USAF leaders made the case that future success hinged on having sufficient numbers of the world’s best air combat machine.

The F-22 On the Line

By John A. Tirpak, Executive Editor

Last spring, Defense Secretary Donald H. Rumsfeld set September as the month in which he would take up the issue of the F-22 fighter. His plans called for him to review whether the Air Force still had a solid need for the stealthy airplane, ought to increase or decrease the planned purchase of 339 aircraft, and should consider developing variants for other missions.

Rumsfeld already said he expected the F-22 to see squadron service. The real issue, he pointed out, was how many of the new fighters actually are needed. Rumsfeld reportedly told members of the Pentagon leadership that he hoped to use this review to finally settle the numbers issue, which was at the heart of the long-running F-22 debate.

A senior Air Force team prepared all summer to present the service’s best F-22 arguments to Undersecretary of De-
USAF leaders made the case that future success hinged on having sufficient numbers of the world’s best air combat machine.

The F-22 On the Line

By John A. Tirpak, Executive Editor

LAST spring, Defense Secretary Donald H. Rumsfeld set September as the month in which he would take up the issue of the F-22 fighter. His plans called for him to review whether the Air Force still had a solid need for the stealthy airplane, ought to increase or decrease the planned purchase of 339 aircraft, and should consider developing variants for other missions.

Rumsfeld already said he expected the F-22 to see squadron service. The real issue, he pointed out, was how many of the new fighters actually are needed. Rumsfeld reportedly told members of the Pentagon leadership that he hoped to use this review to finally settle the numbers issue, which was at the heart of the long-running F-22 debate.

A senior Air Force team prepared all summer to present the service’s best F-22 arguments to Undersecretary of De-
fense Edward C. Aldridge, DOD’s acquisition chief. Aldridge, in turn, was to brief Rumsfeld in time for the Pentagon leader to consider all of the material before making any final decisions about the Fiscal 2004 budget in the fall.

Rumsfeld set the F-22 review in motion in May with the classified Defense Planning Guidance, a document that gives the military services a set of priorities to follow in crafting the budget for the coming fiscal year (that is, 2004). Rumsfeld directed the Air Force to consider whether it still needs all 339 planned F-22s; the impact on operations of buying only 180 of the fighters; the benefits of buying more than 339 aircraft; and the possibilities inherent in a long-range strike variant, tentatively called the FB-22. He sought a range of options.

Under the Gun
Other major systems will be reviewed, too. The Army must again justify its Comanche scout and attack helicopter and indirect fire systems. The Navy must verify its need for both a next-generation aircraft carrier and V-22 tilt-rotor transport, and the Air Force must explain why it should pursue a space based radar system. The Army’s Crusader artillery system, also to have been reviewed, has already been canceled.

“We welcome this opportunity to make the case for the F-22,” Air Force Secretary James G. Roche said at the time the study was launched. “We believe we have a good case to make.”

Pentagon officials made it clear that the review is a tightening not only of operational concepts but also of the DOD purse strings. Rumsfeld wants to find a way to free $10 billion to $12 billion to pay for new transformational technologies and systems, the war against terrorism, and unexpected needs.

The Air Force says it regards Rumsfeld’s attention to the program as an opportunity to restore to the program aircraft cut by previous administrations. It also hopes to flesh out the Aerospace Expeditionary Force structure, which seeks to provide 10 equal packages of airpower for the ever-increasing demands of nonstop overseas contingencies.

In addition to ordering the system reviews, the DPG increased the responsibilities of all the services. The Pentagon added the East Asian littoral to its previous list of “critical areas” (Europe, Northeast Asia, and Southwest Asia) in which there is a demand for US forward presence. The Defense Department is also said to be considering adding a fifth critical area—the Indian Ocean littoral stretching as far south as Madagascar.

Greater geographic responsibilities suggest that the US military will need more people and equipment. In covering today’s requirements, the existing force already is stretched to the breaking point.

The Air Force case for more F-22s rests on three separate but interrelated facts.

