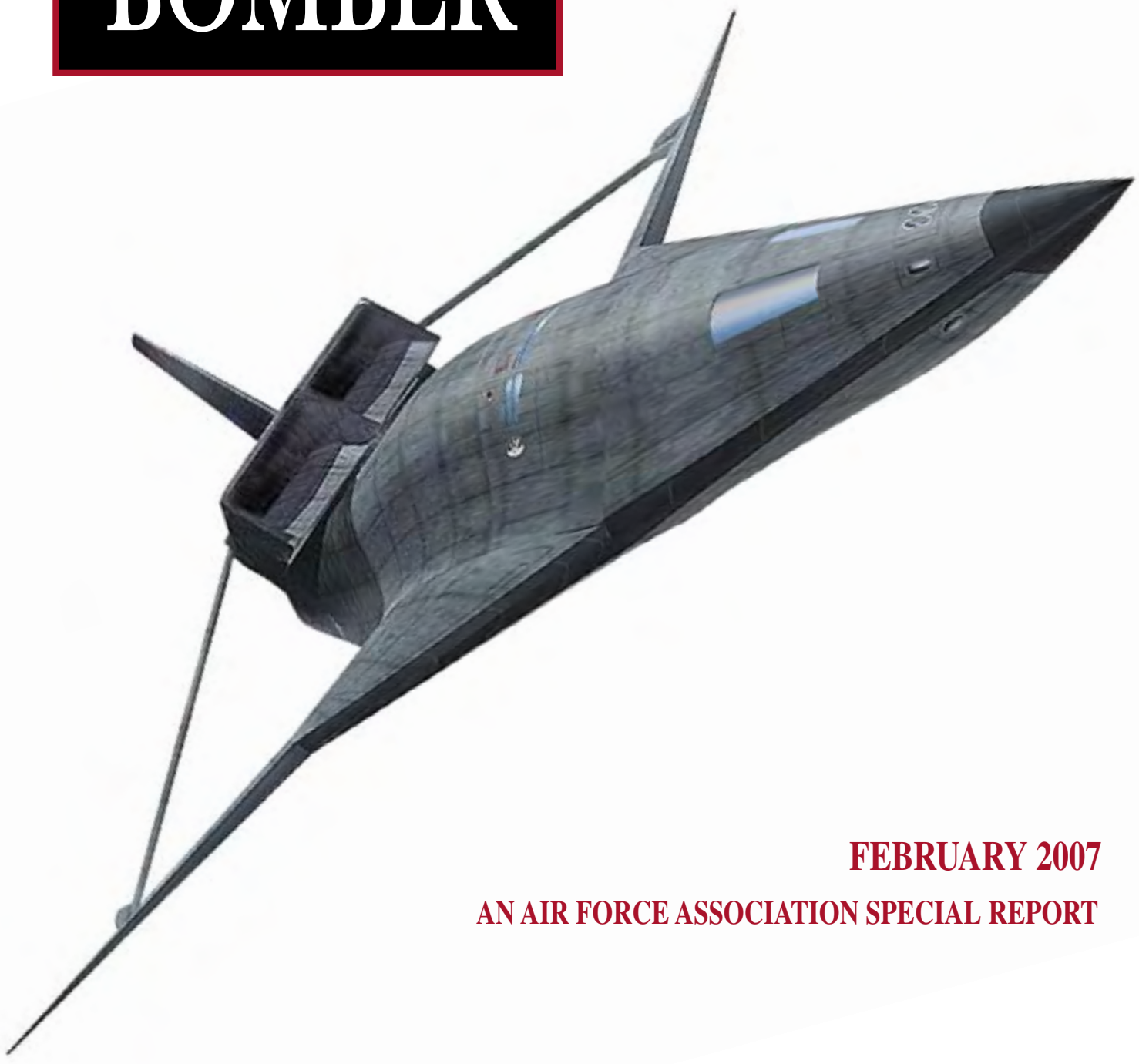
RETURN OF THE BOMBER

THE FUTURE OF LONG-RANGE STRIKE



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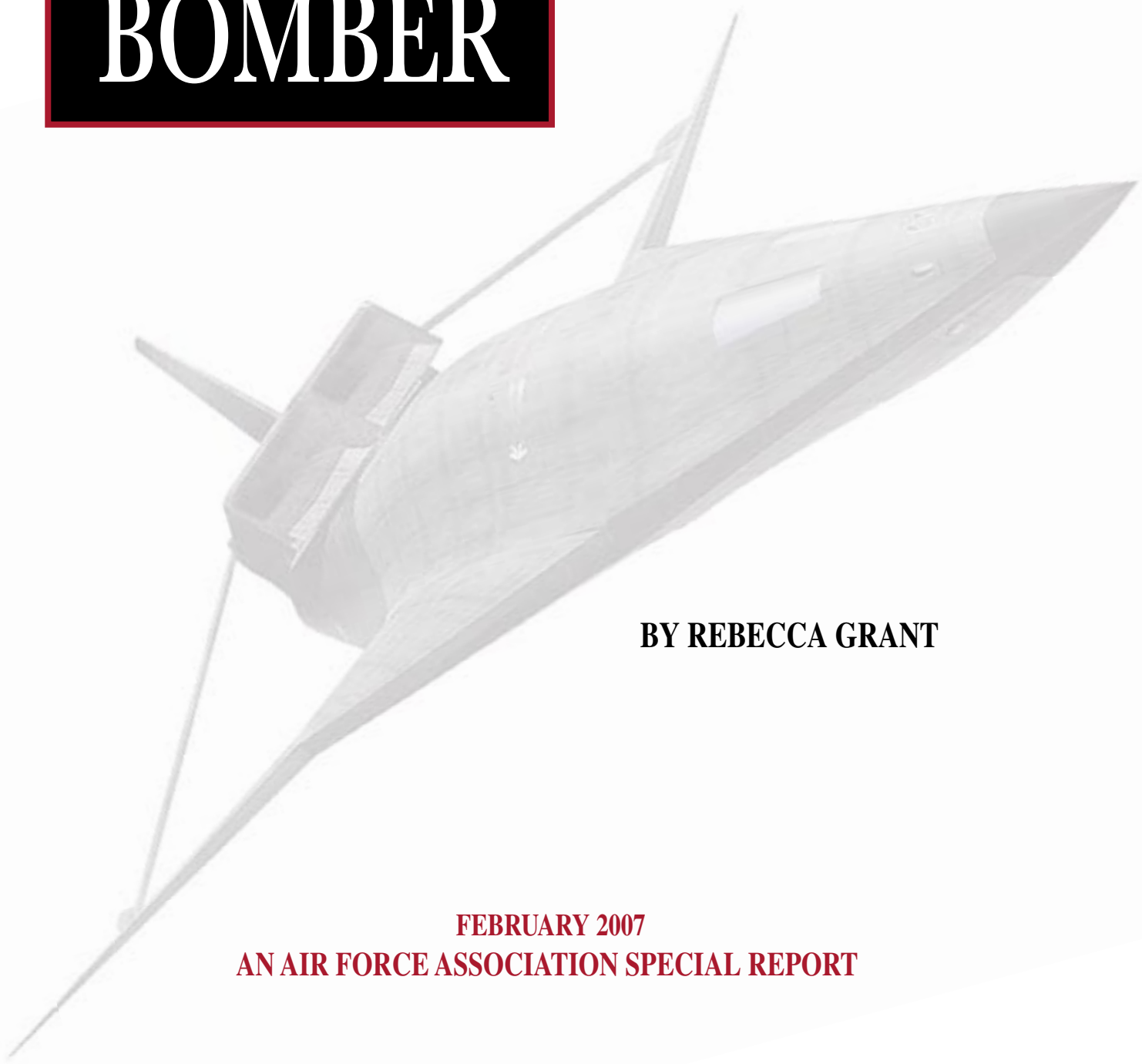

BY REBECCA GRANT

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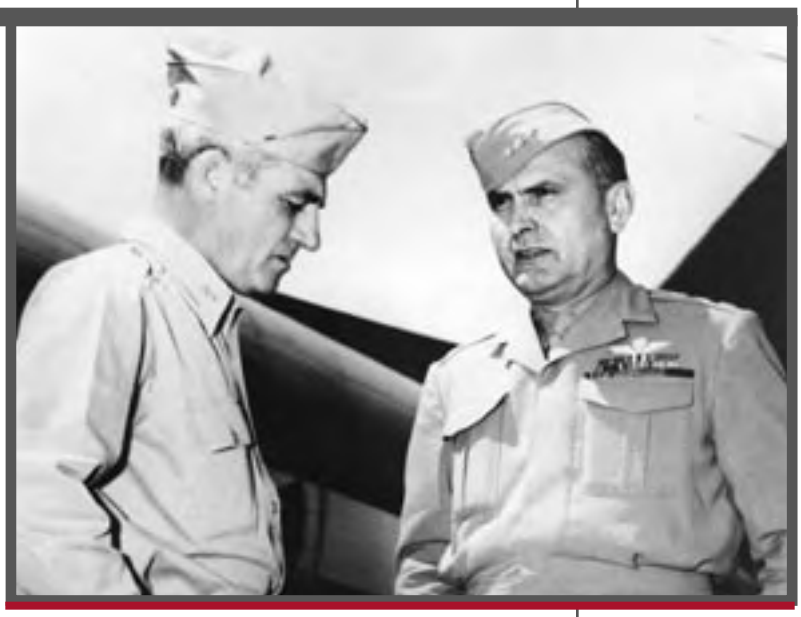
INTRODUCTION

EAKER'S DILEMMA



Then Lt. Gen. Ira Eaker (right), as commanding general of the Mediterranean Allied Air Forces in World War II, with then Maj. Gen. Nathan Twining, commanding general of 15th Air Force.

Brig. Gen. Ira C. Eaker arrived in London on Feb. 21, 1942. He was a fighter pilot by trade, but now he was commanding general, VIII Bomber Command—an organization with a staff of six and no airplanes at all. To reach London he'd flown on a Pan Am Clipper from New York to Lisbon and then on Nazi-controlled KLM airlines to neutral Ireland before finally making his way to England.

Eaker had an important job. "You're going over to understudy the British and start our bombardment as soon as I can get you some planes and some crews," his old friend Gen. Henry H. Arnold, the Chief of US Army Air Forces, had told him. The mission was clear and crucial. "I don't believe we'll ever successfully invade the continent and expose that great [Allied] armada unless we first defeat the Luftwaffe," Gen. George C. Marshall, Army Chief of Staff, reminded Eaker on a visit that April. Eaker replied, "If you will support the bomber offensive, I guarantee that the Luftwaffe will not prevent the cross-Channel invasion."[1]

There was just one problem: Eaker still didn't have any bombers. America had failed to buy them in time.

America's need for large numbers of strategic bombers could hardly have come as a surprise. Arnold and Eaker, in their pre-war book, *Winged Warfare*, called the bomber "the essential nucleus of an air force."[2] Airmen had been striving to develop bombers with more range and power throughout the 1920s and 1930s. The first B-17 flew in 1935 and the B-24 in 1939.

The problem, as two historians put it, was that "the US Army Air Forces possessed a strategic doctrine for fighting the air war against the axis powers but too few weapons to employ it fully."[3] As Eaker watched the British in 1942, wartime production was only beginning to develop the power to provide B-17s and B-24s in the numbers needed for daylight precision attacks.

Summer came and still VIII Bomber Command had no heavy bombers and had flown no missions. Nearby, however, a squadron of American-built A-20 Havoc light, high-altitude bombers, designed by Douglas Aircraft Co., was in training with the Royal Air Force. Eaker borrowed six A-20s and manned them with American crews. It was those aircraft, and those crews, which on July 4, 1942, produced VIII Bomber Command's first mission over Europe.

Just 10 days later, on July 14, the first 40 of Eaker's long-awaited B-17s reached England. On Aug. 17, Eaker hopped aboard the B-17 *Yankee Doodle* as 12 Flying Fortresses flew their first combat mission in the European Theater of Operations—a daylight attack against the Rouen-Sotteville rail marshaling yard in occupied France. The raid was a success, not least because the target was in range for accompanying British Spitfires. Not until Jan. 27, 1943, however, did Eaker's VIII Bomber Command attack Germany itself.

Many bloody battles lay ahead, but at least for the moment, Eaker's air forces had the bombers and crews to start to wage the air war in earnest. In time, there would be many more. World War II assembly lines produced nearly 13,000 B-17s, some 18,000 B-24s, and about 2,500 B-29s. The flyaway cost of the B-17s alone topped $46 billion in 2005 dollars.[4] The

1. James Parton, *"Air Force Spoken Here:" General Ira Eaker and the Command of the Air*, p. 148.

2. Parton, p. 118.

3. *Case Studies in Strategic Bombardment*, R. Cargill Hall, ed., Air Force History and Museum Program, 1998, p. 183.

4. Author's calculation. The price of a B-1B7F built by Lockheed Vega was $337,025. A total of 12,731 B-17s of all types were built. Adjusting from 1943 to 2005 dollars yields the flyaway cost cited in the text.

Then Lt. Gen. Henry H. Arnold, as Chief of the US Army Air Forces during World War II.

return was considered well worth the investment. "Hitler built a fortress around Europe," said President Franklin D. Roosevelt, "but he forgot to put a roof on it."

This ability to circumvent entrenched defenses and attack the enemy with direct blows was the strategic advantage of airpower, especially Eaker's long-range bombers. Today, Eaker, Arnold, and the other great commanders of World War II would be shocked to learn that this critical strategic advantage is at risk.

