

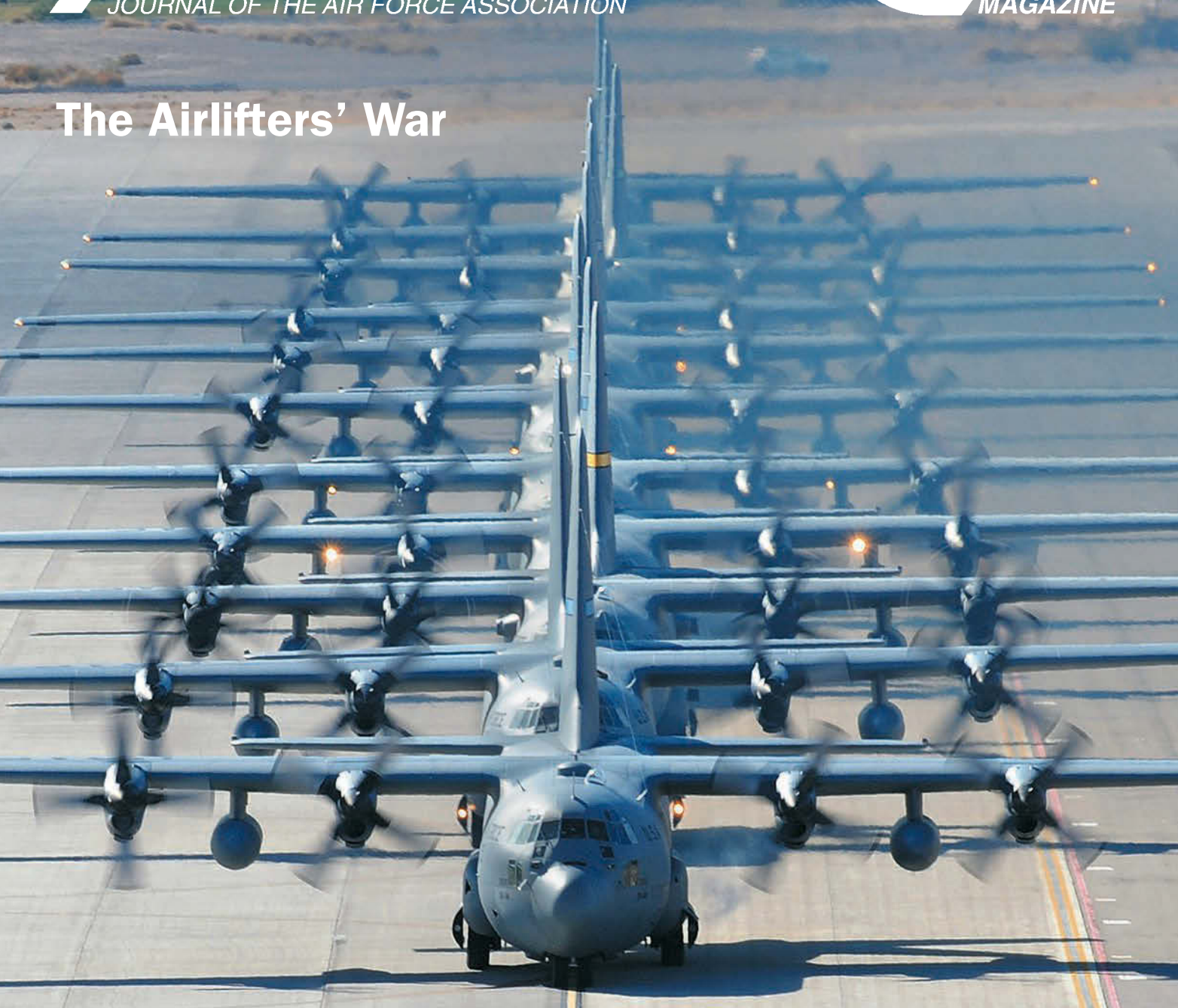
February 2010/\$4

AIR FORCE

JOURNAL OF THE AIR FORCE ASSOCIATION

MAGAZINE

The Airlifters' War



**UAVs are Indispensable
Rising Risk in the Fighter Force
The Cost of Schweinfurt**



how

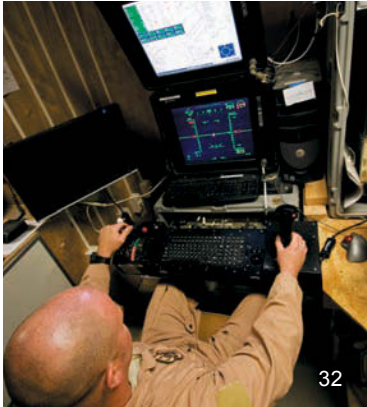
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About the cover: C-130s taxi at Nellis AFB, Nev. See "The Airlifters' War," p. 38. USAF photo by A1C Stephanie Rubi.

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AIR FORCE Magazine (ISSN 0730-6784) February 2010 (Vol. 93, No. 2) is published monthly by the Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Phone (703) 247-5800. Second-class postage paid at Arlington, Va., and additional mailing offices. **Membership Rate:** \$36 per year; \$90 for three-year membership. **Life Membership (nonrefundable):** \$500 single payment, \$525 extended payments. **Subscription Rate:** \$36 per year; \$29 per year additional for postage to foreign addresses (except Canada and Mexico, which are \$10 per year additional). Regular issues \$4 each. USAF Almanac issue \$6 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send changes of address to Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Publisher assumes no responsibility for unsolicited material. Trademark registered by Air Force Association. Copyright 2010 by Air Force Association.

ObamaCare Vs. Defense

ON THE morning of Jan. 19, the American national debt stood at \$12,276,477,277,649.25, according to the US Treasury. Call it \$12 trillion, close to a year's worth of national economic output. Every US citizen—man, woman, and child—owed an average of \$39,900 to the nation's creditors.

By the time you read this, the figure will be higher, since the debt grows by \$4 billion per day. In fact, US indebtedness, which was \$5.7 trillion in 2000, is expected to hit a towering \$21 trillion in this decade.

This can't go on, yet it is against this grim background that Washington has been pushing to forge a massive new social welfare program that would make the fiscal mess worse. We manifestly can't afford it, and all signs are it would pose a special threat to America's military power.

We are speaking, of course, about "ObamaCare," the new health entitlement sought by President Obama and this Congress. For our money, the danger does not lie in any specific provision. The danger would stem from the program's huge future cost.

What is its cost? The truth is, no one really knows, because its publicly stated assumptions are so gimmicky. After the shocking Jan. 19 election of Republican Scott Brown in the Massachusetts Senate race, the White House began floating a scaled-down approach to try to salvage something of the original plan. Yet to be seen is whether that "something" would include all or most of its high-cost provisions.

Even fervent supporters, however, owned to a 10-year cost of \$1 trillion, supposedly "paid for" with some \$500 billion in new taxes (real) and more than \$500 billion in offsetting Medicare cuts (fantasy).

That \$1 trillion was surely a low-ball estimate. Government programs always overshoot predicted cost, as witness the examples of Medicare and Medicaid. According to the *Wall Street Journal*, Congress in 1965 pegged Medicare costs at \$12 billion in 1990. Actual amount that year: \$90 billion.

In the case of ObamaCare, future overruns are built in. No one disputes that, as time went on, its massive subsidies would become more and

more widely available, driving costs much higher, even as planned budget "offsets" somehow always failed to materialize.

Harvard professor Martin Feldstein, a former chairman of the White House Council of Economic Advisors, predicted the actual 10-year net cost would approach \$2 trillion. We believe him.

So, what does this have to do with defense? The answer is, lots.

Future Presidents and Congresses, confronted with an unplanned-for cost gusher, would have limited options. They would be forced to run larger deficits (adding to debt and interest payments), raise taxes, cut discretionary spending, or—more likely—go with some combination of these.

This nation is face-to-face with disarmament by entitlement.

With respect to defense outlays, it is easy to see two depressive effects, one direct and one indirect.

■ Direct. Spending on entitlements and debt service would crowd out other spending, particularly defense.

We have a precedent. In the 1990s, Washington deluded itself it could control a deficit, keep taxes low, and protect social programs by reaping a "peace dividend." It was a strategy that touched all of the capital's political erogenous zones, but it put the armed forces in a deep modernization hole. The next time would be worse.

■ Indirect. A large and professional military is expensive. A strong US economy, and the tax revenues it generates, underwrites this force. The problem is that, if Americans are saddled with huge new ObamaCare taxes and debt service payments, the economy won't grow enough.

For a case study, one need look no further than Western Europe, home of the modern welfare state. It is an arena of heavy spending on health care, pensions, and welfare payments—and stagnant economies. In all but a very few nations, military forces are small, weak, and poorly financed.

Either of these courses would put this nation face-to-face with disarmament by entitlement. Europeans could at least

take shelter in US power. What is our fallback plan?

"This is how empires decline," observes Harvard history professor Niall Ferguson. "It begins with a debt explosion. It ends with an inexorable reduction in the resources available for the Army, Navy, and Air Force."

That defense will be squeezed is not in doubt. In recent remarks at the Naval War College in Newport, R.I., the Chairman of the Joint Chiefs of Staff, Adm. Michael G. Mullen, warned, "Money is [not] going to keep rolling in. ... It's just not going to happen."

We might be more welcoming of the ObamaCare project were the federal balance sheet otherwise in reasonably good shape, but you be the judge:

Last year, the annual budget deficit came in at more than \$1.4 trillion—about 10 percent of GDP, says the Congressional Budget Office. The US hasn't seen a deficit that large for more than 60 years.

Part of the problem, clearly, stems from the deep recession. It has not only prompted several expensive stimulus efforts but also resulted in reduced tax receipts. Still, CBO sees no end to the borrowing and spending binge.

Indeed, the government is in poor shape to cope with a crisis caused by existing entitlements, much less take on an enormous new one. The US already is staring at \$37 trillion in unfunded Medicare liabilities.

Sooner or later, the deficit-spending joyride must end. Social Security, Medicare, and Medicaid have been in place for decades, and they are not going away. ObamaCare, however, is a different story. Abandoning it would be a good starting point for the effort to control future deficits.

In a recent survey, the Pew Research Center found that a large plurality of Americans, 49 percent, think the US should "mind its own business internationally" and leave other countries to fend for themselves militarily.

It would be hard to find a more shortsighted approach to US security. However, unless Washington changes what is now an irresponsible course on ObamaCare, Americans will in a decade or two lack the military strength to pursue any other option. ■

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The Testers From Tucson

I was very pleased to see the cover of the December edition [*"The Testers From Tucson,"* p. 42]. The picture of three Block 32 F-16s from the Air National Guard/Air Force Reserve Command Test Center in Tucson led me to expect a great feature article. I was disappointed to see eight pages of pictures with but a few words in captions that only scratched the surface in describing this incredible organization.

AATC is the model of cost-effective providers of combat capability. It's difficult to imagine our Air Force without the test center. For example, the pre-Block 40 F-16 fleet operated by the ANG and AFRC comprises close to half of the combat coded F-16s in the Air Force, but without the work of AATC, these 300 or so aircraft would be of no value to COCOMs.

AATC has two informal mottos which really tell the story. The first is, "80 percent of the capability at 20 percent of the cost," which is out of necessity. Their budget is small and the National Guard and Reserve Equipment Account (NGREA) that was mentioned in a caption varies year to year and is certainly not big dollars when it comes to fleet modernization. But they use great processes to identify the need, off-the-shelf technology to save money and speed development, and incredible creativity and brain power to finish the product.

The second motto is, "It doesn't count until they're flying it in the field." No glitzy PowerPoint presentations here—just hard, focused work and testing to get the capability to the warfighter. There are so many examples of urgent COCOM needs that this organization has met, especially since the beginning of OEF and OIF. Many are classified but many are so apparently mundane that they are taken for granted, like targeting pods on the A-10.

Maj. Gen. Rick Moisiso,
USAF
Washington, D.C.

SAC's Standard

The report, "Command Shake-ups at Nuclear Minot Wings," [*"Air Force World,"* p. 14], December 2009, induced a feeling (as Yogi said) of déjà vu all over again. Upon reading your report, any officer who had commanded a strategic wing must have had a "there but for the grace of God" moment. The report evoked a

vision of SAC rising from the grave, along with the shade of Curtis LeMay, who has been quoted as saying, "I can't tell whether one of my wing commanders is incompetent or unlucky, and I don't have time to find out."

There is great merit in this renaissance of severe standards for nuclear operations, but the standards are not new. In your report, two commanders of major commands refer to standards of perfection that we demand in the nuclear enterprise. Old SAC wing commanders who served decades ago under such standards will say amen to that, while recalling, with a certain dark humor, an earthier version of those standards: "In SAC, the reward for a perfect job is no punishment."

Brig. Gen. William L. Shields,
USAF (Ret.)
Tucson, Ariz.

Silver Bullet

Thank you, Colonel Boyne, for the excellent and especially relevant article, "Silver Bullet Blunder" [*December 2009, p. 68*], which provided (among other things) an analysis of Japan's pilot training command philosophy and its lack of ability to produce quality pilots in militarily significant numbers throughout World War II. After the Battle of Midway, Japan could no longer take the strategic initiative. Why? Japanese aircrew losses were significant and irreplaceable. Even worse, Japan (Germany, too) continued to keep their "best and brightest" in combat units where attrition [due] to combat losses became profound. In two consecutive months at the end of World War II, the German Luftwaffe lost an incredible 2,000 pilots per month. During this same time, the US rotated its combat aviators back to the US to train

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Circulation audited by
Business Publication Audit



Air Force Association

1501 Lee Highway • Arlington, VA 22209-1198

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To educate the public about the critical role of aerospace power in the defense of our nation.

To advocate aerospace power and a strong national defense.

To support the United States Air Force and the Air Force family and aerospace education.

other aircrew, and to develop follow-on aircraft and weapons systems.

Both Germany and Japan clung to the notion that the mere pulverizing of a city by airpower was enough. For Germany and Japan, the lack of ability to create an effect with airpower consistent with their operational objectives became a significant factor in the outcome of World War II.

Another factor addressed in "Silver Bullet" and particularly relevant today is technical innovation. The Japanese focused on aircraft performance. The US focused on aircraft performance and the technical development of airpower. Close air support (CAS) is a classic example. What makes CAS so effective is the precise application of weapons. For the US, that application, later in World War II, turned on the availability of talented and trained forward air controllers (FACs) embedded with ground forces, using radios capable of communicating with aircrew. Innovation in modern CAS was not that aircraft supported ground forces; it was the capacity to apply command and control structures in the precise application of airpower.

Airpower does not exist for itself. Rather it exists in the context of military power under the authority of a joint force commander. That commander may be a four-star or a field grade officer. Truly, we do not need a B-2 to drop bombs; we need it to create an effect in consonance with the operational objectives of the joint force commander.

At the heart of the precise application of airpower is command and control (C2), be it a FAC/JTAC or the combined air operations center. To apply air assets as the Germans and Japanese did in World War II squandered aircrew, aircraft, and mission—a lesson we ought not to relearn today.

Lt. Col. Tom Brannon,
USMC (Ret.)
Ridgecrest, Calif.

Commander and Chief

Herman S. Wolk, in "Commander and Chief," [December 2009, p. 64], wrote that President Roosevelt called for production of 10,000 airplanes in a 14 November 1938 meeting to discuss the urgency of building up the air forces. Forrest C. Pogue described this meeting in *George C. Marshall: Education of a General 1880-1939*, the first volume of his outstanding four-volume biography of Marshall.

Pogue wrote that Roosevelt really wanted 20,000 planes, but he felt that Congress would cut that figure in half, so he wished the War Department to plan on 10,000 planes. Asked for his opinion, Army Deputy Chief of Staff Marshall, unlike others in that meeting,

courageously told the President that he did not agree.

It is a tribute to President Roosevelt that he appreciated General Marshall's candor and less than six months later announced Marshall's appointment as Army Chief of Staff effective 1 September 1939.

Cmdr. Walter Dunn Tucker,
US Naval Reserve (Ret.)
Henrico, Va.

Speed Is Life

[Regarding] comments by Lt. Col. Richard F. Colarco, USAF (Ret.), Colorado Springs, Colo., in his letter on "The Sixth Generation Fighter," p. 4 of *Air Force Magazine*, December 2009, the following are lessons from history, lessons from my combat experiences flying the F-4 in Vietnam, and lessons from working F-22 subjects at the Pentagon and Eglin [AFB, Fla.]. These lessons clearly indicate the continuing requirement for a speed advantage-supersonic flight capability for our fighter aircraft.