Onboard diagnostics will help reduce the number of people and amount of gear needed to deploy the F-22 in the field. The Raptor will not need kid-glove handling: Its stealth surfaces are designed to be maintained on the ramp.

F-22 testing has produced few surprises. Some have been pleasant: The aircraft has proved stealthier than originally expected. Software has always been a challenge and has slowed flight test, but the pace is stepping up.
“We’re taking a very thorough approach,” said Maj. Gen. Daniel P. Leaf, USAF director of operational requirements and one of four senior officers heading the Air Force’s F-22 presentation for the DPG review.


Gaining Access

Leaf said that the Air Force, when it makes presentations to Aldridge and Rumsfeld, will highlight the service’s new Global Strike Task Force concept of operations, which casts the F-22 in a starring role. The GSTF calls for rapidly hitting anti-access targets such as advanced air defense systems, ballistic missile launch sites, weapons of mass destruction, and other capabilities that could threaten US allies in the region or prevent the US from entering the area in force.

The F-22, because of its all-aspect stealth and ability to cruise at supersonic speeds without afterburner, can rapidly strike such targets without first needing to roll back enemy air defenses, Leaf said. Such a capability will be crucial in holding together future political coalitions and securing allied support in a given region.

No other aircraft will be able to get past intense air defense systems and advanced fighters alike on Day 1 of a future war, Leaf said. No target will be inaccessible to the F-22, and its speed and stealth confront the enemy with an “unsolvable problem,” he added.

Rumsfeld’s key advisors emphasized that, in determining service funding levels, innovative concepts of operation will be given a degree of consideration equal to or even greater than the introduction of some remarkable new technology.

Leaf observed that the current planned total buy of 339 F-22s is a budget-driven number, arrived at in the 1997 QDR carried out during the Clinton Administration.

“It’s been reduced over the years due to ... fiscal constraints,” Leaf said. Planned production, which started at 750 in the late 1980s, has, over time, slipped to 648, then 438, and then 339. The cutbacks were initially justified as a response to the demise of the Soviet Union but have proven more troublesome as the tempo of Air Force operations has only gained momentum in the ensuing decade.

“We know that if we wanted to have a full F-22 squadron in each of 10 Air Expeditionary Forces ... that would take somewhere around 380,” Leaf said.

He explained the number this way: The 10 squadrons of 24 aircraft would add up to 240 fighters. Another 140 F-22s would be needed to maintain a schoolhouse for F-22 pilots, to accommodate aircraft in depot maintenance and test, and to have some spares for attrition.

“If we wanted to get the capability of two [squadrons] per AEF, that would take ... somewhere in the vicinity of 750,” he asserted.

However, Leaf observed that “fiscal constraints are real constraints, too. That’s why we’re trying to do better math and analysis.”

That analysis will try to arrive at a sensible number based on many factors. Those include the desire to equally equip all 10 AEFs, the superiority of the F-22’s capabilities when compared to the F-15 it replaces, new concepts of operations, new air-to-air and surface-to-air threats, and the desire to maintain the fighter force at a reasonably low average age.

Fighting Old Age

A senior Air Force official noted that the service would like to get the average age of the fighter inventory back to the old benchmark of 12 years. The current average age of about 20 years is requiring an inordinate amount of funds for maintenance, repair, and spare parts, while also hurting mission capability.

Getting to that average age will be difficult. Assume that the Air Force buys about 110 of the new F-35 Joint Strike Fighters every year starting in 2010. It would have to buy 762 F-22s before that year if it is to get the fleet average age to 12.2 years by 2020. A buy of 339 F-22s would only get the fighter fleet average age to 17.9 years. When the introduction of F-35s ends, average age would again start to climb.

Deptula noted that the 1997 QDR conceded that an expanded buy of “two wings’ worth of F-22s ought to be in the offering” to replace the F-117 and F-15E attack aircraft when they age out of the force around 2020. That would translate to about 180 more F-22s on top of the bare-bones 339 force now in view.

