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The United States Should Begin Work on a New Bomber Now

by Williamson Murray

Executive Summary

In major conflicts in a post–Cold War world, the United States may find air bases close to the fighting unavailable or vulnerable to enemy attack—especially by ballistic missiles. Yet the U.S. Air Force is investing billions of dollars in two new types of tactical fighter aircraft (the F-22 and the Joint Strike Fighter) that require access to such bases. In contrast, the Air Force will not commence research and development on a new long-range bomber until 2013 and will not begin producing the aircraft until 2034. Under the Air Force's plan, the B-52s will be more than 80 years old before new bombers replace them. The already-aged B-52s are even now vulnerable to enemy air defenses and must either stand outside them to fire their munitions or have the protection of fighter aircraft.

Heavy bombers can carry heavier payloads over much longer ranges than can fighters and can operate from less-vulnerable bases in theaters that are farther away from the fighting or even from bases in the United States. The decline of the long-range bomber force comes at the very time that substantial portions of U.S. military power deployed overseas are returning to the United States. No matter what type of foreign policy the United States adopts in the future, it will have to possess the capabilities to project power abroad. If the United States needs to project power, that will have to be done from the U.S. homeland. The decline also comes at a time when long-range bombers appear to be more survivable, because of stealth technologies, and more capable militarily, because of precision-guided munitions, than they have been at any time since the onset of the Cold War. Also, bombers have been and will continue to be a vital part of the U.S. nuclear deterrent. In a nuclear crisis, their advantage is that they can be recalled and missiles cannot.

The Air Force is giving priority to investment in tactical fighters because the generals who run the service are preponderantly tactical fighter pilots. Their bias is indicated by the increasingly lopsided ratio of dollars invested in tactical fighters to dollars invested in bombers, which balloons from slightly less than 5 to 1 in 1999 to more than 30 to 1 in 2003. The Air Force should cancel one of its two new tactical aircraft—the F-22 air superiority fighter, which was designed during the Cold War and is unneeded after its end. A small portion of the savings should be used immediately to start the development of a new, affordable long-range bomber.

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Introduction

Over the course of the 40-year Cold War, the United States confronted a consistent and well-armed threat to its interests and survival. The policies and aims of the Soviet Union and its powerful military forces represented a significant threat to a number of other nations as well. As a result, with the creation of the North Atlantic Treaty Organization in the late 1940s, the United States committed to defend territories far from its North American homeland. U.S. air, ground, and naval forces found themselves deployed to bases throughout Europe, the Middle East, and Asia. Those bases allowed the United States to project its military power anywhere in the world. In any major conflict, American forces would have needed significant reinforcements from the continental United States, but overseas bases from which to deal with any crisis already existed. There was every prospect that those bases would be available if American forces needed them.

Nevertheless, even during the Cold War, there were limits. In 1973, when American and European decisionmakers disagreed over whether to help the Israelis—who were in the midst of a ferocious war of national survival with neighboring Arab states—the NATO allies (except the Portuguese) closed access to their bases to American transports flying desperately needed spare parts and equipment to Israel. Only the use of Portuguese bases allowed U.S. C-5s and other transport aircraft to execute the airlift mission of resupply to Israel. Similarly, in 1986, when the United States decided to punish Libya for its overt support of terrorist acts against American military forces, the French refused to allow U.S. F-111 bombers to use French air space. Instead, American aircraft had to fly a far longer and more dangerous route, which entirely avoided French territory, from bases in the United Kingdom.

The clear warning even from the Cold War era is that U.S. forces will not necessarily have access to the bases required for the launching of any major air campaign that is needed—especially when the potential host nation is not in agreement with U.S. policy or is threatened by nations hostile to American interests. That problem, which existed during the Cold War, will be even more pronounced in the post–Cold War period—when American support is less important even to the friendliest of nations. For example, in 1999, when a significant number of American allies in the Persian Gulf region disagreed with the U.S. policy of bombing Iraq, the United States discovered that a number of bases—including those in Saudi Arabia, Washington's closest ally in the region—were closed to U.S. and allied air units participating in the attacks.

During the Cold War, the use of bases on foreign soil depended on the acquiescence of the American allies on whose territories those bases rested. For the most part, few problems arose, but the occasions on which they did are significant warning of the potential difficulties of projecting U.S. military power in the 21st century. Moreover, in the decade since the end of the Cold War, we have seen a significant reduction in the size of U.S. military forces as well as the return of those forces to the continental United States. The number of major overseas air bases on which U.S. air units are deployed decreased from 83 in 1962 to 14 in 1998.[1] Thus, the United States confronts the fact that, at present and for the foreseeable future, far less infrastructure may be available abroad to support its air forces should an important conflict arise.

No matter what foreign policy the United States adopts in the future, it will need the capability to project power abroad. Thus, it would seem that the ability to project U.S. air power from North America is an even more crucial component of American security policy than it was during the Cold War. In the contest with the Soviet Union, the projection of American air power from the United States was almost exclusively within the province of the nuclear-capable bomber forces of the Strategic Air Command. The mission of nuclear deterrence—considerably attenuated with the disappearance of the Soviet Union—is

still significant for U.S. long-range air power. But recent events in the air campaign against Serbia suggest that conventional precision-strike attacks are an even more important mission for the long-range bombers deployed in the United States. B-52s, with conventional air-launched cruise missiles, played a major role in the initial air attacks against Yugoslavia. Even more important was the contribution of the B-2 bombers. Although they flew fewer than 1 percent of the missions, the B-2s delivered approximately 8 percent of the precision-guided munitions used. Whether or not the U.S. war in Yugoslavia or like interventions make good policy, the conflict showed that bombers can be a very potent force in a major war.

With the return of much of U.S. military power to North America, the role of long-range air power appears as important as it has been at any time since the dawn of "strategic" bombers early in the 1940s. This paper examines the recent decisions on long-range air power, the current capabilities and force structure of the resulting bomber force, and the plans and prospects for that force in the first half of the 21st century. Unless one believes that the United States will never need to fight another war and that the realities of geography will disappear, the rapid projection of military power from the continental United States will continue to be of great importance.

The Impact of the End of the Cold War on the Air Force

In the early 1990s, in the aftermath of the Persian Gulf War and the collapse of the Soviet Union, the U.S. Air Force produced a White Paper with the slogan "Global Reach, Global Power" as its title. That slogan reflected the recognition that, in the long term, substantial portions of U.S. military power deployed abroad would be returning to North America. Along with that redeployment, and the downsizing that would accompany the demise of the Soviet Union, would come the removal of substantial portions of the worldwide base structure that had supported the deployment of American forces—air as well as ground units. Thus, the United States would confront, to an extent not seen since the end of World War II, the problem of projecting its military power across the great distances of the Pacific and Atlantic Oceans when necessary. Long-range air power, argued the secretary of the Air Force's staff group, would be the least-expensive and quickest response to challenges that the United States might confront in protecting its security interests in the 21st century.

Nearly a decade later, "Global Reach, Global Power" still resonates in Air Force literature. However, Air Force decisionmaking about procurement suggests an entirely different course—one that flies in the face of earlier claims. The Air Force appears to be on the brink of abandoning the strategic framework within which it has nurtured its forces and justified its existence as an independent service over the past 50-plus years.

