USAF plans to keep its operational edge, even with aging combat and support aircraft.

When Aircraft

By **Adam J. Hebert,** Senior Editor

Air Force aircraft are, on average, more than 22 years old—an unprecedented age brought on by the lengthy "procurement holiday" during the 1990s. The service is trying to stay in front of possible problems that tend to creep up as aircraft age, but top officials readily admit that the service is largely in uncharted waters.

The service's aircraft will continue to age dramatically: If all existing acquisition programs are executed as planned, the average USAF aircraft by 2020 will be 29 years old—meaning that for every airplane fresh off the assembly line there will be another that is 58 years old.

Consequently, the Air Force is taking a many-sided approach to managing the problem. On one hand, the service is trying to keep on schedule the procurement of new aircraft to replace older systems. On the other, it is trying to mitigate the problems it sees developing in its older airplanes and provide modifications to maintain their combat capability.

The fighter aircraft situation is typical of the overall problem.

Both the F-15 and F-16 are near the beginning of their planned retirements, while their replacements—the F/A-22 and F-35—are two and seven years away, respectively, from entering service. To bridge the gap, the Air Force is making structural modifications to both the F-15 and F-16 and adding capability in the form of new weapons, computer upgrades, and better radars.

According to Gen. John P. Jumper, USAF Chief of Staff, these changes to the old fighters will preserve their edge until the new fighters come along.

Most of the problems that would prevent fighters from reaching—and going beyond—their planned service lives are being addressed,

Get Old

Two mainstays of the Air Force fleet execute an aerial refueling. Pictured, a 20-year-old F-15C takes on fuel from a 30-year-old KC-135R. Both aircraft have replacements in the works but will remain in service for years.

Staff photo by Guy Aceto

Jumper told *Air Force* Magazine in an interview. Bulkheads that have cracked are being reinforced. Areas of delamination are being examined and fixed.

Yet aging fighters will pose a challenge for the foreseeable future, Jumper said, as the age of the fleet is at historic highs. "We've invested billions of dollars and programs to maintain their safety and viability until we are able to bring aboard the new generation," he said, adding, "We're dealing with it a piece at a time."

One of those pieces is the F-15. Currently, USAF is in the process of replacing the aluminum honeycomb component used in the tails and wingtips with a new structural technology called Grid-Lock. The importance of a seemingly esoteric engineering exercise like honeycomb component replacement was brought to light last spring when an F-15 flying a test mission out of Eglin AFB, Fla., broke apart at Mach 2 over the Gulf of Mexico, killing its pilot, Maj. James A. Duricy.

The official investigation found that the airplane's honeycomb component in the left vertical tail stabilizer had "a structural failure," causing the stabilizer's leading edge to break off. This quickly led to loss of control, further catastrophic structural failures, and the destruction of the airplane. The F-15 in question had an unremarkable maintenance history and was flown by a pilot with a "spotless record," according to the accident report.

The parts that failed had been inspected every 200 flight hours, according to the investigation report. However, the inspections turned up "no indication whatsoever of any structural flaw or defect" in the aircraft's tail.

Battling the Unknowns

In fact, the biggest concerns with aging aircraft are the unknowns.

"Many of the problems with aging material have emerged with little or no warning," said Raymond A. Pyles of RAND, who testified on the subject before a House panel. "This raises the concern that an unexpected phenomenon may suddenly jeopardize an entire fleet's flight safety, mission readiness, or support costs."

Lt. Gen. Michael E. Zettler, USAF deputy chief of staff for installations and logistics, told *Air Force* Magazine that the F-15 honeycombs are worrisome because problems in individual aircraft are "very difficult to detect."

According to Jerry Mobley, an engineer at Warner Robins Air Logistics Center, Ga., honeycomb is a "good structure" that offers a high strength-to-weight ratio. Over time, though, concerns about honeycomb parts developed because water has a way of working its way inside, leading to corrosion and component disbonding.

Over the course of six years, the Air Force will swap out F-15 Eagle honeycomb structures for Grid-Lock components, as the Eagles transition through the depot for scheduled overhauls. To date, about 20 percent of the F-15 fleet has been reworked.