The F-22’s speed in attacking...
ground targets—at first with the 1,000-pound Joint Direct Attack Munition and later with the equally powerful 250-pound Small Diameter Bomb—is what makes it of prime interest to the Air Force now, according to Gen. John P. Jumper, USAF Chief of Staff.

Speaking with reporters in Washington, D.C., in May, Jumper said, “The air-to-air piece is probably less than half of what we are going to count on the F-22 to do.” Its main mission will be striking those anti-access threats that would otherwise keep the US military at bay. When the Small Diameter Bomb comes along, the expectation is that F-22 will be able to carry eight of them, allowing it to accomplish the same destruction on one sortie as four F-117s during the 1991 Gulf War—but at far greater speed.

The F-22’s supersonic capability has not been given the respect it deserves and is not well-understood, Deptula observed. Far from being a flashy stunt, the new capability allows the F-22 to respond as fast as a current fighter but from distances much farther away from a target. This feature will allow F-22s to be stationed beyond the range of enemy ballistic missiles in the opening days of a future conflict. When positioned closer to the enemy, the F-22 will dramatically “shrink adversary threat envelopes,” meaning that its stealth and speed will give enemy air defenses too short a time to detect it, track it, and fire at it, Deptula observed.

“That’s what supersonic gives you,” he said.

Greater Demands

The 339 F-22 benchmark figure was based not only on a desire for defense savings but also on the two–Major Theater War force-sizing concept. The two–MTW concept has been abandoned by the Bush Administration, which replaced it with a more complex formula requiring the military to deal a decisive defeat to two enemies at once, preserving the option to force a regime change, or occupation, of one of them.

In many ways, this new capabilities-based strategy is more demanding than the old strategy, suggesting again that a larger fleet is required to meet the mission.

In developing the Air Force’s contribution to QDR 2001, Deptula said, he tried hard to get the Pentagon to stop thinking in terms of wings of F-22s. Because the Air Force several years ago restructured itself into an expeditionary force of 10 AEFs, the term is really no longer a useful way to think about how aircraft deploy for war and peacetime contingencies.

Instead, Deptula argued that F-22s should be considered in terms of numbers required per AEF.

One-to-one replacement with F-22s of today’s F-15C, F-15E, and F-117 fighters would lead to the need for 2.5 squadrons of F-22s per AEF, Deptula calculated. However, he added, a force of 339 F-22s would provide only nine-tenths of a squadron per AEF. It would take 762 Raptors to provide two squadrons per AEF. To get to the desired 2.5 squadrons per AEF, said Deptula, the Air Force would need 953 of the new fighters.

That’s where what Leaf calls “three-dimensional math” comes in. “We know we need some number of airplanes just to fill out the rotational base [of the AEFs],” Leaf said, “but it’s not just that. You need some number of airplanes, in certain scenarios, to fill out the combat air patrol, the number you have to have airborne, just to have presence and a persistence.” He means that these aircraft would not at that particular time be available for ground attack.

USAF has not yet been able to quantify, for force-sizing purposes, exactly “how much better” the F-22 is when compared to the F-15 it replaces, Leaf noted. Such knowledge will not be available until the service has experience with actual operations. It’s therefore premature to try to develop a formula on how many F-15s equals one F-22, Leaf explained, even though the analysis that goes to Rumsfeld will attempt to answer some of those questions.

“Nonstarter”

A buy of only 180 F-22s—leaving what some call a “silver bullet” force—would impose what one senior USAF official called an “unacceptable operating tempo” on both the aircraft and the pilots who fly them.

“They [the pilots] will vote with their feet when they find they are in the box to be deployed more than six
As with any mass-produced product, the F-22’s price drops as more are built and the learning curve flattens. If the total buy is doubled, the F-22 unit cost will be on a rough par with that of the F-15 and F/A-18E/F.

The F-22 is an “internally funded study of ... the growth possibilities of the F-22,” said Bob Rearden, F-22 program office general manager at Lockheed Martin, the F-22 prime contractor. “We are not under contract to do anything.”

