

Long Arm o



By John A. Tirpak, Executive Editor



Transformation studies place emphasis on long-range strike capability, but their focus is on munitions not platforms. Here, a B-2—possibly the last of the Air Force's big bombers—releases a stealthy new Joint Air-to-Surface Stand-off Missile on a test mission.



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USAF is looking to new technologies and techniques to boost its power to hit hard over great distances.

Air Force

THE Air Force is rethinking long-range strike, a term that used to mean only one thing: big bombers. As the service adjusts to the Pentagon's new capabilities-based strategy and focuses on desired effects rather than the platforms needed to achieve them, the eventual successor to today's bomber fleet remains intentionally unsettled.

Moreover, the distinction between long- and short-range systems is becoming increasingly blurred, as fighters, extended by air refueling, are used to conduct what could be termed "strategic" missions lasting well over a dozen hours.

To be sure, the Air Force plans to be in the big bomber business for decades to come, as its existing fleet of B-1s, B-2s, and B-52s fills out a long and robust service life armed with powerful new munitions and the latest in avionics. Bombers also have done extremely well in recent combat, giving rise to a new generation of bomber advocates.

This much seems clear, though: The Air Force won't be buying any more bombers as it has come to think of them over the last half-century.

"We are not going to spend any



The satellite-guided 2,000-pound Joint Direct Attack Munition was a star of the campaign in Afghanistan, but more precise 500- and 250-pound models will expand the number of targets that can be destroyed per sortie.

more money on buying new ‘old’ aircraft,” Air Force Secretary James G. Roche said in an interview with *Air Force Magazine*. Going back into production with, for example, the B-2 would be very expensive and add to a capability that Roche said is already more than sufficient.

“In the area of blowing things up, there are two kinds of things involved: One is fixed, the other is moving,” Roche explained. Noting a profusion of new and existing munitions—three versions of the Joint Direct Attack Munition, new stealthy standoff missiles and bombs, conventional air- and sea-launched cruise missiles—Roche said fixed targets, such as bridges and power transformers, can be hit “over and over and over. How many times do you want to bounce the rubble around?”

The thrust for the future, he said, will be on quickly finding and hitting mobile targets.

A Different Problem

“Movers—things that move, ... pop up, ... hide and expose themselves for short periods of time, and then hide again—[pose] a completely different problem” than do the targets traditionally associated with bombers, Roche said. Such targets don’t favor a solution derived from a large aircraft moving at subsonic speed. Preferably, these targets will be found quickly and a “fast mover” aircraft or missile will be swiftly dispatched to swoop in and destroy it, he said.

With surface-to-air missiles, cruise missile launchers, command posts, and weapons of mass destruction—even biological weapons labs—all now on wheels, time-critical or time-sensitive targets will be the driver of the future long-range strike requirements.

Moreover, slow bombers—even stealthy ones—will see their missions altered by the qualities of their own weapons.

Edward C. Aldridge, the Pentagon’s acquisition, technology, and logistics chief, observed that the B-2, when equipped with new, small weapons, will be in a paradoxical situation over the target area.

A B-2 could carry “hundreds” of the new 250-pound Small Diameter Bombs, Aldridge noted in remarks to defense reporters in August. “But in order to deliver those bombs on target, you [have to] open the bomb bay, and the stealth capability of the bomber goes away. And [with] hundreds of bombs in the bomb bay, your bomb bay doors are open all the time,” thus exposing the B-2 far more to enemy detection.

“While the bomber is over the target, it probably would be very advantageous to have a supersonic capability because that keeps [the aircraft] out of the target area for a given period of time,” Aldridge noted. The ability to supercruise—fly at supersonic speed without using gas-guzzling afterburners—is “one of the characteristics that you want” and is

resident “within the F-22,” the Air Force’s next air dominance fighter.

The successor to the current bomber fleet will therefore have these characteristics: high speed, stealth, extreme precision, and the flexibility to adapt to a changing battlefield virtually minute by minute.

The Air Force has a study under way on what it wants to do for future long-range strike but is purposely not assuming the answer will be a new aircraft.

“We used to call it a long-range strike aircraft, because we were doing a long-range strike aircraft study,” said Maj. Gen. Daniel P. Leaf, USAF director of operational requirements.

