

The FB-22 is a leading candidate to fulfill USAF's need for an "interim bomber."

The Raptor as Bomber

By John A. Tirpak, Executive Editor



FOR more than two years, the Air Force has been contemplating the development and fielding of a regional bomber variant of its soon-to-be-operational F/A-22 stealth fighter. This "FB-22" is now considered a leading contender to fill a 15-year technological gap between today's fleet of long-range strike aircraft and a still-undefined next generation system, which might incorporate hypersonics or other futuristic technologies.

Since it was unveiled in 2002, the FB-22 concept has evolved to where it would likely have most—though not all—of the Air Force's desired attributes for a regional bomber and do so at an acceptable cost.

Skeptics question whether the system could be delivered within the de-

sired time frame. Even Lockheed Martin, which would adapt its F/A-22 design, cautions that the timing is tight, and a go-ahead would have to be received by the end of this year to achieve the target in-service date of 2015. However, the company believes that, given a quick green light, it can get the airplane—which it sees as the lowest-risk, best value near-term option—on the ramp on time.

The Air Force's now-defunct Bomber Roadmap envisioned waiting until the late 2030s for a next generation capability (see "Long Arm of the Air Force," October 2002, p. 28). For years, USAF forecast a long hiatus in bomber acquisition, arguing that its existing fleet of B-1B, B-2, and B-52 aircraft, with appropriate modifications and new ordnance, could do the long-range strike job

until a new system—possibly orbital, possibly hypersonic—could be acquired.

Congress Takes a Hand

Congress balked, however, at the notion that the US would go some 30 years without producing a new bomber, especially when the value of long-range and long loiter time capabilities seemed to be proved daily during operations in Afghanistan and Iraq. Money was inserted in the Fiscal 2004 defense bill to explore nearer-term possibilities for long-range strike.

The Air Force took a fresh look at the mission, in light of both the technological state of the art and the emerging types of missions needed for the Global War on Terror. It affirmed that the "techno-