America stopped acquiring new bombers 10 years ago. The last production B-2 stealth bomber—Air Vehicle 21—was delivered to the Air Force in November 1997. Money for its production was authorized and appropriated much earlier than that, in 1993. The result has been the opening of a bomber gap. It is the first time since 1917 that America's military airmen have not had a long-range bomber on the way, in one form or another. That's a remarkable situation for a nation whose security relies on its ability to project military power worldwide in defense of its interests and allies.

Eaker would be even more astonished to find that the Air Force was until very recently content to accept the situation. USAF, of course, has not been lackadaisical; the service has maintained and upgraded its fleet of hard working B-52, B-1B, and B-2 bombers and kept them in fighting trim. And yet USAF's ability to hold at risk key targets around the world has been undermined. The bomber fleet is old, and modernization plans largely have lapsed. The Air Force has not seemed eager to tackle the problem.

"Even a superficial examination of the existing bomber fleet reveals a decrepit force ill-suited to the challenges that may lie ahead," Loren Thompson of the Lexington Institute, a Washington, D.C.-based defense think tank, wrote in *Armed Forces Journal*.[5] Barry D. Watts, a former Air Force officer and director of DOD's program analysis and evaluation shop, sees no movement. In a 2005 report, he said, "The evidence argues that the Air Force is neither taking—nor planning to take—the near-term steps to ensure that the United States will have the long-range strike capabilities the country will need in the medium-to-long term."[6]

The Bush Administration's Pentagon leadership took up the issue in its latest Quadrennial Defense Review, which unfolded in 2005 and was published in early 2006. The QDR report urged fielding of a new long-range strike system by 2018. There is evidence that the time for such a move may be ripe.

In the decade since the last B-2 rolled off the production line, several key technologies have advanced dramatically. Now, defense officials believe the US aerospace industry can use these new technologies to underpin production of a very new type of bomber indeed. They say that knowledge gained from development of fifth-generation stealthy fighters, the flight reliability of UAVs, and from other research makes it possible to build a new bomber with greatly enhanced capabilities and minimal risk.

Yet there is a big question: Will the Air Force—and the nation—have what it takes to rally behind a new bomber program, and keep pushing until hardware is on the ramp?

At a World War II conference in England, Gen. Carl Spaatz (center) with Maj. Gen. Ralph Royce (left), Maj. Gen. Hoyt Vandenberg (standing), and Maj. Gen. Hugh J. Knerr.

5. Loren Thompson, "Searching for the Next B-52," *Armed Forces Journal*, September 2006.

6. Barry D. Watts, "Long Range Strike: Imperatives, Urgency and Options," Center for Strategic and Budgetary Assessments, April 2005, p. i.

PART I

The Bomber Gap

Just how the Air Force ended up in the grip of such a bomber gap is a fascinating, if distressing, subplot to the rise of airpower over the last 15 years. The problem looks particularly unusual when examined in the context of the preceding 80 years of American bomber force development.

From 1917 until 1997, the US always had a bomber—or two, three, or four—either in production or on the drawing boards. Wartime contracts let in late 1917 called for American companies to build European-designed aircraft, specifically the De Havilland DH-4 day-bombers and Caproni and Handley Page heavy bombers. Only the De Havillands eventually saw widespread service. The first US-designed bomber was the MB-1, known colloquially as "the Glenn Martin Bomber."[7] The Army ordered 10 in early 1918. The first MB-1 began flying in August 1918, but the rest weren't delivered until October and November, too late to be of wartime service. Overall, these bombers were really observation airplanes adapted to tote a modest load of explosive ordnance.

Americans flew their first bombing missions in French-built Breguet Br.14 bomber aircraft, borrowed from France's air force. With these airplanes, the first American bomber unit, the 96th Aero Squadron, flew its maiden combat mission on June 12, 1918. These day-bombers were near-wrecks pulled out of French training units. Moreover, they were the era's light bombers, capable of dropping only about 500 pounds of bombs from 12,000 feet. By war's end, those first American bomber crews had flown sorties penetrating 160 miles into German air space.[8]

The next eight decades found the US air arm perpetually engaged in the design, development, prototyping, or production of new long-range bomber aircraft. At war's end, the Air Service had in its inventory only a few US-built Handley Page and Caproni bombers. The nation's first true production bomber was the MB-2, designed and built by Martin and other aircraft companies.

Defense austerity between the world wars slowed but did not stop bomber development. Remarkably, the bomber fleet actually grew in size during this period, numbering 59 in 1924. Dozens of variants of Curtiss, Gallaudet, Fokker, and Huff-Daland "Keystone" bombers dotted Army Air Service flight lines in the 1920s.

Despite the Great Depression, bomber development took another leap in the 1930s. Powerful bombers emerged from 1931 and 1932 fly-offs between Boeing Co. and Glenn Martin Co. prototypes. In the end, Martin won the contract, which called for building the superior B-10 aircraft. The sleek, all-metal monoplane topped 200 miles per hour in flight tests, and the Army bought enough to field a true bomber force. The latter 1930s brought the genesis of some of the all-time classic US bombers—the B-17 Flying Fortress, B-24 Liberator, and the B-29 Superfortress, along with the B-25 Mitchell and B-26 Marauder medium bombers.

In the 1940s, World War II kicked bomber production into high gear. Factories by 1943 were churning out B-17s and B-24s. USAAF froze the design of the B-29 to ramp up production. Blueprints for the B-36 were on

7. Fact Sheets, Martin MB-1 and MB-2, National Museum of the United States Air Force.

8. David A. Anderton, History of the US Air Force, p. 28.

the drawing boards. Not that building and buying heavy bombers was ever easy. The B-29, to name just one example, suffered from serious problems with engine reliability in its early days.

The postwar period saw similar travails. The B-36 Peacemaker sparked controversy among the leading generals of the day. Gen. George C. Kenney had pushed bombers such as the B-25 further than anyone expected in the Southwest Pacific in World War II. Now, in 1947, he was the first commander of Strategic Air Command and, if there was one airplane he didn't like, it was the B-36. It was not a true intercontinental-range bomber, he complained. The B-36 lacked self-sealing fuel tanks. It would spend so much time trying to evade enemy fighters that its true combat radius would fall under 3,000 miles and leave vital targets in the Soviet Union untouched. Scrap the B-36 and build a better bomber, argued Kenney. When it came time for the Air Force to "vote," the one vote against B-36 production came from the commander of SAC.

It took none other than Gen. Carl A. Spaatz, who was then USAAF's Commanding General, to sort out the mess. "As you probably know better than most," Spaatz wrote Kenney in January 1947, "we would never have bought a single combat type, including the B-17, if we had waited for a better type we knew was just around the corner."[9] Kenney had reason to grumble about the B-36; it was underpowered, even with new jet engines. Yet Spaatz had a point, too. The superior B-52 was eight long Cold War years and many design hurdles away from entering service. If the service had one unforeseen stumble during the intervening period, Spaatz told Kenney, "Your Strategic Air Force will be without equipment."[10] In the end, the Air Force purchased nearly 400 B-36 bombers.

Next came the first Cold War generation of jet-powered bombers—the B-47 Stratojet, the B-50 Superfortress (a redesignated B-29D), and the B-58 Hustler—followed by production of more than 750 B-52 Stratofortress aircraft of all types. The BUFF was to be followed by a highly experimental aircraft, the B-70 Valkyrie. However, only two of these actually were built and flown.

The closest America ever came to a bomber gap was the period immediately following final delivery of B-52s in 1962. Basic research on what became the supersonic B-1B began the same year, although first flight did not take place until 1974. Then, just as the Air Force was ready to start production, President Jimmy Carter in 1977 cancelled the program, opting to rely on old bombers and cruise missiles. The Air Force flew the prototypes between 1977 and 1981, when President Ronald Reagan restarted production.[11]


B-36

The B-1B and B-2 efforts actually overlapped for several years. Even as the Air Force recommenced B-1B production, serious and secret design work was being carried under the banner of the Advanced Technology Bomber program, which yielded the stealthy B-2. The Air Force took delivery of its last B-1B in 1988—the same year of the unveiling of the B-2. That event came on Nov. 22, 1988.

NO MORE B-2s

Then came the onset of the crisis. The B-2 program began to wobble, and then it collapsed. When it did, that ended a period of 80 straight years of contentious, but continuous, bomber work.

In the original 1981 B-2 contract, the Air Force proposed to acquire as many as 132 B-2s. The number was trimmed to 75 after the Cold War went into a massive thaw in the late 1980s. Then in 1991, the B-2 program was killed after the authorization of a mere 20 aircraft. (One additional B-2 was approved in later years, bringing the total to 21.) The end came a full six years ahead of the last scheduled delivery, and barely six months after the airpower success of the Gulf War campaign. Cost, politics, and the demise of the Soviet Union had caught up with the bomber while it was still in the midst of operational test and evaluation.

Kurt Guthe, a scholar who in 1998 produced a deep study of America's heavy bomber programs, summed up the situation in this way: "In prior years, influential members of the House of Representatives, led by Rep. Ron Dellums (D-Calif.) and Rep. John Kasich (R-Ohio), had tried repeatedly to stop the B-2 program. In 1991, they succeeded."[12]

9. Gen. Carl A. Spaatz, quoted in Walton S. Moody, *Building a Strategic Air Force*, Air Force History and Museums Program, 1995, p. 101-102.

10. Spaatz, quoted in Moody, *Building A Strategic Air Force*, p. 101-102.

11. Walter J. Boyne, "A Tale of Two Bombers," *Air Force* Magazine, July 2006.

12. Kurt , 1998, p. 10.

At that stage, the US had built only 16 B-2s. Secretary of Defense Dick Cheney confirmed the kill but pegged the final B-2 number at 20; he wanted to take advantage of already purchased long-lead production materials. Congress agreed. President George H.W. Bush made the formal announcement in his January 1992 State of the Union address.

Great celebration attended the arrival of the first B-2 at Whiteman Air Force Base in Missouri on Dec. 17, 1993. There was a sense that bomber production had entered a merely temporary hiatus, and development soon would begin again. In 1994, his last year as Chief of Staff, Gen. Merrill A. McPeak, said it plainly: "I expect to see the bomber force build back up toward the end of the century."[13]

It never happened.

In 1995, Paul Kaminski, the undersecretary of Defense for acquisition, advanced a positive theory of the bomber force. He said that, with the B-2 in the fleet, they and the collection of old B-52Hs and younger B-1Bs would meet national needs. Kaminski, an expert on stealth and aircraft development, had been a force in the development of the F-117 stealth fighter. As a result, his assessment carried weight. Kaminski declared, "We concluded from the heavy bomber study that, with 20 B-2s, our bomber fleet size and mix will meet our mission needs."[14]

Nor was there much concern about the impact of the bomber drought on the aerospace industrial base. Kaminski said, "When we examined the specific industrial capabilities needed for the B-2 and previous bombers, we found there is not a unique bomber industrial base." That is to say, failure to build a new bomber would not eliminate critical industrial powers. He went on, "The capabilities required to design, develop, and produce bombers are available in the broader military and commercial aircraft industries. ... All 54 of the key B-2 suppliers also supply other aircraft and/or other non-aircraft programs."

Thus, by Kaminiski's logic, the Pentagon had no real reason to sustain the B-2 production line. The 21st—and last—B-2 rolled off the production line in late 1997. The net result was a gap in bomber production of epic proportions. For the first time since 1917, the United States was well and truly out of the bomber-building business.

DESERT STORM LEGACY

Ironically, the smashing success of airpower in the Desert Storm campaign played a major role in the demise of the bomber. In that war, the heavy bomber force made major contributions. Still, the dazzling performance of precision-weapon-equipped fighters led many to doubt that bombers ever again would be in the front ranks of airpower.

The B-1B sat out the war entirely (the result, it was said, of their role as a strategic reserve force). The B-2 was just barely out of the black world; only two "hand-built" B-2s had even been delivered to the Air Force, which had not gotten very far in development of tactics.

The B-52G warhorses did see combat and performed well, though they were used only in tightly circumscribed roles. Before the war even started, seven B-52s launched from Barksdale AFB, La., flew thousands of miles and delivered conventional air-launched cruise missiles (CALCMs) on specific targets in the first hours of the air campaign. A total of 68 B-52Gs were deployed in Desert Storm, although political constraints on basing forced three of the four deployed bomber wings to fly 14-to-16-hour missions to reach their targets in Iraq.

Still, the B-52s were remembered far more for mass than

USAF/TSgt. Boyd Belcher

for precision. On one memorable mission in February 1991, 12 B-52s struck the weapons plant at Taji, north of Baghdad. Together the B-52s rained down more than 280,000 pounds of explosives.

All told, the BUFF flew 1,035 sorties against such strategic targets as industrial facilities, airfields, oil storage areas, nuclear-chemical-biological facilities, and Republican Guard forces deployed in the field. With another 527 sorties, B-52Gs struck battlefield air interdiction targets, such as Iraqi artillery, armored units, and infantry formations. Their total ordnance delivered accounted for 30 percent of the coalition's total tonnage.[15]

13. James W. Canaan, "New Life for the B-2," *Air Force* Magazine, August 1994.

14. Paul Kaminski, remarks at US Strategic Command Strategic Systems Industrial Symposium, Offutt AFB, Neb., Aug. 30, 1995.