The achievements of strategic bombing in World War II in both the Pacific and European Theaters of Operation were sufficient to justify the establishment of the U.S. Air Force as an independent service in 1947. The nuclear confrontation of the Cold War then justified a dominant position for the Air Force among the services from 1950 through the mid-1960s. Strategic bombers, particularly the B-52, were the cornerstone of American nuclear deterrence. But from 1965 on, the preeminence of strategic bombers as the main striking force in SAC's, as well as the Air Force's, force structure was challenged.[2]

First, the appearance of both land- and sea-based long-range ballistic missile systems challenged the bomber's preeminence in America's arsenal of nuclear deterrence. Second, SAC's performance in the Vietnam War was hardly distinguished.[3] Fighter-bombers, primarily the F-105, waged the Air Force's portion of the Rolling Thunder strategic bombing campaign against North Vietnam from 1965 through 1968, while SAC's B-52s limited their contribution to fly-

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ing uncontested missions over South Vietnam. Only during Linebacker II—the December 1972 and January 1973 bombing of North Vietnam—did B-52s attack major targets in North Vietnam. SAC's unimaginative and unrealistic tactics and combat doctrine contributed to significant losses of B-52s. Thus, SAC emerged from the Vietnam War in a far less powerful position within the Air Force than it had had before the war. In contrast, Tactical Air Command's wartime efforts made it the Air Force's premier combat command.

Nevertheless, through the end of the Cold War, SAC's fleet of B-52s—augmented by the B-1Bs purchased during the Reagan buildup—continued as one of the three legs of the nuclear triad. Throughout the period from 1970 to the early 1990s, the Air Force experienced considerable difficulties in designing a successor to the B-52. In the late 1960s, the Pentagon canceled the XB-70, the high-altitude penetration bomber, program in the face of increasingly sophisticated Soviet air defense systems, which had presented such difficulties to attacking U.S. fighter-bombers over North Vietnam. The crash of an XB-70 prototype during an air show did not help matters. The B-1 came close to extinction. President Jimmy Carter canceled the bomber early in his presidency in favor of cruise missiles. President Ronald Reagan eventually resurrected the B-1 program, probably because of the Air Force's lack of bomber procurement for two decades and because the stealth bomber program—announced by Carter—was too far off in its production timetable. The B-1 was also a political symbol of Reagan's commitment to spending more money on defense.

The stealth bomber—later designated the B-2—represented a significant effort to upgrade the technological sophistication of America's long-range bomber force. But by the late 1980s, that program was also in trouble. The rapid disappearance of the Soviet threat seemingly removed much of the justification for a stealthy nuclear bomber, and considerable political angst had arisen about the cost of the Reagan buildup. Air Force program managers for the B-2 had emphasized that aircraft's nuclear capabilities at the expense of its conventional possibilities. In addition, the cost of the B-2—which by congressional mandate now included the vast sums expended on development of stealth technology—presented a picture of a gold-plated aircraft that only the military-industrial complex could love.

The military cutbacks after the Cold War presented significant challenges to the Air Force, as well as to the other services. The Air Force was going to have to do something not done since the late 1930s—make hard choices among weapons systems. The new Air Force chief of staff in the period after the Gulf War was Gen. Tony McPeak—a fighter pilot extraordinaire. McPeak made his prejudices clear from his early days in command—when he announced that the Air Force consisted of "fighter pilots" and the others, whom he derisively characterized as "weathermen."

McPeak combined TAC and SAC into a single air command—Air Combat Command. The path that McPeak's Air Force has followed since 1992 suggests a number of worrisome trends in its thinking and organization and in its conceptualization of how to address the problem of reduced access to foreign bases in the 21st century.[4]

The Bombers

At the height of the Air Force's buildup during the Cold War, the primary focus was on the strategic bomber force. SAC's preeminent position in the Air Force declined with the failure of the Air Force's procurement system to provide a follow-on bomber to the B-52 that would be effective in combat and have a reasonable cost.

Thus, the B-52, despite its age, has remained a basic element in the bomber force structure. It has two advantages. The first is that the plane's size allows it to carry great payloads, which has been advantageous in two conflicts. The B-52 terrorized North

Vietnamese and Viet Cong forces during the Vietnam War. The aircraft was equally effective during the Gulf War; its bombing raids with "dumb" (unguided) bombs made it the most feared aircraft of that war.[5] The second advantage is that more than seven hundred forty B-52s were procured during the 1950s and early 1960s. So, despite combat losses and peacetime attrition, considerable numbers have remained to support the force.[6] Nevertheless, the B-52 does have disadvantages. The aircraft is old: the H models that the Air Force received from Boeing during the 1960–62 period have served nearly 40 years. Consequently, despite updates, some of the critical combat systems on the aircraft—such as electronic countermeasure defenses—are no longer effective against the increasingly sophisticated air defense systems that exist throughout the world.

The B-1 was supposed to be the replacement for much of the B-52 fleet. One of the reasons that President Carter canceled the aircraft was the considerable doubt about its combat capabilities and survivability. Nevertheless, Reagan authorized production of one hundred B-1Bs early in his presidency. Despite some considerable teething problems—delicate engines, glitches in software, and deficiencies in electronic warfare capabilities—that kept it out of the Gulf War, the B-1 has evolved into the mainstay of the bomber fleet. The aircraft possess speed, maneuverability, and long-range capabil-ities, but its signature (detectability by radar and other sensors) will force it to attack at a low altitude or after enemy air defenses have been significantly degraded. The plane is only now acquiring precision-guided munitions.

The B-2 is the first truly stealthy long-range bomber platform in the U.S. inventory. This aircraft also has had considerable teething problems. The huge research and development expenses of the stealth program have been folded into the aircraft's cost. At approximately $20 billion, those R&D costs work out to nearly $1 billion per aircraft—adding to the already hefty production cost of $1 billion per aircraft. The ability of the B-2 to attack through any weather, however, makes it unique in the U.S. bomber inventory and explains why the plane was able to play such a significant role in the air campaign against Yugoslavia.

The difficulty lies in the number of B-2s the Department of Defense procured for the Air Force. Over the coming decades there simply will not be enough aircraft to sustain a viable force. There has been considerable pressure from the Republican Congress since 1995 to resume B-2 production to increase the numbers in inventory so that peacetime attrition will not eventually force the aircraft's removal from service. The Department of Defense and the Air Force, however, have managed to beat back such efforts to extend production. As a result, the large start-up costs of resuming B-2 production at this late date and the enormous expenses associated with fighter programs for both the Navy and the Air Force (the F/A-18E/F and the F-22) probably preclude the production of more B-2s.[7]

The 25 years since the end of the Vietnam War have seen a significant increase in the ratio of fighters to bombers in the U.S. military. Despite the cuts in U.S. forces after the Cold War, the inventories of tactical fighters possessed by the Air Force, the Navy, and the Marines numbered approximately 3,000 aircraft in 1995. In that year, the number of bombers shrank to 187. Thus, although there had been a 2-to-1 ratio of fighters to bombers in the U.S. inventories in 1950, that ratio had changed to 16 to 1 by 1995.[8] And there is every prospect that this unmistakable trend will continue well into the 21st century.

USAF Plans for Long-Range Air Power

On March 1, 1999, responding to congressional language in the authorization and appropriations legislation for the fiscal year 1999 U.S. defense budget, the Air Force delivered a "roadmap" of its plans for long-range air power for the next half century (Figure 1).