A New Study

“Then we realized, ‘Guess what, folks? It might not be an airplane.’ [It] might be suborbital, might be exoatmospheric, orbital, it might be an airplane. At this point, as we do our study, we don’t want to limit our horizons ... and jump to conclusions.” The study name was reduced to simply “Long-Range Strike.”

The study is looking at what kind of capability the Air Force would like to have to replace its bombers when the existing fleet falls below a certain minimum, somewhere in the 2030 time frame. According to the Air Force’s November 2001 “Long-Range Strike Aircraft White Paper”—also known as the Bomber Roadmap—a new acquisition effort would have to be launched circa 2015.

To meet that timetable, Leaf said it “would be reasonable to make an investment in the ‘06 POM” [Program Objective Memorandum, the six-year funding plan], so some sort of firm direction will be needed before working the POM. He added that the solution could be a hypersonic platform or missile, or even a directed-energy weapon, but nothing has yet been ruled out.

Aldridge told the Air Force in November 2001 that he wanted to accelerate the Long-Range Strike Aircraft program and move the start date up to sometime in the next few years.

An update to the roadmap, set for publication this fall, was reported to have moved the desired start of a new long-range strike platform forward to 2012. A variety of applicable technology demonstrations or

experiments in the interim also figure in the new roadmap.

The Pentagon's transformation studies of last year, as well as policy documents bearing the signature of Defense Secretary Donald H. Rumsfeld, put at the top of the list of needed future systems stealthy platforms that can swiftly strike at great distances with large weapon payloads. It also put strong emphasis on new standoff munitions that could pack a bigger punch in a smaller size, with greater range. (See "Bomber Questions," September 2001, p. 36.)

The 2001 Bomber Roadmap specified a fleet of just 96 combat-ready bombers out of a fleet of 157 through the mid-2020s. The force would comprise 60 B-1Bs, 21 B-2s, and 76 B-52s. Of those, 36 B-1Bs, 16 B-2s, and 44 B-52s would be ready for war at any given time, while the remaining aircraft would be in maintenance, test, or training.

Last year, the Air Force stunned Congress by asking for permission to reduce its fleet of 96 B-1Bs to 60, with the proviso that the funds saved be plowed back into the remaining aircraft to enhance their performance and capability. Earlier this summer, the plan moved forward as B-1 operations ended at McConnell AFB, Kan., Mountain Home AFB, Idaho, and Robins AFB, Ga., and the B-1s from those bases began to consolidate at Dyess AFB, Tex., and Ellsworth AFB, S.D.

The smaller overall bomber force



USAF photo by MSgt. Dave Nolan

USAF is retiring a third of the B-1B fleet. Savings are to be plowed back into the remaining 60 aircraft. The Air Force plans to give all B-1Bs structural, avionics, and weapon upgrades over the next five years.

would receive more than \$6 billion worth of upgrades during the current five-year budget cycle, according to the 2001 roadmap, and that, Roche said, includes integration of weapons such as the Joint Air-to-Surface Standoff Missile, a stealthy missile with a range in excess of 200 miles.

"A B-1 with JASSM and its three rotary launchers will become quite an exciting aircraft," Roche asserted. "With a combat radius, by the way, of roughly 1,300 to 1,400 miles and about two hours time on station."

The 2001 Bomber Roadmap outlined modifications and improve-

ments to the three bombers through 2007 that Leaf summarized as chiefly "enhancements to survivability and situation awareness." In addition, "there are always reliability, maintainability upgrades. Those are most pressing on the B-1," he said.

Spending on bomber improvements is programmed to rise steadily from about \$650 million in Fiscal 2002 to about \$1.3 billion in Fiscal 2007.

On the B-1B, principal upgrades include enhanced electronic warfare systems, radar improvements, data links, displays, and new weapons. For the B-2, digital data links, new weapons—including a unique 5,000-pound bunker buster—forward area shelters, stealth maintainability measures, engine and radar improvements, and computer upgrades are the high priorities. For the B-52, electronic countermeasures, data links, and new weapons get primary attention.

New Capabilities

The Air Force is looking at long-range strike in the near, mid-, and far term. Recent combat experience in the Balkans and Afghanistan has shown that bombers have acquired some impressive new capabilities with regard to precision and flexibility, and these are the lasting hallmarks of the long-range strike mission well into the future.