15. DOD, "Conduct of the Persian Gulf War: Final Report to Congress," 1992, p. 675-676.

For all that, the heavy bomber lost some altitude in airpower circles. The Gulf War I campaign changed the role of mass in air warfare. In the past, a bomber's large payload was essential to inflict the desired amount of damage on a target. Now, with precision weapons becoming plentiful, the same effects of mass could often be achieved with one or two weapons, carried by a fighter-type aircraft.

That implied that heavy, long-range bombers no longer had a lock on so-called "strategic" missions. F-117s, which scarcely fit the true description of a bomber (or a fighter either, for that matter), hit key strategic targets in the most heavily defended parts of Iraq. For their part, the B-52s pulverized Iraqi army formations with saturation bombing and heavily targeted the elite Republican Guards divisions in the same way. They'd performed similar missions in Vietnam on countless occasions.

Thus, precision-attack capabilities erased the classic distinction between strategic bombers and tactical fighters. The desert war's glory went to the stealthy, super-accurate F-117, the tank-plinking F-111s, and the sky-sweeping F-15Cs. Little or nothing was said about the big bombers. After 1991, airpower conversation was all about effects. Nobody was talking about mass.

INHERENT RISK

Some who understood the enduring value of long-range strike were uneasy with the situation. One of these persons was Air Force Gen. Charles A. Horner, the Gulf War air boss who led coalition air forces as air component commander.

"I returned from the Gulf convinced that tomorrow's air commanders required—and would indeed have—a fleet of 60 or more long-range stealthy bombers," Horner said several years after Desert Storm.[16] "Inexplicably, the B-2 fleet was slashed from 75 to 20, undermining our ability" to employ a strategy of long-range, precise, and stealthy strike that, to Horner, seemed to be the natural and inevitable outcome of the Gulf war.

In partial compensation for its numerical decline, the Air Force embarked on a steady program of modernization and upgrades for the B-52Hs, B-1Bs, and B-2s. Still, Horner had good reason to be concerned, for the nation was already taking risks. Accepting the cut in the B-2 force put the bomber fleet behind the curve on wartime commitments. Force structure in the 1990s was governed by the strategy of planning for two major theater wars. Cutting the B-2 put the Air Force in a deficit.

The 1995 Air Force bomber roadmap called for fielding in 1999 a 184-bomber force—79 B-52Hs, 85 B-1Bs, and 20 B-2s. That would net out to just 158 available combat-coded bombers. However, the Air Force, under the current national military strategy, was expected to be able to deploy 100 bombers—42 B-52Hs, 42 B-1Bs, and 16 B-2s—for each major theater war.[17] Under this policy, bombers in one theater obviously would have to finish up their work and "swing" from another theater and start fighting more or less on arrival.

It was close to an absurdity, but it was not enough to jar military officials into action. For the rest of the 1990s, no one could find a way to generate a consensus on the need for a new bomber program. Blue ribbon panels of experts evaluated bomber options at the behest of Congress and others. Their conclusions were similar.

First, most expert panels found that the three types of bombers in service did indeed have a remarkable service life potential as long as they were maintained and upgraded regularly. Billions of dollars poured in to improve B-2 stealth coatings, enhance B-1B reliability, or upgrade B-52H avionics. However, most of these expert groups also concluded that the nation was running the risk of diminished capability. In 1997, the Congressionally chartered National Defense Panel studied the question of transformation. It advocated "greater emphasis on operating at extended ranges, relying heavily on long range aircraft and extended range unmanned systems, employing advanced precision" and seeking bases outside the theater of action for these strikes.[18]

Congress and the Pentagon rebuffed sporadic efforts to buy a small additional force of B-2C bomber aircraft. Prohibitive cost sank any effort to keep open the B-2 line. As a result, moves to extend B-2 production never achieved more than lukewarm support from the Air Force. Moreover, a mission area assessment that the Air Force completed in 1999 reconfirmed the existing service life projections for the three bombers. Curtailing low-level missions reduced wear and tear on the aircraft and therefore increased the already long estimated service lives of the aircraft.

As a result, Air Force officials decided that the service had plenty of time to deal with the bomber issue. It recommended scheduling the next mission area assessment for 2013 to support a bomber replacement initial operational capability (IOC) date of 2037.[19] In short, the Air Force was voluntarily signing up for a 40-year bomber gap.

16. Gen. Charles A. Horner, "What We Should Have Learned in Desert Storm, But Didn't," *Air Force* Magazine, December 1996.

17. Kurt , 1998, p. 21.

18. John T. Correll, "Editorial: Long-Range Blind Spot," *Air Force* Magazine, June 1998.

19. United States Air Force, "Long-Range Strike Aircraft White Paper," November 2001, p. 27.

PART II

EXPEDITIONARY BOMBERS

At first, the bomber gap did not seem to present much of a problem. B-52Gs that flew in Desert Storm were retired as planned in favor of the younger and more efficient B-52Hs. With no one expecting a new bomber for at least 40 years, USAF invested quite heavily in a program of upgrades for the existing bomber fleet.

It paid off. The fleet of B-52Hs, B-1Bs, and B-2s rapidly grew into a force of sophisticated, conventional strike platforms. By the time major combat operations in Iraq ceased in May 2003, everyone from special operations forces in Afghanistan to marines in Iraq was cheering the performance of the bombers. The big aircraft started off slowly and got stronger.

In 1996, US Central Command called on B-52s for their reach. Iraqi Republican Guard forces and a faction of Kurds occupied the town of Irbil in the northern Iraq on Aug. 31, 1996. The move was in direct violation of UN resolutions barring Saddam Hussein's forces from crossing north of the 36th parallel, and Irbil was north of the line. The B-52s answered the call—but there the Irbil crisis posed a very awkward situation for the Air Force, the kind of test likely to be part of future scenarios.

Two US allies, Turkey and Saudi Arabia, declined to participate in what they saw as internal Iraqi business. "This effectively prevented us from using USAF land-based fighters and forced us to turn to our independent options: carrier airpower, bombers, and cruise missiles," reflected Horner, the Gulf war air commander who had since retired.[20] "However, this also raised a set of constraints that, fortunately, I never had to deal with as coalition air commander," Horner said.

According to Horner, "Republican Guard forces in the north were beyond reach of carrier airpower, and sending non-stealthy Navy strike planes into Baghdad was far too risky. B-1B and B-52 bombers had sufficient range but lacked required precision munitions and would have been vulnerable to air defenses."

So B-52s launched CALCMs and the Navy launched Tomahawk land-attack missiles (TLAMs) against air defense sites in the southern no-fly zone, hundreds of miles from the site of Saddam's illegal actions. "Sorely

B-1B

USAF/SrA. Jeff Fitch/SSgt. Randy Mallard

20. Gen. Charles A. Horner, "What We Should Have Learned in Desert Storm, But Didn't," *Air Force* Magazine, December 1996.

missing was the capability that propelled us to swift victory in Desert Storm—to penetrate Iraqi defenses safely and deliver large, powerful, precision weapons," Horner commented.

In December 1998, at the time of Operation Desert Fox, matters had improved somewhat. The B-1B made its combat debut, striking a host of military targets in Iraq. The mission once again was to force Saddam Hussein back into compliance with UN resolutions, and the bombers were key. B-52Hs delivered a total of about 90 air-launched cruise missiles at selected military targets in southern Iraq. B-1Bs dropped unguided Mk 82s. More breakthroughs lay ahead.

BOMBERS AND PRECISION

March 24, 1999 brought the first combat missions for the B-2 bomber. That night, the second-to-last B-2 built became the first to drop its weapons in combat. Two B-2s flying separate routes to strike different targets became the first aircraft to drop the Joint Direct Attack Munition with its satellite-guided precision.

"The B-2 was designed to deliver weapons on the first day—yesterday was the first day of the war and the B-2 was there," said Col. Tony Imondi, the 509th Bomb Wing Operations Group Commander.[21] B-2 bombers flew 51 missions and dropped more than 650 JDAMs during the 78-day air war. On several missions, the B-2 used its satellite communications link to pick up new target coordinates while airborne. For the bomber fleet, it was an early demonstration of the role of time-critical targeting in modern aerial warfare. The bombers excelled at it.

Joint Forces Air Component Commander Lt. Gen. Michael Short had glowing words, which had a bit of the taste of crow to them. "My expectation of the B-2s was that they would not be nearly as accurate as they were, and that, X number of days into the campaign, they'd begin to whine about their stealth, whether they could maintain it or not, and start to come apart," he later said.[22] Needless to say, that did not happen.

President Bill Clinton personally visited Whiteman Air Force Base, the home of the B-2 fleet, to meet and thank the B-2 crews. Secretary of Defense William Cohen praised them, too. "When you can have a B-2 that can fly all the way from the middle of this country, all the way across the Atlantic, drop its bombs that will land within 20 feet of its target and return to its home base—that's quite a testament to the precision, the technology that we have," Cohen said.[23]

B-52Hs and B-1Bs also flew combat missions for Operation Allied Force. According to the Air Force, the B-1Bs delivered close to 20 percent of the total tonnage of bombs while flying not quite two percent of the total strike sorties.[24] The B-2's stealth, range, and payload allowed it to fly unique missions during the conflict. Although one F-117 was shot down, no bombers were lost or damaged, and the B-2s coped with the prospect of loose MiG-29s as well as roaming surface-to-air missiles.

Above all, it was precision and payload that made the B-2 a standout. Armed with the JDAM, the bomber achieved what no other had done before. The B-2 could attack at night, in the weather, and both succeed and survive.

The Air Force later concluded that B-2s hit more than 30 percent of all the targets in Serbia.[25] News media often inaccurately reported that the B-2 strikes were made by TLAMS. "I remember specifically one factory that was hit and they interviewed the locals and they said they'd been hit by 17 cruise missiles in 20 seconds," said B-2 pilot Terry Sunnarborg.[26] In fact, multiple explosions were the JDAM calling card. "We've got airplanes flying in there every night and no one thinks it's us," said then-Maj. Britt Bankson, a B-2 pilot.[27] "You know, what could be better for a stealth platform?"

AFGHANISTAN

If Kosovo was the war that demanded stealth, then Afghanistan was the arena for range and payload. Bombers played critical roles from the beginning of the global war on terror. Through the 1990s the Air Force sustained a program of sophisticated improvements to the bomber fleet. Investment exceeded $800 million in Fiscal 1999 and hovered between $600 million and $1 billion for the next several years. For example, all three bombers had the capability to drop the 2,000-pound JDAM, the GBU-31. "The role of the heavy bomber has evolved from 'dumb bomb' dropper to long-range precision weapon system," said an Air Force white paper published in fall 2001.[28]

Now the investment was about to pay off across the fleet.

21. "B-2s Make Combat Debut, Support NATO," March 26, 1999, 509th Bomb Wing Public Affairs.

22. Author interview with retired Lt. Gen. Michael Short, Nov. 20, 2000.

23. William S. Cohen, DOD press briefing, June 10, 1999.

24. Air Force Fact Sheet on B-1B, October 2005.

25. Air Force Fact Sheet on B-2, June 2006

26. Rebecca Grant, "B-2 Goes to War," IRIS Independent Research.

27. Grant, "B-2 Goes to War."

28. United States Air Force, "Long-Range Strike Aircraft White Paper," November 2001, p. 21.

In fall 2001, Operation Enduring Freedom in Afghanistan introduced a whole new set of operational concepts for the bomber force. Fifteen bombers took part in Night One operations. B-2 bombers flew from the United States to drop their weapons. B-1Bs and B-52s deployed forward to theater bases. Within the first several days of combat, though, the nature of the air war changed. Fixed targets gave way to emerging and time-sensitive targets. Air defenses were down, so the B-2 was not needed anymore.

A force of about 18 B-1Bs and B-52s now became the payload stars of the air campaign. The in-theater Combined Air Operations Center (CAOC) planned for about four sorties per day from the deployed B-1Bs and five from the B-52s. Each aircraft type could carry precision weapons such as the 2,000-pound JDAM or unguided weapons such as the Mk 82 500-pound bomb.

Bombers in Desert Storm and Kosovo typically flew directly to a pre-planned target, released munitions and headed for home, but bombers over Afghanistan operated differently. They were much more likely to take off and head for a target area. Their main source of targets came from special tactics controllers and other battlefield airmen dotted across Afghanistan. A typical mission called for the B-1B or B-52 to fly to a designated point and check in with air and ground controllers. Frequently bombers orbited over the battle space. Hours of loiter time during the bomber's availability or "vulnerability" made it possible for several controllers to task the same bomber during the same mission.

The bomber's qualities of long range and heavy payload were now being used in a completely new way, and the message was not lost on those watching the conflict unfold. For example, Pentagon news briefings featured video of a B-52 strike on Taliban fielded forces. By far the most famous bomber story was the B-52 that put ordnance on target in 19 minutes. It bears repeating here. Forces of the local Northern Alliance, traveling on horseback, came across a Taliban military outpost with artillery, barracks, and a command post. The outpost was not engaged with ground forces at the time, but it was a stronghold. Perhaps an air strike could be launched on the target within the next few days? As it turned out, that target lay in an established engagement zone. An air controller on the ground with the Northern Alliance forces contacted a B-52 on station overhead, and the B-52 dropped its ordnance within 19 minutes of the request.