Rearden described the conceptual FB-22 as being about four feet longer than the “vanilla” F-22. It would also have a larger, thicker delta wing. The configuration provides more weapons-carrying space in the fuselage, more lifting area, and more fuel tankage in the wings for longer range. In the FB-22, the side weapons bays would be eliminated to increase the internal volume of the “belly” weapons bays. As a result, the FB-22 would be able to carry “probably about 30” Small Diameter Bombs, Rearden said, adding that it could conceivably carry 70 SDBs.

Two new internal weapons bays for self-defense AIM-120 Advanced Medium-Range Air-to-Air Missiles would occupy stations under the vertical stabilizers. Overall, Rearden said, the airplane would be “about 80 percent common” to the F-22.

Because the aircraft would be a bomb carrier and not a dogfighter, the F-22 thrust-vectoring nozzles would be eliminated to reduce cost. Similarly, the engines, now optimized for supercruise, would be re-tuned for a more fuel-efficient subsonic flight regime. The FB-22 would still be able to dash at supersonic speed “100 miles in, 100 miles out,” Rearden said.

Lockheed also envisions the airplane would be a two-seater. “When you get into 12- and 14-hour missions ... you may want to put a second person on board.”
Rearden observed, although the company has also drawn the aircraft in a single-seat configuration.

The Air Force has shown some interest in the concept, but it has gone no further than a few briefings, Rearden noted.

Air Force officials said the FB-22 is being considered separately from the basic F-22 mission. They do not expect that a portion of the current planned production of the baseline airplane will be set aside for FB-22s.

For Electronic War

The concept of an EA-22—a variant configured for electronic attack—also surfaced in the last year. If built, this airplane would replace the EA-6B Prowler starting in 2011. Leaf said such a variant was considered in a recent analysis of alternatives as to how to conduct the overall airborne electronic attack mission.

On the EA-22, weapons bay doors would be replaced by special door-size apertures or antennas. However, while a prospective EA-22 is attractive because of its tremendous onboard electrical generating capacity and processing power—as well as commonality with the F-22—Pentagon officials said it ranked among the most expensive options for fulfilling the electronic attack mission and was not among the preferred solutions.

While the final buy of F-22s is being debated, the practical development of the aircraft is heading toward an initial operational capability at Langley AFB, Va., in 2005.

Brig. Gen. William J. Jabour, USAF’s program executive officer for bombers and fighters and himself a former F-22 program manager, said the Raptor is making substantial progress in testing and should make its planned in-service dates. The Air Force, however, should not rush the process, he said.

To be declared operational, the F-22 must pass an Initial Operational Test and Evaluation. It is currently slated to begin that process next spring, but Jabour acknowledged the date likely will slip because of delays in the delivery of the F-22’s software.

“Right now, we’re saying that IOT&E is going to start in April ’03, but there’s a lot of risk to that date,” Jabour said. Even if it slips, though, “what’s key is that the Air Force made a conscious decision that this is an event-based program,” he pointed out. “We are not going to enter IOT&E until we’re ready to pass IOT&E, because a failed IOT&E is worse than a late IOT&E.”

There are reserve funds sufficient to cover the slip, but if it lasts much longer than now expected, the Air Force would have to provide additional funds, Jabour noted.

Delays in the program have to do mainly with software and more rapidly clearing the flight envelope. Jabour likened the software problems to those seen when a personal computer freezes up and will not run an application. Valuable test sortie time sometimes is lost because the pilot has to reboot a system. Flight controls are governed by separate software and are not affected, Jabour asserted.

The problem—software instability in the sensor fusion package—has been mostly fixed in the laboratory, but new updated software has not yet been released to the test fleet, Jabour said.

Problems Resolved

Other F-22 problems that have
made headlines—a brake overheating issue and wing vortex that threatened to damage the vertical stabilizers—have been largely resolved, Jabour said.