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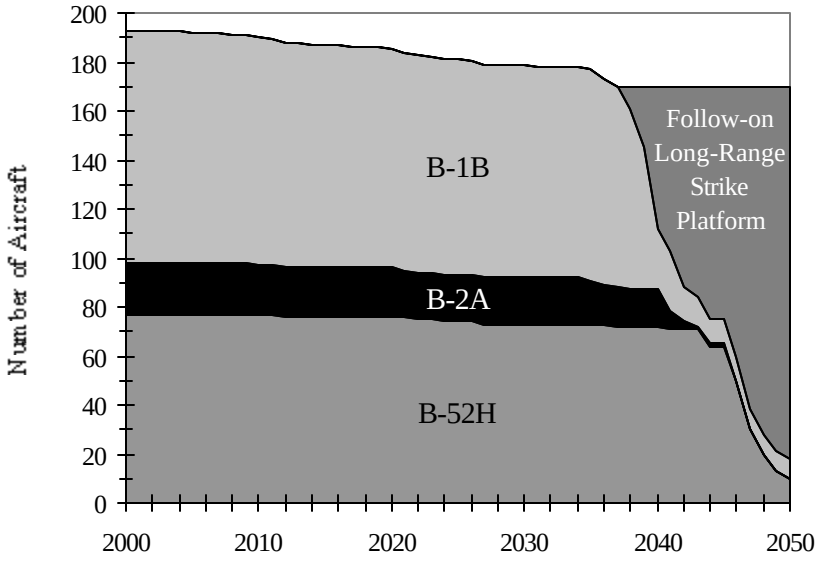
Figure 1
U.S. Air Force Bomber Roadmap, March 1999



Source: U.S. Air Force, "Air Force White Paper on Long-Range Bombers," March 1, 1999.

In that White Paper, the Air Force argued that "today's bomber platforms hold unique combat power capabilities and represent an important piece of air force core competencies of Global Attack and Precision Engagement."[9]

However, the Air Force's recommendations for the future of the long-range bomber force underline how far Air Force rhetoric and reality diverge. The recommendations of the White Paper can be consolidated into the following three points:

1. Given the expected service life of the aircraft and anticipated attrition, the inventory of ninety-five B-1s, twenty-one B-2s, and seventy-one B-52s (187 bombers in total) will be adequate to meet the national requirements for 130 combat bombers through the year 2037.[10]
2. The Air Force does not need to define its requirements for an aircraft to replace a long-range strike platform until 2013 and does not need to begin producing the follow-on platform until 2034—long after all of the officers currently on active duty have left the service.
3. Because the stealthy B-2's signature meets operational requirements for survivability against today's air-defense threats, the Air Force does not require any signature improvements in the bomber force before 2015.[11]

So, other than make foreseeable bomber modifications and improvements (and even here declining investment in the present force is a reality), the Air Force will do virtually nothing for the next decade and a half to improve or extend U.S. requirements for long-range air power in both its nuclear and nonnuclear roles.

The Air Force's senior leaders have turned their backs entirely on the very cornerstone of their service. The irony of this is that it comes at a time when long-range bombers appear to be more survivable, more capable militarily, and more valuable as instruments of U.S. military policy than they have been at any time since the onset of the Cold War.

Air power's growing efficacy results from the marriage of precision-guided munitions and bombers that have a long range and a large payload. The venerable B-52 first used

conventional air-launched cruise missiles for precision attacks against fixed targets during the 1991 Persian Gulf War. The Air Force has recently modified seven B-1s to carry the Joint Direct Attack Munitions, a weapon that provides an all-weather, near-precision attack capability. The remainder of the B-1 force is scheduled for such modifications over the next several years. Moreover, the B-2's relative-targeting system allows inertially (self-) guided precision-guided munitions, which are updated with course corrections from Global Positioning System satellites, to be delivered even more accurately (with an error of less than 20 feet).

Another reason for the B-2's increased effectiveness and value is its low observability, which affords increased survivability. A third reason is that reductions in U.S. forces and in the numbers of overseas bases since the end of the Cold War have increased—rather than diminished—the utility of long-range bombers for nonnuclear missions. (In addition, the B-52s and B-2s continue to make up one leg of the U.S. nuclear triad.)

Despite those strong reasons for believing that the value of long-range bombers has grown since the end of the Cold War, the senior leadership of the Air Force has clearly reached the opposite conclusion. To understand how and why they have done so, a review of the relevant history—starting with the watershed year of 1992—is in order.

Decline of the Bomber Force

In 1990 the Air Force planned to procure a fleet of one hundred thirty-two B-2s. In early 1991, during the Gulf War, the service reduced that number to 75. At that time, the estimated program-unit cost (the average cost to research, develop, and procure a bomber) was approximately $830 million (in FY99 dollars).[12] The $830 million per aircraft represented a substantial increase over the $570 million program-unit cost for the 132-aircraft program. Yet the seventy-five B-2s were a sufficiently large fleet to allow for peacetime attrition (for example, aircraft lost in training exercises).[13] In addition, when combined with nonnuclear precision-guided munitions, a fleet of seventy-five B-2s could be a potent force in combat—especially during the opening days of any major theater war.

The 1992 Decision to Halt B-2 Production and the Air Force's Response

Nevertheless, in the wake of the collapse of the Soviet Union, President George Bush announced—in his January 1992 State of the Union Address—that he was cutting the purchase of B-2s to a mere 20 aircraft.[14] The Air Force—which puts a high priority on procuring a new air-superiority fighter to replace the F-15—acquiesced in the decision. Remarkably, the leaders of the Air Force appear to have raised virtually no objections. They failed to object despite several factors that might have led a more thoughtful leadership to a different set of priorities.

The United States was so dominant in air-to-air combat in the Gulf War that U.S. F-15Cs downed 30 Iraqi fighters in air combat without a single lost aircraft.[15] Second, for the next 10 to 15 years, no nation on earth is likely to field the combination of advanced fighters, skilled pilots, and command and control required to mount a serious challenge to American air superiority. Indeed, U.S. dominance appears so pronounced that potential adversaries are looking for other, asymmetric, ways to offset or negate American control of the air. For example, instead of building a capable air force—which is expensive—potential enemies might buy cheaper surface-to-air missiles to shoot down U.S. aircraft or surface-to-surface missiles to destroy the air bases from which U.S. aircraft would operate. U.S. dominance in air-to-air combat should have led the Air Force to reallocate resources from fighter to bomber aircraft.

The Demise of SAC

President Bush's decision to halt B-2 production at 20 aircraft was not the only event in 1992 to contribute to the demise of the U.S.

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bomber force. A second major event was the deactivation of SAC in June 1992. Whatever deficiencies SAC had in its methods of waging warfare, the command—throughout its history—had been the center of bomber advocacy within the Air Force. With SAC's deactivation, the Air Force transferred its bombers to ACC, which officially stood up on the same day that SAC disappeared.

In effect, ACC was nothing more than TAC with new lettering on the headquarters building at Langley Air Force Base. With virtually every senior position in the new headquarters held by fighter pilots, the transfer of SAC's bombers to ACC was a hostile takeover of the bomber force by the fighter generals. Since that time, the Air Force has lacked an effective institutional advocate for long-range bombers. With Bush's decision to halt B-2 production and the disestablishment of SAC, 1992 appears to have been a watershed year in the history of long-range American air power. The decline of the bomber force had begun.

Fighters as the Centerpiece of American Air Power

The events of 1992 indicated that the Air Force's senior leaders no longer viewed bombers as important either to their service or to American air power. Bush's decision to end B-2 production at 20 aircraft resulted from a belief that the low-observable bomber was primarily—if not exclusively—a nuclear-delivery platform. In fact, Bush made that explicit in his State of the Union Address:

> Tonight I can tell you of dramatic changes in our strategic nuclear force. . . . After completing twenty planes for which we have begun procurement, we will shut down further production of the B-2 Bomber.[16]

Although much of this paper concentrates on bombers in their conventional role, bombers are likely to retain an important role in nuclear deterrence in the next century. This is especially true as the number of available nuclear-capable systems (aircraft, submarines, and missiles) declines. Bombers in their nuclear role are a force that can deploy from home bases to a large number of operating locations. Thus, they complicate an enemy nation's targeting problems. Moreover, unlike ballistic or cruise missiles, bombers can be recalled once they are launched. And they can be retargeted in the air in response to changes in the military and political situation.

