100	245
F-16	0	1145	600	260	250	1360
F-15A-D	0	0	0	0	0	535
F-15E	170	370	310	260	170	220
F-117	0	0	0	0	0	55
UCAS	105	220	195	440	250	0
F-35	460	0	425	245	1120	0
F/A-22	260	115	115	115	260	0
FB-X	150	0	0	0	150	0
Total	1145	1950	1720	1380	2300	2415
Bomber						
B-52	32	62	54	72	76	92
B-1B	26	50	43	58	60	58
B-2	21	21	21	21	21	21
LRSP	0	0	0	6	0	0
Total	79	133	118	157	157	171

Source: CSBA

OPTION 4: ACCELERATE TRANSFORMATION AND BETTER ADDRESS THE ANTI-ACCESS CHALLENGE

Under this option, the Air Force would be transformed more rapidly than called for under the current plan, or any of the other options described in this chapter. Before discussing this option in detail, it is important to understand that it reflects one particular view of the RMA. In many ways it is a persuasive perspective, but it is certainly not the only perspective.

As noted earlier, although it is widely believed that we are in the midst of an RMA that will significantly, if not dramatically, change the way wars are fought in the future, there is considerable disagreement over the nature, pace, timing and implications of this RMA. Air Force officials argue that the Service's current plans not only continue to make sense in light of the RMA, but that those plans will effectively exploit the RMA. Moreover, a case could be made that each of the three preceding options discussed in this chapter are consistent with alternative views of the RMA and military transformation.

This option differs from the current plan and the other options in four important ways. First, it takes the anti-access challenge discussed in Chapter 3 more seriously. In order to address this challenge, under this option, no reductions would be made in the size of the existing bomber force and current Air Force plans for fielding a new bomber would accelerated by five years.[94] Second, this option places more confidence in the potential of unmanned combat aircraft. In this option, the UCAS would be deployed in greater numbers than it would in the current plan or any of the other options. Third, this option places greater emphasis on combating terrorism and related

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[94] This greater emphasis on bombers is also consistent with the view that such aircraft, equipped with large numbers of modern (and relatively small and inexpensive) PGMs, can provide a critical, and possibly revolutionary, improvement in precision-strike capabilities. The capacity of bombers to provide a highly lethal combination of mass and precision in their weapons delivery makes them potentially very useful weapon systems even in cases where their *long-range* strike capabilities are not required.

missions involving unconventional operations. In this option, the Air Force's plans for modernizing its special operations forces would be accelerated, providing the Air Force with significantly more robust SOF capabilities by 2022 than would the current plan, or any of the other options. Fourth, under this option the Air Force would begin an innovative program—involving the use of commercial aircraft—designed to help it meet its aerial refueling requirements in a more cost-effective manner.

As in Option 3, the savings needed to make this option affordable would be generated through a combination of force structure reductions and cuts to the Air Force's current modernization plans. Under this option, the number of active duty Air Force personnel would be reduced by 15 percent, while the number of tactical combat aircraft and ICBMs would be cut by about 40 percent. All of these reductions would be completed by 2012. As in all of the other options, Air Force airlift capacity, and funding for centralized C3I and space activities, would be left unchanged from the current plan. The capacity of the tanker fleet would be cut by about 13 percent. Under this option, reductions in the Air Force's modernization plans would fall mainly on the Service's manned fighter programs.

Tactical Combat Aircraft

As in Options 2 and 3, in this option F/A-22 production would be limited to a total of 125 aircraft (including 57 to be procured over the 2005-22 period), giving the Air Force enough aircraft to maintain at least one fighter wing equivalent of F/A-22s. Likewise, as in the previous two options, the FB-X would be cancelled. To partially compensate for these cuts, the Air Force would procure 100 new F-15E fighters.

As in Option 3, the Air Force would replace its existing force of F-16 fighters through a dual track approach involving the production of both the F-35 and new F-16s. The Air Force would be a total of about 400 aircraft of these two types over the 2005-22 period. Of this total, 300 would be F-35s and 100 would be new F-16s. This is far fewer than the number of F-35s that would be procured under the current plan. This reduction reflects two facts: the number tactical combat aircraft that would need to be replaced in this option would be

far lower than in the current plan, and far greater reliance would be placed on unmanned systems in this option.