These types of seemingly isolated problems become more common with age and have a cumulative effect. "The structural work we had to do on the F-15 10 years ago … was very modest," Zettler said. "It is more than double that today."

The F-15 is one of the Air Force's younger aircraft—and not one of the bad actors. Zettler said the KC-135 is "problematic." The A-10 is seeing the effects of structural defects that have to be fixed "with a sense of urgency." The F-16 needs structural improvements to reach its 8,000-hour service life. The C-5 spends entirely too much time in the depot.

"Those are long-term problems," he added.

Heavy Use

The global war on terrorism has sharply increased aircraft flying hours, which were up 12 percent in Fiscal 2002. Fortunately, the Air Force has been able to manage its aging problems with minimal operational disruption.

Officials said the hard work and long hours put in by maintainers mean older airplanes have not been a hindrance to either Operation Noble Eagle, in which USAF active and reserve forces fly Combat Air Patrols over US cities, or Operation Enduring Freedom in Afghanistan.

Air Force Secretary James G. Roche has warned of "wear and tear" on fighter aircraft. "And certainly, if you talk to the maintainers, those folks who are working on the F-15Cs, the amount of time is really getting horrendous," he said.

Maintainers are keeping the aging aircraft ready "by many, many means, all quite proper, but they really have to work at it," Roche added.

Jumper noted that, while fighters "are racking up lots of hours" enforcing no-fly zones and flying CAPs, those hours are "not as stressful" as the hours of high G maneuvering the aircraft were expected to get in normal training operations at home. Fighters in no-fly zones and on CAPs tend to fly mostly straight and level, without the violent combat maneuvering they would experience in training.

Staff photo by Guy Aceto

USAF is trying to head off age-related problems. Here, an X-ray machine performs a nonintrusive inspection—maintainers can spot cracks or other defects without having to rip the aircraft apart.

"Now, what does that mean?" asked Jumper. "We don't know yet." The Air Force is trying to determine if long, reasonably benign flights will offset planned retirement dates.

According to Zettler, there has been a drop in the major parts requirements for aircraft flying these nontypical flight profiles. "We tend to use more spare parts per sortie than we do per hour," Zettler said. The biggest short-term result is that the CAP fighters need more consumable parts, phased inspections, and routine maintenance work, he said.

During the past year, the F-16 fleet was less stressed, added Zettler, because longer missions mean systems are turned on and off less frequently. That and the CAP profile contributed to higher F-16 Mission Capable rates. Further, since Air National Guard F-16As fly the lion's share of the CAP missions, MC rates for the older F-16As increased faster than MC rates for the newer F-16Cs. The older F-16s have seen their highest readiness level since Fiscal 1997.

These flight hours do not accumulate without cost, however. Col. Michael R. Carpenter, director of plans for USAF's Aging Aircraft System Program Office, Wright–Patterson AFB, Ohio, noted that the "hidden cost in operations" may come in later years—when aircraft begin to wear out faster. Carpenter cautioned that the Air Force may be setting itself up for a future problem because "there's a hidden bill out there."