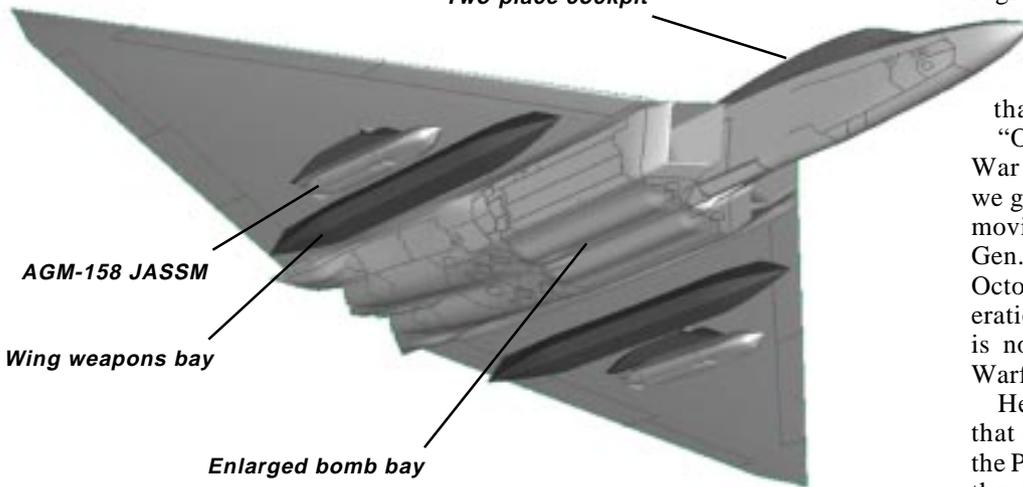


Two-place cockpit

AGM-158 JASSM

Wing weapons bay

Enlarged bomb bay



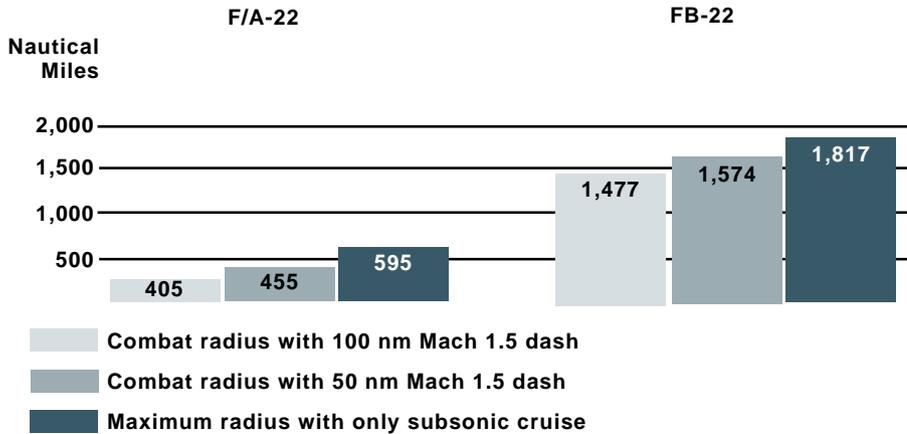
The FB-22 is shown above in an artist's conception. Built around a standard F/A-22, its bigger wings and adapted engines triple the Raptor's range, while stealthy weapons-carrying wing pods and a modified bomb bay boost loadout. The variant is shown launching a Joint Air-to-Surface Standoff Missile.

logical leap” it wanted in a new long-range system was not coming any sooner than had been previously forecast. In that sense, nothing had changed. “On the other hand, as the Global War on Terror continues to evolve, we get a better sense of where we are moving ... in the future,” said Maj. Gen. Stephen M. Goldfein, who until October was USAF’s director of operational capability requirements and is now commander of USAF’s Air Warfare Center at Nellis AFB, Nev. He said it has become “obvious” that to hold targets at risk and meet the Pentagon’s capability objectives, the Air Force cannot wait until the major transformational leap expected in the 2020s.

The Air Force now envisions delivering powerful close support to



The Difference in Mission Radius



ground forces that may often be deep behind enemy lines, enveloped in the heart of an enemy's air defense system. To deliver that promised punch, the Air Force will need a system with long range, a high degree of stealth, precision strike capability, and the ability to defend itself against enemy fighters, as well as the capacity to serve as a forward node in a network of intelligence-surveillance-reconnaissance systems.

In the future, that capability will likely be provided by a "system of systems," Goldfein said. The portfolio could include hypersonic cruise missiles, unmanned combat aircraft, and orbital strike systems, as well as the emerging F/A-22 and F-35 fighters and today's aircraft.

However, "we're going to have a bridge between where we are and where we might end up," Goldfein said.

Now in agreement with Congress on the need, the Air Force in April released a request for information to industry, seeking ideas for systems that could provide a rapid-action, long-range strike capability by 2015.

The responses ranged from conventionally tipped intercontinental ballistic missiles to all-new big bombers (see "Long-Range Strike in a Hurry," November 2004, p. 26). The FB-22 was among the ideas Lockheed Martin offered to the Air Force.

The service accepted the concepts and discussed them with the various companies, but has not yet specified how it will proceed. However, after receiving the pitch from Lockheed, it asked for follow-up briefings on how the company would meet performance and cost targets quoted in its response to the RFI. Lockheed briefed the Air Force F/A-22 Integrated Product Team on those details in early November.

The new FB-22 differs markedly from the one originally conceived, according to John E. Perrigo, senior manager of combat air systems for Lockheed Martin's business development branch. One major change is that it will be stealthier than the F/A-22.

"This thing will have improved stealth capabilities over any other airplane ever built," Perrigo said. The FB-22 will incorporate all the advances in low observable or stealth technology that have come since the F/A-22 design was set, roughly 12 years ago. Perrigo claimed that the FB-22 will be even stealthier than the B-2 bomber.

"It can go places other airplanes can't go. Even the B-2 can't go back there [far behind enemy lines] and survive and ... do global persistent attack."