Under this option, the number of UCAS procured through 2022 would be increased from 300 to 500. By 2022, UCAS would account for 32 percent of the Air Force's fleet to tactical combat aircraft, compared to 11 percent in the current plan, and 9 to 11 percent in the other options.

Bombers

In contrast to the three preceding options, the size of the bomber fleet would be kept at the levels projected in the current plan through 2022. In addition, under this option the Air Force would accelerate its plans to acquire a new bomber by roughly five years. Specifically, it is assumed that the Air Force would start procuring a new bomber in 2018, and that it would purchase a total of 12 new bombers by 2022 (reaching a rate of three bombers per year in 2020).[95] Few, if any, of these new aircraft would be deployed in operational units by 2022, but they might all be fielded relatively soon thereafter. Once deployed, the new bombers would be used to replace a comparable number of B-1B or B-52 bombers, keeping the overall size of the bomber fleet at the levels projected in the current plan through 2022 and beyond.

Airlift

No change from the current plan.

Tankers

The size of the Air Force's tanker fleet would be cut by about 13 percent in this option. As in the other options, this reduction reflects the smaller number of aircraft, especially tactical combat aircraft, that

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[95] It is assumed that the new bomber, which might be manned or unmanned, would have a unit procurement cost of about $1.3 billion.

would need to be supported as a result of the cuts in fighter force structure also included in this option. As in the preceding options, and for the same reasons, it is assumed that this change would also reduce the number of new tankers the Air Force would need to purchase. In this case, cutting the planned procurement of new tankers by 13 percent would reduce the number of aircraft purchased to about 240, including 120 medium and 120 small tankers. In contrast to the preceding options, however, under this option, the Air Force's own tanker fleet would also be augmented by 50 commercial cargo aircraft which, in wartime or other emergencies, could be rapidly modified for use as tankers. This program would be closely modeled after the CRAF program (discussed earlier), through which the Air Force is able to draw upon commercial passenger and cargo aircraft to augment its airlift capabilities. When activated, these tankers would be operated by active duty Air Force, Air Force Reserve or Air National Guard personnel and used primarily to carry out homeland security and deployment-related refueling missions—thereby freeing up the Air Force's dedicated tanker fleet for more critical, and potentially dangerous, wartime missions. [96]

SOF

The modernization of the Air Force's SOF aircraft fleet would be accelerated under this option. Specifically, the procurement of the AC-X (gunship), M-X (transport) and K-X (tanker) aircraft would begin in 2018, some five years earlier than projected (in this analysis) under the current plan. It is assumed that the Air Force would, over the 2018-22 period, purchase 15 aircraft of each type, for a total of 45 aircraft.[97] By 2022, perhaps half of these aircraft would be deployed in operational units. Under this option the CV-22 would be procured as scheduled in the current plan.

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[96] For a discussion of the tanker CRAF concept, see, Capt. Patrick Harmand (French Navy) and Col. Carl D. Rehberg, Ph.D., "A Modern Reserve Component for the European Union in a Post-Cold War Era," *The Officer*, May 2004, p. 44.

[97] It is assumed that these aircrafts would have an average unit procurement cost of about $200 million each.

ICBMs

In this option, the number of operational ICBMs would be cut by 40 percent, compared to the current plan, to 300 missiles. Since fewer ICBMs would need to be replaced, the number of ICBMs procured under this option would also decline. Instead of procuring 200 ICBMs between 2016 and 2022, as projected in the current plan, a total of 120 missiles would be purchased.

Funding

Under this option, Air Force procurement funding would average $33 billion a year over the 2005-22 period. As in the two preceding options, this reduction reflects both the decision to cut some modernization programs and the fact that a significantly smaller force structure would need to be modernized. R&D funding requirements would average about $22 billion a year in this option, somewhat higher than under the current plan. R&D funding would need to be increased due to the decisions to accelerate the acquisition of a new bomber and special operations aircraft, but those costs would be partially offset by the decision to cancel the FB-X regional bomber. Funding requirements for O&S activities would average $71 billion annually in this option.