The conflict that the United States is least likely to fight in the 21st century is an all-out nuclear war. But at the same time, nuclear war is the one type of conflict that the United States most needs to deter. For the duration of the Cold War, long-range bombers provided an essential component of U.S. deterrence strategy. For the same reasons that they proved so useful during that period, they should continue to be a major factor in U.S. deterrence strategy into the 21st century. The resources and training required to conduct the nuclear mission will add considerably to the strain on a bomber force that also requires such inputs to fulfill its enormously useful role as a conventional strike force.

When President Bush and his advisers canceled the B-2 bomber, they apparently did not consider the B-2's potential for conducting conventional warfare. Had Air Force leaders focused on the operational implications of long-range, stealthy bombers armed with precision-guided weapons, they might have counseled against that decision. Their failure to mount even a faint protest suggests that they had already decided that their service's future lay almost entirely in fighter aircraft, not bombers.

The abandonment of the bomber force went against the Air Force's historical roots. In his 1993 book on the Army Air Forces in World War II, Geoffrey Perret observed that the bomber had been pivotal in the emergence of an independent American Air Force following the defeat of Germany and Japan in 1945: "Heavy bombers justified an independent air force, because only the AAF had employed them. They were clearly not weapons the army

could wield."[17] That conclusion was certainly not news in 1993. More than two decades earlier, Perry Smith, who later retired as an Air Force major general, had written that "the doctrine and decisiveness of strategic bombardment in future wars were inextricably tied to the AAF case for [post–World War II] autonomy."[18]

Perret went on to note that, since Vietnam, "bombers have become irrelevant. The essential combat aircraft of the 1990s is the fighter-bomber."[19] Although the Gulf War might well have suggested that bombers and fighter-bombers dropping large tonnages of unguided ("dumb") munitions were becoming less relevant, one could certainly question whether bombers armed with precision-guided munitions were becoming less useful. For an American military confronting the occasional problem of projecting accurate, nonnuclear firepower over global distances on relatively short notice, the combination of long-range bombers and precision-guided munitions arguably remained both attractive and relevant in the strategic environment that was already emerging in the early 1990s. Yet, as a statement of the prevailing thinking within the Air Force's senior ranks, Perret's claim rings true. What else would explain the Air Force leadership's acquiescence in—if not tacit support for—terminating the B-2 buy at 20 aircraft in 1992?

If there were any lingering doubts about the ascendancy of fighters over bombers in Air Force thinking, Gen. Joseph Ralston, vice chairman of the Joint Chiefs of Staff, laid those doubts to rest in testimony before Congress in March 1999. Ralston told a Senate subcommittee that during the preceding three years at interagency deputies' committee meetings on military options for crises, "the weapon of choice" had been "TACAIR" (tactical air power).[20]

The unstated assumptions underlying the Department of Defense's view of the ascendancy of tactical air power need to be addressed. First, most senior U.S. military leaders, particularly in the Air Force, must believe that the United States will always have ready access to military bases in the area of any major conflict. Indeed, one of the first lessons the Air Force seems to have drawn from the air campaign against Serbia in 1999 was that that assumption was valid.[21] Second, U.S. military leaders must think that the United States will not have to fight its way into an area. Third, they must believe that the logistical problems involved in bringing bombs and bullets to the theater of operations will not be insurmountable. Finally, and perhaps most important, they must think that projecting military power from the continental United States—if need be—will not be a major problem.

All of those assumptions are flawed. Military bases might be unavailable or destroyed by enemy ballistic missiles. There may be rare cases in which the United States must fight its way into the theater if no friendly nations exist to support U.S. forces. Moving the great amount of supplies needed for a large tactical air force into the theater can be daunting. Finally, projecting power into a foreign theater from the United States without long-range aircraft can be slow and difficult (building up tactical aircraft and their supplies at bases in the theater can take longer than using bombers based in the United States).

Unintended Consequences

Bush's decision to halt B-2 production at 20 aircraft and the Air Force's acquiescence in that decision have had a number of unintended consequences. First, by 1992 the already expended and anticipated costs of R&D for the B-2 program—which had begun in 1981—were largely set and no longer subject to appreciable reduction. Through FY99, R&D costs for the aircraft totaled some $19 billion (adding the total spent in current dollars for each year). Because those costs were spread across only 20 aircraft rather than 75 (many fewer than the 132 aircraft originally scheduled for production), the bomber's program-unit cost ballooned to more than $2 billion for each aircraft produced—$1 billion of which was money already spent on R&D. (Because the F-22 is

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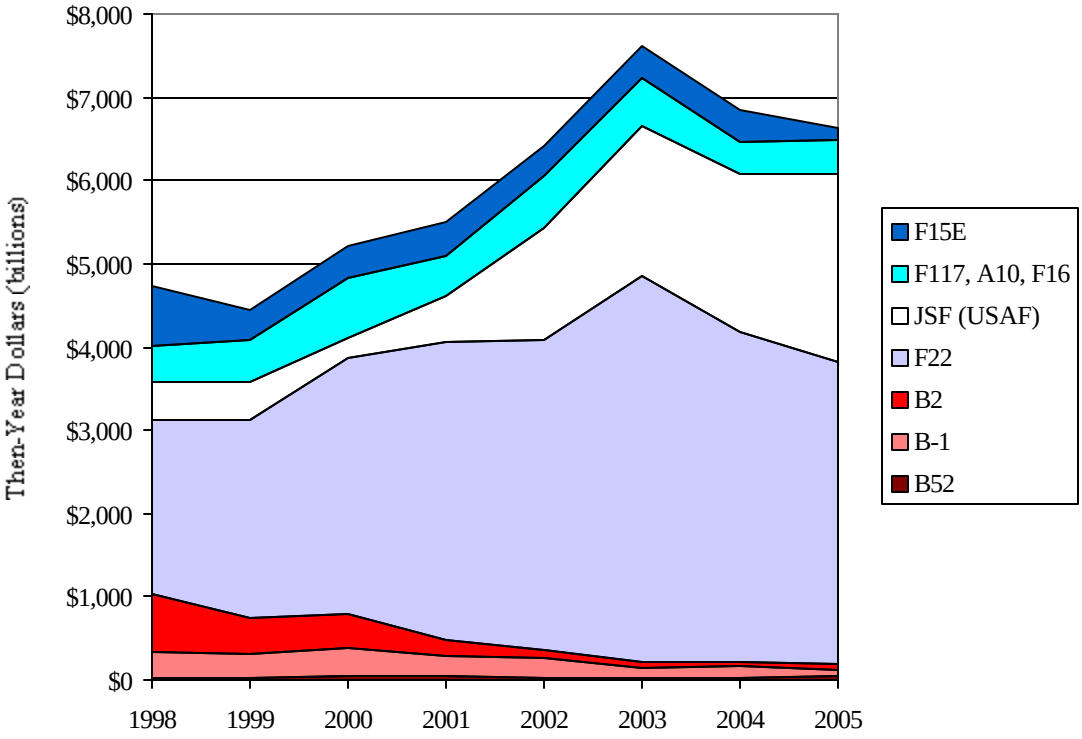
expected to cost $20 billion to develop, a purchase limited to 20 aircraft would result in the same explosion of unit costs.)

That accounting phenomenon induced "sticker shock" even among B-2 supporters. (The cost per pound—a shorthand measure of the sophistication of an aircraft—of the F-22, a plane that was not canceled, was already higher than the canceled B-2's cost per pound even before the growth in costs for the F-22 program over the last several years is taken into account.) Virtually overnight, sticker shock rendered the procurement of additional B-2s a steep, uphill battle—regardless of the aircraft's value for nuclear deterrence and conventional operations.