“We are gathering more data” on the stabilizer issue, but a fix involving a beefed up rudder actuator and some strengthening of some of the ribs in the rudder should do the trick, he said. The change will not affect the mold line of the airplane—its external shape—nor will it affect the F-22’s stealthiness.

The brake issue has been looked at, and the aircraft has been cleared for hot-pit refueling—meaning that ground crews are allowed to refuel the airplane when the brakes are still hot, and this is not considered especially dangerous.

An F-22 a few months ago showed its mettle when it absorbed a bird strike, Jabour noted. On takeoff from Lockheed Martin’s Marietta, Ga., plant, he said, the aircraft collided with a “nine-pound bird,” but the pilot reported that he could feel “no change in engine performance” and landed merely as a precaution.

The Air Force’s F-22 cost predictions, made at last year’s low-rate initial production decision point, are holding up, Jabour said. USAF and DOD estimators had a spirited disagreement about how many aircraft could be produced for the amount of money DOD was willing to make available. DOD estimators said 295; USAF said 331. (Eight already had been procured.)

So far, said Jabour, “we’re tracking to the Air Force’s prediction.” He went on, “For Lot 2, the [DOD] prediction was that we could afford 11 airplanes. We signed that contract with Lockheed for 13 airplanes. ... We bought more airplanes than [DOD] thought we could.”

The Air Force has invested considerable sums to improve F-22’s “producibility,” Jabour said, and USAF predicts it will gain an 18-to-1 return. So far, it looks like those numbers will be correct, assuming the full 339 aircraft fleet is built. “We’ve invested money to reduce the cost of the individual jets,” he said. “We’re on track to get 339.”

Rearden said such improvements include streamlining the production line. As one example, he noted that F-22s will ride along a track through the factory, eliminating the use of a crane to “move the line ... every time an airplane goes out the door.” Shifting all the airplanes on the line to the next station is now expected to take just two hours.

Increases in production are shifting the aircraft’s mission. “The Air Force has an increasing mission emphasis.” Jabour said. “We’re welcome to ask for more F-22s or to suggest shifting the aircraft’s mission emphasis.

“The Air Force is convinced the F-22 will be a thoroughbred, adaptable to many missions and setting the air combat benchmark for 30 years or more. It is also the one system on which all US war plans depend.

In another example, Rearden noted that all the power cables, hydraulics, cooling hoses, and other umbilicals that usually have to be connected to an airplane in assembly will now flow from a single “vault” in the floor beneath each station, reducing accidents and disconnections and saving time as the line moves.

A 44-day production strike at Lockheed Martin also affected the program. The reduced time resulted in slowing the numbers of aircraft available for test, thus slowing the rate at which the Air Force can burn down the required flight test points, Jabour said.

The Rumsfeld review is likely to have heavy input from Stephen A. Cambone, the Pentagon’s new program analysis and evaluation chief and a Rumsfeld confidante. Cambone explained to reporters in Washington in June that the big-ticket systems review is “not a budget-cutting drill” and that good answers are what are being sought. The Air Force, he said, is welcome to ask for more F-22s or to suggest shifting the aircraft’s mission emphasis.

“There’s nothing that is prohibited from being presented,” Cambone noted. However, he pointed out that the money available is not infinite. After taking out personnel costs, the cost of the war, and other earmarked projects, “the total dollars left out of the budget of $379 billion which was requested is not substantial. ... If you want to make changes in the programs and you want to start new programs, then something has to give.”

Still, Cambone demonstrated he’s acutely aware of the pressures facing the Air Force as it mulls the future of the F-22. “The Air Force has an increasing age problem in its aircraft that has to be addressed,” Cambone said. “JSF [the F-35] doesn’t come on for them until after the turn of the decade. The F-22 is here now. It has characteristics and capabilities that other aircraft simply do not have. So you put all that in the mix and ... start weighing the risks, and people make their arguments and ... then a decision is taken, and the budget is done, and the Secretary recommends, the President decides, and away we go.”