Table 7: Air Force Aircraft Inventories in 2022

Type	Option 1	Option 2	Option 3	Option 4	Current Plan	2004
Fighter/Attack*	1145	1950	1720	1380	2300	2415
Bomber	79	133	118	157	157	171
Strategic Airlift**	318	318	318	318	318	296
Tactical Airlift	510	510	510	510	510	510
Tanker**	500	570	550	520	600	600
SOF	120	120	120	120	120	120
ICBMs	250	425	375	300	500	520

* Includes the UCAS and the FB-X Regional Bomber.

** The KC-10A is included in the Tanker category.

Source: CSBA

SUMMARY AND COMPARISON OF OPTIONS

Determining which of these options would support the most capable and effective Air Force for the United States, or whether any of these options, or the current plan, would result in an Air Force that would be sufficiently capable to meet US security requirements today and in the future, is beyond the scope of this report. That said, it may be useful to summarize these different options, and compare and contrast them along a number of different dimensions. Such an overview provides at least a starting point for the broader kind of analysis one would need to undertake to determine which, if any, of these options could, indeed, effectively meet US security requirements.

The US Air Force would be smaller. In each of the four options the size of the Air Force, and particularly the Air Force's fleet of combat aircraft, would be reduced. Compared to the current plan, measured in terms of active duty personnel, the magnitude of the cuts would range from 7 percent (Option 2) to 23 percent (Option 1). In terms of tactical combat aircraft the cuts would range from 15 percent (Option 2) to 50 percent (Option 1). These cuts could diminish the Air Force's ability to carry out some missions. On the other hand, the US Air Force, like the other Services, has traditionally replaced its major weapons platforms on less than a one-for-one basis.

Viewed from a long-term perspective, DoD's past modernization efforts have often been financed in part by cuts in the size of the military. Indeed, over the past 50 years DoD has consistently decided that the best way to improve the overall capability of the US military is to adopt progressively more modern, but also smaller, forces.[98] Illustrative of this general trend is the fact that at the end of the Cold War, in 1990, the Air force was 44 percent smaller, measured by active duty personnel strength, and as much as two-thirds smaller, measured by its total aircraft inventory, than it had been in 1955—despite the fact that the Air Force's budget was 23 percent higher in 1990 than in

[98] To be sure, this decision has not always been entirely conscious. Not surprisingly, DoD planners generally wish to replace old equipment with new (and typically much more costly) equipment on a one-for-one basis and to retain existing force structure. However, when budget realities have forced them to choose, they have consistently chosen quality over quantity.

1955. At the same time, few would argue that the US Air Force that existed on the eve of Operation Desert Storm was not at least several times more capable than the Air Force of the mid-1950s.

The US Air Force would remain much larger than the air forces of the most likely US adversaries. Although the size of the US Air Force would be cut under all of the options discussed in this chapter, in all cases it would remain far larger than the air forces of the most likely potential US adversaries, such as North Korea and Iran. Currently, the North Korean military possesses a total of about 600 combat aircraft,[99] while the Iranian military has a total of some 250 combat aircraft.[100] By comparison, under the four options the US Air Force would retain between 1,145 and 1,950 tactical combat aircraft, as well as 79-157 bombers. Including the air forces of the US Navy and Marine Corps would vastly increase the magnitude of the US advantage. Even assuming the tactical aircraft fleets of those Service's would be cut by the same amounts (i.e., 15-50 percent) projected for the Air Force in each of the four options, including Navy and Marine Corps aircraft in the total would increase the US inventory of tactical combat aircraft to some 1,800-3,000 aircraft.[101]

The fact that the United States would likely retain an enormous edge in numbers of combat aircraft over these potential adversaries certainly does not prove that US air forces would retain their current level of superiority in the future. Such numerical comparisons would need to be supplemented by, among other things, qualitative comparisons, and in particular an analysis of the ground-based air defenses of those countries, as well as their ability to counter US

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[99] GlobalSecurity.Org, "North Korean Aircraft Equipment," www.globalsecurity.org/military/world/dprk/air-force-equipment.htm.