"More Stealthy"

Compared to the F/A-22, the FB-22 will be "more stealthy, and it

needs to be, because it's going to operate in an environment where the F/A-22 may not. ... It could be down in very direct support of forces on the ground—we see that as one of its prime missions."

The FB-22 would also take advantage of a very significant breakthrough: the ability to carry stores external to the airplane but still do so in a stealthy way. On the FB-22, this takes the form of what Lockheed calls a "wing weapons bay" but which resembles a faceted pod.

The exact shape of the container is classified, and published artist's concepts will likely be intentionally inaccurate "for years," Perrigo said, but the under-wing bay can substantially add to the payload of the FB-22.

Until recently, it was believed that an aircraft could only be stealthy if it carried its weapons internally in its fuselage. The development of the stealthy pod—as well as a "stealth pylon" on which stealthy missiles can be carried—has changed that equation.

"We used to say that had to be internal, but we don't anymore," Perrigo said. He called it "low observable carriage."

Lockheed offered the Air Force six different versions of the FB-22, each one tuned to a particular set of requirements and targets. This was necessary because targets, payload, and range have yet to be defined and are still subject to trade-offs with other platforms and munitions.

However, the most likely version will feature the fuselage of the "basic" F/A-22 with few modifications. Lockheed discovered that lengthening the fuselage immediately added a 25 to 30 percent cost penalty in weight, materials, and development, Perrigo said. Instead of making the airplane longer, a very wide, fuel-carrying "wet" wing will be added, with capability for two to four of the under-wing weapons bays. The wing would be three times the size of that on the F/A-22.

With the additional internal fuel, the FB-22 could have a combat radius of about 1,800 nautical miles—more than triple that of the F/A-22.

While the F/A-22 can carry eight 250-pound Small Diameter Bombs for precision attack, the FB-22 would be able to carry at least 35. It could reach that number by using not only

the under-wing weapons bays but also the side weapons bays used for AIM-9 short-range air-to-air missiles on the basic Raptor, as well as a modified main weapons bay.

Bigger Bombs

Moreover, the FB-22 would be able to carry larger weapons. The basic Raptor is limited to bombs of no more than 1,000 pounds, but the FB-22 could carry any ordnance up to and including a 5,000-pound bunker buster, Perrigo claimed. Two 2,000-pound bombs could be carried internally in the fuselage, thanks to a bumped-out weapons bay door, he said, and two 2,000-pound bombs could be carried in each wing bay, in tandem.

Electro-optical systems will be added that could permit man-in-the-loop terminal guidance of weapons.

To save cost, the aircraft would likely not use thrust-vectoring, two-dimensional nozzles, as on the basic Raptor. However, Lockheed is working with Pratt & Whitney to offer an improved F119 engine that will deliver more power and longer range. The new engine would not be tuned to “supercruise”—flying at supersonic speed without afterburner—but would be able to dash at supersonic speed.

All told, the FB-22 would be able to carry 15,000 pounds of weapons stealthily and up to 30,000 pounds of ordnance when stealth is not necessary.

One area still in question is the Raptor’s vertical tails. Lockheed is



Artist's concept by Erik Simonsen

Lockheed Martin has done preliminary work on a tailless version of the F/A-22. Although this X-44 concept has not flown, USAF will consider such a configuration for the FB-22, if costs stay within bounds.

exploring whether they are even necessary. While removing them might save money on materials and maintenance, there would be additional cost in flight-control computer code. Lockheed is continuing with trade studies to find the optimum configuration, from the perspective of cost. Lockheed has done some work on a tailless F/A-22 concept called the X-44.

“Should the customer decide that they want to take this ... as far as they can ... aerodynamically, that body of work is certainly available to us,” Perrigo noted.

James G. Roche, outgoing Secretary of the Air Force, and Gen. John P. Jumper, the Chief of Staff, both have said that they envision the “bridge” strike aircraft as not only being very long-legged and stealthy but able to defend itself against enemy fighters. The FB-22 would retain capability to carry at least two AIM-120 AMRAAM radar-guided missiles on every mission and will be able to maneuver at six Gs.