From World War II history, we know that the German Me 262's superior speed provided a virtual sanctuary for them from which to attack B-17s and a sanctuary from attack by slower fighters like the P-51. The 262 could attack and disengage with impunity. It was only vulnerable during and shortly after takeoff and in the landing pattern—when it was slow.

An adequate supersonic speed advantage over enemy fighters allows a US air combat fighter to accelerate from a base or from an optimum patrol speed orbit to a high-energy level where the US fighter can maneuver to create the optimum attack geometry (snap-up, head-on, front quarter, flank, stern, etc.), attack, separate out, and reposition to re-engage again if necessary. Further, the option to disengage when out of weapons or at combat "bingo" fuel (time to leave) is preserved. Once engaged in a multibandit environment, a lack of superior speed can result in a "Custer's last stand" scenario—you can't get away and they want your scalp.

Speed, along with persistence, maneuverability, situation awareness, all aspect weapons (to include the gun with an all aspect computing sight), integrated avionics, teamwork, etc., is life. Fighting and living throughout an engagement to fight again is a requirement.

Lastly, I personally know of a number of engagements in Vietnam that involved supersonic flight to include a Mach 1.2+ snap-up attack against MiG-21s at 30,000 feet. Superior speed over an adversary is required.

Col. John Madden,
USAF (Ret.)
Mill Creek, Wash.

Stealth skywriting; Watched by Gorgons; Stopping START?

Stealth Messenger

The Air Force has acknowledged the existence of a new and stealthy reconnaissance aircraft. Though it offered scant information about the machine, USAF intended to convey a message to many audiences, both at home and abroad.

Called the RQ-170 Sentinel, this UAV followed the now-traditional USAF spyplane pattern: designed and built by Lockheed Martin's Skunkworks, operated secretly in Nevada for several years, and eventually injected into real-world missions. The aircraft has been spotted in Afghanistan.

The Air Force's brief, no-fanfare Dec. 4 statement regarding the craft answered some questions about grainy photos of a gray, flying-wing-type unmanned airplane taken near Kandahar Airfield, Afghanistan. These had been circulating widely on the Internet.

The Air Force did not officially claim ownership of the aircraft depicted in those photos. However, it acknowledged it is "developing a stealthy unmanned aircraft system (UAS) to provide reconnaissance and surveillance support to forward deployed combat forces."

Further, it noted, the program "aligns with Secretary of Defense Robert M. Gates' request for increased intelligence, surveillance, and reconnaissance (ISR) support to the combatant commanders, and Air Force Chief of Staff Norton [A.] Schwartz's vision for an increased USAF reliance on unmanned aircraft."

Senior defense officials said the release should not be difficult to interpret: Sentinel's Afghan deployment is an Air Force demonstration that it has indeed gone "all in" the current fight with the ISR gear at its disposal, even experimental systems.

In 2008, Gates began complaining that the Air Force wasn't throwing its full ISR capability into the war effort, a dubious charge that USAF has quietly sought to challenge. Gates has since relented, saying he is now largely satisfied with USAF's efforts in wartime ISR.

Gates has pushed the Pentagon to orient itself more toward irregular warfare, and the preponderance of new USAF aircraft in the past few years has been remotely piloted vehicles, which work well in uncontested airspace against insurgents but would be useless against an adversary well-equipped with air defenses. Many in Congress have worried that USAF has abandoned preparing itself for possible big wars in favor of little ones.

Speaking of the meaning of the Sentinel, a senior DOD official said, "We have not taken our eyes off the future. We will not always have a permissive air environment, but the ISR products we are accustomed to having from remotely piloted aircraft [aren't] something we're going to want to give up, in any kind of conflict."

He said the aircraft also sends this message to potential peer adversaries: "We haven't forgotten about them. ... We are putting our money where our mouth is when we say we will invest in systems that have application across the spectrum of conflict."

Although the Sentinel's dimensions and performance characteristics have not yet been established, the shape and even color of the aircraft suggest it is meant not for extremely high-altitude missions—such as those flown by



Is this the Sentinel?

the U-2 and Global Hawk—but medium-altitude missions in the same operating bands as the MQ-1 Predator and MQ-9 Reaper.

The RQ designation suggests it is strictly an ISR platform and not armed, as an MQ designation would indicate.

The value of a stealthy, remotely piloted aircraft operating in an environment where the enemy has no radars isn't apparent. However, the system may not be focused solely on the irregular fight in Afghanistan. If it has sufficient range, the RQ-170 may be looking inside the borders of neighboring countries, tracking external suppliers of weapons and aid to insurgents in Afghanistan. Its revelation would therefore be a message to patrons of the insurgents that their activities and culpability can be documented.

The Air Force said the Sentinel is operated by the 30th Reconnaissance Squadron at Tonopah Test Range in Nevada. The long-dormant electronic reconnaissance unit was reactivated in 2005, and in 2007, USAF approved its new squadron patch: It shows a black bird standing astride Asia and East Africa.

ISR Multiplication Tables

The intelligence-surveillance-reconnaissance technology effort in Afghanistan is turning a corner, and it's not so much the number of flying platforms or CAPs anymore as it is the capabilities of those platforms. The shift could give the Air Force some relief from the incessant demands that it field more and more ISR drones.

The Air Force is also streamlining the way it sends signals collected by ISR aircraft, so that its communications "pipes" don't get clogged, and is ardently pursuing high-flying airships as potential ISR platforms.

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So said Lt. Gen. David A. Deptula, deputy chief of staff for ISR. In a December meeting with defense writers, Deptula said dozens of remotely piloted systems are flying over Afghanistan and its environs. They have the ability to transmit pictures to ground forces, said Deptula. Moreover, he added, the aircraft have a new podded capability that will vastly increase the number of pictures those drones can send.

Called "Gorgon Stare," the pod, said Deptula, "will allow us ... to transmit up to 10 different video images to 10 different users on the ground within a wide area. That effectively increases the number of CAPs. ... You effectively increase the CAPs by 10, by introducing one pod set."

The first three Gorgon Stare pod sets will arrive in theater in the spring. By summer, there will be three more. Late in the year, three additional pod sets will arrive, but with the ability to feed 30 images at once, not 10.

"You can see now, we're vastly increasing the output or the capability without dramatically increasing the number of platforms," Deptula pointed out. Three more, capable of 30 feeds each, will come in 2011.

The version after that will be able to send video feeds to 65 users at once, he added. In short, Predator drone-like capabilities offered by the Air Force are about to increase exponentially.

Deptula went on, "Do we want to add additional platforms? Yes. But the quickest way to add [coverage] is to add capability to what you already have."

He also noted that "Predator" has become a generic term—like Kleenex—which ground commanders use when they want imagery. They may not actually need or want a Predator feed; a small Raven RPV may do "if all you're interested in is what's on the other side of the hill." He said ground forces need to be educated about the ISR products available, and there must also be a process of "identifying validated demand. There's a big difference between need and want, and separating the two is very important, particularly as we face a constrained resource environment."

Given that vast increase in data collection and transmission, though, how will USAF cope with the demands on its bandwidth, particularly since it was counting on the now-canceled Transformational Satellite Communications System (TSAT)?

Deptula said part of the problem can be solved by simply sending imagery directly from the air to the ground units below that need them. Sending it to analysts around the world in the US may not be necessary. Another technique is sending the imagery to something called the imaging access system, a storehouse of the latest images that US forces can tap into without the need for even a password.

He also said USAF is looking into putting more onboard processing capabilities into its ISR platforms, and signals are being compressed to use as little bandwidth as possible. The Air Force has been proactive in anticipating the ISR needs of ground forces in Southwest Asia, and has been developing a flexible force of analysts to answer those requirements, Deptula said.

"My perspective was ... let's not wait to be asked. Let's build and capitalize on this distributed processing, exploitation, analysis, and dissemination system such that we can tap into it and rapidly add or subtract, adjust analytical capability very quickly."

When the US surges its ground forces in Afghanistan, "boom, we can add analytic capability at the speed of light just by shifting or adding additional analysts to it."

Deptula said the future will likely see greater use of airships that can maintain station and altitude for long periods of time—perhaps years at a time.

"I'm a big fan of airships and it's about time that we get these things out there, move them off PowerPoint [briefing slides] into the three-dimensional airspace."

The Air Force is collaborating with the Defense Advanced Research Projects Agency on a program called ISIS that would operate an airship above 60,000 feet "and dwelling for up to 10 years," Deptula said.

The potential is enormous, not just for resolution with ground moving target indication, "but also detecting airborne targets," said Deptula.

The cost of such a system would be highly attractive, he said, noting it would be "a fraction—a fraction—of what the operating costs for large airborne systems are."

No Nukes, No Treaty

A group of 41 Senators wrote President Obama in December, urging him to fix the nuclear weapons infrastructure and hinting they'll block any new nuclear treaties with Russia if he doesn't.

The Dec. 16 letter, signed by 40 Republicans and one Independent, carries just enough names to block Senate ratification of a planned new arms treaty with Russia. A follow-on to the 1991 START agreement, still in negotiation, is expected to reduce each side to a level of about 1,500 warheads over a 10-year period.

The Senators reminded Obama that the Fiscal 2010 defense authorization act requires that he submit a 10-year plan for modernizing the nuclear weapons infrastructure at the same time he submits any new nuclear arms agreement to the Senate for ratification.

"We don't believe further reductions [in nuclear weapons] can be in the national security interest of the US in the absence of a significant program to modernize our nuclear deterrent," the Senators wrote.

The group was talking not about the force structure of nuclear delivery vehicles—the missiles, submarines, and bombers that comprise the nuclear triad—but the warheads themselves. Many are decades old, have lost their ginger, and present a danger of being unreliable if needed. Meanwhile, the national apparatus to develop, build, test, and rehabilitate the warheads is in serious disrepair. Many leading figures—notably US Strategic Command chief Gen. Kevin P. Chilton—have been trying to raise awareness about the condition of the warhead inventory for several years.

The Senators asserted that "the linkage between nuclear force reductions and modernization" is reinforced by the findings of the so-called Perry-Schlesinger Commission, a bipartisan group that assessed the health of the US nuclear weapons complex and determined it to be in "serious disrepair." The commission was launched in 2008 and was so distressed about the condition of the nuclear infrastructure that it issued a preliminary report in late 2008 before presenting a full-throated version in mid-2009.

"The members of this commission were unanimously alarmed," the Senators wrote, and "made a series of recommendations to reverse this highly concerning situation. We endorse these recommendations and believe they constitute the minimum necessary to permit further nuclear force reductions."

The Senators want Obama to fully modernize the B61 and W76 warheads; fund development of a new warhead or devise a way to reuse components of existing warheads; fully fund the nuclear science and engineering efforts at the national laboratories; and fully fund the infrastructure that refines and enriches uranium and plutonium and the chemistry capabilities that attend them.

"We are committed to the defense authorization act's requirement that the treaty and modernization plan be submitted at the same time, and we believe they must be acted on together as well," the lawmakers wrote.

They also insisted that other provisions of the act must be observed as well—those that say the US must not limit missile defenses, space capabilities "or advanced conventional modernization, such as non-nuclear global strike capability." ■

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Remotely operated aircraft systems produced by General Atomics Aeronautical Systems are routinely operated over world trouble spots. With the persistence and precision capability to detect, identify, track, and even strike time-sensitive targets instantly, U.S. Air Force MQ-1 Predators and MQ-9 Reapers fly missions beyond the capabilities of manned aircraft.

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A cost-effective force multiplier in every sense. Not only operational, but indispensable.



Airman Dies in Afghanistan

TSgt. Anthony C. Campbell Jr., 35, of Florence, Ky., died Dec. 15 from wounds he received from an improvised explosive device that detonated in Helmand province, Afghanistan.

Campbell, an explosive ordnance disposal technician with Air Force Reserve Command's 932nd Civil Engineer Squadron at Scott AFB, Ill., was a police officer in Cincinnati in his civilian life.

WGS-3 Ascends Into Orbit

The Air Force and its industry partners on Dec. 5 successfully launched WGS-3, the service's third Wideband Global SATCOM spacecraft, into space aboard a United Launch Alliance Delta IV rocket fired from Cape Canaveral AFS, Fla.

WGS manufacturer Boeing announced on the following day that initial signals from the satellite indicated that it was healthy. Following its on-orbit tests over the US West Coast, WGS-3 will be placed into geosynchronous Earth orbit over the Atlantic Ocean, according to the company.

WGS-3 joined WGS-1, which sits above the Pacific Ocean and WGS-2, which is perched above the Indian Ocean. WGS satellites will augment and eventually replace the Air Force's legacy Defense Satellite Communications System constellation.

START I Accord Expires

The 1991 Strategic Arms Reduction Treaty I expired Dec. 5, leaving the United States and Russia still negotiating the details of a follow-on agreement and hoping to finalize the new pact at the earliest possible date.

"We are quite close to an agreement," said President Obama during a joint press briefing with Russian President Dmitry Medvedev Dec. 18 in Copenhagen. State Department spokesman Robert Wood said the previous day that "verification issues" were one of the items still to be resolved.

Concerned over the loss of access to monitor Russian strategic nuclear forces in the interim until the new follow-on agreement takes effect, Sen. Jon Kyl (R-Ariz.), Sen. Richard G. Lugar (R-Ind.), and Sen. John Kerry (D-Mass.)

introduced a resolution in November that would extend the START I inspection and monitoring protocols.

USAF's Iraq Presence May Endure

Secretary of Defense Robert M. Gates told airmen during a townhall session Dec. 11 at FOB Warrior in Iraq that the Air Force could remain in Iraq after the main US troop pullout.

Asked about USAF assistance to the Iraqi Air Force, he said, "I wouldn't be a bit surprised to see agreements between ourselves and the Iraqis that continue a 'train, equip, and advise' role beyond the end of 2011."

In fact, he said the same applied to Afghanistan. Both countries, Gates said, recognize that that "kind of role is very likely to continue beyond the end of our combat operations." But he acknowledged there were no long-term agreements in place yet.

F-22s Return From Middle East

Six F-22 Raptor stealth fighters and about 150 airmen from the 1st Fighter Wing at Langley AFB, Va., returned home in mid-December from a nearly one-month training deployment to the Middle East, the first time that Raptors have been in the region.

"We didn't know how the jet was going to perform or react, given the temperature differences as well as the dust, sand, and wind," said Lt. Col. Lance Pilch, commander of the 27th Expeditionary Fighter Squadron, who led the contingent. He added, "But we were able to fly more sorties than we scheduled for, so the F-22 actually exceeded expectations."

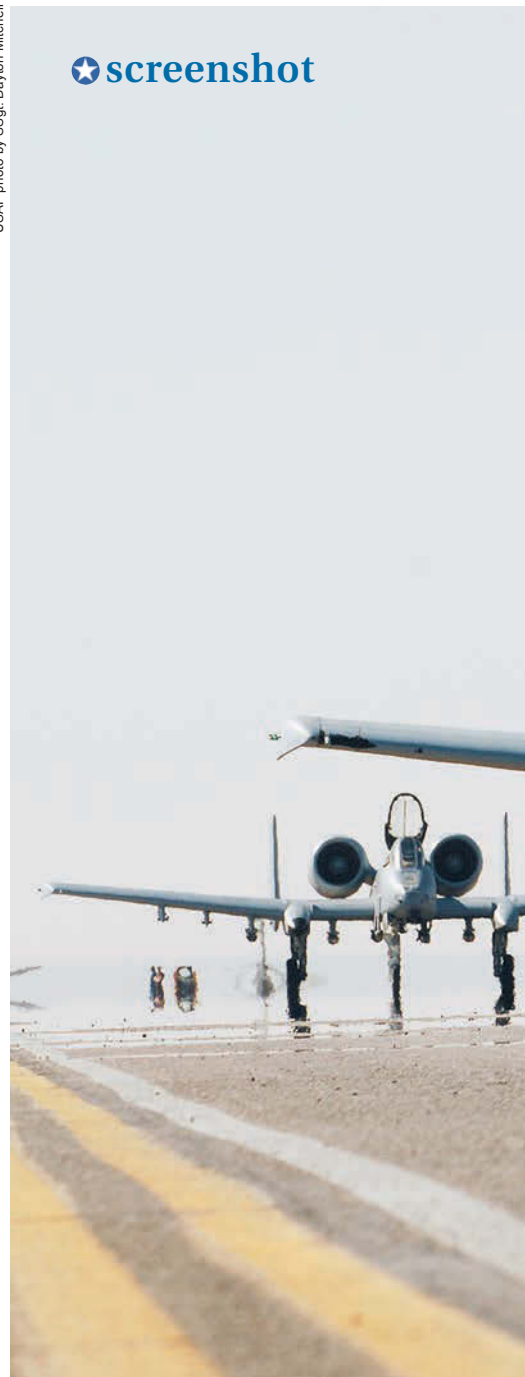
During their time there, the F-22s flew with British, French, Jordanian, and Pakistani fighters taking part in an exercise at the United Arab Emirates' Air Warfare Center, according to the Air Force.