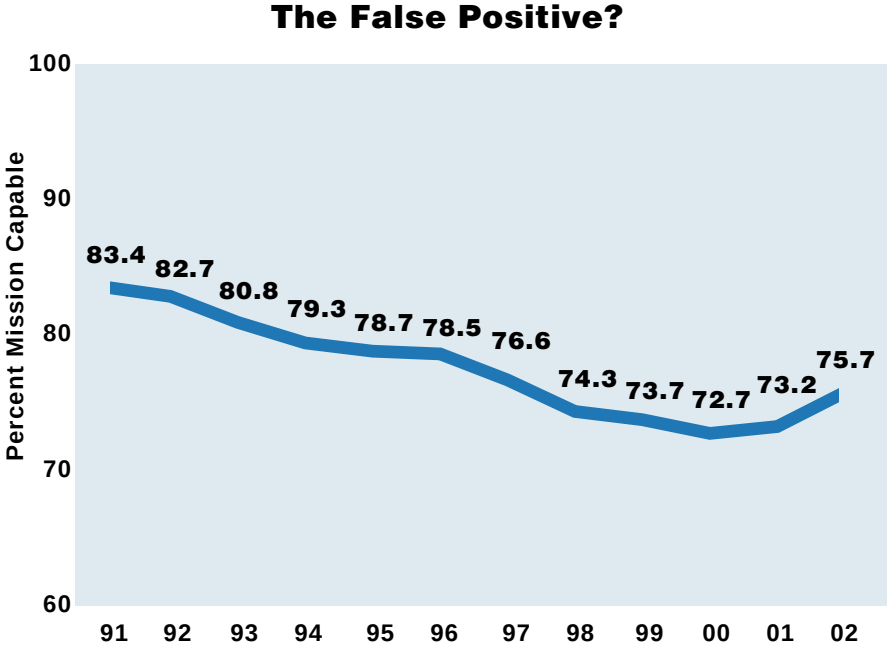
Staff photo by Guy Aceto

An Oregon Air National Guard F-15A flies a Combat Air Patrol. Low-stress CAP missions have helped improve the near-term reliability of fighters such as this, but flying hours are now accumulating more rapidly.

Zettler confirmed that even the "easy" CAP hours could have long-term consequences, partly because the aircraft are flying with heavy munitions loads. From a structural standpoint, he said, "we are accruing more structural hours than we would have in a normal training environment."

The Air Force has already decided to accept some additional risk. Plans call for F-16s to be retired faster than F-35 Joint Strike Fighters are fielded. The risk inherent in this so-called "fighter bathtub" will increase if F-16s reach the end of their service lives even sooner than expected.

Zettler said the Air Force continuously re-evaluates modernization plans, and a year of the war on terrorism has not forced any changes in long-term fighter modernization strategies.



Mission Capable rates are moving up thanks to the hard work of maintainers and full funding of spare parts. Still, USAF leaders base some of the MC turnaround on CAP missions, which are less stressful on fighter airframes.

Single-Point Failure?

The same cannot be said for airlifters and tankers. The war on terror has heightened concerns about the long-term health of airlift and air refueling aircraft. "We are aging in uncharted waters," Zettler commented.

The demands of Enduring Freedom and Noble Eagle have added new urgency to the Air Force's recent efforts to obtain new, Boeing 767–based aircraft as next-generation tankers. When looking at the logistical consequences of 9/11, "you come back to the tankers all the time," said Zettler. Air refueling aircraft are needed for homeland defense and for overseas operations. Their value goes beyond the Air Force; the Navy relies upon them as well.

By aviation standards the tankers are ancient. The average USAF tanker is now 39 years old and that average

includes relatively young KC-10s purchased in the 1980s. The 707–based KC-135s average 43 years of age.

"You'd better pay attention to tankers and you ought to find a way to modernize that tanker fleet," Zettler said.

The tankers are "the lifeblood of our fleet," Carpenter added, and they have been "worked pretty hard."

The concern is that the KC-135 platforms are so old that a major problem could spring up and force a grounding of the entire fleet.

Analysts at RAND note that unexpected failures in older aircraft had occurred many times before, and it is not far-fetched to believe they could happen again. "Major problems may result from corrosion, insulation cracking, composite delamination ... for which there are no scientific aging models or relevant historical experience," said Pyles. He cited examples of unanticipated failures such as the C-141 weephole, the VC-137 corrosion workload, and the C-5 horizontal stabilizer tie-box fitting.

Generally speaking, aircraft built before 1970 are more susceptible to corrosion, Carpenter noted. Newer aircraft are also simply more efficient.

"You won't find airlines operating 707–type airplanes," said Zettler. "That would be as inefficient as hell. They want the airplanes in the air; they don't want them sitting in the overhaul facilities."

Over the past 10 years, the amount of KC-135 depot maintenance work has doubled, and the overhaul cost per aircraft has tripled, he added.

These increasing costs may be crowding out funds that could otherwise be used for modernization.

The cost of USAF's flying hour program grows by about 11 percent per year because of aging aircraft. In the Air Force's $3 billion flying hour program, a one percent cost increase translates into a bill of $30 million.

Preventing cost spikes is a major Air Force goal. "We don't field equipment and let it operate until something goes wrong," Zettler said.