"Flexible application of precision ordnance ... in mass" is the way Leaf



Some believe the next long-range strike platform will present only modest advances and resemble today's bomber aircraft. Suborbital and hypersonic craft are also strong contenders.

summarized how the service is thinking about its bombers.

In Kosovo, Leaf pointed out, the B-2 was routinely able to achieve the destruction of 15 or more targets on a single mission, forever upending the calculus of airplanes needed per target killed, to “targets killed per airplane per mission.”

In Afghanistan, B-52s orbited the battlefield, on call to precisely deliver 2,000 pounds of ordnance to any ground unit requesting it, and B-1s were diverted to new targets while on their way to a bombing run.

“Who would have ever thought you’d have B-52s doing CAS [Close Air Support]?” Leaf asked, incredulous.

“The fact that you can dynamically retarget precision ordnance and employ [it] in mass from bombers is a very, very significant shift,” he went on. Coupled with increasing connectivity with the myriad of air- and space-based sensors, ground units in visual contact with targets, and links to “operational-level control” at a regional air operations center, “we put those three together, we get a ... dramatic force multiplication,” he asserted.

This conclusion holds despite the fact that bombers in Afghanistan enjoyed what Leaf termed a “very permissive air defense environment,” meaning that enemy air defenses were quickly destroyed or subdued and enemy fighters were never launched to challenge US aircraft.

Bombers in the early phase of Operation Enduring Freedom delivered 70 percent of the ordnance, while flying only 10 percent of the sorties.

In a less permissive combat arena, bombers will revert to the Air Force’s tiered approach. Stealthy B-2s would serve as deep penetrators, with B-1Bs serving as penetrators—aided by countermeasures and speed—after major air defenses have been reduced. B-52s would either be used as stand-off platforms or to overfly the targets directly when air dominance has been achieved and defenses completely rolled back.

For the near term, bombers are considered in good shape. Upgrades for all three types are funded, and the munitions program is moving ahead on schedule.

■ The production rate of the JDAM has been trebled since stocks came perilously close to being depleted in last year’s campaign against the Taliban and al Qaeda. The weapon is now available in 1,000- and 2,000-pound versions, and a 500-pound model is expected to be fielded within a couple of years. The 500-pound JDAM will allow the B-2 to strike 80 targets on one mission.

■ The JASSM has cleared its test program and is in production, and the Air Force is considering development of an extended-range version, called JASSM-ER, which would increase its standoff distance to perhaps 500 miles. Lockheed Martin, which builds the missile, believes

that a more efficient engine and using internal volume for additional fuel would allow the longer range without changing the weapon’s external dimensions, called the “mold line.” Keeping the same mold line would dramatically reduce development and test cost and time. The JASSM has a 1,000-pound warhead.

■ The Air Force is continuing to convert nuclear AGM-86B Air Launched Cruise Missiles to conventional AGM-86C and D models, the latter of which have the ability to penetrate hard targets. The Conventional Air Launched Cruise Missile has a range in excess of 500 miles. However, since stocks of ALCMs available for conversion are limited, the JASSM-ER seems to be the preferred follow-on in this category.

■ The Joint Standoff Weapon is a stealthy glide vehicle that carries submunitions such as the Sensor Fuzed Weapon. Each one can be released about 40 miles from the target area and, with the SFW, attack as many as 120 armored vehicles on the ground.

■ The Small Diameter Bomb, a 250-pound, satellite-guided munition, will make its operational debut in the next five years. Its range is classified but expected to be extended by pop-out wings and the speed and altitude of the aircraft using it. A Phase 3 version may have the ability to loiter or autonomously seek out targets. The B-2 is set to carry between 64 and 192 SDBs on one mission. The Air Force is planning to acquire 12,000 fixed-target versions and a like number of the moving-target version. Lockheed Martin and Boeing are competing for the program.

The Small Diameter Bomb is considered one of the most significant programs on the books because it will dramatically increase the strike capability of every combat aircraft in the inventory. In the case of the F-22, it will permit the destruction of up to eight targets on a single mission.

Besides the increased “loadout” (number of weapons), the smaller SDB reduces the possibilities of collateral damage, Roche pointed out.