What would not have to be developed for the FB-22 as now configured would be a dramatically new set of flight-control laws and avionics, frequently the most expensive aspect of a new weapons system. It was the avionics that proved to be the pacing factor on the F/A-22.

Roche told *Air Force Magazine* that, while no decision has been made to proceed with an FB-22, the idea has great appeal versus going to a new-start program costing as much as \$40 billion.

The concept is “a heck of a lot better than designing from scratch,” Roche said.

The avionics—especially the radar, the sensor fusion, the network-centric features, and the electronic warfare equipment—is “all done. That’s all done,” Roche said.

He also believes that the FB-22—or, as he described it, “an FB-22-like thing” to avoid implying that it is already the Air Force’s preferred



Lockheed Martin artist's concept

The FB-22 (in an artist's conception) was not stretched to increase commonality with the standard Raptor. Life cycle savings alone, compared to producing an entirely new aircraft, could amount to \$10 billion over the program's life.



Operating behind enemy lines, the FB-22 would deliver air support to dispersed ground forces and special operations forces. It could carry more than 35 Small Diameter Bombs, shown here in a B-2 weapons bay.

option—could indeed be developed and fielded “in less than a decade.”

Wing Changes

The key physical changes, he said, will have to do with the wing. More expense would accrue if the “outer mold line changes,” but Lockheed is planning to retain the F/A-22 fuselage, so much of that cost could be avoided.

Other industry experts are not so sure. George K. Mueller, head of Boeing’s Air Force projects division and a former top uniformed USAF acquisition official, said the scope of work may not be as easy as a re-wing job.

It is “not a simple task” to convert the F/A-22 to an FB-22, he said.

Boeing is a partner with Lockheed on the F/A-22 and builds the aircraft’s wings and much of its aft fuselage. It has been suggested by some in Congress and industry that Boeing, with long experience in bombers, might take the lead on an FB-22 program, both to take advantage of its corporate knowledge and to spread some of the combat aircraft work around the industry. (After the F-15 ends production, Lockheed alone will be building strike aircraft for the Air Force.)

“Could we build it? Sure,” said Mueller. “Could Boeing take the lead? Sure,” he added.

He insisted, however, that the FB-22 is “not a quick solution” to the interim strike problem, and “we shouldn’t kid ourselves” that such a

variant project would be anything other than “difficult.”

In obtaining stealth, shaping of the aircraft is the key, Mueller said. To be stealthy, an airplane’s angles have to match up in such a way as to present minimal radar reflection in certain directions. The much larger wing of the FB-22, he said, would have a different angle of sweep, “optimized for long range.”

“It would not be like starting from scratch,” but the technical challenges would be formidable, Mueller asserted. He estimated that it might take until “2025, maybe a little ear-

lier” to field such a capability, by which time the longer-term solution might be at hand. He based his estimate on the time it took to develop the B-2 and the F/A-22, taking into account both the technical difficulties as well as the funding ups and downs suffered by each of those programs.

“The question becomes, What do you really want?” Mueller said. He noted that the Defense Science Board last year determined that the Air Force “probably has adequate platforms ... for the next 10 to 15 years,” given new munitions to keep up with requirements.

Perrigo, however, said that Lockheed is convinced that the re-winging will not disrupt the stealthy aspects of the aircraft and that the company has done considerable wind-tunnel work to satisfy itself that the larger wing will be stable and strong enough, given a few reinforcements at certain stress “hot spots.” He also noted that Boeing, while a partner on the F/A-22, is also the prime contractor for the B-1B and B-52 and stands most to benefit from the Air Force’s reliance on those airplanes for long-range strike.

Two in the Cockpit

Lockheed believes the Air Force will want a two-seat FB-22. The second seat would accommodate a second pilot, who could relieve the front seater on long missions—the aircraft could be flying 15 hours or



The FB-22 could use the avionics and upgrades developed for the F/A-22—an enormous savings of time and money. Above, an F/A-22 finishes up operational testing with an F-16C chase airplane over Nellis AFB, Nev.

more—or take up additional duties with targeting. Lockheed did basic work on a two-seat F/A-22 early in the program, before the second-seat option was canceled to save money, so elaborate stealth refinement of an extended forward fuselage will not be necessary.