A second unintended outcome of Bush's decision to terminate B-2 production was to preclude the Air Force from retiring the remainder of its aging B-52 fleet. In 1993 the secretary of defense's "Bottom-Up Review" concluded that the United States needed an inventory of at least 184 long-range bombers to cope with two nearly simultaneous major regional conflicts.[22] With ninety-six B-1s remaining in the inventory in 1992 and B-2 production stopped after 20 aircraft, the Air Force could meet the review's bomber requirements only by retaining the B-52Hs in its active-duty inventory.

The B-52Hs, which the Air Force received from Boeing during the 1961–62 period, are currently completing their fourth decade in operational use.[23] Yet, incredibly, according to current Air Force plans, those venerable bombers may be only half-way through their service life (Figure 2). The Air Force's White Paper indicates plans to retain B-52s in operational service beyond 2040.[24] In other words, Air Force leaders are planning an unprecedented service life for the B-52H of some 84 years. If this comes to pass, the great-grandchildren

Figure 2
U.S. Air Force Fixed-Wing Investment (R&D plus procurement), 1998–2005



Source: U.S. Department of Defense, Fiscal Year 2000 Budget, www.dtic.mil/comptroller/FY2000budget/.

(and perhaps even great-great-grandchildren) of the first pilots to fly the aircraft could be flying the plane in the last years of its service life.

Recurring Congressional Doubts

Given those developments, some members of Congress have repeatedly questioned the wisdom of stopping B-2 production at 20 aircraft. They have also voiced longer-range concerns about the future of the bomber force and its associated industrial base. Perhaps the most forceful manifestation of such concerns was the congressional decision to add $493 million to the FY96 defense budget to convert the first B-2 flight-test aircraft into an operational bomber—thereby bringing the B-2 inventory to 21 combat aircraft.

The Questionable Results of the Heavy Bomber Study

To date, the Pentagon's responses to Congress's recurring concerns about the bomber force have not indicated any noticeable change of mind in either the fighter-dominated Air Force or the Office of the Secretary of Defense. For instance, in the FY95 Defense Authorization and Appropriations Act, Congress directed the Department of Defense to carry out a study of its bomber force requirements and submit the results by mid-April 1995. The study, presented by Paul Kaminski, then-under secretary of defense for acquisition and technology, concluded that a detailed analysis of hypothetical near-simultaneous major regional conflicts in Korea and the Persian Gulf in 1998, 2006, and 2014 did "not make the case for buying additional B-2s."[25]

Putting aside the dispute over whether the United States should size its forces to fight two wars nearly simultaneously, there were some rather questionable assumptions built into the study's scenarios. The study assumed that, before an enemy attack, the United States could count on two weeks to deploy forces to the first major regional contingency and that the political leadership of both the United States and its allies would allow such massive deployments of military forces to take place during a threatening international situation.[26] Thus, the study insisted that the addition of 20 more B-2s would make only "a very small difference" because of the large contribution that tactical fighters deployed during the buildup phase could make to the battle.[27]

Not all senior leaders of the Air Force agreed. Gen. Chuck Horner, the recently retired air component commander during Desert Storm, trenchantly commented that the study's assumption of 14 days of unobstructed buildup time "jibes neither with history nor with military logic."[28] An enemy that was smarter than Saddam Hussein might attack quickly so that tactical air forces would not have time to build up. Alternatively, politicians might not allow the military to undertake a provocative buildup of tactical aircraft in an atmosphere of crisis. Nevertheless, despite considerable congressional doubts, the conclusions of the Heavy Bomber Force Study were that bombers could be made more cost-effective by better precision-guided munitions, that the Department of Defense would need to take no action to preserve the bomber industrial base, and that the Pentagon's existing plans for a bomber force of sixty-six B-52Hs, ninety-five B-1Bs, and twenty B-2s "were well-founded."[29]

Long-Range Air Power Panel

A more recent expression of congressional doubts about the Pentagon's plans for the bomber force was contained in the FY98 Defense Appropriations Act. The act established the Long-Range Airpower Panel. Chaired by Gen. Larry D. Welch, former chief of staff of the Air Force, the panel examined a number of issues, including the role of long-range air power, the value of stealth, the adequacy of the current force to support likely contingencies, and the desirability of buying additional B-2s. Like the Air Force's White Paper of 1999, the Long-Range Airpower

The Long-Range Airpower Panel concluded in March 1998 that "long-range air power is an increasingly important element of U.S. military capability."

The bottom line of the Long-Range Airpower Panel's report was that the Air Force needs to begin major R&D work on a follow-on bomber immediately.

Panel concluded in March 1998 that "long-range air power is an increasingly important element of U.S. military capability." The panel also endorsed the value of stealth for increasing bomber survivability against defended targets.[30] In his testimony to Congress, Welch stated:

> The panel reviewed a wide variety of studies conducted by the Department of Defense and other people and arrived at the conclusion that, given that we bring the B-2 fleet to its full potential—and I think that we know how to do that—and given that we are putting precision weapons on the B-2 and the rest of the bomber force and leverage the potential of that existing force, our conclusion was that we probably have adequate capabilities for the next fifteen years.[31]

Thus, in a limited sense, contrary to the suspicions and doubts of some members of Congress, the Long-Range Airpower Panel judged the current bomber inventory probably adequate for another decade and a half—assuming that the Air Force made needed modifications and upgrades to the current bomber force. The panel recommended improvements that included making all bombers capable of launching precision-guided munitions, substantially increasing the number of Joint Air-to-Surface Stand-off Missiles purchased, and upgrading the ability of the B-2 to maintain its low-observable signature.[32] Astonishingly, the panel discovered that the Air Force had no long-range blueprint for the bomber force[33]—a defect that its White Paper has attempted to rectify in a less than satisfactory fashion.

Only when looking beyond the next 15 years did the Long-Range Airpower Panel worry about whether current plans adequately addressed the future of U.S. long-range air power. Given the lead times necessary to develop a follow-on platform to the B-2, the panel suggested that the Pentagon develop a plan to replace the existing force over time. According to General Welch's careful testimony before Congress:

> If you assume a static sitation, which I think is a wrong assumption but the only way I can answer your question beyond a fifteen year period— based on the past decade's experience and not on models—which are more optimistic—then we will begin to run out of planned B-1s in that fifteen year period. . . . B-52s last far beyond that because we have more airframes than are planned to be maintained in the primary force. We have no experience with the B-2. It is clear that given the value of the B-2, it will be operated in a very conservative manner. At the current time there is no attrition reserve. As for the overall numbers we only concluded that you could maintain the numbers for the next fifteen years. After that you could begin to see some deterioration.[34]

The bottom line of the Long-Range Airpower Panel's report was that the Air Force needs to begin major R&D work on a follow-on bomber immediately. Given the long lead times required for R&D, it is unlikely the Air Force could begin production of such an aircraft much before the 2015–20 time frame.

In fact, the Air Force's own White Paper indicates that the Air Force plans to begin R&D on such a bomber only in 2013 and to begin production 21 years later in 2034. How can that unwillingness to begin R&D for a decade and a half be explained? A cynic might suggest that the current Air Force leadership—recognizing the considerable costs of an R&D program for a new bomber and fearing a conflict between such funding requirements and the huge amounts to be lavished on the short-range fighter programs, such as the F-22 and the Joint Strike Fighter—decided to eliminate a new bomber from its plans until F-22 production was

complete and JSF production was already well under way.

Since 1992 the recurring doubts in Congress about the Pentagon's stewardship of the bomber force have been met with assurances from the Office of the Secretary of Defense and the Air Force that current plans for long-range air power remain adequate. The Air Force's 1999 bomber roadmap is simply the latest reiteration of the Pentagon's opinion that no new bombers or follow-on platforms are necessary to satisfy the country's long-range strike requirements for the next three to four decades. Thus, the Pentagon's R&D bureaucracy has no program to develop a follow-on bomber to the B-2. Astonishingly, Air Force leaders see no need to even begin thinking about the mission requirements for such a platform until 2013!