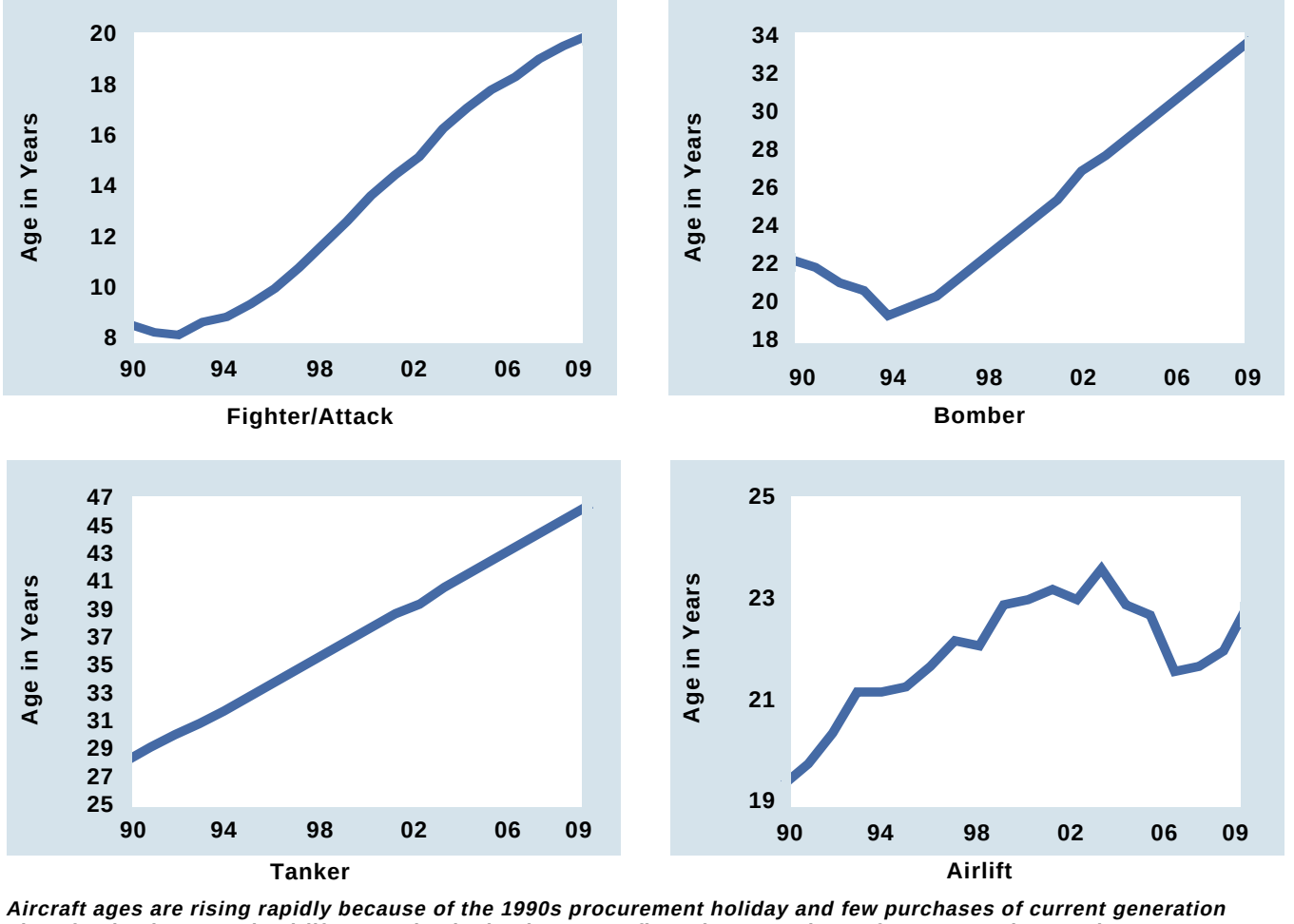
Treating Obsolescence

Another danger is that some parts may simply become unavailable. Older aircraft are hindered because sometimes there are no vendors willing to manufacture components that are technologically obsolete and have no commercial application.

Zettler noted that aging avionics represent a problem because no one makes vacuum tubes anymore. "That is real—we still have a few of those situations around," he said. "More importantly, there are few makers of transistors and diodes and chips" of the type required by many USAF aircraft.