KC-X Requirements Called Sound

Air Force Secretary Michael B. Donley said Dec. 14 major revisions were unlikely in the final version of the KC-X tanker solicitation that was expected to hit the streets in late January or early February, despite Northrop Grumman's threat to exit the contest. Northrop Grum-

USAF photo by SSgt. Dayton Mitchell

 screenshot



man asserts that the terms in the draft language favor rival Boeing.

“The requirements part of the [request for proposals] is very strong,” Donley told reporters at a Reuters summit in Washington, D.C. He added, “I wouldn’t anticipate major changes to the RFP in that area.”

Northrop Grumman President Wesley G. Bush informed the Pentagon acquisition leadership on Dec. 1 that the company would not submit a tanker bid

“absent a responsive set of changes” in the final RFP. But Donley, echoing senior Department of Defense officials, said the Air Force was “very leery” of making changes that could be seen as benefiting one company.

Strike Command Acquires ICBMs

Air Force Global Strike Command at Barksdale AFB, La., on Dec. 1 assumed responsibility for the nation’s Minuteman III ICBM force from Air Force

Space Command under a scheduled shift of authority.

With the switch, AFGSC now manages the nation’s 450 Minuteman III missiles, which are divided equally among 20th Air Force’s 90th Missile Wing at F. E. Warren AFB, Wyo., 91st Missile Wing at Minot AFB, N.D., and 341st Missile Wing at Malmstrom AFB, Mont.

This move was part of the phased buildup of Global Strike Command,



01.01.2010

A pair of upgraded A-10C attack aircraft of the 354th Expeditionary Fighter Squadron taxi at Kandahar Airfield in Afghanistan. This C model has been equipped for the use of precision weapons. The twelve Warthogs of the squadron, which deployed from Davis-Monthan AFB, Ariz., had just pulled 10,000 hours of combat flying, comprising some 2,500 sorties, over a six-month period. The lead Warthog is handled by Lt. Col. Michael Millen, 354th commander, the second by Col. John Cherrey, 451st Expeditionary Operations Group commander.

Pentagon Slows F-35 Production Ramp-Up

Secretary of Defense Robert M. Gates has reportedly directed Pentagon planners to shift more than \$2.8 billion originally earmarked to buy F-35 Lightning II strike fighters through 2015 back into the aircraft's development to keep the multibillion-dollar project from derailing.

Bloomberg news wire service broke the news Jan. 6, citing an internal Pentagon budget document that Gates, who has made the F-35's success a top priority, signed Dec. 23.

This move, expected to be included in the Pentagon's Fiscal 2011 budget request that will go to Congress in February, would reduce the number of F-35s purchased over that period by 122 airframes, or roughly one-quarter, including a 10-aircraft cut in Fiscal 2011.

Senior Department of Defense officials had been acknowledging near the end of 2009 that the F-35 program was facing serious challenges, a bow to the assessment by the Pentagon's Joint Estimate Team that warned last year that the program still faced lengthy delays and could require hefty funding infusions to stay on track.

"We don't like some of the trends we see, and we are determined not to accept those trends," said Deputy Defense Secretary William J. Lynn III Dec. 2 in his remarks at an aerospace and defense conference in New York City.

While not outright confirming these changes reflected in Gates' directive, since the final budget request had not been issued, Air Force Secretary Michael B. Donley said Dec. 14 at an aerospace and defense conference in Washington, D.C., that there would be "adjustments in dollars" and "adjustments in schedule" for the F-35 program.

But he said there were no plans to cut the overall F-35 buy, which now is projected to include some 1,760 fighters for the Air Force and another 680 for the Navy and Marine Corps, plus more for allied partners.

Rather, the changes would merely shift aircraft purchases to later years, according to defense officials and representatives from Lockheed Martin, F-35 manufacturer.

USAF's newest major command, as overseer of all Air Force nuclear assets. Next up, 8th Air Force, parent of the service's three nuclear-capable bomber wings, is scheduled to transfer from Air Combat Command to AFGSC on Feb. 1, completing the nuclear consolidation.

C-27J Training Center Opens

Air Force, Army, and community and industry partners on Dec. 9 celebrated the opening at Robins AFB, Ga., of a \$1.8 million center for training the Air National Guardsmen who will operate the service's new C-27J transport aircraft.

The new center replaces the interim training site at the facility of L-3 Communications, C-27J lead contractor, in Waco, Tex. It offers classroom instruction and will feature a full-fidelity operational flight trainer and a fuselage trainer, when fully equipped in 2011, according to L-3.

At peak levels in about five years, 144 airmen will pass through it each year. The Air Force is procuring 38 C-27Js for the Air National Guard, which expects to start operating them by year's end in intratheater roles.

Long Drop: Lt. Col. Stephen Goodman (l) and Capt. Robert Wilson hurl themselves out of an aircraft in a high-altitude, low-opening training jump over the Shima Island, Japan. Both airmen are assigned to the 31st Rescue Squadron at Japan's Kadena Air Base.

USAF photo by A1C Chad Warren



Guardsmen Flying Reapers in Combat

Airmen of the New York Air National Guard's 174th Fighter Wing at Hancock ANGB in Syracuse on Dec. 1 entered steady-state operations flying MQ-9 Reaper remotely piloted aircraft in the skies of Afghanistan, supporting coalition ground forces in armed overwatch roles.

The Air Guardsmen control the Reapers from ground stations in Syracuse, sending commands to the aircraft in theater through satellite networks.

The wing is the first Air Guard unit to operate MQ-9s, having shed its F-16 flying mission in June 2008 per BRAC 2005. It also opened the Air Force's sole MQ-9 maintenance schoolhouse in October.

Land Gained for Melrose Expansion

New Mexico Gov. Bill Richardson (D) announced Dec. 7 that the Office of the Secretary of Defense had granted the Air Force a waiver so that the service could receive a \$5 million land gift from the state to expand Melrose Bombing Range in eastern New Mexico.

"I am pleased that the Department of Defense has approved the waiver that will allow the Air Force to acquire the land," he said in a release that day. The waiver was necessary since DOD currently has a moratorium on major land acquisitions by the services for installations in the US.

In 2005, Richardson committed \$5 million worth of land to the bombing range to help save Cannon Air Force Base from closure during BRAC deliberations. The state's legislature appropriated the money in 2006 to acquire the land.

Block 30 Global Hawk Arrives

The 9th Reconnaissance Wing at Beale AFB, Calif., on Nov. 24 took delivery of its first RQ-4 Global Hawk Block 30 unmanned reconnaissance aircraft. This airframe flew in from Edwards

Bill Funds C-17s, F136 Engine, Slows Fighter Phaseout

Among the provisions in the Fiscal 2010 defense appropriations bill, signed into law by President Obama on Dec. 19, are funds for more Air Force C-17 transport aircraft and for keeping the F-35 Lightning II strike fighter's alternate engine project alive.

The legislation also slows the retirement of Air Force legacy fighter aircraft this year.

The Senate on Dec. 19 passed the \$636.3 billion bill, which includes \$128.3 billion for overseas contingency operations. The House had approved it three days earlier.

The funding total is \$3.8 billion shy of the Administration's \$640.1 billion request.

Like the Fiscal 2010 defense policy act, the spending act contains no funds to buy any additional F-22 Raptor stealth fighters beyond the 187 airframes already ordered.

But despite Administration resistance, the act contains \$2.5 billion added for 10 C-17s that will increase the Air Force's program of record to 223.

The Air Force did not request these airframes and the White House did not want them, but Obama did not threaten to veto the bill over this add-on.

Going against the Administration in another area, the act also provides \$465 million to continue development and fund initial procurement of the General Electric-Rolls Royce F136 engine, the turbofan propulsion system competing against Pratt & Whitney's F135 to power future F-35s.

The spending act also prohibits the Air Force from carrying out its plan to retire some 250 legacy A-10, F-15, and F-16 fighters in this fiscal year, pending April 1 delivery of the results of an independent review conducted by a federally funded research and development center.

The Air Force is required, too, to divulge to Congress more of its legacy fighter plans, particularly in regard to the air sovereignty alert mission.

The act also directs the Air Force to conduct a cost-benefit analysis of its plan to shift F-15 training from Tyndall AFB, Fla., to the Oregon Air National Guard's Klamath Falls Arpt./Kingsley Field. That move is now also delayed until at least April.

AFB, Calif., where it had been used in developmental flight tests.

The Block 30 model has a wider wingspan and can carry 1,000 pounds more payload than the Block 10s that already call Beale home and have been in use over Afghanistan and Iraq. It will carry an enhanced imagery sensor suite and a signals intelligence payload.

The aircraft's arrival came four days after Global Hawk-manufacturer Northrop Grumman announced that the Block 30

variant—as well as the Block 20 configuration—had received military airworthiness certification, a prerequisite for FAA clearance for these Global Hawks to fly routinely within the US.

Human Error Blamed in F-15E Crash

An incorrect assessment of elevation led to an F-15E crashing in the mountains of eastern Afghanistan last July 18, killing its aircrew, according to the findings of Air Combat Command's accident investigation released Dec. 1.

Two F-15Es from the 336th Expeditionary Fighter Squadron at Bagram Airfield were practicing nighttime strafing after completing a close air support mission. The weapon systems officer in the lead aircraft miscalculated the practice target's elevation as 4,800 feet above sea level when it was actually at 10,200 feet, said ACC officials.

The second F-15E approached the target not realizing the discrepancy and subsequently impacted the ground, claiming the lives of Capt. Thomas J. Gramith, 27, and Capt. Mark R. McDowell, 26.

Energy Plan Released

The Air Force on Dec. 9 issued a new energy plan that lays out the service's long-range—to 2035—institutional-

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Gen. Lew Allen Jr., 1925-2010



Gen. Lew Allen Jr., the Air Force's 10th Chief of Staff and a key shaper of the service's nuclear, space, and other key technology programs, died Jan. 4. He was 84.

Allen was unique among USAF Chiefs of Staff in that he held a doctorate degree and never served in either an overseas assignment or a combat command. However, he was highly regarded for his keen management of cutting-edge technological programs and for setting high ethical standards for the organizations he led.

Born in Miami, Allen was admitted to West Point in 1943. Three years later, he graduated and was commissioned, having also

received his pilot wings. In the years just after World War II, he flew B-29 and B-36 bombers out of Carswell AFB, Tex.

In 1950, Allen entered the University of Illinois, earning both a master's and a doctoral degree in nuclear physics. In 1954, he was assigned to Los Alamos Scientific Laboratory in New Mexico, where he investigated the effects of high-altitude nuclear detonations. A four-year tour followed at Kirtland AFB, N.M., as a science advisor to the Air Force Special Weapons Center.

Allen was then posted to the Pentagon, where he worked on the top-secret Corona satellite intelligence program, determining how radiation would affect the reconnaissance satellite's photographic film.

In 1965, Allen was sent to Los Angeles to the Directorate of Special Projects, and in 1969 became director of the space systems staff back in Washington. In these posts, he helped manage the Air Force's most classified space projects.

He returned to Los Angeles in 1971 and became director of the Office of Special Projects. In that position, Allen was responsible for the cradle-to-grave procurement, launch, and operation of USAF satellites.

After a stint as chief of staff at Air Force Systems Command, Allen in 1973 was appointed deputy to the Director of Central Intelligence. Just a few months later, he was made the three-star head of the National Security Agency, an organization he led for four years. During his tenure, he not only oversaw the NSA's worldwide intelligence collection activities but also created a culture that won Congressional praise as a model of ethical practices.

Allen received his fourth star in August 1977 and became head of Air Force Systems Command at Wright-Patterson AFB, Ohio, where he oversaw the development of all Air Force technology. Eight months later, he was tapped to be vice chief of staff.

Allen succeeded Air Force Gen. David C. Jones as Chief of Staff in July 1978, when Jones was appointed to be Chairman of the Joint Chiefs of Staff.

As Chief, Allen advised Presidents Jimmy Carter and Ronald Reagan on the SALT II nuclear arms treaty. Internally, he worked to overhaul the Air Force's cumbersome personnel system and maintained the Air Force's technology edge during what was later called the "hollow force" era following the Vietnam War. He moved forward the nascent technology of stealth, launching both the F-117 and B-2 bomber programs, and pushed through the A-10 and F-16 fighters. As Chief, Allen also oversaw the creation of Air Force Space Command.

Allen retired from the Air Force in 1982, but proceeded to put his mark on the civilian space program as well, heading NASA's Jet Propulsion Laboratory through 1989. The period is now regarded as a heyday for JPL, during which it racked up abundant scientific successes in the exploration of the solar system.

After his retirement from NASA, Allen served in a variety of advisory positions, significantly on the President's Foreign Intelligence Advisory Board and the Intelligence Oversight Board.

The Air Force's Lew Allen Jr. Trophy is given annually to an officer and NCO to recognize outstanding performance in aircraft sortie generation.

—John A. Tirpak

ized energy goals. It lists how the Air Force aims to reduce energy demand, increase supply through alternative and renewable energy sources, and change the service's culture so that energy is a consideration in everything airmen do.

"Military forces will always be dependent on energy, but we must dramatically reduce the risk to national security associated with our current energy posture," said Debra K. Walker, deputy assistant secretary of the Air Force for logistics, in addressing the plan.

About two years in the making, the plan builds on recent USAF policy guidance. The Air Force is the largest energy consumer in the federal government and is also at the forefront of national alternative and renewable energy activities.

UAV Airmen Will Stay in Mission

The Air Force announced in late October that the service leadership had extended the policy that prohibits MQ-1 Predator and MQ-9 Reaper operators from transferring out of the UAV mission through Fiscal 2011.

The service is working to establish 50 UAV combat air patrols by 2011 and had 39 supporting Southwest Asia operations, as of mid-December (31 MQ-1 Predator, seven MQ-9 Reaper, and one RQ-4 Global Hawk).

In a memo to UAV airmen, Air Force Secretary Michael B. Donley and Chief of Staff Gen. Norton A. Schwartz said, "We cannot overstate how important you and the unmanned aircraft system capabilities are to our joint and coalition teammates—and to our nation."

US-Singapore Launch F-15SG Unit

US and Singaporean government officials on Nov. 19 celebrated the inauguration of the combined F-15SG fighter detachment at Mountain Home AFB, Idaho, under the bilateral Peace Carvin V initiative.

Under it, Mountain Home's 366th Fighter Wing is hosting the 428th Fighter Squadron, a unit that will train Republic of Singapore Air Force airmen to operate their new fleet of F-15SGs. The squadron will have 12 F-15SGs and function with USAF and Singaporean airmen working side by side.

"While our relationship with the Republic of Singapore and its air force has been strong in the past, I know the partnership here will bring us even closer together," said Air Force Secretary Michael B. Donley, at the inauguration ceremony.

Joint Texas Base Outlined

On Dec. 16, Air Force officials announced that USAF and Army leadership

Operation Enduring Freedom—Afghanistan

Casualties

By Jan. 20, a total of 955 Americans had died in Operation Enduring Freedom. The total includes 953 troops and two Department of Defense civilians. Of these deaths, 687 were killed in action with the enemy while 268 died in noncombat incidents.

There have been 4,829 troops wounded in action during OEF. This number includes 2,018 who were wounded and returned to duty within 72 hours and 2,811 who were unable to return to duty quickly.

Coalition Offensive Pushes Into Uzbun Valley

A major coalition assault led by 800 French legionnaires with US special forces and Afghan soldiers, backed up by artillery and airpower, pushed into Kabul province's Uzbun Valley in mid-December, the site of a deadly 2008 ambush where 10 French troops were killed.

Operation Septentrion began on the night of Dec. 17.

The object of the offensive, initiated after coalition troops had negotiated with local villagers for weeks, was to show militants that coalition elements could operate in enemy strongholds whenever they wanted, said Rear Adm. Christophe Prazuck, a French military spokesman.

Militants and insurgents have held one strategic portion of the valley, about 25 miles east of Kabul, known as the Sarobi District, where French troops were ambushed in August 2008 in the deadliest attack on that country's forces since 58 of its paratroopers were killed in a bombing in 1983 in Beirut.

The coalition forces came under rocket-propelled grenade and heavy weapons fire from Taliban and militant elements within several hours of the initial advance, French officials reported.

The French responded with artillery, and US and French aircraft provided air support.