The Afghan air war saw bombers doing the lion's share of the bomb dropping. B-1Bs accounted for nearly 40 percent of the total tonnage during OEF's first six months. In that time they released nearly 3,900 JDAMs, according to the Air Force, which was about 67 percent of the total number of those weapons.[29]

OPERATION IRAQI FREEDOM

Crews flying missions during the major combat operations phase of Operation Iraqi Freedom also found themselves tasked with everything from fixed targets to SOF support to on-call close air support for ground forces. Precision, stealth, range, and loiter time of the bomber force were all employed to good advantage in the air campaign. Fifty-one Air Force bombers participated in the conflict. All three bombers flew missions during OIF. In a historical first, the B-52H, B-1B, and B-2 aircraft all simultaneously hit areas near Baghdad on March 29, 2003.

USAF/SSgt. Shane Cuomo

Bomber missions reflected the growth of the conventional missions. They ran from precise attack of fixed targets to deep attacks on Republican Guards units to close support. B-1Bs in western Iraq were assigned a block of grid-box engagement zones to watch over in case special operations forces called for air strikes. B-2s—deployed to theater—took real-time targeting updates from the CAOC and unleashed JDAMs one-by-one on Republican Guard positions.

A huge sandstorm wiped out visibility in the area beginning on March 25, 2003. It didn't affect the bombers. "We were watching these guys with the Joint Stars and the ground moving target indicator radars, coming out of Baghdad trying to reinforce the Medina Division, and the B-1Bs and the B-52s were up there pounding the heck out of them," said the Air Force Chief of Staff, Gen. John P. Jumper.[30]

Other accounts of the coalition's drive to Baghdad showed

29. Air Force Fact Sheet on B-1B, October 2005.

30. Gen. John P. Jumper, "Leveraging Lessons Learned with Tactical Operations," remarks to the National Security Forum, Maxwell AFB, Ala., May 27, 2003.

B-2

USAF/SSgt. Cherie Thurlby

the bombers in good light. In the sandstorm, Air Force SSgt. Mike Shropshire, an enlisted terminal attack controller (ETAC) with the 3/7th Cavalry, radioed for assistance against attacking Iraqi irregulars. A B-1B responded with JDAMs. Later that night, an E-8 Joint STARS picked up indications of an Iraqi column moving down the road to reinforce the fight at Najaf. An orbiting B-52 got that call and dispensed JDAM, WCMD, and Mk 117 bombs on the Iraqis. At another point, coalition ground forces took prisoner 150 Iraqi soldiers "that were hit by the B-52 and then surrendered, said then-Maj. Gen. Daniel P. Leaf, who was air liaison to the Joint Force Land Component Commander.[31]

Two B-52Hs were even equipped with Litening pods that enabled them to carry laser-guided bombs on external hard points and self-guide them to targets.[32] One B-52 crew dubbed "Thrill 35" flew a mission under the tactical direction of the 1st Marine Division's Direct Air Support Center (DASC) on April 1, 2003. The B-52 struck an ammunition dump north of Baghdad. Then the crew was "put in touch with a marine division that was being threatened by a very large Iraqi tank column," said the aircraft commander of Thrill 35. They dropped two CBU-105 canisters containing sensor-fuzed weapons on about 20 tanks, "killing the whole first third" of the column. Iraqis in the rear of the column "poured out of the tanks, hands up, game over," said this aircraft commander. The marines "didn't have to do a single thing except cover their ears," lauded one controller. The DASC then sent this B-52 on to strike a covey of parked tanks in another location.[33]

The B-1B logged one of the highest-profile missions of OIF. Lt. Col. Fred Swan was at a weapon systems station aft of the cockpit when his B-1B got the call to try to hit Saddam in downtown Baghdad on the night of April 7, 2003. CENTCOM intelligence had "credible information" on a "regime leadership meeting" taking place.[34] Swan said the B-1B was "just coming off the tanker in western Iraq" and setting a course for another target area when coordinates for a new "priority leadership target" came in. "You get kind of an adrenaline rush," he said.[35] The B-1B headed for the Mansour neighborhood in Baghdad with SAM-killing F-16CJs nearby and EA-6B Prowlers along to jam air defenses. Twelve minutes later, the B-1B dropped two hard-target penetrator JDAMs on the target plus two JDAMs with fuses set for a 25-millisecond delay to push deep into the structure. A Joint Staff spokesman said the next day that the timeline for the whole strike was just 45 minutes "between when we received potential intelligence and putting ordnance on target."[36] Unfortunately, Saddam Hussein—the principal target—had already left the area and survived.

Did the B-1B, at that point, call it a night? No. The same B-1B had plenty of weapons and time on station so for the B-1B, the mission was not over; "We did go ahead and strike 17 more targets in two different locations immediately following that strike," added Swan.

American heavy bombers flew 505 sorties during the major combat operations phase of OIF in 2003. That amounted to 2.4 percent of the total of 20,733 strike sorties.[37] By any measure the B-52Hs, B-1Bs, and B-2s were valuable contributors to the joint campaign. Marines praised the way the air component commander "would have B-52s check up on the net and we weren't expecting them."[38] The question was: Could the B-52Hs, B-1Bs and B-2s pull off the same kind of performance in the future?

31. Author interview with Maj. Gen. Daniel P. Leaf, June 27, 2003.

32. Adam J. Hebert, "The Long Reach of the Heavy Bombers," *Air Force* Magazine, November 2003.

33. "SFW in OIF," Textron video presentation, July 9, 2003.

34. US Central Command press briefing, April 8, 2003.

35. DOD press briefing with B-1B crewmembers, April 8, 2003.

36. DOD press briefing, April 8, 2003.

37. "Operation Iraqi Freedom—By the Numbers," US Air Force, April 30, 2003.

38. Author interview with then-Maj. Rich Hilberer and Maj. Brian Annichiarico, March 12, 2004.

PART III

CLOSING THE GAP

Gulf War II was a turning point, of sorts, for the bomber. Just as Horner had been uneasy about the demise of the B-2 in the 1990s, Lt. Gen. T. Michael "Buzz" Moseley, the air boss of the 2003 war with Iraq (and future Vice Chief of Staff and Chief of Staff), returned from OIF concerned about the future. It was a re-run of Eaker's dilemma in the early 1940s: Could a future Combined Forces Air Component Commander in 2010 or 2020 count on long-range airpower forces to hit all types of targets?

The conclusion: Probably not.

It was significant, for example, that the historic use of B-52Hs, B-1Bs, and B-2s around Baghdad took place 10 days into the war, only after the integrated air defenses of the so-called "Super Missile Engagement Zone"—or Super MEZ—around the capital were out of business.

While praising the work of the B-52 and B-1B, Moseley explained: "We're not going to be able to fly these old airplanes into the 21st century and keep them survivable and be able to penetrate a fifth-generation threat array. We can stand off now with some of the finest aircraft ever built, and, when you control the air space, you can park yourself over the top of a set of targets and hold them at risk with the B-1B and B-52. But against a fifth-generation defensive system, this is not going to work for us."[39]

Even in 2003, appraisals of the operating environment suggested that there were already signs of change. Tougher air defenses, longer distances, time-critical counter-weapons of mass destruction (WMD) missions—when any were added to the mix, it meant that future campaigns might need a much more survivable, persistent long-range strike system—a capability not in the nation's inventory.

WARNING SIGNS

The most highly publicized warning sign was emergence of the barriers to entry into regional war zones. Access—the ability of US military forces to reach fighting areas and conduct operations—has become one of the primary operational concerns in global contingency planning. "If allowed to be effective, anti-access strategies would slow US force projection and constrain national leadership options," US Joint Forces Command declared in a statement.[40]

The 2003 air campaign highlighted just one of those problems—base access. Base access disputes affected nearly all aspects of the campaign. Tankers were scattered across the theater. Turkey refused to allow any air or land combat operations from bases there. US heavy bombers, with few places to go, crammed into the Indian Ocean atoll of Diego Garcia. Some Gulf States permitted access but did so very quietly and were publicly described only as "forward operating locations." On the whole, the experience amounted to a warning about the diplomatic problems inherent in in-theater basing.

Top Air Force officials acknowledged that even the limited availability of bases in OIF might not be an option in all future scenarios. "We are unlikely to encounter such a luxury in subsequent conflicts," Moseley, who had been awarded a fourth star and became Vice Chief of Staff, told a Congressional panel in March 2004.[41] "In the future, we will require deep strike capabilities to penetrate and engage high-value targets during the first minutes of hostilities anywhere in the battle space."

39. Gen. T. Michael Moseley, remarks at Air Force Defense Strategy and Transformation Seminar Series, Washington, D.C., April 4, 2006.

40. US Joint Forces Command news release, "Wargame set to tackle real-world issues," Aug. 15, 2003.

41. Gen. T. Michael Moseley, testimony to House Armed Services Committee, March 3, 2004.


Aldridge

DOD/R. D. Ward

Independent defense analysts took up the refrain. "If you're looking at Turkey as the model of the future," analyst John Pike, head of GlobalSecurity.org, told *Defense News*, "the front-line states are not going to give you basing rights and you can't do short-range strike missions. If you can't get any closer to the targets than Diego Garcia or Guam, what kind of airplane are you going to use? You're not going to fly a bunch of Joint Strike Fighters halfway around the planet."[42] Pike's words also echoed those of other scholars. In a January 2003 study of major conflict, Christopher J. Bowie, Robert P. Haffa Jr. and Robert E. Mullins had declared, "Evidence from the three conflicts [Desert Storm, Allied Force, and Enduring Freedom in Afghanistan] underscores the potential for military 'showstoppers' arising from political issues, the tyranny of distance, and infrastructure constraints."[43]

Two retired Air Force officers, Lt. Gen. Charles May and Col. Carl van Pelt, writing in *Armed Forces Journal* in June 2004, had this to say: "National guidance, the operational environment and Air Force CONOPS have fundamentally changed in the past three years, yet the bomber road map and modernization priorities remain unchanged and underfunded."[44]

CHANGING COURSE

In the face of all this, the corporate Air Force at first held fast to its late 1990s position that 2037 was the right time to field a new bomber. The service, as a whole, saw the period between the present and 2037 as the minimum needed to get through other modernization priorities and develop enhanced technologies such as hypersonics or sub-orbital capability.

Even earlier, the Air Force had chosen not to respond to oblique overtures from the Office of the Secretary of Defense. First to suggest much earlier acquisition of a new bomber was Edward C. Aldridge, a former Secretary of the Air Force who was serving as undersecretary of Defense for acquisition. In 2001, Aldridge, thinking 2037 was too far away, suggested bringing on a new bomber in the 2012-15 period.[45] He sent a memorandum to the Air Force encouraging the service to develop a long-range strike strategy speeding up the modernization process.

As late as October 2003 Air Combat Command—which managed not only fighters but also heavy bombers—contended that fighter modernization was the top priority and that the service life of the three bombers would carry them through for another three decades. "By 2012 or 2014, when the technology is available, we can start the development of a follow-on bomber when we have a better understanding of what that aircraft will look like," said Col. Gary Crowder, who was chief of ACC's Strategy and Doctrine Branch, at a Heritage Foundation forum in 2003. "The Air Force has studied this about nine times."[46] In short, there was little enthusiasm for embarking on a major new bomber program.

However, change was on the way. A very senior group of Air Force officers was about to look again at the host of studies of long-range strike technologies. A year later the Air Force was talking about new modernization priorities. Inspiring the change was some cool and calm analysis of what heavy bombers could do and could not do, and how those factors fit with the rest of the force. Moseley hosted a long-range strike summit. At the Dec. 12, 2003 conference, he and other USAF leaders reviewed more than two dozen studies on different aspects of future long-range strike. It "was designed as a place where we could vet and discuss everything," said then-Brig. Gen. Stephen Goldfein at a Jan. 20 media roundtable, "and come out of it with a flight plan of sorts, a clear way ahead in the long-range strike business and [to] help shape our future investment strategy."[47] As

42. Laura M. Colarusso, "Suddenly, USAF Wants a New Bomber," *Defense News*, July 7, 2004.

43. Christopher J. Bowie, Robert P. Haffa, and Robert E. Mullins, "Future War: What Trends in America's Post-Cold War Military Conflicts Tell US About Early 21st Century Warfare," Northrop Grumman Analysis Center Papers, 2003, p. 3.

44. Charles May and Carl Van Pelt, "Out of the Loop: Bombers Await Net-Centric Hookup," *Armed Forces Journal*, June 2004, p. 30-33.

45. Barry D. Watts, "Long Range Strike: Imperatives, Urgency and Options," Center for Strategic and Budgetary Assessments, April 2005, p. 8.

46. Sharon Weinberger, "Air Force Considers Waiting 10 Years for Work on New Bomber," *Defense Daily*, Oct. 28, 2003.

47. Elizabeth Rees, "Air Force Long Range Strike Summit Re-Looks Future Bomber Timeline," *Inside the Air Force*, Jan. 23, 2004.

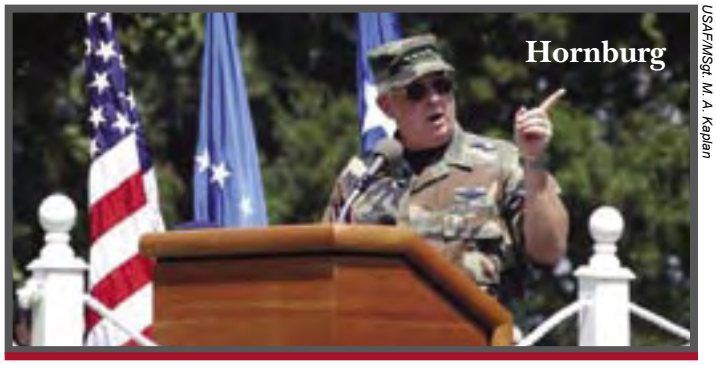
a result, Chief of Staff Jumper, set up long-range strike program offices at Air Combat Command and Air Force Material Command in February 2004.