Exiting the Bomber Business

As noted earlier, over the last decade fighter pilots have dominated the leadership of the Air Force. The careers of those officers have revolved around short-range air-superiority and attack aircraft. Most have little love for bombers and even less for the nuclear weapons that were so intimately connected with them during the Cold War. Many military people do not consider nuclear arms real weapons because they believe those weapons to be so catastrophic as to be unusable. Looking back, the Air Force's fighter community would argue that the bomber community became so wedded to the efficacy of manned bombers and nuclear weapons that it was unable to cope with such challenges as the limited air war against North Vietnam from 1964 through 1973 and that fighter pilots, by contrast, were innovative, flexible, and versatile.[35]

Do the plans of the current Air Force leadership suggest that it is being a steward of America's long-range air power? Or is the leadership so set on fielding a new generation of fighters that it is unwilling to maintain even the semblance of a bomber force? Is that leadership preserving America's long-range air power or, in reality, exiting the bomber business? One way to answer such questions is to examine the Air Force's recent and planned investments in fighters and bombers. Figure 2 shows Air Force investment—both for research and development and for procurement—in fixed-wing combat aircraft for fiscal years 1998–2005. For fiscal years 1998 and 1999, the investment ratio favors fighters by slightly less than 5 to 1. If current trends continue, by fiscal year 2003, the fighter/bomber investment ratio will climb to more than 30 to 1.

The Air Force's White Paper announced that "the Air Force is committed to bomber modernization."[36] The figures provided in the various charts in that document, however, suggest a steady decline in investment in improvements and modifications over the course of the first decade of the 21st century. Despite the Air Force leadership's rhetoric about a commitment to "Global Reach, Global Power," little doubt exists about its investment preferences for the foreseeable future.

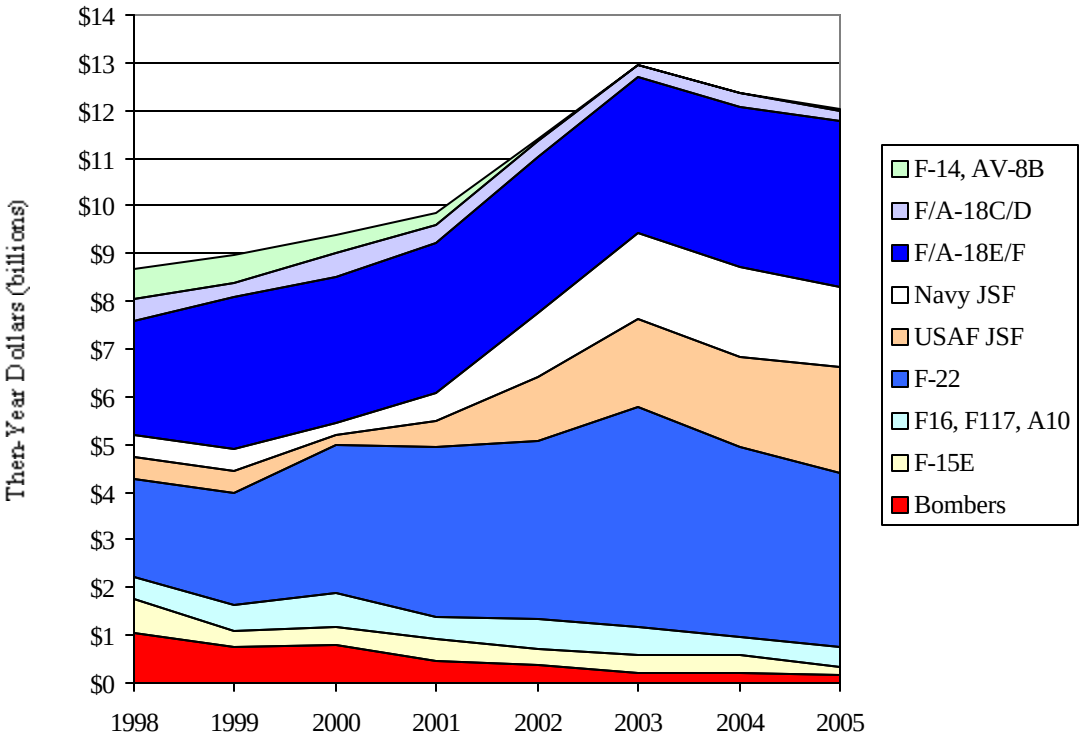
The Department of Defense's preference for short-range fighters is even more pronounced if one examines planned investments in fixed-wing combat aircraft in the whole defense budget rather than in just the Air Force budget. When the Department of Defense's investment patterns (Figure 3) are combined with the Air Force's insistence that a follow-on long-range bomber does not need to be funded until 2034, it is difficult to escape the conclusion that Air Force, Navy, and Marine aviators—encouraged and supported by senior-level civilians in the Department of Defense—are making investment decisions that will inexorably lead the United States to fail to build bombers during the first decades of the 21st century.

At the level of rhetoric, Air Force leaders would deny this conclusion. Their 1999 White Paper argues:

> The vision for "bomber" platforms is a subset of a larger vision for the future of all aerospace forces.

The Pentagon's R&D bureaucracy has no program to develop a follow-on bomber to the B-2.

Figure 3
U.S. Department of Defense Fixed-Wing Investment (R&D plus procurement), 1998–2005



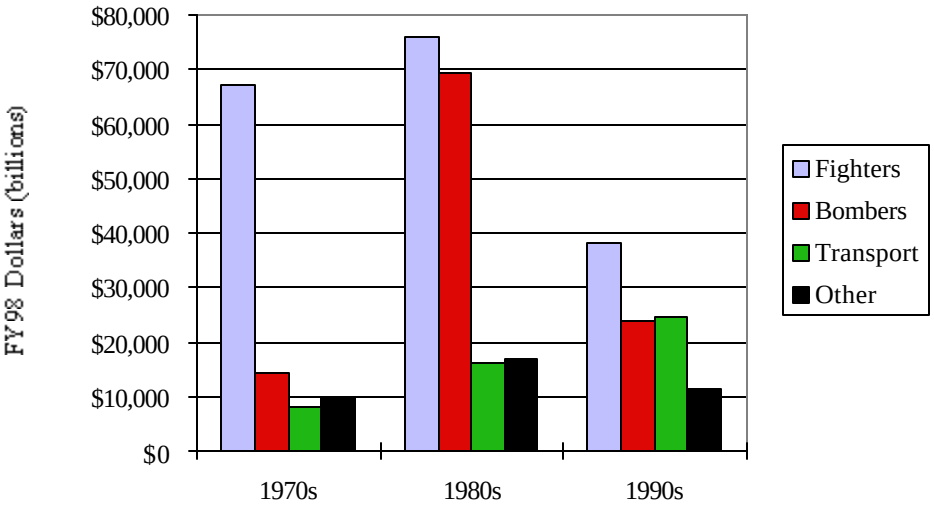
Source: U.S. Department of Defense, Fiscal Year 2000 Budget, www.dtic.mil/comptroller/FY2000budget/.

As a whole, aerospace forces exist not only to ensure freedom from attack, freedom to maneuver, and freedom to attack or be employed across the spectrum of operational requirements. Aerospace forces mitigate risk to all other forces not only by providing aerospace superiority, but also by providing effective combat power capabilities at minimal risk to friendly forces or personnel. Today's bomber platforms hold unique combat power capabilities and represent an important piece of Air Force core competencies of Global Attack and Precision Engagement. As such, they play a crucial role in fulfilling the aerospace force contributions to theater CINCs [commanders in chief] across the world and across the spectrum of combat.[37]

However, the fixed-wing investments of the Department of Defense and the Air Force from 1998 through 2005 suggest that such statements are rhetoric rather than reality. In reality, the Air Force's senior leaders believe that the future of U.S. air power lies in short-range aircraft such as the F-22 and the JSF—not in a follow-on to the B-2. Despite the U.S. military's movement of two new fighters—the F-22 and the F/A-18E/F—toward full production and substantial increase in R&D funding for the JSF, R&D funding for upgrades to existing bombers is rapidly disappearing from the budget.