USAF F-15Es operated in the vicinity during the operation, according to Air Forces Central, and released precision munitions on enemy elements in at least one strike.

Operation Iraqi Freedom—Iraq

Casualties

By Jan. 20, a total of 4,377 Americans had died in Operation Iraqi Freedom. The total includes 4,364 troops and 13 Department of Defense civilians. Of these deaths, 3,478 were killed in action with the enemy while 899 died in noncombat incidents.

There have been 31,633 troops wounded in action during Operation Iraqi Freedom. This number includes 17,723 who were wounded and returned to duty within 72 hours and 13,910 who were unable to return to duty quickly.

MC-12 Fleet Reaches 1,000th Combat Mission

The Air Force's new fleet of MC-12W intelligence-surveillance-reconnaissance aircraft on Nov. 16 flew its 1,000th combat mission in Iraq.

The milestone was reached only five months after the 362nd Expeditionary Reconnaissance Squadron began operating MC-12s out of Joint Base Balad. As of mid-December, it had six MC-12s in use.

These aircraft provide invaluable real-time, full-motion overhead video and signals intelligence to ground troops inside Iraq.

According to Balad officials, the MC-12s had thus far aided in the capture of 12 high-value enemy individuals and had helped discover three weapons caches.

Further, the troops for whom they have provided overwatch had suffered zero casualties, they said.

Air Force Takes Charge of Al Asad Air Base

The Air Force held an assumption of command ceremony on Dec. 15 at Al Asad AB, Iraq, as the new commander of the 532nd Expeditionary Operations Support Squadron assumed responsibilities for the facility from the Marine Corps.

The Air Force took over the mission as part of the changes associated with the drawdown of US forces across the country.

The 532nd EOSS conducts airfield maintenance, tower control, aerial port, facility security, and other functions.

Al Asad is expected to play a critical role as an air hub in coming months as US forces are repositioned inside Iraq and are moved from it.

had signed a memorandum of agreement outlining how Joint Base San Antonio will operate. It is the largest joint installation being created as a result of BRAC 2005.

The joint facility, an amalgam of Ft. Sam Houston and Lackland and Randolph Air Force Bases, is expected to be fully operational on Oct. 1, under the leadership of the new 502nd Air Base Wing at Randolph.

Clarence E. Maxwell, San Antonio Joint Program Office deputy director, said the most challenging element of the MOA negotiations was "allocating expenses" that derive from all of the ongoing BRAC actions in San Antonio.

Heavy Lifting: An aerial porter carefully directs the movement of a 60-ton K-loader laden with MRAP all-terrain vehicles at the transit center at Manas, Kyrgyzstan. The heavily armored vehicles are ideal for traversing the rugged desert and mountain terrain of Afghanistan.



USAF photo by TSgt. Myco Apat

Senior Staff Changes

RETIREMENTS: Lt. Gen. Maurice L. **McFann Jr.**, Maj. Gen. Thomas B. **Wright**, Maj. Gen. Stephen J. **Miller**.

NOMINATIONS: To be Major General: Steven J. **Lepper**. **To be Brigadier General:** Kory G. **Cornum**, Daniel B. **Fincher**, David C. **Wesley**. **To be AFRC Major General:** Eric W. **Crabtree**, Wallace W. **Farris Jr.**, Craig N. **Gourley**, Carol A. **Lee**, David S. **Post**, Donald C. **Ralph**, Jon R. **Shasteen**, Richard A. **Shook Jr.**, James N. **Stewart**, Lance D. **Undhjem**. **To be AFRC Brigadier General:** Gary C. **Blaszkiwicz**, Paul S. **Dwan**, Arthur C. **Haubold**, Michael D. **Kim**, Linda S. **Marchione**, Richard O. **Middleton II**, Dixie A. **Morrow**, Robert N. **Polumbo**, Jane C. **Rohr**, Patricia A. **Rose**, Peter **Sefcik Jr.**, James F. **Smith**, Edmund D. **Walker**, William O. **Welch**.

CHANGES: Brig. Gen. Edward L. **Bolton Jr.**, from Cmdr., 45th Space Wg., AFSPC, Patrick AFB, Fla., to Dir., Cyber & Space Ops., DCS for Ops., P&R, USAF, Pentagon ... Brig. Gen. (sel.) Daniel B. **Fincher**, from Dir. of Staff, JAG, USAF, Pentagon, to Cmdr., AF Legal Ops. Agency, Bolling AFB, DC. ... Brig. Gen. John E. **Hyten**, from Dir., Cyber & Space Ops., DCS for Ops., P&R, USAF, Pentagon, to Dir., Space Acq., Office of the Undersecretary of the AF, Pentagon ... Maj. Gen. (sel.) Steven J. **Lepper**, from Staff Judge Advocate, AMC, Scott AFB, Ill., to Dep. JAG, USAF, Pentagon ... Maj. Gen. Susan K. **Mashiko**, from Dir., Space Acq., Office of the Undersecretary of the AF, Pentagon, to Dep. Dir., NRO, Chantilly, Va. ... Brig. Gen. Thomas J. **Masiello**, from Dep. Dir., Strat. Effects, Multinational Force-Iraq, CENTCOM, Baghdad, Iraq, to Dep. Asst. Secy, Plans, Prgms., & Ops., Bureau of Political-Military Affairs, US Dept. of State, Washington, D.C. ... Brig. Gen. Craig S. **Olson**, from Chief, Office of Security Cooperation, Multinational Security Transition Command-Iraq, CENTCOM, Baghdad, Iraq, to PEO, Enterprise Info. Sys., ESC, AFMC, Maxwell-Gunter AFB, Ala. ... Brig. Gen. (sel.) David C. **Wesley**, from Staff Judge Advocate, AETC, Randolph AFB, Tex., to Staff Judge Advocate, AMC, Scott AFB, Ill.

SENIOR EXECUTIVE SERVICE CHANGES: Joan A. **Causey**, to Dep. Asst. Secy. for Financial Ops., Office of the Asst. SECAF for Financial Mgmt. & Comptroller, Pentagon ... Ava Sue **Dryden**, to Dep. Dir., 309th Maintenance Wg., Ogden ALC, AFMC, Hill AFB, Utah ... David **Hamilton**, to Exec. Dir., AFOTEC, Kirtland AFB, N.M. ... Russell B. **Howard**, to Dir., of Engineering & Tech. Mgmt., AFMC, Wright-Patterson AFB, Ohio ... Richard Vince **Howie**, to Dep. Dir., 76th Maintenance Wg., Oklahoma ALC, AFMC, Tinker AFB, Okla. ... Gail M. **Jorgenson**, to Dep. Dir., Acq., TRANSCOM, Scott AFB, Ill. ... Gregory G. **Stanley**, to Dep. Dir., 402nd Maintenance Wg., Warner Robins ALC, AFMC, Robins AFB, Ga. ... Steven H. **Walker**, to Dep. Asst. SECAF for Science, Tech., & Engineering, Office of the Asst. Secy. for Acq., OSAF, Pentagon. ■

"No other joint base is experiencing [this] kind of growth," he explained.

Eglin Eyed as F-35 Software Center

Eglin AFB, Fla., is under consideration as a "reprogramming facility" for developing and distributing software upgrades to future international operators of the

F-35 Lightning II stealth fighter, reported Reuters news wire service Nov. 24.

Citing a senior F-35 program official, Reuters reported that this type of facility is envisioned since the United States does not intend to release the F-35's sensitive software source code to the international partners sharing

in the aircraft's development, despite their requests, or to those countries that will purchase the aircraft off the production line.

Friction between the US and the F-35 partners over technology sharing has arisen at times, but has so far not derailed the massive multinational project. Eglin is already the planned location of the F-35 initial joint schoolhouse.

Fractionated Satellite Effort Advances

The Defense Advanced Research Projects Agency has awarded a one-year, \$75 million contract to Orbital Sciences Corp. for the second phase of the System F6 fractionated spacecraft demonstrator program.

During this time, Orbital's industry team will mature its fractionated satellite design up through a critical design review, along with completing development of the majority of the software, stated the agency in a Dec. 4 release.

An on-orbit demonstration of this fractionated space architecture is planned in 2013 to show the value of operating a cluster of separate, small free-flying spacecraft modules as a much larger "virtual" satellite. This approach could spawn a new design paradigm that moves away from large monolithic satellites.

Grand Forks Gets Expanded UAV Mission

Grand Forks AFB, N.D., will host an expanded unmanned aircraft mission with the stationing of a mission control element there to operate RQ-4 Global Hawk Block 20 unmanned reconnaissance aircraft, announced the Air Force on Dec. 17.

The MCE is expected to arrive in fall 2011, pending a favorable environmental assessment. With it, Grand Forks airmen will control Global Hawks equipped with a communications relay called the Battlefield Airborne Communications Node.

Grand Forks, which is scheduled to lose its last KC-135 tanker aircraft in December, is also slated to be the future home to Global Hawk Block 40 aircraft that will feature a sophisticated radar system for tracking moving ground targets. The first Block 40 aircraft made its maiden flight on Nov. 16 over the skies of southern California.

C-5M Completes Surge Tests

Air Force officials at Dover AFB, Del., announced Dec. 3 that they had successfully completed the surge-operations portion of operational testing of the C-5M Super Galaxy transport aircraft, a 31-day period of nonstop sorties from Dover to Incirlik AB, Turkey.

Over this period, the C-5M flew 34 missions and moved 3.8 million pounds of cargo, bypassing traditional fuel

USAF photo by S/A Cynthia Spalding



Heading South: Fifteen F-22s from the 90th Fighter Squadron based at Elmendorf AFB, Alaska—seven of which are shown here—began to arrive at Andersen AFB, Guam, on Jan. 13 as part of US Pacific Command's rotational theater security package. Two other Raptor squadrons recently departed the theater.

stops for the C-5B variant at Rota, Spain, and flying directly to Incirlik. This saved more than 365 hours and about 1.3 million pounds of fuel, said the Dover officials.

The next step in C-5M operational test and evaluation was cold-weather testing, which began in Alaska in December. The C-5M features new avionics, engines, and reliability enhancements. The Air Force is upgrading 52 of its 111 C-5s to this configuration.

B-52 Radar Upgrade Eyed

The Air Force announced in late November its interest in investigating the applicability of an existing radar system as a potential replacement to the current AN/APQ-166 radar used on its force of 76 B-52H bombers.

In a request for information to industry, the service said the APQ-166—a mechanically scanned array system fielded in the 1950s and last upgraded in the early 1980s—is “approaching the end of its useful life.”

Forecasts are that the radar “will become unsupportable beginning in the 2016 time frame,” stated the RFI. The Air Force is therefore interested in a replacement system that would be available for initial delivery in Fiscal 2016. It must have a “minimum lifecycle through the 2040 time frame,” according to the solicitation.

X-51A Nears First Flight

In a captive-carry test Dec. 9, a B-52H bomber carried aloft the X-51A Wave Rider hypersonic test vehicle over Edwards AFB, Calif., paving the way for the X-51’s maiden free flight that is scheduled around March.

“We successfully captured all of our test points without any anomalies,” said Charlie Brink, X-51A program manager

Gen. Paul K. Carlton, 1921-2009

Retired Gen. Paul K. Carlton, who commanded Military Airlift Command, predecessor of today’s Air Mobility Command, from September 1972 to March 1977, died Nov. 23 in San Antonio at age 88.

Under Carlton’s leadership, MAC consolidated the Air Force’s tactical and strategic airlift assets and was responsible for high-profile missions such as Operation Homecoming, the repatriation of US prisoners of war from Vietnam.

“His accomplishments as a commander will be remembered and honored; he embodied the core values of integrity, service before self, and excellence,” Gen. Raymond E. Johns Jr., AMC commander, said of Carlton Nov. 25.

Carlton was born in April 1921 in Manchester, N.H. He attended the University of Pittsburgh and Ohio University. In September 1941, he entered the Army Air Corps aviation cadet program, receiving his pilot wings and commission as a second lieutenant in April 1942.

He was a B-17 instructor pilot until 1944. After that, he amassed 350 combat hours flying B-29s against the Japanese home islands from India and China.

After World War II, he spent more than three years with Strategic Air Command’s first atomic bomb organization, the 509th Bombardment Wing, at Roswell AFB, N.M. Following this, he was aide-de-camp to Gen. Curtis E. LeMay, SAC commander, for four years.

Assignments over the next decade or so took him to SAC bases across the US and to Guam and saw him in various command and planning and operations roles, including two more stints at SAC headquarters at Offutt AFB, Neb., and in August 1968 taking command of 1st Strategic Aerospace Division at Vandenberg AFB, Calif.

He led 15th Air Force at March AFB, Calif., from August 1969 to September 1972, when he assumed command of Military Airlift Command.

He was a command pilot with more than 12,000 flying hours in the B-47, B-52, B-58, KC-135, C-141, C-5, and SR-71.

with Air Force Research Lab’s propulsion directorate at Wright-Patterson AFB, Ohio, of the test.

Program officials expect the Wave Rider to light its supersonic combustion ramjet engine for a five-minute hypersonic flight over the Pacific Ocean when it flies free for the first time. One dress rehearsal was planned before the first flight.

Edwards Solar Project Discussed

The Air Force announced Nov. 24 that

it was poised to begin negotiations with Fotowatio Renewable Ventures of San Francisco, an independent solar power producer, on a lease deal to develop the largest crystalline photovoltaic solar project in North America on the grounds of Edwards AFB, Calif.

The service said it selected FRV for the negotiations, following a competitive evaluation of proposals that were due last September.

Once negotiations are finalized and an enhanced use lease is signed with FRV, development of the 3,288-acre solar farm will commence. According to the Air Force Real Property Agency, it will deliver enough energy to power nearly 89,000 homes.

Space Debris Removal Explored

The Defense Advanced Research Projects Agency announced Dec. 9 that it is exploring the merits of removing man-made debris from Earth orbit, out of concern over the growing danger that these objects pose to spacecraft and satellites.

This study, known as Catcher’s Mitt, will model debris, both now and projected in the future, and then, if appropriate, explore technically and economically feasible solutions for debris removal, said the agency.

“If justified, potential follow-on efforts might include a new DARPA-led program, or DARPA support for an effort led by another US government organization,”

USAF photo by SrA Jennifer H. Calhoun



Good Night, Dragon Lady: A U-2 assigned to the 380th Air Expeditionary Wing comes to a rest at an air base in Southwest Asia after completing a surveillance mission. The venerable aircraft type has been providing intelligence-surveillance-reconnaissance data since the mid-1950s.

TRANSCOM Plots Afghanistan Surge Support

US Transportation Command officials are focused on creating more transport capacity to support the insertion of an additional 30,000 troops and their equipment into Afghanistan by mid-2010 and on optimizing the flow of these forces, Air Force Gen. Duncan J. McNabb, TRANSCOM commander, told reporters Dec. 9 in Washington, D.C.

President Obama announced this troop surge on Dec. 1.

McNabb said Afghanistan is a “unique place,” in terms of the logistical challenges that it presents, because the nation is landlocked, with rugged terrain and very high altitudes.

The supply pipeline into the nation is limited and trying to force more men and materiel through it would only overwhelm the system, he said.

Accordingly, the best means of enabling the greater flow of forces is to create new access routes.

“You want to have options,” he said.

Currently, about one-half of all cargo destined for Afghanistan traverses two land routes through Pakistan, said McNabb. Another 30 percent of supplies travels over northern land routes from Tajikistan, Turkmenistan, and Uzbekistan.

The final 20 percent comes in by air, he said.

While he said he thought the US military already had the air and overland capacity to support additional troops, he was still looking to increase that capacity twofold to mitigate the effect of potential disruptions arising from issues such as severe weather or man-made factors.

As a fallback, McNabb said he wanted to be able to move everything into Afghanistan by air, if necessary.

One promising “niche” air option would be to utilize air routes that would extend from the US over the North Pole and then over parts of Russia and the Central Asian republics, directly into Afghanistan, said McNabb.

Such access would allow modern commercial freighters such as 747-400s and military C-17s to fly nonstop from the US into places such as Bagram Airfield, he said.

The US and Russia in July 2009 signed a transit agreement that allows flights through Russian airspace to Afghanistan.

transfer, access to these personnel files was limited to veterans, their primary next of kin, and federal agencies.

Airman Receives Bronze Star Medal

SSgt. Charles Holley of the 509th Logistics Readiness Squadron at Whiteman AFB, Mo., has received a Bronze Star Medal with valor device for service in Southwest Asia.

Holley was honored Nov. 25 for his actions as Humvee gunner during a convoy mission in Tikurit, Iraq, in 2008. An IED exploded under his vehicle. Despite his own injuries—he ultimately suffered second-degree burns to his hands and face and took shrapnel in one leg—he tried to extract two bodies from the burning Humvee and then refused medical treatment and helped return enemy fire until the scene stabilized.