Indeed, except for the “60-inch plug” needed for the second crew station, the forward fuselage will not change, Perrigo said. The plug will also provide new room for expanded avionics or fuel. However, the aircraft will not carry a gun.

While Lockheed declined to be specific about the cost of an FB-22 program—the figures are proprietary—Perrigo asserted that the FB-22 could be had for less than twice the cost of an F/A-22.

He also said, “We’re one-fourth or less of any new-start program” and estimated that a new bomber program could cost \$30 billion to \$40 billion.

Because of commonality with the basic Raptor and its engines, Lockheed believes that the FB-22 would represent a savings of “over \$10 billion, over a 20-year period, in logistics costs alone,” Perrigo maintained. That savings would be over and above the cost avoidance of a new-start aircraft.

The Air Force has asked for cost information given a 150-aircraft fleet, or about two wings’ worth of aircraft.

Given a go-ahead in 2005, Perrigo said that Lockheed could get a prototype flying in short order, especially if the Air Force would let the company use an engineering and manufacturing development F/A-22 aircraft as a test airplane. Several test Raptors will not be converted for operational use and could be the basis for a concept demonstrator, should the service wish further risk reduction.

The Computer Version

At the Air Force Association’s national conference in September, Roche told reporters that the service has performed computer modeling and simulation of a notional medium-range bomber.

The aircraft, he said, had “the following characteristics. ... One is, it goes equal to or farther than the B-2, so, say 2,500 miles; it has the capability to fight so as to put stealth in



Lockheed Martin artist's concept

With missions of more than 15 hours, the FB-22 likely would have a two-pilot cockpit. The second pilot could spell the front seater and handle weapons management, as well as other missions.

the daytime; ... it probably goes fast when you want it to go fast and can fight back when it has to fight back.” The notional aircraft would also have “highly accurate” munitions, able to attack deeply buried or hardened targets, and be able to “sense and to attack moving targets.” It would be able to support the Air Force’s intention to support US ground forces deep behind enemy lines and loiter in the battle area.

“Some number of those—to augment the existing long-range strike fleet and as a transition to something [further out]—seemed to make sense,” Roche said. Monies appropriated by Congress to pursue a long-range strike aircraft “are to flesh that out and start to get concepts that fit along those lines.”

The FB-22 would fulfill all of those attributes except the range. The FB-22, at 1,800 miles combat radius, would be 700 miles short of the desired operating range. The only stealthy aircraft today to meet the 2,500-mile target is the B-2, which is very large, with capacious fuel tanks and extremely benign aerodynamics.

Perrigo said the 2,500-mile target is not out of the question, but would require substantially more work than the best value option Lockheed feels meets the broadest part of the Air Force requirement. “We don’t want to challenge ourselves too much because cost and value is clearly on the customer’s mind,” he added. Still,

“we haven’t eliminated anything. ... If money’s no problem, we can do it.” However, achieving it by 2015 would be less certain, he said.

Given the notional FB-22 described, “we think you can reach out and touch 98 to 99 percent of all required target sets for all the government scenarios with this airplane,” Perrigo asserted.

To get to the 2015 initial operational capability, Lockheed envisions starting production around 2011. There would be about an 18-month overlap with production of the F/A-22.

The “baseline” avionics of the FB-22 would be the “Spiral 5” set of improvements for the basic Raptor, which would include “the latest generation radar, the side arrays, all the new things that the F/A-22 will have,” Perrigo said.

“We feel it’s very achievable by 2015,” he said. “We feel very comfortable saying that.”

Jumper cautioned that the Air Force really doesn’t know yet whether an “FB-22-like thing,” as Roche described it, is the right way to go.

“Until we know what the material solutions are” that will be the long-term answer to long-range strike, “then we don’t know how much of a midterm solution we really need.”

He added, however, “I personally believe we’re going to need a midterm solution. ... But how many of these, and when, we still have to be able to work into our [budget planning] process.” ■