“If you make a mistake, you want to limit the amount of the mistake,” he said. “Or you want to blow something up, but not blow up the thing next to it.”



A test JASSM reaches impact point. Stealthy, autonomous, and long-legged, JASSM exemplifies future long-range strike munitions. An extended-range model is also being considered.

Mindful that GPS signals can be jammed, the Air Force is also readying other types of guidance for the SDB that would yield comparable precision but be resistant to jamming. These are expected to include a suite involving laser designation, other off-board sensors, and possibly millimeter-wave radar. (See “Smaller Bombs for Stealthy Aircraft,” July 2001, p. 42.)

“We’ve pretty much got the near term covered,” a senior Air Force official said, “provided the funding stream is not interrupted. These are all, every one of them, high priorities. This is our attack capability for the next decade.”

For the midterm—considered the period from about 2008 to 2012—upgrades to the three bombers in the area of connectivity with off-board sensors, as well as improvements in both self-protection systems and possible escort protection, are considered sufficient to keep the fleet healthy in terms of combat effectiveness. A bigger question mark hangs over the health of the airframes themselves.

The B-2, being newest of the three, is expected to serve without any structural problems into the 2020s. The only unknown is how gracefully its composite materials will age. Although composites have been in widespread aerospace use for 20 years, it remains to be seen whether they will hold up as well as the alloys used in the B-1 and B-52.

“The Bad Teeth”

The B-1 is generally considered in the worst structural shape of the three bombers—a key fact in the decision to retire a third of the fleet. Movable wings, low-level operations, violent maneuvers, and a history of chronic parts shortages have made it a challenge to keep ready.

The reduction of 36 aircraft from the B-1 fleet was, in part, a move to “get rid of the bad teeth” in the B-1 force, Roche said. The retiring aircraft will comprise all of those built in 1983 and most built in 1984, and the remaining fleet will consist of mostly the lowest-age, least-abused aircraft. The 60 that remain will benefit from better spares stocks, the availability of some of the retired ones for cannibalization, and new, less-failure-prone avionics.

The low-level aspect of the B-52’s



Staff photo by John A. Tirpak

An FB-22 model sits in Air Force Secretary James Roche’s office.

The FB-22

The operational utility of bombers in the new, riskier battlefield of faster, smarter, and longer-ranged defenses is one of the top reasons the Air Force is looking at the F-22 and a larger-winged, longer-ranged variant, the FB-22, as midterm strike possibilities, according to Secretary of the Air Force James G. Roche.

“The F-22 ... has about three times the range of any fighter-attack airplane, when loaded with weapons,” Roche said. Too often, he said, ranges are quoted for current aircraft that do not include the weight or drag of weapons carried externally. The F-22, with internal carriage of its full weapons load, can attack a target 600 miles away and return on internal fuel, Roche said.

Enhancing this capability by adding range and weapons load resulted in the idea for the FB-22, he said, describing it as a “regional bomber,” with a role comparable to that previously covered by the F-111.

The avionics are identical for the F-22 and an FB-22, said Roche, meaning that “one of the most troublesome things” about developing a new aircraft is done. Likewise, engines, the cockpit, and much of the airframe would be similar, and it would still be stealthy, dramatically reducing the cost to fill this new niche. Optimized for ground attack, though, the FB-22 would not be a dogfighter.

“Much bigger wing, more fuel, you can carry more things—but you can’t fight,” Roche summed up. The payoff would be “instead of carrying eight Small Diameter Bombs on the F-22, you can carry 30 on the FB-22,” with a range of 1,600 miles. Such a capability would, in a smaller aircraft, duplicate the fighting effectiveness of two B-2 bombers armed with 2,000-pound JDAMs. Like the B-2, the FB-22 would carry two pilots, since missions could last more than 12 hours.

“That complements the bomber force, the long-range strike force,” Roche said. He added that “long range is a function of with or without tankers. With tankers, almost anything is long range.” For time-sensitive targets like weapons of mass destruction, command posts, or air-defense nodes, the FB-22 “may be a valuable device.”

The FB-22 is, however, “a notional thing,” Roche said. “You have the option to start it any time you have a production line with the F-22. ... Because the more you do with the F-22 in avionics, electronics, etc., it just translates directly.”