World War II Bomber Crew Buried

The remains of the aircrew of *The Happy Legend*, a B-25 bomber that crashed in the mountains of New Guinea on Dec. 5, 1942, were laid to rest on Nov. 17 at Arlington National Cemetery in Arlington, Va.

Although the bomber’s wreckage was first located in 1943, it took until 2006 for the remains and effects to arrive back in the US and another few years to organize the burial ceremony for all the families, reported the Chicago *Daily Herald* Nov. 24.

Two caskets were interred. One had the individual remains of 2nd Lt. William N. Stocking, the navigator. The other contained the personal effects of the crew members for whom no remains were recovered: 1st Lt. Charles L. Maggart, the pilot, 1st Lt. Wilson Pinkstaff, copilot, 2nd Lt. Frank Thompson, bombardier, Sgt. Aubrey L. Atkins Jr., radio operator, Cpl. Richard P. Grutza, engineer, and Cpl. Antonio P. Calderon, gunner. ■

said Wade Pulliam, a DARPA program manager.

Airmen Records Go to Archives

Approximately 177,000 official military personnel files on Nov. 18 became part of the public record with their transfer from the Air Force Personnel Center to the National Archives and Records Administration in St. Louis for permanent retention.

USAF was the last service to make this move as part of an arrangement between the Department of Defense and US Archivist, under which personnel files become archival 62 years after an airman is discharged, retired, or dies in service.

Included in the batch now in St. Louis are the personnel files of such airpower pioneers as Gen. Jimmy Doolittle and Brig. Gen. William Mitchell. Prior to this

News Notes

■ Retired Lt. Gen. John L. Hudson, ex-commander of the Aeronautical Systems Center, on Dec. 10 was named to fill the newly created position of deputy director of the National Museum of the United States Air Force at Wright-Patterson AFB, Ohio.

■ Air Force officials announced in mid-November that the service would not implement its new fitness standards until July, six months later than originally planned, in order to give airmen more time to adapt to them.

■ The USO on Dec. 9 presented its Distinguished Service Award to the five living Air Force Medal of Honor recipients, all retired colonels: George E. “Bud” Day, Bernard F. Fisher, James P. Fleming, Joe M. Jackson, and Leo K. Thorsness.

■ Capt. Ryan Bone, an F-15E weapon system officer deployed with the 335th Fighter Squadron from Seymour Johnson AFB, N.C., on Nov. 22 reached 1,000 flying hours in the backseat of the Strike Eagle during a mission over Afghanistan.

■ The Air Force’s Thunderbirds air demonstration squadron will kick off its 2010 airshow schedule, its 57th season of performances, March 20-21 at Davis-Monthan AFB, Ariz. There are a more than 65 shows through November on the unit’s calendar.

■ Maj. Tammy Barlette of the Arizona Air National Guard in December became the first reserve component remotely piloted vehicle operator to graduate from the Air Force Weapons School instructor course at Nellis AFB, Nev.

■ The Airbus A400M military transport, designed to compete against Boeing’s C-17 and Lockheed Martin’s C-130J on the international stage, made its maiden flight on Dec. 11 from Airbus’ facility in Seville, Spain.

■ Airmen at Andersen AFB, Guam, on Dec. 16 conducted the annual Operation Christmas Drop, delivering more than 12 tons of cargo—food, supplies, tools, and toys—to 51 islands across more than 1.8 million square miles in the Pacific region.

■ Raytheon announced Dec. 9 that a modified AIM-9X Sidewinder air-to-air dogfight missile fired from an F-16 fighter sank a rapidly moving target boat during a Sept. 23 test in the Gulf of Mexico. ■



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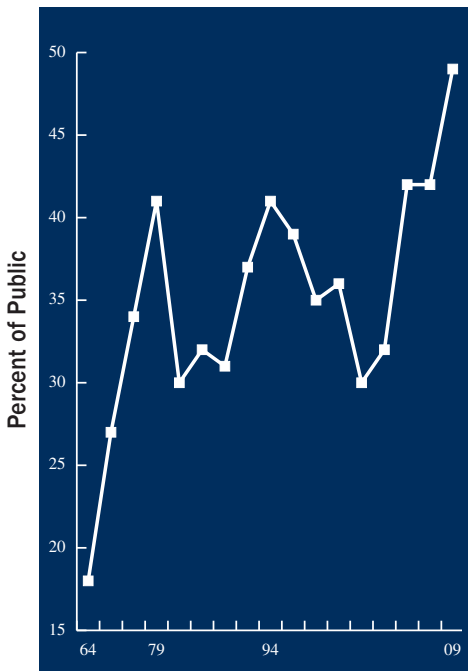
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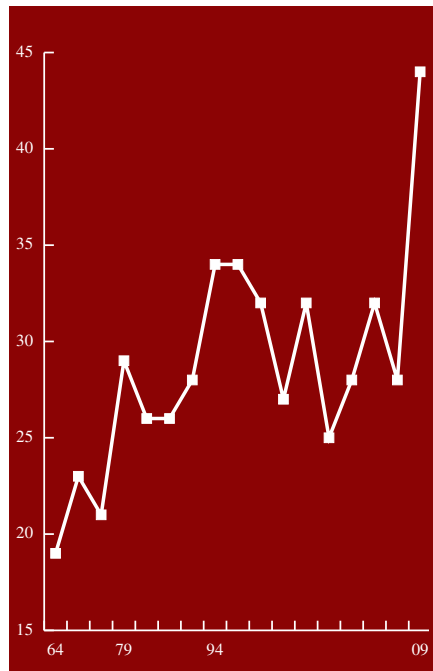
Americans are in a cranky mood, apprehensive about their role in global affairs. They have turned inward and become impatient with world engagement. So concludes “America’s Place in the World,” a quadrennial survey by the Pew Research Center in conjunction with the Council on Foreign Relations. For the first time in 45 years, a plurality (49 percent) said the US should “mind its own business”

(Figure 1). At the same time, 44 percent—a record—said we should “go our own way” in the world (Figure 2), while 76 percent said we should “concentrate more on our own national problems” (Figure 3). “There has been a sharp rise in isolationist sentiment among the public,” said the survey, but it noted that Americans, by a wide majority (57 percent), want America to remain the world’s superpower.

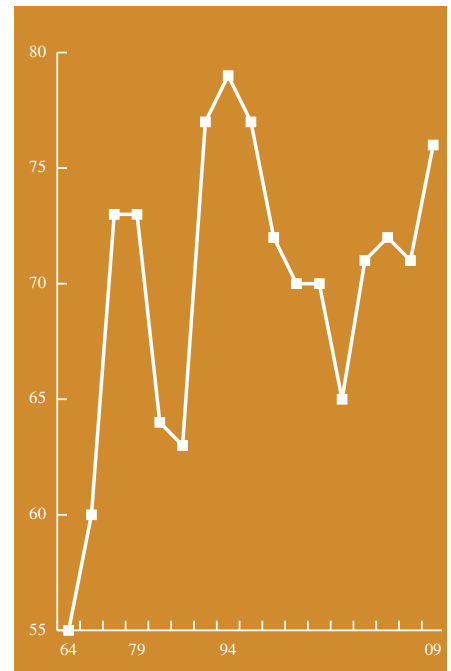
Isolationism, Unilateralism, Nationalism All on the Rise



US should “mind its own business”



We should “go our own way” in the world



We should “concentrate more on our own national problems”

Source: “America’s Place in the World 2009,” Pew Research Center for the People & the Press, in association with the Council on Foreign Relations, December 2009.



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From Many, One? Or Maybe Two?

As matters stand today, the US aerospace industry will, by the end of this decade, be producing one fighter—the F-35. Airlifter assembly could be down to one line—the C-130 tactical transport. Production of a long-range bomber? Maybe, but probably not. USAF's new tanker aircraft should be coming off an assembly line, but, in the twisted world of the KC-X, that is no sure thing.

Such will be the diminished state of a once-mighty arsenal that churned out numerous manned aircraft models in large numbers for decades.

The Pentagon must decide what, if anything, to do about this withering of the aircraft industrial base. The approach thus far has been to let the number of defense contractors shrink as programs declined, even though at some point, this will seriously limit competition.

In many areas, the Pentagon appears content to have a single prime contractor for an entire category of aircraft, such as manned tactical fighters.

Note, for example, that fighter lines currently producing Air Force F-15, F-16, and F-22 as well as Navy F/A-18 aircraft are almost certain to close down within the next five years. Today's plans call for the F-35, in future decades, to comprise some 95 percent of the combined Air Force, Navy, and Marine Corps fighter force. If the Pentagon gets its way, moreover, the thousands of engines used to power these fighters would be manufactured and supplied by a single engine house.

This free-market approach may make short-term economic sense, but the long-term consequences are difficult to determine.

For example, if the F-35 or its engine develops major problems, what is Washington's fallback option? Where will the US turn for alternative capabilities? On a more fundamental level, will the nation still be able to call on several competitors to design and develop a state-of-the-art aircraft the next time one of the military services determines it needs a new system?

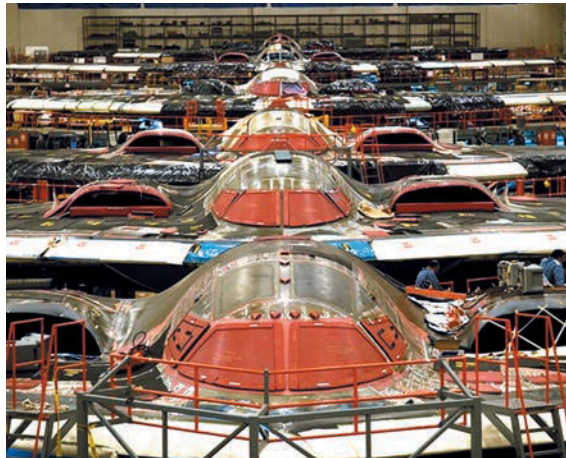
The problem is that industrial competition isn't a free good; typically, keeping several competitors alive and struggling for a piece of the action entails greater up-front expense. This becomes especially difficult during periods of austerity. Such is the case today, with DOD warning that acquisition budgets will fall in coming years. Asserted DOD's 2009 industrial base report to Congress: "Over the next five to 10 years, most current military aircraft production programs will end, precipitating the need for a new round of consolidation in order to reduce infrastructure costs."

DOD freely admits that this could restrict future options. Brett B. Lambert, Pentagon director of industrial policy, told the trade magazine *National Defense* that defense contractors should expect to have to shut down some of their industrial capacity. DOD is "not in the business of propping up indi-

vidual sectors or industries just because we used them in the past," he said.

Where do all of these developments come out? For the contractors, it appears there can be two outcomes.

One was exemplified by Missouri's now-defunct McDonnell Douglas, proud designer and builder of the F-15 and F/A-18 fighters. McDonnell Douglas was driven into a 1997 merger with Boeing after the St. Louis company lost out in an early round of the F-35 competition. Too much of this, and DOD's prospects for future competitions become dim.



Competition keeps everybody doing their best.

Second is Boeing's example. Boeing, despite losing some high-profile competitions such as its struggle with Lockheed Martin for the F-35 contract, nevertheless has survived (some would say flourished) as a military contractor in airlifters, fighters, space systems, and more.

Realizing the stakes, lawmakers in several states are advocating a "dual-source" approach to upcoming programs, but support for dual-sourcing is typically determined not by manufacturing rationality but by politics, local economics, and parochial self-interest.

Note the debate over the wisdom of supporting separate Pratt & Whitney and General Electric production of F-35 engines—a fight in which state interests play a major role. Also controversial: The notion of awarding two contracts for the KC-X tanker, so that Boeing and Northrop Grumman-led teams could build rival tankers at the same time.

Detractors say dual-source arrangements ensure the best team does not win. Rather, they claim, these situations reduce economies of scale, increase support costs, and lead to far more expensive training and logistical support operations.

Claimed benefits are faster production, greater responsiveness to military needs, higher quality, and insurance against a devastating "single point failure."

Uniformed military officials speak out frequently in favor of preserving competition—in the abstract. "In all cases, competition is a very good thing, and competition tends to make sure everybody works better," said Air Force Gen. Duncan J. McNabb, head of US Transportation Command. Competition, he went on, "keeps everybody doing their best."

Affordability and security must be carefully balanced because there can be no competitions without competitors. Following the rapid and sometimes chaotic industrial consolidation of the 1990s, the then-Secretary of the Air Force, James G. Roche, got it right: "The most direct way to drain innovation and cost savings out of programs is to deaden competitive pressures," he said. "Excessive consolidation, unfortunately, contributes to that problem." ■

More information: http://www.acq.osd.mil/ip/docs/annual_ind_cap_rpt_to_congress-2009.pdf



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After the QDR, USAF will have fewer fighters, fewer options, and therefore tougher choices.

Rising Risk in Fighter Force

By John A. Tirpak, Executive Editor

The Air Force is poised to launch a dramatic restructuring of its fighter fleet. Anticipating years of flat budgets and a changing military strategy, the service will shrink its fighter force as much as 20 percent. There will be fewer squadrons and they will have fewer people.

There will be newer machines—and the average age of the fighter fleet may stabilize after steadily graying for 20 years—but a portion of the inventory will be geared toward less demanding wars.

The service has developed a matrix of options for the future of the fighter fleet. The set it chooses to implement

will depend on the answers to three questions, all of which should be forthcoming this spring:

- What military strategy will the Air Force be asked to execute, based on the results of the latest Quadrennial Defense Review?

- At what rate will the Air Force be allowed to buy the new F-35 fighter?



USAF photo by SSGT. Michael B. Keller

the

F-22 Raptors of the 27th Fighter Squadron at Langley AFB, Va., in formation during a December 2009 training mission in Southwest Asia.

■ Will Congress grant USAF's request to retire some 250 of its inventory of fourth generation "legacy" fighters?

A fourth perennial but critical question—how many F-22s will the Air Force be allowed to buy?—was put to rest last year, when Congress and the Air Force leadership capitulated to the decision by President Obama and

Defense Secretary Robert M. Gates to terminate production at 187 aircraft.

Gen. William M. Fraser III, head of Air Combat Command, affirmed that the fighter force faces what could prove to be significant turbulence, declaring, "All options are on the table."

Speaking in late December, Fraser explained that the QDR will answer

some major questions: How many wars, of what size, and at what intensity the Air Force must be able to fight in the future. The QDR will then be translated into a National Military Strategy, which will spell out the Air Force's specific responsibilities.

Balancing Demands

That, in turn, will determine how many combat aircraft the service will have to field. If stealthy new F-35s enter the fleet at a rapid rate, ACC won't need to keep as many older, legacy fighters that are outclassed by those now fielded by many other countries. If the F-35s are bought slowly, or delayed by testing or production difficulties, USAF will have to undertake a series of expensive service life extensions on its older fighters, as well as upgrades that would make them relevant to a modern, all-up fight.

Moreover, these calculations will be made in the context of continuing and expensive wars in Iraq and Afghanistan.

"We're still going to have to fight today's fight in this irregular war," Fraser said, adding that the Air Force is seeking to balance the demands of the present, in which the Air Force enjoys a permissive airspace, against the need to prevail in the toughest scenarios, where USAF's control of the air will be harshly and competently challenged.

Fraser warned that the Air Force has to be "prepared for tomorrow, should the need arise [to fight] a more intense conflict, where other capabilities may be needed."

By late December, no one had any of the answers that USAF needed in order to craft its plan. The QDR's findings remained tightly held by the Pentagon leadership, although Fraser said it was unlikely the Air Force would be asked to do less in the future.

"I've not heard any discussion about mission relief," he said.

It's expected that the QDR will steer toward a different strategy than that which forces are currently directed to carry out. For the moment, US forces are still observing the so-called 1-4-2-1 strategy, which calls for being prepared to defend the homeland, deter aggression in four critical geographic regions, fight two nearly simultaneous and widely separated major theater wars, and achieve a decisive victory in one of them. "Decisive victory" implies a lengthy ground-force occupation.



Air Force leaders point out that numbers of fighters aren't the whole story. Tankers, ISR assets, and logistics are force multipliers. Here, an F-15 tanks up over Afghanistan.

Gates has said that the new strategy will put a bigger emphasis on what he calls “likely” wars—in his view, those that would be similar to conflicts in Iraq and Afghanistan—and a reduced emphasis on preparing for major conventional conflicts with near-peer adversaries. Gates finds those unlikely.