In March, Rep. Roscoe Bartlett, (R-Md.), a member of the House Armed Services Committee, called together experts to testify on Air Force, Navy, and joint options for long-range strike. When called to testify, Moseley created a stir. "Today, our current projections show all three bombers (B-1, B-2, and B-52) to be viable weapon systems for decades to come," he said.[48] He then added, "However, aging aircraft sustainment and advances in threat technology will eventually make a new bomber equivalent mandatory." It was a subtle but significant change of Air Force tone.

For a time, the Air Force continued to plan for "fielding in the 2025 to 2030 timeframe," as Moseley told Congressman Bartlett's subcommittee in March 2004. By April 2004, however, there was a new date: 2015. ACC's preliminary functional area assessment surveyed previous studies plus after-action reports from Afghanistan and Iraq. The exercise revealed clear limitations on the current bomber fleet. While all of the bomber aircraft had considerable service life left in their airframes, the operational scenarios of 2015 and beyond called for greater survivability and persistence for day and night operations.

The Air Force issued a request for information to the aerospace industry and laid plans for a formal analysis of alternatives focused on rollout in 2015 and operational capability in 2020.[49] Numerous responses poured in. They ranged from unmanned vehicles to upgrades of current bombers. "It's not a panic," one Air Force source said at the time. "It's the looming reality that we are running out of time."[50] Gen. Hal M. Hornburg, who commanded ACC, had even more to say. He endorsed accelerated procurement and divided near-term technology from futuristic bomber studies. "The way our procurement and acquisition system is [means] we probably have to produce a bomber in 15 or 20 years based on today's technology," Hornburg told defense reporters on June 23. "But then, if you take a look at what technology offers and promises in the future, it's also prudent to look [at] a future bomber even past that."[51]

That fall, Jumper talked even more explicitly about the need for an interim or bridging capability. No longer was the Air Force content to wait for a set of revolutionary technologies that might be 30 years off. "What does the bridging capability have to be able to do?"[52] Jumper asked. At the top of the list was a need to improve significantly on the ability to fight and penetrate hostile airspace. Then he gave his warfighter's assessment of how to meet upcoming threats. "Can it be done with modernizing the existing bombers with new weapons? Or do you really need a midterm solution? I personally believe we are going to need a midterm solution."



USAF/MSgt. M. A. Kaplan

Subtle as it was, the shift of 2004 marked the turning point. Senior Air Force officials kept details to themselves. But it was clear that the December 2003 summit and the February 2004 Corona South meetings of senior leaders had produced a degree of consensus. The 2030s were too far away. The nation was going to need a new bomber much, much sooner.

THE QDR PROCESS

The drive to produce a new bomber got another boost from the Pentagon's 2005 Quadrennial Defense Review. "We cannot accurately characterize the security environment of 2025; therefore, we must hedge against this uncertainty by identifying and developing a broad range of capabilities," said Chairman of the Joint Chiefs of Staff Gen. Peter Pace in the Chairman's assessment of the QDR, published in early 2006.[53] The Chairman went on to say that future forces need "the agility and flexibility to deal with unknowns and surprises in the coming decades." In long-range strike, he was saying, the nation was shouldering far too much risk to conform to DOD guidelines.

One of the Administration's priorities was evaluating the nation's power to carry out a prompt, global attack—perhaps

48. Gen. T. Michael Moseley, testimony, House Armed Services Committee, March 3, 2004.

49. Elizabeth Rees, "ACC Team Taking First Steps in Future Long-Range Strike Acquisition," *Inside the Air Force*, May 28, 2004.

50. Laura M. Colarusso, "Suddenly, the Air Force Wants a New Bomber," *Defense News*, June 7, 2004.

51. Gen. Hal M. Hornburg, Defense Writers Group roundtable, June 23, 2004.

52. Lorenzo Cortes, "Air Force Ponders a Future Date with Mildred," *Defense Daily*, Sept. 20, 2004.

53. Quadrennial Defense Review, Chairman of the Joint Chiefs of Staff Assessment, February 2006, p. A-6.

on terrorist targets, perhaps on exceedingly difficult targets related to weapons of mass destruction. "It turned out that if 'prompt' was defined as within an hour and the strike had to be reasonably discriminate (meaning non-nuclear), the cupboard was bare," wrote the Lexington Institute's Thompson in *Armed Forces Journal*.[54] "This was not a congenial finding for an administration that has to think about pre-empting weapons of mass destruction on a daily basis."

Closed-door discussion brought the issue of long-range strike back to the table. The QDR also gave the Air Force a chance to re-examine its priorities. Recapitalization, of course, topped the list, and, in most areas, the Air Force had mature plans in place. The QDR preserved F-22 fighter production options and maintained the F-35 Joint Strike Fighter program. Support for a fair and open competition was expected to lead to a new tanker acquisition process beginning in 2007. Progress was also being made toward revamping intra-theater lift capabilities, space programs, and combat search and rescue helicopters. That left long-range strike—the bomber force—as the area most in need of attention.

The QDR boldly endorsed a new, accelerated program. Specifically, the QDR confirmed an Air Force goal "of increasing its long-range strike capabilities by 50 percent and the penetrating component of long-range strike by a factor of five by 2025."[55] The QDR went on to say that "approximately 45 percent of the future long-range strike force will be unmanned" and that "the capacity for joint air forces to conduct global conventional strikes against time-sensitive targets will also be increased." What could not have been more clear was the Pentagon's key goal: "Develop a new land-based, penetrating long-range strike capability to be fielded by 2018 while modernizing the current bomber force."

USAF/MSgt. Jim Varhegyi

To that end, the QDR backed the concept of trimming the B-52H fleet from 94 to 56 aircraft and using the generated savings for other purposes. It also "restructured" the Joint Unmanned Combat Air System (J-UCAS) and effectively moved as much as $5 billion in that program's earmarked money into a new bomber program. The Navy was directed to keep pursuing an unmanned strike vehicle suitable for use aboard aircraft carriers, but the elimination of the J-UCAS land-based program opened the door wide for a 2018 bomber.

Expert analysts took the QDR seriously. Clark Murdock, a former top civilian strategic planner in the Air Force and now a senior adviser at the Center for Strategic and International Studies in Washington, D.C., concluded that, "on the whole, the 2006 QDR has charted with considerable specificity its course forward and, unlike its predecessors, is likely to have a significant impact on how DOD copes with future challenges."[56] Air Force officials, too, were quick to endorse the QDR plan. For example, Moseley said he wanted to "build a new bomber so I can penetrate airspace and maintain persistence, and I can deliver this effect [in] opposed or unopposed airspace."[57] Secretary of the Air Force Michael W. Wynne announced: "We intend to come forward in the FY 2008 president's budget with a hard plan to essentially offer a fly-before-buy option so that we can in fact lock in a 2018 initial operational capability."[58]

"WE HAVE A GAP"

One reason—perhaps *the* reason—for the new emphasis on a 2018 bomber was exponential worldwide growth in deadly integrated air defenses. In the hands of potential US adversaries, advanced fighters and surface-to-air missiles could create an environment that would differ drastically

54. Loren Thompson, "Searching for the Next B-52," *Armed Forces Journal*, September 2006.

55. Quadrennial Defense Review, February 2006, p. 46.

56. Clark Murdock, "An Assessment of the 2006 QDR," Center for Strategic and International Studies, Feb. 4, 2006.

57. Gen. T. Michael Moseley, testimony, Senate Appropriations Defense Subcommittee, March 29, 2006.

58. Michael W. Wynne, testimony, Senate Appropriations Defense Subcommittee, March 29, 2006.

from the permissive skies of Afghanistan or even the Baghdad Super MEZ.

Richard P. Hallion, the former chief historian of the Air Force and still a keen observer of the background of US bomber development, pointed out that the B-52 was designed to go up against air defenses that today are considered museum pieces. Future B-52H crews would face threats several generations advanced over those anticipated by the aircraft's designers. "They won't be up against 130 mm Soviet antiaircraft artillery or early SAM-2s," said Hallion.[59] "They won't even be up against SA-10s. They'll be confronting integrated air defense networks of missiles, fighters, and perhaps even directed energy weaponry of which we only have a glimmer, conceived and operated by tenacious, resilient, imaginative, and dedicated foes."

The air-defense threat also is cited by Maj. Gen. Jack J. Catton Jr., director of Requirements at Air Combat Command, Langley AFB, Va. Catton manages the definition of operational requirements and chairs the Combat Air Forces Requirements Oversight Council. While Catton's background is in fighter operations, bombers are a point of emphasis. "There are some areas that would place our legacy bomber fleet at risk," he said.[60] Adversary fighters, some of them fourth-generation types such as the widely exported MiG-29, are "on a par with our legacy fighters," he went on, adding that helmet-mounted cueing systems and off-bore-site weapons could make even a few adversary fighters a severe problem.

The same holds true for SAMs, where recent developments have created highly capable systems. A prime example is Russia's S-400 Triumph. Testing of this surface-to-air missile began in 1999 and the first Russian air defense regiments reportedly began to deploy it in late 2006. "There will be no Desert Storm over Russia," declared one Russian journalist in 1999.[61] Indeed not. The S-400's range—more than 200 miles for its biggest missile variant—may be twice that of the US Patriot. More worrisome is the prospect of exports, which could give some nations the power to "lock out" all but the stealthiest American aircraft.

The real danger lies in the ability of near-peer competitors to deploy multi-layered SAM defenses. The S-400 variant upgraded the already deadly S-300 system sold in large numbers to China and other nations. The S-300 series was designed specifically to go after lower radar cross-section objects and to thwart jamming aircraft. If attacked by a US cruise missile, the S-300 (and also the S-400) may very well shoot it down, unless it is stealthy enough to penetrate the minimum engagement ring.

Australian expert Dr. Carlo Kopp provided one example of just how deadly the advanced SAMs might be. According to Kopp, "the F-35 JSF's forward sector stealth is likely to be adequate, but its aft sector stealth performance may not be, especially considering the wavelengths of many of the radars in question," Kopp wrote in 2003.[62] Therefore, "an F-35 driver runs a real risk of taking a 3,000-pound hypersonic SAM up his tailpipe if he cannot kill the target SAM engagement radar in his first pass."

Projections such as these led to a consensus that the world threat environment between 2010 and 2020 will be too perilous for B-52Hs, B-1Bs, and B-2s to handle. Enemy fighters also complicate the problem. China's People's Liberation Army Air Forces have hundreds of fighters capable of forming a dense carpet of defense against a bomber attempting to penetrate. At some undefined point in the near future, legacy bombers will not be able to penetrate to all types of targets. The B-2 is the only stealth platform of the three legacy bombers. However, the B-2 is effectively confined to operating at night. In a dense air defense threat environment, the B-2 almost certainly would need help countering enemy fighters. As for B-1Bs and B-52Hs, they can only be viewed as standoff platforms.

Senior leaders certainly are now regarding this as a serious problem. "Our national military strategy really requires deep strike capability effective in the face of anti-access limitations or the limited use of overseas bases," said Catton."[63] In the words of Moseley, "We need to be able to penetrate. We need to be able to capitalize on those attributes of an Air Force, which are range and payload and persistence. So this takes us to a new bomber."[64]

59. Richard P. Hallion, "Does Long Range Strike Have a Future?," Air Force Association National Air & Space Conference, Sept. 25, 2006.

60. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

61. Sergey Sokut, "There Will Be No 'Desert Storm' Over Russia: 'Triumf System Will Be a Worthy Response to Foreign Aircraft Development," Moscow Nezavisimoye Voyennoye Obozreniye No. 6, Feb. 19-25, 1999, p. 6.

62. Carlo Kopp, "Asia's New SAMs," Part 2, *Australian Aviation*, November 2003.

63. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

64. Gen. T. Michael Moseley, remarks at Air Force Defense Strategy and Transformation Seminar Series, Washington, D.C., April 4, 2006.

PART IV

Range, Payload, Survivability, Speed

If there is to be a new bomber, what will it look like? As Arnold and Eaker wrote, the bomber "is distinctly offensive in character."[65] That, they said, is because "battles are won by vigorous offensive and seldom, if ever, by the defensive. Few who have analyzed the problem would disagree with the claim that the 2018 bomber must keep its offensive edge above all else.

Bombers—by definition—make the toughest of technical trade-offs in order to achieve that edge. It is still the bomber's great combat radius that gives it its distinctive offensive punch, and those designing the 2018 bomber will have to do whatever is necessary to get it.

The operational dilemma is how to take the best of range, payload, survivability, speed, and other factors and blend them to meet all mission requirements.

During numerous studies, aerospace industry experts have outlined ideas ranging from an arsenal plane and modified variants of today's bombers and fighters to sleek ultra-advanced supersonic designs. The whole question of manned bombers vs. unmanned bombers is very much open. There are hints of exotic technologies in secret "black program" development—technologies that may give the 2018 bomber a very different look indeed.