One of the more astonishing arguments that senior Pentagon officials have made to skew modernization so heavily in favor of short-range fighters over the next decade is that it is the fighter's turn. In 1996 General Ralston argued that the modernization of fighters was emphasized in the 1970s, the modernization of bombers and other strate-

Figure 4
U.S. Air Force Investment (research, development, testing, and evaluation plus procurement) by Decade



Sources: Almost all data in Figure 4 were extracted from Ted Nicholas and Rita Rossi, *U.S. Military Aircraft Data Book 1999* (Fountain Valley, Calif.: Data Search Associates, 1998). To cover a wider span of time, other works, including the *U.S. Historical Military Aircraft and Missile Data Book* (Washington: Data Search Associates, 1999), were consulted. The most recent volume of Nicholas and Rossi was assumed to be the most accurate source. In a very few cases, supplemental data were drawn from other sources, but those account for only a tiny fraction of the dollars. In many cases, the year-by-year breakdown of program cost data had to be estimated.

gic systems in the 1980s, and the modernization of mobility assets—including transport aircraft such as the C-17—in the 1990s.[38] The data in Figure 4, however, suggest that such a claim is questionable. Fighters received the lion's share of Air Force dollars for modernization during the 1970s. Although bombers did better in the 1980s, they still received less support than fighters—even though immensely expensive investments in R&D for stealth technology were assigned to bombers. In the 1990s investment in fighter aircraft vastly exceeded that in transport aircraft.

According to the data, over the past three decades fighter aircraft have by a wide margin consistently received greater support in the Air Force budget than any other type of aircraft. During the same period, bombers appear as a sporadic investment within the budget. The Air Force's plans indicate an intention to devote virtually all future R&D funding to the fighter community.

Moreover, because the Navy does not procure large transport aircraft or heavy bombers, naval aviation has invested almost entirely in short-range fighters over the past three decades. Thus, over that period, the Department of Defense as a whole has placed an even heavier emphasis on fighters than has the Air Force. The plans shown in Figures 2 and 3 indicate that the Pentagon has decided to skew future investments even more heavily in favor of fighters than has the Air Force.

Long-range aviation is a national asset. Within the Department of Defense, only the Air Force operates long-range bombers. A decision within that service to exit the business is also a strategic choice for the United States—a choice with far-reaching consequences. It is far from self-evident that the current generation of

Over the past three decades fighter aircraft have by a wide margin consistently received greater support in the Air Force budget than any other type of aircraft.

fighter generals is making the right choice.

Dissenting Voices

It would be wrong to infer that all former and current Air Force leaders have embraced this decision. Two of the key figures in the planning and execution of the Desert Storm air campaign were Lt. General Horner and (then) Lt. Col. David Deptula.[39] During the 43 days of Desert Storm, those airmen gained first-hand experience with the large-scale employment of heavy bombers (mostly B-52s delivering "dumb" bombs), precision-guided munitions (including laser-guided bombs and conventional air-launched and Navy Tomahawk cruise missiles), and the combination of precision-guided munitions and stealth manifested in the F-117.

After the Gulf War, Deptula served on the staff of the Commission on Roles and Missions and was that organization's team leader for the examination of deep precision attack systems—including bombers. In its report, the commission assessed the value of modern bombers equipped with precision-guided munitions in the following terms:

> The synergy of advanced munitions with the range and payload of long-range bombers may be more important to the Department of Defense in the years ahead than at any time during the Cold War. Combined with the stealth of the B-2, precision munitions with long-range bombers have the potential to provide key capabilities not available from any other forces to meet critical future national security requirements. . . . The B-2 capabilities of stealth, long range, high payload, and precision strike give the United States a singular ability among nations to respond in near–real time to short-notice contingencies using conventional force anywhere in the world.[40]

Since retiring, Horner, who got his fourth star after Desert Storm and led the U.S. Space Command, has been equally outspoken about the value of modern, long-range bombers armed with precision-guided munitions. In 1996 he noted:

> The Gulf War gave me a glimpse of the future of warfare. I saw adversaries who attacked without warning. I saw adversaries armed with [weapons of mass destruction] and ballistic missiles. I saw an American public that expected our wars to be swiftly won and relatively casualty free. In 1996, I see the same things, but my confidence that we can overcome these things has faded. The difference? In 1991, I returned from the Gulf convinced that tomorrow's air commanders required—and would indeed have—a fleet of sixty or more stealthy bombers. Inexplicably, the B-2 fleet was slashed from seventy-five to twenty, undermining our ability to employ a newly relevant strategy.
>
> The B-2 is the only weapons system in the U.S. inventory free of the range, survivability, and lethality limitations that plagued us during the recent Iraqi crisis [in August 1995]. . . . The planned force is far too small to underwrite a large-scale air campaign.[41]

Horner was even more explicit in comments before the National Press Club in May 1999:

> With regard to planes like the B-2, they're the most important thing we have in our military arsenal. They allow us to operate at great range, because the enemy is going to come back at us with SCUD missiles. He's going to preclude us from closing with massive forces, like we did in Desert Storm, because he will have weapons of mass destruction. And, believe me, there are countries that went to

school on Desert Storm, and they're saying, "No way you're going to fight the Americans unless you have ballistic missiles," which we could not stop during Desert Storm, "and you have chemical, biological, and nuclear warheads."

So we need the ability to reach out and touch somebody with the precision and the survivability of things like the B-2. So it isn't a case so much of heavy versus light or tactical versus fighter. It's a case of military capabilities that meet the demand of the future battlefield. And things like the B-2 are the most important thing we can have in our arsenal.[42]

Conclusion

Although the wisdom of the U.S. intervention in Yugoslavia is questionable, the contribution of U.S. long-range bombers to the war against Yugoslavia underlines their importance even in an air campaign against a relatively ill-equipped opponent from plentiful air bases available in the immediate area. The 509th B-2 Wing employed six Block 30 B-2s from the United States; thirteen B-52s and five B-1Bs flew from the United Kingdom. Those 24 bombers represented fewer than 5 percent of the 535 aircraft used by the United States and NATO in the campaign. Yet those bombers dropped 52.6 percent of the 23,000 bombs and missiles expended in the campaign. Furthermore, the bombers delivered 9.6 percent of the precision-guided munitions used in the war. The B-2s, using Joint Direct Attack Munitions, were particularly effective; they destroyed approximately 87 percent of the targets they attacked.[43]

Air Force fighter pilots tend to identify themselves directly with the aircraft they fly. As Carl Builder wrote in 1989:

> The air force is, by far, the most attached of the services to toys. Air force pilots often identify themselves with an airplane. "I'm a 141 driver." "I flew Buffs [B-52s]." Sometimes this identification goes right down to the model of the airplane. "I fly F-4Cs." The pride of association is with a machine, even before the institution. . . . This is not to denigrate the great skill and courage of those who are prepared to fly and fight, but simply to note that flying and flying machines are nearest to their hearts. The prospect of combat is not the essential draw; it is simply the justification for having and flying those splendid machines.[44]

The fighter generals view themselves as operators rather than thinkers and doers rather than conceptualizers. Despite the dissent of a few, those generals see no need to procure long-range strike platforms for at least three decades. They recoil at the idea of sending Air Force fighter pilots into air-to-air combat during the first decade of the 21st century in F-15Cs—first built in the 1970s but upgraded and produced into the 1990s. Yet they apparently have no qualms about condemning bomber pilots to fly the ancient B-52Hs—which were last produced in 1962—into combat during the first three decades of the 21st century.