For most of this decade, the Air Force’s benchmark was a total of 2,250 aircraft. Maj. Gen. David J. Scott, director of operational capability requirements on the Air Staff, said the required number is actually “between 1,800 and 2,250.” The Combat Air Forces Reduction—or “CAF Redux,” as ACC calls it—would lower the fielded fighter force from 2,250 to about 2,000, so the fleet would still be “smack in the middle of the range,” Scott said. He acknowledged that, against today’s strategy, “obviously there’s a risk” with lower numbers.

Of the new fighter mix, Scott said probably 50 or so “could probably be ... a Reaper or Predator-type aircraft”—remotely piloted aircraft with an attack capability geared to a low- or no-threat environment. Some small proportion, not yet determined, will be light attack aircraft, likely propeller driven, for counterinsurgency operations.

Scott said that the quality of the aircraft will determine how many are needed.

“If you have 1,500 fifth generation aircraft”—those with stealth, sensor fusion, and advanced electronic capabilities—“maybe you need only 300 fourth generation aircraft.” Bottom

line, he said, “it may not always be 2,000 [fighters] from [the years] 2010 to 2032. That number may change.”

The Air Staff is looking at the potential mixes of fighters the Air Force might have at various times, and is comparing them against anticipated threats, to find the essential numbers required, Scott said.

The Biggest Question Mark

A smaller number of fighters will mean fewer options and tougher choices. They can’t be in two places at once. “We are taking risk,” Fraser acknowledged, “but it’s measured risk.”

Scott maintained that, even at reduced levels, “we can do everything we need to do with those numbers.” He maintained that the number of platforms is not the whole story.

“It’s [the] weapons that you put on those platforms,” he said. “It’s the ability to get those platforms where you need to get them with the tankers and the lift. It’s the protection and the airborne control with the AWACS and the Rivet Joints and those sorts of things. ... It’s an integrated fight, [and] we can take care of our nation’s priorities.”

The rate at which the F-35 will join the force is perhaps the biggest question mark in the Air Force’s future plans. Over the past few years, the planned F-35 accession rate has swung as high as 130 a year and as low as 48, the last officially blessed number. Each shift has rippled into USAF’s planning for legacy fleet upgrades.

Air Force officials said a rate of 80 F-35s per year or more will permit modernization of the fighter fleet at an acceptable rate, and reduce the need to spend large sums extending the life of the legacy aircraft.

“Obviously, 110 [per year] is ... the number we would like to have,” Scott said. “As we currently look at what 80 gives us, and the service life that we currently have on our legacy fighters, we maintain above the numbers that the Chief needs ... for the current fight” and the current strategy.

However, the F-35 ran into trouble last fall, when delays in production and flight testing prompted a Pentagon analysis group to warn of potential



A1C Kyle Crawford of the 332nd Expeditionary Maintenance Squadron checks a tool kit. Many maintenance billets are being transferred to shorthanded specialties.



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significant future cost jumps in the program. Increased costs could result in a slower or reduced buy of the F-35, which again would affect legacy fleet plans.

Pentagon spokesman Geoffrey S. Morrell said that in charting a course for the F-35, Gates hoped to find “the sweet spot” between cost estimators who tend to highlight worst-case scenarios, and program office and contractor management, who tend to be optimistic.

Late in the year, though, word came from the Pentagon that Gates would assume poorer rather than better performance on the F-35 program, and that the services would budget accordingly. Since most of the F-35’s development money has been spent, reductions would have to come from production money, either stretching it out or eating into the overall planned buy. The Air Force’s long-stated requirement for the F-35 is 1,763 aircraft.

For the Fiscal Year 2010 budget, the Air Force asked to retire 250 legacy fighters early—a hefty number amounting to more than three wings’ worth of capability. It has argued that it will use the savings derived for legacy fighter upgrades and to increase the rate at which F-35s are bought.

However, late last fall, Congress balked at the Air Force’s plan. House-Senate authorization and appropriation conferees both ordered the Air Force to provide a series of reports on how it will restructure its fighter activities before Congress will permit the reductions. Authorization conferees in October ordered USAF to provide “a roadmap that resolves the looming tactical aircraft shortfall” before the service can proceed with fighter retirements. Conferees were concerned that the Air Force hasn’t developed a plan that will address both the needs of the active duty force and those of the Guard and Reserve.

Fraser said that at least some of the savings from the early retirements will indeed be “put back into the combat air forces. But it’s a corporate decision.”

Manpower savings, for example, have already been spent. Some of them have been “applied to new, emerging missions, to some of the stressed Air Force specialty codes,” Fraser said. The savings “in dollars and personnel ... will be taken and applied to where the Air Force best needs it. ... It’s not confined to one specific command.”

Given that the F-22 is now capped at 186 aircraft (one operational aircraft was lost in an accident) and with likely



Photo by Bryan William Jones

A multibillion dollar program is under way to replace the worn-out wings on 1980s-era A-10s such as this one. A dove-tailing digital upgrade gives the aircraft capability for new sensors and weapons.

delays in the F-35, USAF is assuming it will have to retain some number of legacy aircraft to meet its quota of fighters. Much of the fleet was built in the 1980s or even earlier, however, so the first order of business is to determine how much life is left in the old airplanes.

Extreme Fatigue

To that end, USAF is conducting what are called fleet viability boards. For fighters, the effort was spurred by an accident in late 2007, when an F-15 in a practice dogfight broke in half. The service discovered that a longeron—a “life of the aircraft” part—buckled and caused the aircraft to fold up under heavy G forces.

The F-15 fleet was grounded for months, and the service dug deep to

discover whether the aged airplanes were still safe to fly. Ten or so suspect items were either replaced or inspected, and the F-15s were cleared to fly again. However, USAF has launched a full-scale fatigue test, in which a representative F-15 is being subjected to simulated years of hard use in laboratory conditions.

“You’ve got strain gauges all over this bird, and there’s a telemetry room that looks at every aspect of what those strain gauges are feeling,” explained Col. Timothy Forsythe, chief of ACC’s combat aircraft division.

Any failures in the test F-15 will inform maintenance people of trouble spots to watch in the flying aircraft, as it will be years ahead of the fleet in experiencing those stresses.



USAF photo by MSgt. Scott Wagers

The Air Force expects to keep 176 F-15C/D fighters such as this one until about 2030. Here, A1C Kevin Romer performs a postflight inspection in Southwest Asia.



A big question is how fast the Air Force will get new F-35 fighters. Slowed or postponed deliveries will cause old warbirds to stay on the job even longer. Left, Lockheed Martin pilot David Nelson takes an F-35 on his first flight in the new fighter.

The test will be completed in 2014-16, but Fraser said he sees “no reason to doubt” that the F-15s will be safe to fly until then. Besides the stress test, the Air Force was funded for data recorders on the fighter, to help track the fatigue applied to it in combat and training flights.

“We will not put guys out there in an unsafe airplane,” Forsythe said.

Although originally built to fly around 12,000 hours, analysis by Air Force Materiel Command indicates the F-15C can fly as many as 20,000 hours; “it can easily get past 2030,” Forsythe said. That applies, though, to the youngest and least-stressed F-15Cs in the fleet.

These so-called “Golden” or “Long-Term” Eagles will be retained and outfitted with active electronically scanned array radars, like those on the F-22 and F-35, and which are now proliferating widely among foreign fighters. The AESA is an advancement that Forsythe said represents an evolutionary milestone in air combat.

“It throws you into a whole new ballgame,” Forsythe said. “You’re able to look further, ... with more accuracy. You can use it for things that you cannot use a mechanically scanned array radar for. You’re able to task it in different ways simultaneously.” Whereas the mechanical radars on F-15s and F-16s are maintenance-intensive, the mean time between failure of AESAs “is huge. ... In the long run, they become much more cost-effective.”

The Air Force is planning to retain 176 F-15C/Ds into the late 2020s at least. Some 107 new AESAs are already funded for them, and 18 of those to be retained already have an earlier-version AESA, which was funded by the Air National Guard. Eventually, USAF would like to equip all the Long-Term Eagles with AESAs, although ACC officials said budget austerity may require some noncombat-coded aircraft to go without them.

Other upgrades would include some structural strengthening and the addi-

It took 20 years to field the F-22, shown here performing at an air show, and USAF is already inside the window to begin defining its replacement, a sixth generation fighter. Preliminary studies are about to begin.



tion of new gear such as an Infrared Search and Track system. The IRST is like a heat-seeking radar; it can spot radar-stealthy objects at long range by their heat signatures. Additional improvements would be added in electronic warfare and electronic self-protection systems. Most foreign fighters of the fourth generation and better have IRSTs.

The F-15E Strike Eagles were mostly built in the 1990s and were constructed with stronger structures to maneuver hard with big loads of weapons. Forsythe said the F-15Es are in the best shape of all the fighters and will last well past 2035.

The F-16 fleet has also undergone fleet viability analysis. What are called the “pre-blocks”—the early Block 25, 30, and 32 aircraft—are now almost all retired, with the exception of a few aircraft used for test purposes. The current versions in Block 40/42 and 50/52 are expected to last as long as the F-15Cs—up to about 2030.

No fatigue test is yet in motion on the F-16, but ACC wants to do one on an F-16 Block 50 aircraft. Any fatigue problems that showed up on that airplane would also inform maintainers of areas of concern on the Block 40, 42, and 52 versions, since they are structurally similar.

Like the F-15C, the F-16 will probably get AESA, IRST, and electronic warfare improvements. A structural enhancement is probably needed, too.

Although there would have to be a competition to equip the F-16 with

an AESA, Forsythe said it wouldn't take "as much time as one would think," despite the glacial process of most acquisitions. That's because the technology readiness level of AESA radars is very high, he said. Development would be quick.

Many F-16s already have capability for the Joint Helmet Mounted Cueing System, which allows the pilot to see cockpit information inside his helmet and direct missiles by looking at the target. It's another game-changer, according to Forsythe, but "a helmet can only give you so much" by way of displays and still be transparent. Many cockpit displays are still four-inch, monochrome squares, he said.

"Our sensors have more fidelity than some of the displays that we have," so cockpit upgrades are another necessity.

The venerable A-10, built tough for hard duty killing tanks at low altitude, is in good condition considering that all remaining models date back to the early 1980s. Due to a wing-crack problem, USAF has invested in rewinging all the A-10s it plans to keep, and is upgrading them to a standard A-10C version with digital systems that expand its capabilities. The rewinging program will be concluded in 2016 and will leave ACC with 347 aircraft.

The F-22 is still considered brand-new—the Air Force hasn't even taken delivery of all the airplanes yet—but Fraser said he's trying to make sure that "we get the maximum capability out of the platform" and fund it properly to maintain its edge as the top fighter in the world. A bevy of upgrades that will make the F-22 even better is already in the pipeline, and Gates has said they're worth \$6 billion to \$7 billion over the next years.

The F-22s, even with a truncated inventory, will remain the key enabler for US airpower, paving a stealthy path through enemy air defenses in any contested airspace.

Starting next year, the Raptor will get the Increment 3.1 software, which adds capabilities for synthetic aperture radar, the Small Diameter Bomb, electronic attack and geolocation of radar emitters. It will sharply enhance the F-22's power in ground attack and suppression of enemy defenses.

Upgrades will then come along at two-year intervals. In 2013, advanced electronic protection and combat identification systems will be added, along with capacity for Link 16 data reception. In 2015, the F-22 gets the



USAF photo by SrA. Michael Cowley

Capt. Matthew Feeman pilots an F-16 from Shaw AFB, S.C., in a homeland defense exercise. Planned upgrades may be displaced if USAF isn't allowed to retire hundreds of its oldest fighters.

Increment 3.2 software, adding the Multifunction Advanced Data Link (or MADL), the AIM-120D AMRAAM, and AIM-9X missiles—the most advanced versions—an automatic ground collision avoidance system, and continued improvements in electronic warfare. Further improvements haven't been chosen yet, but could include an IRST, improved identification, friend or foe gear, new satellite navigation, and various navigation, communications, and surveillance enhancements.

Now That We Know the Number

Fraser said he's looking at a variety of options to get even more capability out of the Raptor, to include increasing the fraction of the fleet that is "combat coded," that is, ready for war at any time. He declined to identify the alternatives specifically, but they may include steps such as reducing the number now set aside for training of new F-22 pilots.

Another study under way is examining what size F-22 squadrons should be.

"Now that we know what number" of F-22s the Air Force will have, "we're going to have to go back and look, with all options on the table, as to how best to manage that fleet," Fraser said. The planned 24 aircraft per squadron has never been filled out; it may stay at 18 per squadron, or fewer, given the Raptor's ability to cover more airspace and fly more frequently than F-15s.

Besides the major platforms in USAF's fighter arsenal, the service is well under way in developing new weapons that will expand the reach and destructive power of those aircraft. The AMRAAM—USAF's radar-guided

air-to-air weapon—will be improved with longer range and new warheads. Beyond the AMRAAM, which is a 25-year-old design, the Air Force is looking for a new missile.

"There is a next generation weapon that we are working on," Scott said, adding that it will likely be a multimode munition able to seek targets both in radar and heat-seeking mode.

More than that, "we have a next generation jammer [and a] next generation fighter. We are always looking at what [to] do next. If you think about F-22s and F-35s, one day, they are going to age out."

Scott said ACC is beginning an analysis of alternatives to "look at what's next in the fighter world," and added that it will take 12 to 18 months.

"We've begun the planning ... for sixth gen," Fraser said, noting that ACC is looking at a fighter beyond the F-22, "with some preliminary planning for sixth gen Tacair capability and what we'll need in the future." Although USAF will be investing in remotely piloted vehicles and longer-range standoff weapons, Fraser said that they alone cannot do the job in the decades to come.

"It's got to be a proper balance," he said. "I still think we need to be prepared for the high-end fight, in an anti-access environment, should we be called upon to do that. And that's not going to be in purely a standoff role."

He acknowledged that the F-22 took 20 years to go from the drawing board to squadron service, and "it's going to take us a while" to get the next generation of fighters.

"That's why we've got to start now," he said. ■

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It's the Air Force UAV, which delivers vital information as well as an occasional shot between the eyes.

The Indispensable Weapon

By Marc V. Schanz, Associate Editor



USAF photo

In just a few years, USAF's fleet of unmanned aerial vehicles has become a critical factor in the success of US combat operations in Iraq and Afghanistan. Contributions now range from dismantlement of improvised explosive devices (IEDs) to the tracking of foes in some of the harshest terrain on Earth.

The aircraft, flown in combat by airmen stationed at US sites, can monitor combat activities for many hours more than has been possible with manned aircraft. The MQ-1 Predator, for example, boasts an operational endurance of 22 hours.

UAVs often play vital roles in the slow, painstaking process of gathering

information on militant activity and "pattern of life" analysis, which is usually compiled over the course of days or weeks.

Lt. Gen. David A. Deptula, USAF's deputy chief of staff for intelligence, surveillance, and reconnaissance, cites the example of the 2006 mission targeting Abu Musab al Zarqawi, the leader



USAF photo by TSgt. Efen Lopez



USAF photo by SSGT. Samuel Morse

Above left: An MQ-9 Reaper flies a combat mission over Afghanistan. Left: An MQ-1 Predator heads out on a night mission from Kandahar Airfield, Afghanistan. Above: Maj. Rick Wageman pilots an MQ-1 Predator from a virtual cockpit at a base in Southwest Asia.

of al Qaeda in Iraq. That operation ended with an F-16 strike, but was made possible by hundreds of hours of MQ-1 Predator surveillance and time spent analyzing the raw data.

Airmen involved in theater operations are low key about their contributions.

Maj. Michael Navicki, UAV liaison officer at Air Forces Central's combined air and space operations center in Southwest Asia, said, "The guy on the ground dictates our requirements."

Navicki helps choreograph the use of Predators, the larger and more fearsome MQ-9 Reapers, and other remotely piloted aircraft.

Requests from ground commanders and joint terminal attack controllers (JTACs) pour in without letup. Ground forces seek assistance with tasks from watching over raids to assisting in "troops in contact" firefights, to tracking the movement of improvised explosive device teams on vital transit routes. "We're going to flex and meet the missions they have," added Navicki.

We Own Time

Predator and Reaper aircraft bring distinct capabilities to combat. UAV operators "have a high capacity to make sure that we have the exact, right target in our crosshairs," said Col. Peter E. Gersten, commander of the 432nd Wing at Creech AFB, Nev. "Time is not our enemy. We own time."

The demand for UAVs has spurred Defense Secretary Robert M. Gates and senior service leaders to aggressively develop both the aircraft and the infrastructure supporting them.

Today, troops in the field in Iraq and Afghanistan can't imagine conducting operations without the sensors and full-motion video capabilities UAVs bring, according to the airmen who work in the rapidly expanding mission.