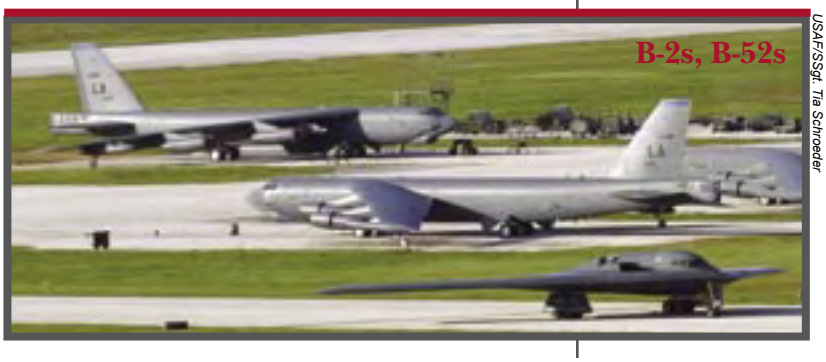
However, the Air Force came out of the recent QDR debates with some clear parameters already in mind.

First, in a real sense, the Air Force already has made one set of choices by fixing its sights on a bomber that can be deployed in 2018. That decision already is rippling through the requirements and planning process. Yet to come are decisions concerning range, payload, survivability, speed, and persistence, only to name the most important facts. When it comes to operational characteristics, airmen already have a good idea of what they want. "Range and payload are numbers one and two, with survivability a close third," said Catton.[66]

RANGE

Range is the supreme requirement, to state things bluntly. In fact, inadequate range was one of the major drawbacks of J-UCAS, from the Air Force's perspective. Boeing's system concept for the X-45C J-UCAS air vehicle proposed a combat radius of just under 1,400 statute miles. A bomber with a combat radius of 3,500 statute miles would be much more effective.

Range requirements are affected by two distinct points in space. The first is "the finish line"—the target. Bombers need sufficient range to make sure that a potentially hostile nation can't just move targets into the interior to make them invulnerable. In China, for example, Beijing is relatively near the coast. Reaching points in the interior of China, however, could add thousands of miles to a bomber's route. May and Van Pelt point out that it is almost 2,300 statute miles from Diego Garcia to a hypothetical refueling track prior to



USAF/SSgt. Tia Schroeder

65. James Parton, *"Air Force Spoken Here:" General Ira Eaker and the Command of the Air*, p. 118.

66. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

an Asian landfall, "and targets ... could be several thousand miles beyond this track."[67] The second point is "the starting line." Where will the mission begin—that is, from what base will the bomber be allowed to take off? If you think it will be in a foreign land, you get one set of answers. If you think it will be in the United States, the answers will be different. "Range is very important if you can't do overseas basing," Catton said.[68] The distance from, say, Guam to Beijing is about 2,500 statute miles, as the crow flies. The distance from Missouri is much further.

The point is not that China is an adversary; this may or may not prove to be the case over the next 50 years. The point, rather, is that the bomber's mission is to hold targets at risk all over the globe—not just near the littorals. The more important the target, the more likely it is that its keepers will try to make it as inaccessible as possible. Reaching and digging out such targets will require a true long-range platform. Even a bomber with a 3,000-mile combat radius still will need tankers to boost its range. Pre-strike and post-strike tanking over open ocean will be essential parts of the mission profile.

PAYLOAD

Payload is the next most important feature of the new bomber. In this area, the 2018 aircraft will have an enormous advantage over all other bomber designs: precision weapons. The B-52, B-1B, and B-2 were all designed long before the advent of satellite-guided precision weapons. Huge bomb bays for nuclear and conventional weapons were essential to bomber effectiveness. The B-1B with its three bomb bays had the most payload capacity of the three, and, today, it can carry 24 2,000-pound JDAMs.

In future bombers, the payload will be built around different variables. It is theoretically possible to have a significant reduction in payload. The GBU-39 Small Diameter Bomb program is intended to yield a weapon—in a bomb body weighing only about 250 pounds—that can penetrate hardened aircraft shelters, armor, and other battlefield targets. Therefore, a future bomber toting GBU-39s might need much less of actual payload capacity and still be able to match the effect of much bigger aircraft. The volume of the bay could be smaller. "Payloads of 10,000 to 20,000 pounds will probably suffice," estimated Watts.[69] As he pointed out, a smaller bomb bay could make the future bomber lighter, cheaper to build, and even more survivable, inasmuch as smaller air vehicles can have smaller signatures.

Certainly, trends in munitions usage point to much smaller bombs. After its combat debut in late 2004, the 500-pound JDAM—the GBU-38—quickly became the most frequently employed munition in stability operations in Iraq. However, the 2018 bomber will need to have a sizeable payload capacity. Here again, planners point to the shortcomings of the J-UCAS air vehicle as an object lesson. Its payload of about eight 250-pound small diameter bombs was not quite enough to put it in a true bomber class.

Catton notes, "The combination of precision and payload will hold more targets at risk"[70] Few would dispute that claim. The central question regarding payload is whether the bomber must carry the heaviest, deep-penetrating munitions in order to strike and destroy hardened, deeply buried targets. For those missions, the GBU-28 is king. The bunker buster was built in great haste for use in the 1991 Gulf war. Engineers converted old artillery tubes, filled them with high explosives, and delivered them into the theater with cases still warm from the pouring. A pair of F-111s released laser-guided GBU-28s on two critical targets.


Small Diameter Bomb

The GBU-28 is prized for its abilities to penetrate 100 feet or more of earth or 20 feet of concrete over a target. At a length of 25 feet and weight of about 5,000 pounds, it's a weapon best left to heavy bombers. The new aircraft clearly should be able to carry several of them. Exactly how many, however, will be a subject of extensive analysis, the result of which would have a big impact on the shape and size of the 2018

67. Charles May and Carl Van Pelt, "Out of the Loop: Bombers Await Net-Centric Hookup," *Armed Forces Journal*, June 2004.

68. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

69. Barry D. Watts, "Long Range Strike: Imperatives, Urgency and Options," Center for Strategic and Budgetary Assessments, April 2005, p. 70.

70. Author interview with Catton.

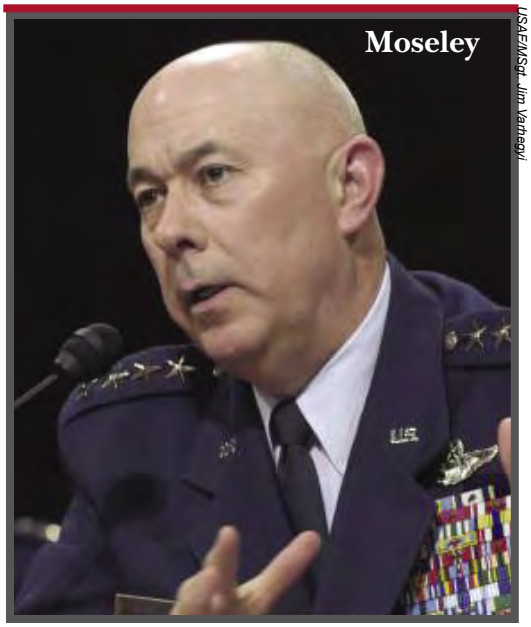
bomber. The B-2 can carry a total of eight GBU-28s, four in each bomber bay, but that may or may not be viewed as a sufficient number.

Size the 2018 bomber to carry a weapon like the GBU-28, and it will also have the volume to carry many different mixes of weapons. In reality, range and payload are tightly linked. Build a bomber with long range and it will be close to the size needed for hefty munitions carriage, too.

SURVIVABILITY

Even though it comes third on Catton's "must-have" list, the survivability of the new bomber is a critical factor. Current bombers enhance survivability through electronic warfare, mission planning, and, in the case of the B-2, stealth properties. Much will be working in favor of the next system. Twenty years have passed between the design of the B-2 in the 1980s and the present day. In the interim, aerospace industry experts pioneered fifth-generation stealth technologies and techniques for both the F-22 and the F-35 fighters.

Improvements in materials, design, and maintenance concepts have already taken away much of the "cost of stealth" associated with the F-117 and the early B-2 programs. For example, new seals for access panels on the F-22 were designed to be opened and closed during maintenance without the need to restore stealth coatings. The stealth materials themselves are much improved, too. Rugged coatings for the F-35 were designed to withstand the salt air environment and other stresses of shipboard operations. The new bomber will seek to capitalize on these improvements and probably take them another step or two to achieve reliable survivability for near-peer scenarios.



USAF/MSgt. Jim Varney

The prospect of much-improved survivability is actually one of the top reasons for going with a new-start 2018 bomber; it will be built to take advantage of two decades of advanced technology development. "As we've improved the fleet, we've learned lots with F-22 and F-35," Catton pointed out.[71] They are "more low-observable, easier to maintain," he said. Based on that expanded technology base, advanced stealth is considered a given for the 2018 bomber. According to Catton, "we could in the very near future develop long range strike that is more survivable." It also is likely that advanced electronic countermeasures could still have a part to play in improving survivability for the 2018 bomber. Catton made clear that the new weapon would take a system-of-systems approach to achieve survivability. Stealth, speed and other "on-board survivability measures" will work in concert.

Other aircraft will help out, too. Some may be F-22 fighters. Catton reserved the option for giving the new bomber a fighter escort, depending on the scenario. "I would never say it [the 2018 bomber] can go in without other assets we're going to put the best team on the field," he said.

SPEED

Speed is a compelling topic. Frequently, however, it is the attribute that is traded off during the definition of new bomber aircraft. The pursuit of the 2018 bomber will force a major decision at the usual barrier point: the speed of sound. Aircraft proposals from industry have ranged from those featuring speed in the high-subsonic range—similar to the current fleet—to those with supersonic speeds at Mach 2 and above.

What we know for certain is that the new bomber won't have hypersonic speed—that is, above Mach 6. For now, that is not a feasible option for a bomber platform that must be on the ramp in 2018. It is a disappointment to some who hoped for a hypersonic platform. Moseley told Congress in 2004 that studies by the Air Force Research Lab and the Institute for Defense Analyses concluded that hypersonics would not be mature enough to support a 2012 program start, much less a start in 2008.[72] In 2006 Congressional testimony, Moseley said such technology for a long-range strike platform is still out "beyond 2025-2030."[73]

Formally, the Air Force is still undecided on speed. Flight at

71. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

72. Gen. T. Michael Moseley, testimony, House Armed Services Committee, March 3, 2004.

73. Gen. T. Michael Moseley, testimony, House Armed Services Committee, March 1, 2006.

Mach 2+ would minimize the time spent in a target area. Zipping past SAM threat rings and enemy fighters alike, the supersonic bomber could introduce an entirely new concept of operations. Higher speed also boosts weapon ranges. The faster that a bomber flies, the farther its kinetic energy can hurl a weapon. Yet such speeds pose a major challenge to maintaining range. Of greater concern is the cost of developing engines for a Mach 2+ bomber. Time is also a problem; while extensive research is underway, the risks of schedule slippage are many.

The safer bet is a 2018 bomber with high subsonic speed that can be achieved now with near-term engine technology. It poses no new problems for stealth, survivability, weapons release, and systems integration. Final decisions on speed

J-UCAS concept

come down to analysis of trades. "We don't know yet," Catton said of the speed question.[74] "We're trying to be very open-minded. It could be subsonic. It could be subsonic with supersonic dash. It could be straight-out supersonic. We'll make all the trades and see what falls out."

PERSISTENCE

The Air Force has made clear that persistence will be a major characteristic of the new bomber. Effective attack boils down to the ability to find, fix, target, and attack the enemy rapidly enough to prevent adversaries from moving or reconstituting his forces. The air campaign has to be persistent enough to achieve that effect. "If adversaries are likely to confront US forces more and more with emergent, time-sensitive, fleeting, or even moving targets, then the ability to persist relatively deep inside enemy airspace will be at a premium," explained Watts.[75] It's exactly that ability—persistence against difficult targets deep in heavily-defended airspace—that is the wedge opening the gap in long-range strike capabilities.

Persistence in the attack on high-threat areas is not the same thing as loiter time in a permissive air defense environment. "It is persistence over the battlefield—day or night—in the weather or not" that is needed, explained Catton.[76] It is needed "so the adversary can't hide in weather or behind an IADS [integrated air defense system]." Persistence here means "persistently keeping the enemy's head down," Catton said. The concept is not to strike just once and then give adversary systems 24 hours to recover or reposition. Instead, with a truly persistent bomber force, "we're hammering over and over so he can't recover," Catton said.

2030 AND BEYOND?

Building the 2018 bomber does not signal the end of research on even more advanced technologies. Catton noted that, on the horizon, there are some "super-transformation" technologies—wing warping and directed energy—in addition to hypersonics that eventually will find their way into new systems. "I'm very, very interested in those," said Catton, but, as Moseley said, they are more for "2035 and beyond."

After the 2018 bomber, he is suggesting, long-range strike may take a radical turn. This change may occur in the platform, the payload and weapons, or in the whole concept of long-range strike. For now, however, the pressures created by the national bomber gap points toward rapid acquisition of a new system.

IS AIR CREW OPTIONAL?

In a sense, there is only one remaining question: Will the bomber's crew be in the cockpit, or seated in a ground station, possibly thousands of miles away? There's every

74. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

75. Barry D. Watts, "Long Range Strike: Imperatives, Urgency and Options," Center for Strategic and Budgetary Assessments, April 2005, p. 56.

76. Author interview with Catton.

possibility that the 2018 bomber will turn out to be what officials call "optionally manned."