The Air Force's leadership, as well as the senior decisionmakers in the Office of the Secretary of Defense, refused to buy more than twenty-one B-2 aircraft. Besides, it is probably too late to reopen the production line. As the 1999 bomber roadmap makes crystal clear, Air Force leaders see little value in investing in long-range strike aviation and have instead chosen to buy a new generation of short-range fighters and fighter-bombers. Present Air Force plans call for no R&D for a follow-on bomber until 2013.

This glaring deficiency should be corrected by immediately starting a new R&D program for a more affordable long-range bomber. The Air Force could cancel the F-22 air-superiority fighter—designed during the

Air Force leaders see little value in investing in long-range strike aviation and have instead chosen to buy a new generation of short-range fighters and fighter-bombers.

The Air Force could cancel the F-22 air-superiority fighter and use some part of the savings to finance development of the new bomber.

Cold War and unneeded after its end—and use some part of the savings to finance development of the new bomber.[45]

As General Horner's remarks suggest, comprehending how either the Air Force or the civilian decisionmakers in the Office of the Secretary of Defense could see their choices as representing a responsible stewardship of the nation's bomber force is difficult. The Air Force leadership has lost sight of its service's value in the post–Cold War era.

Notes

1. Rep. Duncan Hunter (R-Calif.), Introductory remarks, Hearing on the Report of the Long-Range Aircraft Airpower Review Panel before the Subcommittee on Military Procurement of the House Committee on National Security, April 1, 1998.

2. For a general discussion of Air Force culture, see Williamson Murray, "The United States Air Force: The Past as Prologue," in *America's Defense*, ed. Michael Mandelbaum (New York: Holmes and Meier, 1989), pp. 231–78.

3. For the most thorough examination of the air campaigns against North Vietnam, see Marshall L. Michel III, *Clashes: Air Combat over North Vietnam, 1965–1972* (Annapolis: Naval Institute Press, 1997).

4. Perhaps the clearest example of the worrisome trends within the Air Force is its current basic doctrinal manual, which in 1997 replaced a clear-headed and intelligent formulation of Air Force doctrine. See U.S. Air Force, *Air Force Basic Doctrine*, Air Force Doctrine Document 1 (Washington: Government Printing Office, 1997).

5. At least according to reports of Iraqi prisoners of war at the conclusion of the war. Williamson Murray, *Gulf War Air Power Survey* (Washington: Government Printing Office, 1993), vol. 2, part 1, p. 324.

6. Walter J. Boyne, *Boeing B-52: A Documentary History* (Washington: Smithsonian Press, 1981), p. 11.

7. Williamson Murray, "Hard Choices: Fighter Procurement in the Next Century," Cato Institute Policy Analysis no. 334, February 6, 1999.

8. Barry Watts, "The Air Force in the Twenty-First Century," in *The Emerging Strategic Environment*, ed. Williamson Murray (Westport, Conn.: Praeger, 1999), pp. 183–217.

9. U.S. Air Force, "Air Force White Paper on Long-Range Bombers," March 1, 1999, p. 10.

10. Ibid., pp. 2, 21–22. Of the present fleet of about 190 bombers, 130 are directly assigned to combat, 24 are assigned to training, 14 are reserve aircraft to replace those that are victims of attrition, 2 are test bed aircraft, and 20 are for backup.

11. Ibid., pp. 5, 8.

12. U.S. Air Force, "The Case for the B-2: An Air Force Perspective," June 1990, p. 19.

13. Reducing the production run from 132 aircraft to 75 aircraft increased costs from $570 million per aircraft to $830 million because R&D expenses and the creation of production facilities and tooling were spread over fewer aircraft.

14. "Text of Bush's Message: Heating Up the Economy, and Looking Beyond," *New York Times*, January 29, 1992, p. A14.

15. During the first night's air battle, however, a Navy aircraft (an F/A-18) appears to have been shot down by an Iraqi MiG-29.

16. "Text of Bush's Message," p. A14. Emphasis added.

17. Geoffrey Perret, *Winged Victory: The Army Air Forces in World War II* (New York: Random House, 1993), p. 463.

18. Perry McCoy Smith, *The Air Force Plans for Peace, 1943–1945* (Baltimore: Johns Hopkins University Press, 1970), p. 27. Smith also pointed out that bombardment and autonomy were natural partners and that fighters were antithetical to both—except when used to support the strategic bombing mission. Ibid., p. 25.

19. Perret, p. 464.

20. Joseph Ralston, Testimony at Hearing on Tactical Aviation Modernization before the Airland Subcommittee of the Senate Armed Services Committee, March 10, 1999.

21. The facts, however, indicate the exact opposite: that the air campaign against a rather insignificant

Serbian military power, even when there were plenty of bases available to the allies in the immediate vicinity, had to rely to a considerable extent on long-range air power from the continental United States and from the United Kingdom.

22. Les Aspin, "The Report of the Bottom-Up Review," U.S. Department of Defense, October 1993, pp. 18–19, 28–29.

23. Boyne, p. 146.

24. U.S. Air Force, "White Paper," p. 21.

25. Paul Kaminski, Transcript of U.S. Department of Defense special briefing to the House Armed Services Committee, May 3, 1995.

26. Those assumptions were the exact opposite of what happened in the immediate run-up to Iraq's invasion of Kuwait in the summer of 1990.

27. Kaminski.

28. Chuck Horner, "What We Should Have Learned from Desert Storm, But Didn't," *Air Force Magazine*, December 1996, p. 52.

29. U.S. Department of Defense, "Heavy Bomber Study," quoted in Kaminski.

30. Panel to Review Long-Range Air Power, "Summary of the Principal Findings and Recommendations of the Panel to Review Long-Range Air Power," March 1998, p. 3.

31. Larry D. Welch, Testimony at Hearing on the Report of the Long-Range Airpower Review Panel before the Military Procurement Subcommittee on the House National Security Committee, April 1, 1998, p. 2. Emphasis added.

32. Ibid.

33. Ibid., p. 3.

34. Ibid.

35. Mike Worden, *The Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945–1982* (Maxwell AFB, Ala.: Air University Press, 1998), pp. 236–37. However, Michel suggests that the fighter pilot communities were no more innovative, flexible, or versatile than the bomber community in that war.

36. U.S. Air Force, "White Paper," p. 4.

37. Ibid., p. 10.

38. Joseph Ralston, Testimony at Hearing on Tactical Aircraft Modernization before the Subcommittees on Military Procurement and Military Research of the House Committee on National Security, June 27, 1996.

39. During Desert Storm, General Horner was the air component commander who served under Gen. Norman Schwarzkopf. Deptula was the chief planner for the air campaign against Iraq.

40. Commission on Roles and Missions, *Future Bomber Force* (Washington: Aerospace Education Foundation, 1995), pp. 10–11. Emphasis added.

41. Horner, "What We Should Have Learned from Desert Storm," p. 56.

42. Chuck Horner, Comments before the National Press Club, May 18, 1999, www.npc.press.org.

43. William Cohen, U.S. Department of Defense briefing, June 10, 1999; and 509th Bomb Group briefing, June 11, 1999, www.defenselink.mil/speeches/secedf.html.

44. Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore: Johns Hopkins University Press, 1989), p. 23.

45. The United States will likely have dominance over any other air force on the planet in air-to-air combat with or without the F-22 aircraft. The likely future air-to-air threats do not justify the purchase of this extremely expensive aircraft, which was designed to combat Soviet fighters that were never built. For a summary of the arguments for terminating the F-22, see Murray, "Hard Choices."

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