[100] GlobalSecurity.Org, "Iranian Aircraft Equipment," www.globalsecurity.org/military/world/iran/airforce-equipment.htm.

[101] The Chinese military currently possesses some 2,300 combat aircraft of various types. GlobalSecurity.Org, "PLAAF Equipment," www.globalsecurity.org/military/world/china/plaaf-equip.htm. While China's air forces are much larger than those of North Korea or Iran, a US conflict with China appears significantly less likely. In any event, to the extent China does pose a potentially serious military challenge, it is far from clear that the US Air Force's appropriate current plan focus on the acquisition of large numbers of relatively short-range combat aircraft is appropriate.

tactical air power through attacks on US air bases with ballistic and cruise missiles—and such analyses are beyond the scope of this report. Nevertheless, measured by at least this one dimension of capability, US air forces would likely retain a significant advantage under any of the options discussed in this chapter.

The US Air Force would retain enough aircraft to carry out future OIF-size air campaigns. Not only would the US Air Force retain its current numerical superiority over the most likely potential US adversaries under each of the options, it would also sustain a large enough force structure to conduct one or more OIF-size air campaigns (assuming the growing anti-access challenge does not preclude large in-theater deployments in the future). The Air Force deployed about 300 tactical combat aircraft in support of OIF, plus 33 bombers.[102] This is equivalent to about 20 percent of the PAA strength of the Air Force's fleet of tactical combat aircraft, and one-third of the PAA strength of its bomber force. By comparison, even under Option 1, which includes the deepest cuts in force structure, the Air Force would retain 50 percent of the aircraft in its tactical combat aircraft and bomber fleets. Moreover, under all of the options, the Air Force would be able to deploy a force of 300 tactical combat aircraft and 33 bombers that is on average (i.e., aircraft-for-aircraft), considerably, if not far, more capable than the force deployed in OIF. Under some options, the Air Force might have enough aircraft to simultaneously deploy several OIF-size forces.[103]

The US Air Force's inventory of stealthy aircraft would be dramatically increased. Under all of the options, the number of both manned and unmanned stealthy aircraft in the Air Force would be greatly expanded. Today, the Air Force's fleet of stealthy combat aircraft consists of a total of 76 aircraft, including 55 F-117 fighters and 21 B-2 bombers. By comparison, in the four options discussed in this chapter, the Air Force would, by 2022, have a total of some 335-975

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[102] "Operation Iraqi Freedom—By the Numbers," p. 7.

[103] In addition to airbase access and the number or combat aircraft available, the main constraints on deploying more than one OIF-size aircraft deployment would include: limits on the number of specialized support (e.g., C4ISR) aircraft, airlift and other assets; the need for some fighters to protect US airspace (i.e., the homeland security mission); and the need to keep some combat aircraft in reserve.

stealthy aircraft (see Table 8). Even measured in terms of manned aircraft alone, the number of stealthy aircraft would increase dramatically to 115-870 aircraft by 2022. The share of the Air Force fleet of tactical combat aircraft made up of stealthy aircraft would increase from only two percent today, to 17-85 percent by 2022. This is one of the reasons why, aircraft-for-aircraft, the Air Force's fleet of tactical combat aircraft would likely be much more capable in 2022 than it is today.

Table 8: Air Force Combat Aircraft in 2022

Type	Option 1	Option 2	Option 3	Option 4	Current Plan	2004
Fighter / Attack						
Total Aircraft	**1145**	**1950**	**1720**	**1380**	**2300**	**2415**
Stealthy	**975**	**335**	**735**	**800**	**1780**	**55**
% of force	**85%**	**17%**	**43%**	**58%**	**77%**	**2%**
Unmanned	**105**	**220**	**195**	**440**	**250**	**0**
% of force	**9%**	**11%**	**11%**	**32%**	**11%**	**0%**
Bomber						
Total Aircraft	**79**	**133**	**118**	**157**	**157**	**171**
Stealthy	**21**	**21**	**21**	**27**	**21**	**21**
% of force	**27%**	**16%**	**18%**	**17%**	**13%**	**12%**