The technology of unmanned air vehicles has progressed to the point where the Air Force can consider building a manned bomber or an equally capable unmanned bomber. More likely, it will be a platform that can switch back and forth from manned or unmanned missions.

"Optionally manned means just that," explained Catton. "It has a cockpit and a crew can fly it, or in autonomous mode, you can fly it like a Predator." Sources outside the Air Force are moving optionally manned concepts forward, too. The 2006 QDR stated: "Approximately 45 percent of the future long-range strike force will be unmanned" in the 2025 timeframe.[77]

DARPA official Arthur Morrish described how a multi-role large aircraft might serve as bomber, transport, or tanker. In his view, aircraft could be "optionally manned, meaning that you'll have a crew for critical flights like a combat bombing mission, but for routine stuff like cargo hauling in peacetime, the plane will fly itself."[78]

ENDURANCE

Flying a bomber without an airborne crew is attractive for many reasons. Start with endurance. Human factors put limits on the duration of manned missions. B-2 crews of course hold the record in that department. The longest flight by the two-man crew of the stealth bomber was a 44-hour mission flown early in OEF. The cockpit is big enough for pilots to get up from their seats, stand upright, or curl up in a folding chair. Like other bombers, the B-2 carries a small chemical lavatory.

Still, the long missions came about through necessity, not choice. "You've got to think they were jelly at the end of it," noted Bowie.[79] Other flights have topped 50 hours and they point out the true dilemma. "Fifty hours is no problem mechanically for the aircraft," said one B-2 instructor pilot, "but the pilots need to practice managing their fatigue so they will be prepared for combat."[80] The B-2 crews flew their record missions mainly because of range requirements; it took time to fly from Missouri to the target on the other side of the world and back again, with time added in for in-flight refueling and the strike itself. During OIF in 2003, B-2 bombers deployed to a base in theater to cut sortie duration.

Bombers in future need to be able to do two things: fly long-endurance missions from CONUS to worldwide targets and loiter for long periods over a target area, as B-1Bs and B-52Hs have done in Afghanistan. Taking out a crew could greatly lengthen mission duration in a combat zone.

One of the best current examples of endurance is the Global Hawk intelligence-surveillance-reconnaissance UAV. Over Iraq the high-altitude UAV's time on station routinely went 20 hours or more, not counting flight time from its in-theater launch and recovery base to the target area. Cycles of 20 hours or more enable one Global Hawk to cover nearly an entire 24-hour Air Tasking Order. As one CAOC expert noted: "You'd have to schedule 2, 3, or 4 of another airframe type" to equal Global Hawk's coverage.[81]

Concept developers with the old Unmanned Combat Aircraft System program took the idea further. Jumper described a loiter bombing mission for UCAS. He told *Air Force* Magazine in 2005, a "very stealthy" unmanned vehicle could "go and loiter over maneuver units on the ground, in direct contact with battlefield airmen, [who] can directly order up a weapon that can be delivered within seconds."[82] Once over enemy territory, it would be able to persist by simply going back and forth to an aerial tanker "as long as it's got weapons." That would scale up the vehicle. "If you make it with long endurance, it's going to be fairly big," said Jumper.

STATE OF THE ART

Airmen experimented with unmanned technologies in the earliest days of aviation. But it took software, the Global Positioning System satellite constellation, and two decades of operational experience with aircraft such as Predator and Global Hawk to demonstrate real flight reliability.

Optionally manned technology is ready. It can be glimpsed in the concept for a Special Operations Forces "little bird" helicopter that can fly with or without crew. The key? An autopilot that uses consistent flight control rules. Project manager Waldo Carmona of Boeing explained, "If you look at the full range of missions, you'll see that some missions

77. Quadrennial Defense Review, February 2006, p. 46.

78. Arthur Morrish quoted in *Popular Mechanics*, May 2005.

79. Author interview with Christopher J. Bowie, Dec. 15, 2006.

80. 2nd Lt. Matt Hasson and TSgt. Lisa Polarek, 509th Bomb Wing Public Affairs Office, and Gerry J. Gilmore, American Forces Press Service, "Striking From the Heartland," *Profile: Life in the Armed Services*, December 2001.

81. Author interview with Lt. Col. Sven Johanson, June 2005.

82. Gen. John P. Jumper quoted in "Toward an Unmanned Bomber," *Air Force* Magazine, June 2005.

are very demanding and require pilots, while other missions are fairly dull or tedious and can be done autonomously and fairly easily with today's technology."[83]

In the summer of 2004, a team conducted a test by purchasing a "little bird" helicopter airframe off-the-shelf and configuring it for optionally manned flight. "From the get-go, we designed our open mission management system and flight control system to be optionally manned," Carmona said. This UAV system can be inserted into a manned aircraft. Then, "it can be flown by a pilot with the system, then when the pilot gets out and wants to send it out to do something in the unmanned version, it turns into a UAV and flies off to do that." One Little Bird flight with unmanned control demonstrated a cargo resupply mission. The helicopter hovered, retrieved a 500-pound load, and delivered it to destination, all controlled by operators on the ground.

Global Hawk provides an example on a whole different scale. With a wingspan of 116 feet, length of 44 feet, and weight of 25,000 pounds, it is a big airplane—about the size of a World War II B-17 Flying Fortress. This big UAV is also fast. Global Hawk can fly at speeds of almost 400 miles per hour. According to the Air Force, it can fly 1,200 miles to a target area and then linger for 24 hours. This surveillance platform has exactly the range and endurance traits needed in a bomber.

The trickiest aspects of unmanned flight, as with manned flight, are two: the takeoff and the landing. Engineers developing Global Hawk in the mid-1990s found out that extremely fine control over the position of the Global Hawk was essential for autonomous takeoff and landing. Part of the flight test process entailed learning how to cope with small errors in GPS signals, which gave a slightly erroneous picture of the location of the air vehicle in time and space.

Developing software routines for all possible contingencies in flight was essential for Global Hawk to be able to fly itself. As Global Hawk designer Alfredo Ramirez put it, "the 'seat of the pants' that a pilot would do on a regular airplane—you've got to code it" for Global Hawk."[84] Crews divided Global Hawk's unmanned flights into two phases: launch and recovery, and in-flight operations. A special launch and recovery unit positioned at Global Hawk's operational base handled take-offs and landings. Once the Global Hawk reached its operating altitude, it would be taken over by another team of pilots and sensor operators located at Beale AFB, Calif. So far, Global Hawk has duplicated the high degree of flight reliability achieved by unmanned systems.

At about the same time that the Air Force was starting to test Global Hawk, NASA conducted experiments with the "optionally piloted" Proteus aircraft. Proteus was designed by Burt Rutan as an all-composite aircraft. Its mission?—telecommunications relay or perhaps long-endurance research and collection of data on Earth's environment. Overall, there's no question that American aerospace industry can deliver optionally manned technology at will, and for a reasonable cost.

Optionally manned technology is becoming a competitive option for many aircraft programs. Take, for example, the recent move by Gulfstream to offer a variant of its Ultraluxe G550 business jet to compete for the Navy's Broad Area Maritime Surveillance (BAMS) buy of up to 48 aircraft. Under the Gulfstream concept, pilots would fly the G5 to forward locations, then deplane and send the aircraft on to its "dirty, dull, and dangerous" missions in unmanned configuration.[85] That put an optionally manned aircraft in competition against unmanned frontrunners Global Hawk and the General Atomics' Mariner—a modified Predator. It's a sign of the advanced state of optionally manned technology that such offerings are part of major competitive programs.

The future may indeed shape up to be a competition between the inherent virtues of unmanned versus optionally manned configurations. This trend—already emerging in the ISR field—is set to spread to fighters and bombers, too. Lockheed Martin's advanced research and development "Skunk Works" operation has confirmed that it has developed concepts for both optionally-piloted and unmanned versions of the F-35 Lightning Joint Strike Fighter. "We need to get recognition that we are in the unmanned systems business," Lockheed official Frank Mauro told a trade publication in August 2006.[86]

The prospect of an unmanned F-35 showcases some of the trades. A dedicated unmanned platform can swap out a cockpit and add extra fuel, for example. The global information grid opens up other prospects. No aircrew is needed to process targeting and threat data if it can be done

83. Scott R. Gourley, "Unmanned Little Bird," *Special Operations Technology*, Dec. 21, 2004.

84. Alfredo Ramirez quoted in "The Rise of Global Hawk," IRIS Independent Research, 2003.

85. Paul Richfield, "When Business is War," C4ISR Journal.com, Aug. 14, 2006.

86. "Lockheed Martin reveals plans for unmanned JSF among other new UAV concepts," flightglobal.com, Aug. 15, 2006.

via the network. That frees an optionally manned bomber to function differently from the lead B-17 with the Norden bombsight or even the unmanned ISR aircraft packed with valuable sensors. A bomber could operate as an extension of the grid. Plug it into a network and the unmanned craft can download information needed to avoid threats, release weapons, perform sensing missions, and so on. When networked information is available, the single platform does not have to carry out as many information functions.

AUTONOMOUS REFUELING

All this makes an optionally manned bomber a real possibility, but a critical question remains. What about refueling? The high-altitude Global Hawk achieves mission endurance without it. Payload and combat mission profiles make refueling a necessity for a bomber, however. Here again, the timing is right. "We're making great progress on autonomous refueling," confirmed Catton of ACC.[87]

Research and experiments are paying off. A series of tests sponsored by the Air Force Research Laboratory's Air Vehicles Directorate proved out the concept late last summer. Boeing's Phantom Works and subcontractors built an autonomous aerial refueling flight control computer to manage station keeping by the tanker and receiver aircraft. The break-through tests demonstrated for the first time the feasibility of refueling an unmanned receiver.

In the August 2006 tests, a Learjet test bed equipped with autonomous refueling software rendezvoused with a KC-135 tanker from the New York Air National Guard. The Learjet's pilots engaged the system at the contact point. Autonomous control took over, and tanker and receiver flew 23 minutes in contact position. Ultimately, the tanker observation post will direct the unmanned receiver to the pre-contact and contact positions.

"The Station Keeping flight tests were a major step forward for automated aerial refueling technology," said Jake Hinchman, Air Force Research Laboratory's manager for automated aerial refueling programs.[88] "The next step for the program is to mature the technology into an operational capability." David Riley, Boeing Phantom Works AAR program manager, commented, "With autonomous air refueling capabilities, unmanned aircraft will have greater combat radius and loiter time."[89] Work through 2007 calls for testing maneuverability and then for moving from the Learjet test bed to Air Force inventory aircraft. The technology is ready to mature rapidly. Autonomous air refueling will not be a problem for a 2018 bomber.

Optionally manned technology presents nothing but good choices for the Air Force's next bomber. Said Air Force Secretary Wynne: "I'd love to have the capability of essentially pushing out a near sky hook that can be tanked by itself and stay there. On the other hand, there are some times that a man in the loop is a really good thing."[90]

USAF/MSgt. Jim Varhegyi

Political and diplomatic factors may also be considered. For certain missions, the reassurance of positive control from a live crew in the cockpit could remain important. Then there is the issue of cost. If it's a very expensive system, officials may be loath to risk it in optionally manned flight. Yet it's equally possible that the operational attractions of optionally manned flight will override those concerns. Risking an aircraft—but not a crew—makes one part of the decision easier. Much depends on continued refinement of reliable systems for flight and mission performance, including air refueling.

And in the end, that depends on the bomber crews. They will still be there, whether they are cruising at 40,000 feet en route to a target or glued to the screens and systems in ground stations. Most likely, the bomb wing commander of 2018 will have the option to do either.

87. Author interview with Maj. Gen. Jack J. Catton Jr., Sept. 10, 2006.

88. Susan A. Murphy, "Scientists Test Unmanned Aerial Systems Refueling," AFNEWS, Sept. 19, 2006.

89. "Boeing, US Air Force Demonstrate UAV Automated Aerial Refueling Capability," Boeing news release, Dec. 11, 2006.

90. Rebecca Christie, "Air Force to Step Up Bomber Research in Next Budget," *Market Watch,* June 29, 2006.

PART V

Skeptics and Challenges

In 2007, the Air Force is on track to set requirements for a powerful new bomber—the first in a technological generation. The service is in a position to put an end to an unprecedented, decade-long gap in bomber development. One finds strong Pentagon backing for long-range strike system and a newfound Air Force willingness to pursue it—hard.

Not everyone, however, is convinced of the need for such a bomber, or overly confident that it will ever become operational. Skeptics abound. So do opponents, who challenge the project on many grounds—some flimsy, some worthy of attention. One of the flimsy ones is enunciated this way by Thomas Donnelly, a former editor of *Army Times* and unabashed booster of land forces: "A dollar spent on persistent long-duration surveillance by unmanned vehicles is a better investment than a new bomber fleet."[91] Land forces, of course, are the prime beneficiaries of ISR. Donnelly acknowledged the need for reach in Asia but based his argument of the priority of finding terrorist targets in the "long war" against the harmful variants of Islamic fundamentalism. He also derided the Pentagon "mania" for long-range strike.

In other quarters, there are recurrent doubts about the Air Force's determination and sincerity in the pursuit of a new long-range strike system. Strong positive statements by Wynne, Moseley, and even in the QDR itself have done little to dispel doubts. Skeptics have made several points, many starting with a kernel of truth, all blown well out of proportion.

Below are some of the most common "one-liners."