Occasionally, Zettler said, the Air Force will seek a spare part but find no suppliers because the component is obsolete. In these cases, the ser-

The Four Faces of Aging Air Force Aircraft



Aircraft ages are rising rapidly because of the 1990s procurement holiday and few purchases of current generation aircraft. The downturn in airlifter age, beginning in 2003, reflects large numbers of C-17s entering service.

Staff photo by Guy Aceto

The BUFF at 80?

USAF's B-52 fleet now is expected to remain in service until around 2040. Thus, the venerable bombers—delivered in 1961 and 1962—are roughly halfway through their service lives.

Col. Michael R. Carpenter, director of plans for USAF's Aging Aircraft System Program Office, said the prospect of flying such old airplanes is "a troubling thought."

Fortunately, the B-52s are structurally sound. Carpenter said Strategic Air Command was "obsessed" with ensuring there was no corrosion on the bombers, and SAC maintainers worked overtime to ensure B-52 airframes stayed in top-notch condition.

The B-52 fleet also benefitted from the years the aircraft spent sitting on alert, rather than in the air, during the Cold War and from ceding the more stressful flying profiles to B-1 and B-2 bombers. Consequently, B-52 airframes are in relatively good shape for their age.

In recent years, the Air Force increased its use of the B-52, sending the aircraft to support operations in Iraq, the Balkans, and Afghanistan. That has led to some new age-related problems. For example, last year the service discovered that 53 of its 94 B-52s showed signs of fuel tank erosion, known as Fuel Tank Topcoat Peeling.

Service officials attributed the problem to two factors: an increase in flying hours and a switch from JP-4 to JP-8 jet fuel.

"Age, fuel, and fuel additives are playing a role in this problem," said Rex Cash, B-52 fuels engineer at Tinker AFB, Okla. Other aging aircraft, such as the Air Force's KC-135s and the Navy's P-3, are also developing FTTP problems.

The problem manifested itself in the B-52s when the bombers' boost pumps began failing at a higher rate. With the increased flying time, officials said that B-52s pumped more fuel through their boost pumps in a matter of weeks than they would have used in a normal year's worth of flying.

The Air Force launched a three-year, $12 million study to determine the extent of the problem and potential solutions. According to Cash, if the topcoats need to be replaced in the entire B-52 fleet, the work could require 20,000 man-hours to complete. Officials had no estimate on cost.

vice will go back to the manufacturer to find the original specifications, then seek another vendor or try to manufacture the necessary components in an Air Force depot.

The Air Force tries to avert such problems by making a lifetime buy if a part is going to be headed out of production. "You generally can see the trend coming," Zettler said, and the lifetime-buy strategy has been executed successfully several times for B-52 components.

Nonetheless, the older the aircraft fleet gets, the more the maintenance bills will grow. Air Force officials noted that an F-15C flying hour is 15 percent less expensive than that of the older F-15A. On the airlift side, C-5As and C-5Bs have similar operating costs, but the newer B models have Mission Capable rates 25 percent higher, and that difference is increasing, according to USAF.

In ongoing research, RAND analysts note that "preliminary estimates indicate that aircraft support costs might grow by as much as $9 billion a year by 2020" if maintenance and procurement trends continue.

Air Force officials believe the solution is a robust modernization program. By pushing forward with plans for the F/A-22, F-35, more C-17s, C-5 upgrades, and next-generation tankers, the Air Force could save even more money than is projected in the long term, Zettler said, because some cost benefits are not easily identified. "I think modernization has to be our first priority," he added.

Newer aircraft will allow the Air Force to retire the aircraft that are most difficult to sustain. Moreover, next-generation equipment is generally easier to maintain from the start. For example, the C-17 is less expensive to fly than the C-141 or C-5, and USAF officials say the F/A-22 will be 25 to 30 percent less expensive to operate than the F-15.

When the F/A-22 and F-35 begin to enter service, the average age of fighters will begin to decline, but overall fleet averages will only level off.

Consequently, Carpenter noted that the Air Force is "always going to have aging aircraft" and must continue to devote the resources needed to study the issue and pursue innovative solutions to head off potential problems. ■