"Initially, this was a piece that people underappreciated," said Col. John P. Montgomery, commander of the 98th Range Wing at Nellis AFB, Nev. Now, "somebody is watching the ground [24 hours a day] in the places that matter" to the people on the ground—and it means life and death. This is now "completely invaluable" to the war effort.

Montgomery told reporters visiting Creech in spring 2009—when he was 432nd vice commander—that the Air Force's rapid expansion is partly inspired by the hard-fought urban combat operations of the Iraqi surge. Montgomery, a career F-16 driver, described flying combat missions over Sadr City—a once violent and dangerous section of Baghdad which was a flash point during surge operations—and how Predators changed the combat dynamic.

"When I flew over Sadr City, I knew where they hung out the laundry, I knew when they took out the trash, and I knew the traffic flow," he said. "And when that changed, I knew it. It was part of the pattern of life that was



An MQ-9 powers up for departure from Kandahar Airfield.

USAF photo by TSgt. Efren Lopez

going on. We could tell people on the ground what was happening, and when something changed—which meant something was about to happen.”

The ability to keep aircraft overhead in an ISR role, carrying up to 3,000 pounds of ordnance—for 24 hours at a time while swapping out crews—has proved to be a game changer for the Air Force.

“You are going to have the opportunity to become more familiar with the area,” Navicki said. “You spend hours and hours talking with support units, ... through radio or [secure] chat.” The ground commanders, JTACs, and operators are now very smart about what UAVs can and can’t do, he added. “If we feel we might give better effects, we could recommend more appropriate actions in combat,” Navicki said.

The demand for persistent ISR and strike capability has driven operational statistics through the roof. When Montgomery arrived at the 432nd Wing in June 2007, the Air Force was flying 10 combat air patrols in the US Central Command region daily. The plan at the time was to build to 12 CAPs by Fiscal 2010.

The number of Predator and Reaper CAPs has actually increased 680 percent in five years—going from five in 2004 to 39 as of mid-December 2009. The CAPs were composed of 31 MQ-1 patrols, seven MQ-9 orbits, and one RQ-4 high-altitude surveillance patrol. The fleet of Predators surpassed

600,000 flight hours in September during operations in Southwest Asia—an incredible statistic considering the fleet had achieved the half-million flight hour mark a mere seven months earlier.

More Kinetic Options

Crucial to the Air Force’s ability to leverage so much UAV combat power so quickly is the rapid expansion of the mission in the Air National Guard—from

flying units to intelligence analysis and ground control capability.

In Fiscal 2006, the Air National Guard had six ISR units, said Col. Gregory T. White, the National Guard Bureau’s director of ISR. Today, the ANG has 36 ISR squadrons, from flying units to training units and signals intelligence squadrons.

Guard squadrons in Arizona, California, North Dakota, and Texas all operate

USAF photo by MSgt. Jerry Morrison



Deputy Secretary of Defense William Lynn III (left), escorted by Lt. Col. Morgan Curry (right), examines Predator and Reaper aircraft on a tour of Kandahar Airfield.

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Predator orbits in theater daily and their capability is expanding, White said, performing approximately two CAPs every day. To aid the Air Force's effort in expanding the pilot and maintainer training for Predators, the California ANG's 163rd Reconnaissance Wing conducts both flying and maintenance training at March Air Reserve Base, to help relieve the burden on the Creech schoolhouse.

The active duty Air Force is also expanding training activities—announcing in July that Holloman AFB, N.M., would be the site of the service's new Predator and Reaper formal training unit for combat operators.

Most Guardsmen have years of flight experience and are eager to volunteer for the mission. If an Air Guardsman is available for four or five days a month, he can come in and fly a fighter for a few sorties, White explained, even as some organization issues are still being smoothed out.

As the Air Force drives toward its goal of 50 CAPs, the service has decided it will not buy any more Predators—choosing instead to expand its fleet of MQ-9 Reapers. With more payload capacity and enhanced sensors than MQ-1s, the Air Force plans to eventually purchase 319 Reapers, according to the service's 2009 unmanned aircraft system's flight plan. By 2016, the Air Force plans to have 50 CAPs composed solely of Reapers.

USAF's MQ-9 Reaper field training detachment opened at Hancock ANGB, N.Y., in October, the first schoolhouse in the Air Force dedicated to training personnel for Reaper maintenance. On Dec. 1, 2009, the wing entered steady-state operations flying MQ-9 Reaper missions for operations in Afghanistan—the first Air Guard unit to operate the more robust and heavily armed MQ-9 in theater, White said.

"It enhances the fleet, it offers many advances, ... more kinetic options," Navicki said of the transition to an "all Reaper" force. The Reaper has a slightly reduced loiter time due to its size, but that can be managed depending on the weapons load. The difference between staying on target 10 hours vs. 20 hours often comes down to the availability of crews to switch out of the ground control station.

There will be additional training requirements in the coming years for fields such as weapons loaders, White said of the Reaper transition, but in the ground station back home, pilots will be flying "the same stick and rudder."



USAF photo by SrA. Larry E. Reid Jr.

SrA. Jason Atwell secures the fins of a GBU-12 Paveway II laser guided bomb at Creech AFB, Nev. There is so much demand for Predator expertise that training is now also being done by the California ANG.

The payload capacity of the Reaper will also enable the Air Force to expand use of modular sensors and payloads, to eventually enable and expand missions such as electronic attack, strike, and "multi-INT ISR missions," according to the UAS flight plan. This spring, the service will add a new podded wide-area surveillance sensor called Gorgon Stare to its Reapers, which will enhance the amount of live simultaneous video feeds from a single aircraft. Air Force officials say the pod will be able to broadcast up to 10 feeds at first, eventually growing in capability in later iterations of the system.

Fill the Billets

Airmen working in six UAV-related specialty codes are currently prohibited from transferring out of the field. Airmen are not prohibited from transferring for reassignment within the remote piloted aircraft community, however.

In November, USAF announced it is seeking combat systems officers (lieutenants through majors, including those without a commercial instrument rating) to volunteer to fly UAVs. Once trained, they will be awarded the new 18X Air Force Specialty Code and become permanent unmanned system experts, said Lt. Col. Jeffrey Kwoka, the UAS career field manager. As of June 1, however, CSOs who have commercial instrument ratings must go through the full UAS pilot training course.

Early in 2009, the Air Force initiated a voluntary recall of reservists

who were previously on active duty to return to fill UAV billets for a limited time, among others.

Initially hesitant to return to active duty, Lt. Col. Rob Perrin—a former KC-135 navigator and deputy director of the 717th Test Squadron at Arnold AFB, Tenn., until last month—said a lower deployment cycle was one of the reasons he was attracted to the field. While UAVs are unmanned in the literal sense, they demand more manning per sortie—one of the reasons the Air Force has relaxed its requirements enough to allow experienced navigators to return to active duty in the UAS field.

"This is a unique career field," Montgomery said, and there continues to be debate on how to develop it properly. Sensor operators are different from classical imagery analysts—a career field many current sensor operators came out of. "They can do [imagery analysis], but there are more skills involved. ... There are motor skills, more situational awareness," he said. They want to be sure they're not stovepiped into a narrow career field. Similar issues exist with the development of a pilot cadre for UAVs.

"Over the coming years and decades, we're going to [perform] more and more missions and roles in unmanned aircraft," White said, in both the active duty and the reserve components.

The burgeoning field of unmanned aircraft operations is expected to become even more prominent over the next few years. ■

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Mobility airmen have approached their Afghanistan missions with a messianic zeal.



The Airlifters' War

USMC photo by Sgt. Christopher R. Rye

By David Wood

Darting through the shadows of the C-130 cargo bay, MSgt. William Raby made last-minute adjustments to the cargo pallets straining against their webbing constraints. He nodded at a voice in his earphones. The floor tipped up sharply, and six tons of tightly packaged Gatorade, frozen meals, Snapple, ammunition, spare parts, and other items slid out into the night and swung beneath a billowing chute.

Raby is a 34-year veteran Ohio Air National Guard loadmaster. He has deployed to Iraq or Afghanistan seven times. He scampered around the cargo bay, climbing out by the rear ramp where the slipstream roared and the ground moved along barely visible several hundred feet below, cutting and slicing away at bits of webbing, clearing the way for the next multiton load, poised behind him in the cargo bay.

Everything has to go perfectly. The cargo is packed in heavy green nylon and strapped onto pallets and impact-absorbing cardboard honeycomb, rigged to the right size chute. The drop point has to be calculated precisely, with due accounting of the wind. The load must

USAF photo by SSgt. James L. Harper Jr.



Top: C-130 airdrops food and water to marines at a forward base in Afghanistan. Above: Capt. Don Rolleg on a C-130 mission over Afghanistan.

slide out without getting snagged and the chute must snap open properly. If it's a "streamer"—a tangled chute that fails to open—the troops get a cargo of wreckage. And it all has to go quickly.

"We don't want to linger out here where there are bad guys with big guns," Raby shouted with a wink. "One minute!" the navigator intoned on the intercom, as the C-130 banked sharply and its nose lifted.

“C’mon, Loads,” someone said to Raby, using his nickname.

“Forty seconds,” the navigator announced, and the seconds ticked away as Raby scrambled to safety. And at an unseen but precise point in the sky, the second load skidded silently out into the night air, floating down and away toward a cluster of isolated American troops anxiously awaiting their resupply. “Four bundles away, no streamers,” Raby reported.

This operation—this complicated concert of parachute riggers, pallet handlers, loaders, and aircrews—is a largely unseen but critical mission in the war in Afghanistan. Without it, the Obama Administration’s war strategy would falter. It is the unmatched ability of the United States to deliver critical war supplies precisely, on time, and without fail that enables small US troop units to break away from their large bases and still be assured of the food, water, and ammunition they need to live and operate.

This key element in the US counter-insurgency strategy also provides aid for Afghanistan’s population, which is scattered in thousands of rural villages and in deep mountain valleys.

The C-130 operation is merely the neighborhood delivery system of a vast global network which also uses C-5 and C-17 strategic lifters to create an unprecedented air bridge into Afghanistan. This aerial artery carries an unending stream of troops, munitions, water, concertina wire, rations, fresh blood, heavy armored trucks, filing cabinets, relocatable buildings, and everything else needed for a long military campaign.

A typical leg takes cargo from Charleston AFB, S.C., to Ramstein AB, Germany, for refueling and a crew change, then on into Kabul. At Charleston, loadmasters guided two heavy armored trucks—MRAPs, or mine-resistant, ambush-protected vehicles—up the ramp and into the vast hold of a C-5. At 60,000 pounds, MRAPs are so heavy that their precise placement inside the fuselage is critical to avoid tipping the giant aircraft on its tail or nose.

Inevitably, something will go wrong and the Air Force’s mobility airmen are forced to improvise.

This C-5 flight, for instance, left its home base at Westover Air Reserve Base in western Massachusetts five hours late due to an elevator relay problem. En route to Charleston, the airplane lost cabin pressure and the crew quickly donned air masks and dropped to a



USAF photo by S/A. Felicia Juenke

C-130s with the 455th Air Expeditionary Wing line the ramp at Bagram Airfield, Afghanistan.

lower altitude. They landed to find a broken strut, which took another five hours to fix.

The 10-hour delay caused schedulers at the Tanker Airlift Control Center at Scott AFB, Ill., to spring into action. Eventually, the C-5’s loadmaster announced his satisfaction with the load, and the TACC adjusted the flight’s schedule.

A thunderstorm then forced another delay. The skies cleared just as a fire detection warning light winked on; the system had to be checked and fixed, a problem the crew thought they’d have to fly to Dover AFB, Del., to solve. But soon, a technician appeared and quietly fixed the indicator light problem. At long last, the C-5 departed for

Ramstein and on to Kandahar Airfield, Afghanistan.

The TACC manages the global operations of airlifters and tankers, and “it doesn’t matter how well you did the day before, you gotta do it again today perfectly,” Lt. Col. Aaron Gittner, chief of the TACC commander’s action group, said last year.

Experience, Guts, and Zeal

That it all goes so smoothly is a tribute to the hard work and experience the Air Force has gained during the almost two decades it has been at war in the US Central Command region of operations.

But it’s not just experience that counts. Airmen at all levels are zealous to get the job done. The people on the ground—



A flight last year with a C-130 crew from the Missouri Air National Guard included Maj. Chuck Newton, a former Marine pilot who flew Harriers on active duty. The flight, ISAF 44, was scheduled to lift off from Bagram Airfield, Afghanistan, at 5:30 a.m. At 3:30 a.m., Newton and Capt. Cade Keenan were already on site, and explained to a reporter that they were waiting for “HR.”

We Can Save Lives

This turned out to be “human remains,” an Afghan who had passed away at the Bagram hospital and whose body was to be flown home on the short hop to Kabul.

Past sunup, the remains had not shown up, and ISAF 44 was told to take off anyway. Minutes later, wheels down on final approach into Kabul, the flight deck got a text message: Come back and pick up the remains. The message was, for the moment, ignored.

At Kabul, several dozen Afghan soldiers in stiff new fatigues lined up to board the C-130. Keenan and Newton conferred: Should they hold the Afghan troops and fly back just for the HR, or tell Bagram, no way? They told Bagram, no way.

Left: Soldiers jump from a C-17 Globemaster III during an exercise at the Nevada Test and Training Range. Below: Loadmasters with the 816th Expeditionary Airlift Squadron watch over air-dropped pallets of supplies from the back of a C-17 over Afghanistan.

whether refugees or isolated American troops—are depending upon the Air Force-delivered supplies.

Brig. Gen. Randy A. Kee, vice commander of the TACC, typified the airmen’s drive. He flew C-130 missions delivering humanitarian supplies to Sarajevo during the worst fighting of the Bosnia war. Landing amid mortar bursts, Kee kept thinking, “We gotta win this. Help keep these people alive.”

The same mix of experience, guts, and zeal is needed for the airlift job into and around Afghanistan. Heavily loaded C-130s dodge fighters, unmanned drones, commercial 747 cargo liners, transport and attack helicopters, and even occasional artillery shells. They squeeze through Afghanistan’s high mountain passes and battle heat, blinding dust, heavy winds, fading radios, and inevitable schedule snafus. Missions last up to 12 hours only on paper.



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At Bagram Airfield, Army Specialist Joshua Vazquez pulls straps holding a pallet, in preparation for an airdrop mission over Afghanistan.

As the Afghans clambered aboard, smiling bravely but clutching airsick bags, a text message from Bagram arrived: Forget the HR.

In Kandahar, the C-130 needed fuel. No fuel truck was in sight, and Keenan, grumbling, went stomping off in search of one. Hours later, fueled and loaded, the C-130 headed back toward Kabul, where heavy winds had churned up a dust storm. Keenan got the C-130 onto the ground, but the crosswinds were too fierce to take off again. A delay of even 90 minutes meant the crew would exceed the maximum allowable time on flight duty, requiring 13 hours of rest before they could fly again.

Waiting to see if the wind would abate, the crew dozed in the parked C-130, which rocked gently in the gusts. Suddenly, Keenan bounded up the ramp. “We’re going,” he shouted, and minutes later, ISAF 44 was airborne.

It had been 16 hours since the crew gathered for the flight. But the cargo was delivered and the crew did its part to get reinforcements and supplies to the ground troops, which is what mattered.

“You know, apart from being with my wife,” said Newton, “there is absolutely nothing I’d rather be doing than this.”

Aerial resupply is critical because maintaining a supply line on Afghanistan’s treacherous roads is difficult and dangerous. Since the war began more

than eight years ago, 387 Americans have been killed and 2,189 wounded on Afghan roads, mostly by improvised bombs. The skyrocketing demand for other war materiel has outrun the capacity of military trucks and convoys, so local truckers are hired to haul nonlethal supplies.

Thanks to bandits, insurgent attacks, and breakdowns, it takes an average of 21 days for local truckers to struggle from Bagram Airfield, where cargo flights arrive from the US and Europe, to Kandahar, the staging base for allied forces in southern Afghanistan. In winter, an Army logistics officer said, it can take twice as long.

“Airlift keeps people off the road, and we can save lives,” Gen. Arthur J. Lichte, the commander of Air Mobility Command, said before he retired in January.

Running on Adrenaline

Increasing the US and NATO military force in Afghanistan requires more airplanes, and that means airlifters, tankers, and their crews work harder. “You put boots on the ground, they need supplies, and airlift requirements go up,” Lichte said. Last year, monthly airdrop totals over Afghanistan grew from 1.4 million pounds in January to 1.8 million in April

to 3.2 million in June before growing even larger.