Source: CSBA

The US Air Force's airlift capabilities would increase as projected in the current plan. In one critical mission area, airlift, the Air Force's capabilities would—under all four options—remain unchanged from the current plan. As noted earlier, in each of the options the Air Force would buy the number of C-17 strategic and C-130 tactical airlift aircraft projected in the current plan, and sustain the planned airlift force structure. Thus, in all cases the Air Force would remain capable of supporting large deployments of US forces to forward areas (again, assuming the anti-access challenge does not preclude or greatly limit such airlift operations in the future).

The average age of the Air Force's aircraft inventory would be roughly the same or lower than it is today. Under all four options, the Air Force would buy fewer new aircraft than it would in the current plan. However, the number of new aircraft procured would still be considerable. Moreover, in all four options more aircraft would be retired from service than projected in the current plan, with the oldest aircraft generally retired first. As a result, in all four options, the average age of the Air Force's aircraft inventory would remain at or below today's level.

The Air Force's investment in long-range precision-strike capabilities would be far lower than it has been historically. As noted earlier, the Air Force is projected, under current plans, to buy no new bombers until after 2022. By comparison, it is projected to spend $125-165 billion to buy over 2000 new (manned and unmanned) tactical combat aircraft over the 2005-22 period. By comparison, over the past 30 years, the Air Force has spent an average of $1 on bomber procurement for every $2.20 spent on the procurement of tactical combat aircraft. Put another way, historically, an average of about 70 percent of the Air Force's overall procurement budget for combat aircraft (tactical aircraft and bombers) has been allocated to tactical combat aircraft and 30 percent to bombers. As discussed earlier, such an investment approach might not be appropriate given the growing anti-access challenge. Under Option 4, the production of a new bomber would be accelerated and a total of $15 billion would be provided for bomber procurement. This is about 28 percent of the procurement funding provided through 2022 for all combat aircraft in this option.

This brief review only scratches the surface, in terms of the range of factors that would need to be taken into account to determine which of the four Air Force options discussed in this chapter would best meet US security requirements or whether any of these options would adequately meet those requirements. Nevertheless, to the extent that this preliminary review suggests anything, it would seem to be that under each of the four options the Air Force would remain a highly capable force over the next two decades.

Conclusion

The US Air Force is currently projected to purchase a broad range of next-generation combat, airlift, tanker, special operations, and other aircraft over the next two decades, as well as new ICBMs. Altogether, the Air Force plans to buy more than 2,000 new combat aircraft alone, between 2005 and 2022. Over these years, the Air Force plans to maintain largely the same force structure it has today, and to continue to maintain those forces at very high states of readiness.

The cost of these plans can be only roughly estimated. But it seems likely that the Air Force's budget would have to be increased to an average of some $148 billion a year over the next two decades if the current plan is to be fully implemented. This is $23 billion more than the administration included for the Air Force in its 2005 request. Costs could be less, perhaps $133 billion a year, if the Air Force is far more successful at meeting its cost goals for new weapons programs than it has been in the past, and it is able to limit cost growth in O&S activities well below the historical norm. But, while possible, such an outcome seems highly unlikely.

If the Air Force is not able to hold down cost growth in weapons acquisitions and O&S activities, it may prove difficult or impossible to implement its current long-term plan. This is because, in coming years, the Air Force will face stiff competition for budget dollars both from non-defense federal programs and priorities, and from other components and programs within DoD.

If the increases in the Air Force's budget needed to pay for its current modernization, force structure and other plans cannot be achieved, or sustained over the long-term the Air Force will have to scale back those plans to make them more affordable. As discussed in the last chapter of this report, a range of options are available that would allow the Air Force to sustain its forces at essentially today's budget levels over the long term.

Judged by a range of measures, it seems clear that these options would, to varying degrees, provide the United States with a highly capable Air Force in 2022. However, determining which of these options would best meet US national security requirements, or whether any of them would adequately meet those requirements, is beyond the scope of this report.