- "It's really an FB-22." One source of skepticism comes from the recent discussion of a potential bomber variant of the advanced F-22 fighter. Production F-22s already carry significant internal ordnance as well as air-to-air missiles and all concepts for using F-22s call for the latest in precision weapons. However, then-Air Force Secretary James Roche in 2002 initiated studies of an "FB-22." Studies suggested that a stretched version of the Raptor could carry up to 30 Small Diameter Bombs and fly up to 50 percent further than the vanilla fighter. The FB-22 would retain super cruise, making it a supersonic bomber. Just having the FB-22 concept on the table led some to conclude that the sudden acceleration to the 2018 bomber was not a sign of a new program, but simply a way to move out on FB-22.

The contrary is more true. The QDR-backed move to build a 2018 capability signaled the end of the FB-22 initiative, at least in its old form. The Air Force may well decide to explore options for F-22 variants—a fact richly hinted at in the F-22A designation—but, for now, that's separate from the 2018 bomber. For years the Air Force has aspired to either extend F-22 production or produce a different variant over time. This may still be the case, but it is separate from the new long-range strike program.

91. Thomas Donnelly, "Long-distance affair: The Pentagon's fixation on long-range strikes is shortsighted," *Armed Forces Journal,* August 2006.

■ "Year 2018 is too close." Others believe that 2018 leaves no time to develop advanced technology. This camp did not greet the new priority with any enthusiasm because certain advanced technologies such as hypersonics or exo-atmospheric vehicles are known to be too far off. These experts reason that it's not possible to bring on the 2037 bomber in 2018. "Unless they have something in the black world, it's going to be a lot longer than 2018," said aerospace analyst Richard Aboulafia.[92]

Leaving aside questions about black world programs, there is every reason to count on significant technology advances. The F-22 and F-35 programs stand as testimony to that reality. Unlike in the days of the B-36 bomber, technology advances in the aerospace industry guarantee a leap in capability with near-term options.

■ "Fighter pilots won't pay for it." It's a nasty variation on the "white scarf disease" slur, one that postulates that fighter pilots run the Air Force and they won't buy a bomber. It's rare to find people willing to say it in print but the rumblings are common. Fighter pilots do dominate top positions. Christopher Bolkcom, senior analyst with the Congressional Research Service, surveyed the records of 80 generals serving in top Air Force positions at major commands and on the headquarters staff in September 2006. Of that number, 37 were fighter pilots by trade. Only three were bomber pilots.[93] A famous 1998 study by fighter pilot Mike Worden documented the "remarkable shift in leadership from bomber generals to fighter generals" in the 1970s and how it "culminated in 1982 with the selection of the first in a continuous string of generals with fighter backgrounds as Air Force chiefs of staff."[94]

However, the idea that fighter (or pursuit) pilots won't buy bombers is nonsense. In the 1950s, Gen. Nathan Twining was Air Force Chief of Staff and Chairman of the Joint Chiefs of Staff during some of the prime years of buying the B-52. Twining started life as an attack pilot and had stints commanding fighter-dominated units, as well as the bomber-heavy 20th Air Force and the postwar continental air forces. More recently, Gen. Charles Gabriel (Chief of Staff 1982-86) and Gen. Larry Welch (Chief of Staff 1986-90)—both were fighter pilots—supported and helped bring on the B-1B and B-2 bombers in the 1980s.

■ "Without a SAC, you can't buy bombers." A related question is whether the Air Force can buy a bomber without the existence of Strategic Air Command—the bomber-centric command that stood down in 1992. For most of its history, SAC was commanded by dynamic leaders—the prime case in point was Gen. Curtis E. LeMay—who demanded and got large numbers of high-technology bombers and support aircraft. Some saw more than coincidence in the demise of SAC and the subsequent deflation of the bomber imperative within the Air Force.

There is no doubt that SAC could be a strong advocate of the manned bomber. SAC's ability to buy bombers was not so much about a separate culture as it was a feature of the broad national commitment to pour money into building overpowering strategic nuclear deterrent forces. In its most critical development days, the B-2 bomber had no better advocate that Gen. Michael Loh, a fighter pilot who served as the first commander of Air Combat Command. Loh was at the controls of the first B-2 when it arrived at Whiteman AFB, Mo.

■ "It's really all about prompt global strike." Skeptics here erroneously conflate US Strategic Command's quest for so-called "prompt global strike" with the Air Force's acceleration of "next generation long-range strike" and come up with a system solution that is not a bomber. High speed, rapid-re-entry vehicles like FALCON could in theory hit a target in under an hour or two.

Still, the tricky part of time-sensitive strike is usually "actionable intelligence," not aircraft speed. In many cases aircrews have waited over the target area for final permission to strike, and it's taken a succession of on-call fighters or bombers to keep the strike option open. Then there is the possibility of a slight location error, or the chance that the target could move. Watts charged: "Hypersonics offer little operational utility against the problem of time-sensitive/emerging targets."[95] The Pentagon will most likely continue to explore prompt global strike technology. But that is not the same thing as a have a penetrating bomber capable of striking over long ranges.

■ "The Air Force can't sustain support for it." There are those who don't trust the Air Force to buy a new bomber,

92. Rebecca Christie, "US Air Force to Step Up Bomber Search in Next Budget," Dow Jones Newswires, June 29, 2006.

93. Christopher J. Bolkcom, "Future of Long Range Strike," AFA National Air and Space Conference, Sept. 25, 2006.

94. Mike Worden, *Rise of the Fighter Generals,: The Problems of Air Force Leadership 1945-1982*, Air University Press, 1998, p. x.

95. Barry D. Watts, "Long Range Strike: Imperatives, Urgency and Options," Center for Strategic and Budgetary Assessments, April 2005, p. 74.

and an even bigger group who are leery of trusting in the competence of the Air Force to manage such a program. Take note: even some bomber advocates signal mistrust of the Air Force's ability to pull it off.

More balanced views embrace the idea that it will take institutional commitment to see a new bomber program through to completion. Tom Ehrhard, another CSBA analyst and retired Air Force colonel, summed up his view with these words: "It will take support from successive Chiefs of Staff."[96] Today, the resolve is definitely there. Only time will tell how well the Air Force builds and sustains support over a decade or more.

STRATEGIC CHOICES

The 2018 bomber is a national strategic investment in unique capabilities, but the price will be high. It is therefore fair to ask: Are there better ways to accomplish the mission of global, persistent strike?

The Navy's nuclear-powered big-deck aircraft carrier is another, highly flexible type of power projection platform. The carrier's ability to control the sea and to launch aircraft from its decks without base access calculations creates an unquestionably valuable strategic asset.

A good example of the carrier's worth came early in OEF. In the fall of 2001, USS *Enterprise*, USS *Vinson*, USS *Theodore Roosevelt*, and the USS *Kitty Hawk*—the latter carrying SOF forces—supplied most of the fighter sorties flown during the first months of the Afghanistan campaign. Carrier aircraft assured air superiority for C-17s dropping relief supplies on night one of the campaign and for bombers operating in Afghanistan's airspace. Although threats proved minimal, having carriers in place was essential for the swift start to the operation in October 2001.

However, the relatively short legs of the naval fighters circumscribed their depth of penetration. Those that made it up north relied on Air Force tankers (as did all other platforms) for multiple refuelings and arrived with very limited time on station. None were stealth aircraft.

After 2015, the F-35 and the new CVN-21 aircraft carriers will improve carrier strike range and survivability. Add a stealthy, unmanned system (like Navy UCAS) with a range of 1,750 or so statue miles, and the carrier becomes a viable long-range strike platform. The Naval Aviation Vision, published in 2005, showcased the F-35's 800-statute-mile radius of action "without refueling."[97] Plans for an unmanned carrier air vehicle will further enhance power projection from the carrier strike group. Still, the Naval Aviation Vision looks toward a range of priorities for naval operations. Dedicated long-range strike with heavy payload and global ranging was not part of the picture.

What carrier-based forces will lack in 2020 is a large payload and greatly extended range. Those, of course, are two very large "lacks." Indeed, they are the sine qua non of long-range strike. Clearly, long-range carrier strike will be complementary to, but will not take the place of a 2018 bomber, just as naval fighter aviation is merely complementary to much more powerful and flexible land-based fighter aviation.

MAKING THE DEADLINE

Larger than any other doubts is the challenge of fast-tracking a bomber program to reach IOC in 2018. Consider the schedule. Step One is to complete the Analysis of Alternatives, due in spring 2007. Then Air Combat Command and Air Force Material Command must write a formal requirement—and vet it via the evaluation processes of the Joint Staff and the Office of the Secretary of Defense. If all goes well, a Request for Proposal could be issued in the fall of 2007. System Development and Design could begin in 2009.

The Air Force wants to use the new bomber as an opportunity to reinvigorate competitive, advanced aerospace research. Admiration abounds for the F-117 style of testing and development. There is a feeling that a new competition will raise excitement among the engineers and scientists and skilled production line specialists working on it, and help keep a new generation of aerospace experts engaged. There's also a good reason for doing it fast. Kaminski, who helped lead the F-117 program, later said that compressing the F-117 acquisition cycle time worked. "IOC was achieved within 59 months after program inception," Kaminski wrote.[98] "I believe a large part of that accomplishment was due to the decisions made on what to buy and how to go about that decision process."

96. Col. Tom Ehrhard, USAF (Ret.), "Is There a Future for Long Range Strike?," AFA National Air and Space Conference, Sept. 25, 2006.

97. "Naval Aviation Vision," Department of the Navy, June 2005, p. 68-71.

98. Paul G. Kaminski, "Low Observables: The Air Force and Stealth," in Jacob Neufeld, George M. Watson, and David Chenoweth, eds., *Technology and the Air Force: A Retrospective Assessment*, Air Force History and Museums Program, 1997, p. 307.

Of course, the F-117 owed its fast development in part to the program's security classification. That meant "the F-117 was not in visible competition with other Air Force programs," said Kaminski. Security also gave the F-117 program incentive to "find all the problems early and fix them," Kaminski added. Radical as it was, the F-117 sought to minimize risk. The choice to build a fighter, not a bomber, was made for the art of the doable. With the program underway, managers made "a conscious decision to rely on as much off-the-shelf hardware as possible. Finally, the F-117 program set up and built facilities for a steady, low-rate production. Kaminski cited it as one of the few modern aircraft programs built close to predicted production rates—without the cost penalty of "over-facilitizing." All that stands as good advice for the 2018 bomber.

COST ISSUE

Cost will undoubtedly become a sticking point. The 2018 bomber will almost certainly be a small fleet—probably no more than 100 aircraft. Economies of scale won't be possible. This is not like the F-35 program, where the prospect of up to 3,000 units spreads initial investment and production costs over time and over many purchasers.

Many factors will heighten the expense of the 2018 bomber. Topping the list is the clear projection of extensive software integration for advanced avionics. The Air Force intends to take full advantage of aerospace industry lessons learned from F-22, F-35 and other programs. Accurately estimating and controlling cost will be a top priority.

Still, building the 2018 bomber will take a national, strategic commitment. There's no question that the nation can afford it. Defense spending—yes, even with the high costs of Iraq—remains remarkably affordable—about 3.9 percent of America's vast $13 trillion economy. This is a historically low percentage of the nation's wealth. For purpose of comparison, consider a December report from the US economic front line. The investment banking firm Goldman Sachs announced plans to award some $16 billion (not million; billion) dollars in year-end bonuses, based on 2006 revenues of about $37 billion.[99]

America can afford the new bomber. It all depends on how much Americans want to invest in their own security. Yet the spending won't be popular. Defense spending never is. Americans will demand a clear strategic accounting of national priorities—not only from the Pentagon but also from the Air Force, which will be called on to act as steward of the public funds.

MAKING THE CASE

Eaker heard all that in his time, too. He wrote of the almost visceral reaction against bombers displayed by many in the public. As unmistakably offensive weapons, bombers ran counter to the deep American belief that the purpose of the military should be essentially defensive in character, capable of protecting its own shores but not designed to facilitate foreign entanglements. As Eaker wrote, "The bomber, like the snake in the grass, is a particularly unpleasant fellow. He was unpopular with all and sundry because of his ability to drop high explosives, not always well aimed, at some establishments and peoples heretofore believed safe from molestation in warfare."[100]

Although Eaker was writing early in World War II, the feelings echo down through the years. Add in the cost of aircraft today, a dose of service rivalry, and persistent federal budget deficits and the tide against bombers runs strong.

Yet the arguments in favor of bombers are even stronger.

"The Air Force owes its existence to the strategic bombing mission," said Thompson of the Lexington Institute.[101] He added, "The rise of American airpower from obscurity to independence during the first half of the 20th century can be attributed mainly to the contention of aviators that long-range aircraft could leap beyond battling armies to strike the vital centers of enemy power." In 1947, Gen. Dwight D. Eisenhower, the wartime Supreme Allied Commander in Europe, testified to Congress that America should have an independent Air Force because of "the paramount influence of airpower upon modern warfare."[102]

That has not changed. Making the case to end the bomber gap is up to the United States Air Force and to all those who believe that airpower remains at the core of national security. ■

99. Mary Katherine Burke and Elizabeth Kolleeny, "What To Do With Your Goldman Sachs Bonus," ABC News.com, Dec. 13, 2006.

100. James Parton, "*Air Force Spoken Here:" General Ira Eaker and the Command of the Air,* p. 118.

101. Loren Thompson, "Searching for the Next B-52," *Armed Forces Journal*, September 2006.

102. Gen. Dwight D. Eisenhower, testimony to Congress, March 25, 1947.