There is no need to rush into an FB-22 program, Roche said, since the immediate needs of the bomber force are met, and the focus for the near term should be on getting the F-22 into service. The FB-22 is a concept that the Air Force could “keep ... warm for a couple of years” as the service evaluates the threat and the health of the bomber force in the decade to come.



The B-52 could serve another 20 years. This BUFF is en route from Afghanistan. Its performance there—as well as that of the B-1B and B-2—spawned a new generation of bomber advocates.

mission has been eliminated, meaning the aircraft will fly mostly benign flight profiles at high altitudes. Air Force officials said the way in which the B-52 is used now, coupled with the relatively easy life the remaining aircraft have led—H models that mostly “sat alert” for nuclear missions over the last 40 years—means there is plenty of time left in the airframes.

“Based on current projections, all three bombers should be structurally sound for the next four or five decades,” according to the 2001 Bomber Roadmap.

However, Air Force officials have also said they are watching carefully the effects of corrosion—a huge problem on the KC-135 tanker fleet, which is of comparable vintage to the B-52.

The 2001 roadmap also noted that such a long life for the bomber fleet—up to 90 years in the case of the B-52, based on the most recent projections—may be radically curtailed by “significant developments in counterstealth technologies, directed-energy weapons, or proliferation of and advances in surface-to-air missiles and fifth-generation fighters.” Such advances in the hands of adversaries “have the potential to render much of [the bomber fleet] obsolete.”

The Air Force also noted that attrition losses due to combat or accidents, or sudden sharp increases in sustainment costs—such as dimin-

ishing manufacturing sources for parts, especially for the B-52—could spell an earlier end to one or all of the current bombers.

Aldridge said it’s important to think now about what kind of long-range strike capability the Air Force will need in “the 2015–2020 time frame ... because B-52s aren’t going to last forever. ... They’re 50 years old right now.”

For the near term, however, Aldridge said, “What we’re focusing on, rather than the bomber platform, is the munitions that the bombers carry. That’s the important factor.”

For the far term, he said, the next long-range strike platform should probably be “smaller than a B-2” because weapons are now smaller, and the platform should be faster.

Aldridge also said, “High speed, probably a smaller airplane that’s not quite as expensive as the B-2—those are kind of the trade-offs that have to be made. Where all that comes out, I just don’t know at this point in time.”

However, Aldridge noted that a bomber follow-on “could be unmanned, ... supersonic, ... subsonic, it could be FB-22s, ... and it could even come from space. We are not eliminating any possibility for the future. There are activities under way within the Air Force at Wright-Patterson AFB [Ohio] looking at these alternatives.”

Industry is looking at the next step in long-range strike, as well. How-

ever, George K. Muellner, vice president of Air Force systems for Boeing, observed, “There are no clear-cut solutions.” He added, “There’s no immediate path forward that says this is the right technology to pursue.”

Muellner, who was until recently head of Boeing’s Phantom Works advanced technology division, said he believes the greatest potential lies in a solution derived from next-generation launch technology.

He said that work on reusable launch vehicle technologies “is going to drive us down a path to develop a two-stage-to-orbit capability, and that first of the two stages may well be a hypersonic, long-range strike aircraft.”

The technologies necessary for the two vehicles are “the same,” Muellner said.

“The design characteristics are similar. ... You may develop this long-range strike aircraft at a hypersonic closure speed as a result of really trying to drive down the cost of getting to orbit.”

However, Muellner said the technology is not in hand, yet.

“The problem is the thermal environment,” he explained. At speeds of Mach 6 to 8.5, “the conventional materials we use are just not practical.”

“The reality is, we haven’t solved a lot of those problems. ... We have trouble providing thermal protection for these vehicles, period.” Pressed for the most promising possibility, Muellner said he thinks a scramjet-powered vehicle could be the answer.

Yet another study of the possibilities, which will examine doctrine and operational concepts as well as technology, is the subject of an Air Combat Command review, due next April, called the Long-Range Global Precision Engagement Study, or LRGPEs. It was launched at Roche’s direction last summer, after guidance from Aldridge asking for a speedier review of long-term plans for a global attack capability.

Leaf said the Air Force is being “pushed” to provide a “hard answer” on the successor to the bomber force, but he added, “We don’t know. Because we don’t want to know yet. ... It’s not time to lock ourselves into the conventional mind-set.” ■