“We’re running on adrenaline and three hours of sleep a night,” MSgt. Dave Vesper, a C-130 loadmaster, shouted one night as he helped push pallets into an aircraft hold. Vesper, an Air National Guardsman from Mansfield, Ohio, volunteered for an assignment in Operation Enduring Freedom.

In fact, Air Guard crews fly the majority of intratheater airlift over Afghanistan. On rotations of 30, 60, or 90 days, they transit their C-130s from their home states, fly airlift missions four to six times a week, then swap out with another Guard crew before making their three-stop flight back home.

It’s an expensive shuttle, at \$14,762 per C-130 flight hour, but there is no other way the Air Force can meet the demand. In the first 11 months of 2009, airlifters dropped 27.2 million pounds of supplies to troops in Afghanistan, compared to 16.6 million pounds in all of 2008. During the height of the fighting season, in August 2009, C-130s dropped 3.8 million pounds—more than twice as much as the 1.6 million pounds dropped in August 2008.

That doesn’t count the routine air hops which take C-130s from Bagram to Kandahar to Kabul and back, ferrying troops and supplies, including 15,000 pounds a day of US mail.

The airlift statistics are staggering in part because the air bridge to Afghanistan is almost invisible. Airlifters lift off from East Coast ports at Charleston and Dover, routinely carrying 350 tons of cargo into Afghanistan. The cost is substantial: \$44,351 an hour, according to the Air Force. For this reason, even though Afghanistan is a landlocked country, most MRAPs go by sea and on into Afghanistan through Pakistan.

Wear and tear on aircraft is substantial, and these are not new airplanes. The typical C-5 is more than 30 years old; the workhorse aerial tankers, the KC-135s, average almost 50 years.

For this geriatric fleet, every flight is critical. There are very few empty shuttle legs. Return trips bring out troops scheduled for leave, who are returning home from their tours, and the dead and injured. By the end of October 2009, air mobility flights had taken 67,000 patients to Europe and on home to the United States. ■

David Wood is the national security correspondent for Politics Daily. His most recent article for Air Force Magazine, “Holding Fire Over Afghanistan,” appeared in the January issue.



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Declaring Our Intentions

"We are in this thing to win."—**Secretary of Defense Robert M. Gates, en route to Afghanistan, Washington Post, Dec. 8.**

This Is Not Vietnam

"There are those who suggest that Afghanistan is another Vietnam. They argue that it cannot be stabilized, and [that] we're better off cutting our losses and rapidly withdrawing. I believe this argument depends on a false reading of history. Unlike Vietnam, we are joined by a broad coalition of 43 nations that recognizes the legitimacy of our action. Unlike Vietnam, we are not facing a broad-based popular insurgency. And most importantly, unlike Vietnam, the American people were viciously attacked from Afghanistan, and remain a target for those same extremists who are plotting along its border."—**President Obama, speech at West Point, Dec. 1.**

Our Strengths, Not Theirs

"Play to our strengths. The insurgents have available for use only one tactic: short-range, ground combat. They have to get close and slug it out. The tactic can be quite effective (ask General Custer), and we should refuse to cooperate. Let's stay out of the clinches, jab, and move. They can't touch us if we put primary reliance on long-range, precision attack. By the way, some Army officers, themselves trained in close combat, have difficulty with this idea, suggesting we should look at putting a Navy or Air Force officer in charge."—**Retired Gen. Merrill A. McPeak, former Air Force Chief of Staff, The Oregonian, Nov. 7.**

Depend on It

"Our mission is to keep the joint ground fighter out of trouble, and when he gets into trouble, it's to get him out of trouble as soon as possible. ... We have the ability to oversee the joint ground warfighter 24 hours a day, seven days a week, with no weekends and holidays and without a break. We are not going 500 miles an hour. We are going 120 knots, right on top of him, and we are orbiting around him and helping him."—**Col. Peter E. Gersten, wing commander at Creech**

AFB, Nev., on air support provided by the MQ-1 Predator and MQ-9 Reaper, American Forces Press Service, Nov. 13.

Stray From the Course

"The new doctrine that seems to enjoy enormous cachet among the smart foreign policy set is: Fight wars until they get hard, then quit."—**Robert Kagan, a senior associate at the Carnegie Endowment for International Peace, Washington Post op-ed, Dec. 3.**

Best of the Best

"Overall, the survey asked Americans to rate the federal government on a five-point scale. ... The military was included and was the highest. We asked which branch of the military is most important to the United States and it historically continues to be the Air Force."—**Frank Newport, editor in chief of the Gallup Poll, Air Force News Service.**

Airpower Makes It Possible

"Our battlefield success in Afghanistan is, to a great degree, underwritten by aviation and space platforms. In a landlocked nation with few workable roads, helicopter lift and cargo aircraft make possible almost everything we do, from dumps of food, fuel, and ammunition, to maneuver support. It's hard to imagine a more difficult place to support combat operations. Yet even in Afghanistan's remote corners, combat air patrols and search and rescue teams watch over our troops day and night. So do intelligence, surveillance, and reconnaissance platforms, both manned and unmanned. Without question, our offense against the Taliban and al Qaeda depend on airpower."—**Deputy Secretary of Defense William J. Lynn III, Aerospace and Defense Finance Conference, Dec. 2.**

Imagine That

"The American military thought that they were fighting a war and when the war was over they were expecting to go home. ... They looked still much more in fighting mode than in peacekeeping mode."—**David Manning, former British ambassador to the United States, on the focus**

of US forces after the overthrow of Saddam Hussein in Iraq, Associated Press, Dec. 1.

The Enduring Contribution

"The primary enduring contribution of the Air Force is the ability to establish and maintain freedom of action in the air for US and coalition forces, permitting them to operate with minimum risk of hostile air attack. The increased speed, range, and flexibility that is achieved by our ability to operate in the air and in space also allows us to rapidly project power in response to threats and crises, wherever they may emerge in the world. While airpower cannot win wars on its own, and does not offer boundless strategic potential, some degree of control in the air has become absolutely essential for any reasonable hope of success in modern warfare."—**Gen. Norton A. Schwartz, Air Force Chief of Staff, Aerospace and Defense Finance Conference, Dec. 3.**

Tough Standard

"Humans are imperfect beings but this mission demands perfection."—**Col. Ferdinand B. Stoss, newly assigned 91st Missile Wing commander at Minot AFB, N.D., following a series of nuclear-related problems, Associated Press, Nov. 29.**

Targeting Osama

"I believe he [bin Laden] is an iconic figure at this point whose survival emboldens al Qaeda as a franchise organization across the world. I don't think we can defeat him until he is captured or killed."—**Army Gen. Stanley A. McChrystal, top US and NATO commander in Afghanistan, testimony to Congress about importance of Osama bin Laden, McClatchy Newspapers, Dec. 9.**

The Strategic Perspective

"We could have an operation that was a great success tactically, but we kill one or two civilians, or more than that, and then it's a strategic failure. As strategic failures pile up, the strategy would fail."—**Adm. Michael G. Mullen, Chairman of the Joint Chiefs of Staff, speaking to marines at Camp Lejeune, N.C., Dec. 7.**



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USAF photo

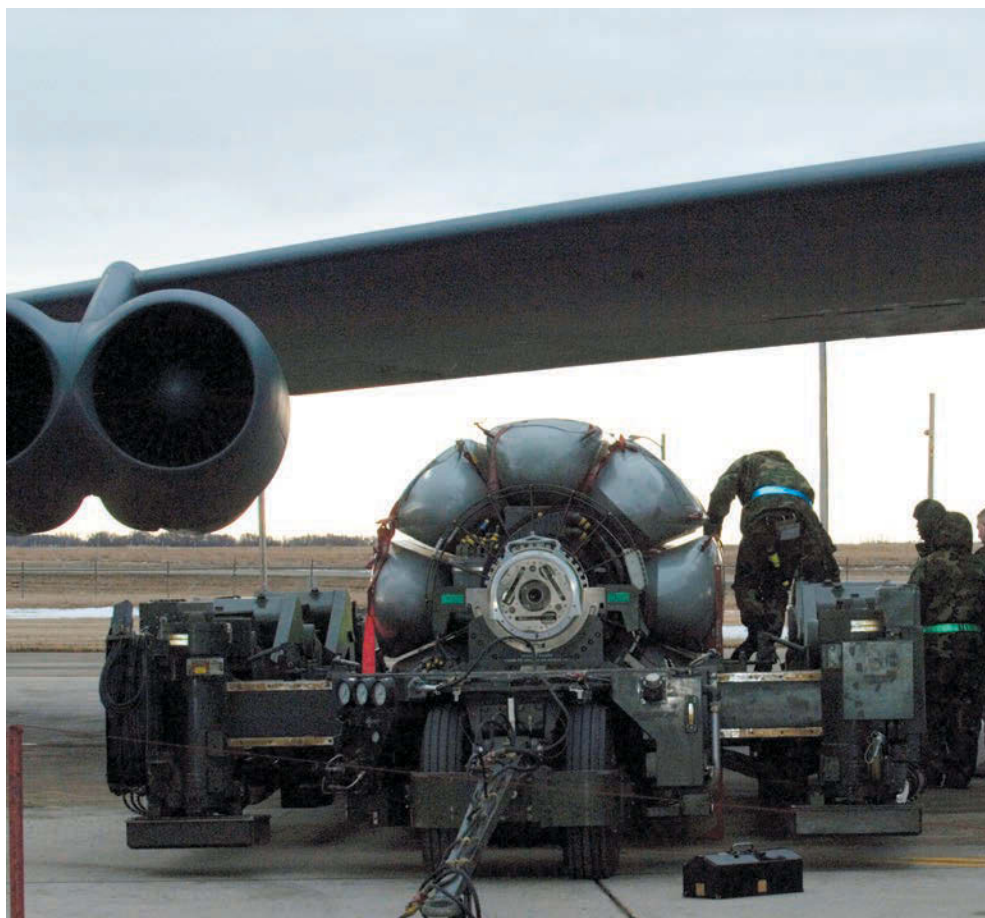
In addition to violently roiling the Air Force for months, the infamous “Minot Incident” of August 2007 did something else. It highlighted a new view of the future of nuclear-armed cruise missiles.

That event saw B-52H bombers unwittingly fly operational Advanced Cruise Missiles from Minot AFB, N.D., down to Barksdale AFB, La. Mostly unremarked is that weapons were being taken south for decommissioning. The Defense Department is retiring the nuclear-armed AGM-129 ACM entirely.

As a result of strategic nuclear arms treaty obligations, the Pentagon scrapped planned life extension programs for the ACM. DOD moved to eliminate the ACM entirely and dramatically cut back its inventory of earlier generation AGM-86 Air Launched Cruise Missiles.

The net result of these decisions was to greatly reduce the number and profile of nuclear cruise missiles in the US arsenal.

Recent developments could limit the Air Force’s cruise missile capability even further. Reductions in the ALCM fleet, reducing its numbers from 1,142 to 528, and complete elimination of the



The Cruise Missile Question

By James Kitfield

Will arms control and tighter budgets finish off the nuclear armed version?

ACM inventory were critical to reaching even the 2002 Moscow Treaty limits of 2,200 operationally deployed nuclear warheads by 2012.

Nuclear weapons trends are likely to further constrain nuclear cruise missile inventories. The Obama Administration is pursuing an aggressive arms control agenda that portends further cuts in coming years, in both nuclear weapons and their delivery systems.

Left: ALCMs on the pylon of a B-52. Below: Members of a nuclear surety staff and airmen from the 5th Aircraft Maintenance Squadron review serial numbers at Minot AFB, N.D.



USAF photo

President Obama and Russian President Dmitry Medvedev have agreed in principle to go down to no more than 1,675 and perhaps as few as 1,500 warheads in a follow-up to the START I arms accord. This treaty expired Dec. 5, but both sides have agreed to abide by its provisions while bilateral negotiations continue.

In addition, the number of nuclear weapons “carriers” would notionally fall to between 500 and 1,100 delivery vehicles.

“These program changes, taken together, raise serious questions about the future of nuclear-armed cruise missiles and nuclear-capable bombers in the US strategic force,” concluded a 2009 Congressional Research Service report “US Strategic Nuclear Forces: Background, Developments, and Issues.”

Contrived Counting Rules

For reasons that have to do with “counting” formulas, both nuclear-capable cruise missiles and bombers could prove increasingly vulnerable in follow-on strategic nuclear arms reduction treaties.

“Under the original START arithmetic, a bomber was counted based on the maximum number of cruise missiles it can carry,” said Amy F. Woolf, the CRS researcher who wrote the report. Thus, she went on, “you could achieve significant reductions [in warhead numbers] by simply making bombers into conventional weapons carriers without paying a high political or monetary cost.”

The Air Force is well aware of how contrived counting rules have affected nuclear inventories, however. “We’ve learned a lot about counting rules,” said one official involved in arms control discussions, and the service does not want arbitrary rules to “hinder us in the future.”

Under a new START agreement, says this person, future cuts in nuclear cruise missiles will likely be reflected in the final tally, independent of bombers—potentially making the missiles tempting targets for negotiators.

The fates of the strategic cruise missiles and the B-52 have been inextricably linked ever since the Air Launched Cruise Missile was specifically designed to extend the useful life of the bomber as a standoff nuclear weapons delivery platform.

By the late 1970s, the B-52 was seen as becoming more vulnerable to advancing defenses, and the cruise missile was a way to extend weapons range while keeping the bomber itself out of harm’s way. The B-52H can carry ALCMs both on underwing pylons and on an internal rotary launcher.

First operational in 1982, the ALCM (or AGM-86B) deploys its own folded wings and turbofan jet engine upon launch, finding its way to targets via a terrain-following guidance system while flying at low altitudes to evade radar detection. Armed with a W80 nuclear warhead, the ALCM is not stealthy, but is designed to evade air- and ground-based defenses to strike targets at any location within an enemy’s territory.

When the Air Force became worried that the ALCM would have trouble penetrating future Soviet air defenses utilizing “look down” radars, USAF developed the stealthy and longer-range Advanced Cruise Missile, which was first tested in 1985. ACM procurement, however, was halted at 460 missiles in lieu of the originally planned 1,460. The last missile was delivered in 1993, and the Air Force is retiring the ACM because of reliability issues and higher maintenance costs.

In the decades since the cruise missiles became available, B-52H bombers



USAF photo by SRA Kelly Timney

SSgt. Deonta Griffin (l) and A1C Ethan Payne load weapons at Minot AFB, N.D.

have provided the bulk of the strategic bomber force's nuclear firepower.

The B-1 bomber was never equipped to carry nuclear cruise missiles, for instance, and in 1997 the Air Force converted it entirely into a conventional bomber to meet START obligations.

The service's small fleet of 20 B-2 bombers can penetrate air defenses by virtue of its low observable characteristics, and can therefore be expected to accurately deliver nuclear gravity bombs against heavily defended targets. But the tiny stealth bomber inventory leaves the Air Force heavily reliant on its force of B-52Hs.

Politically Expendable?

"The B-52 itself is good until 2040, so 2018 [the proposed in-service date for the now-deferred next generation bomber] is not tied to the airframe. That date [is] tied to some of the weapons" used to perform the deep strike mission, said now-retired Lt. Gen. Robert J. Elder Jr. in 2009. At the time, Elder was commander of 8th Air Force, USAF's nuclear bomber force.

Specifically, he said, 2018 had to do with "when the ALCM is getting ready to go out of the inventory."

Air Force officials say all of the stealthy ACMs will be demilitarized by 2013, and USAF now has a program funded to keep the ALCM in service out to 2020. The Air Force is also currently studying how to keep the ALCM in service as a viable weapon until 2030.

However, "the results of service life extension program (SLEP) studies identified system components that cannot be sustained beyond the standard service life," according to Defense Department budget planning documents.

Missile components and ALCM support equipment are becoming nonsupportable, but a SLEP of this "critical weapon" remains "essential" to meet global commitments, documents state.

USAF photo



An Air Launched Cruise Missile is loaded onto a Barksdale AFB, La.-based B-52H. The venerable bombers should last until 2040, but ALCMs are slated for retirement much sooner.

Areas of concern include the long-term health of the ALCM's arming and fuzing subsystems, the navigation and guidance systems, and the electrical distribution system. Because the ALCM will soon be the only nuclear cruise missile left in service, the Air Force needs to identify "aging trends prior to failures in fielded components that would result in fleetwide reliability and supportability problems."

The diminishing and old fleet of B-52s, ALCMs, and ACMs—coupled with delays in the Air Force's development of a new strategic bomber—has raised continuing questions about the service's commitment to the strategic bombing mission altogether. According to the Congressional Research Service report, during the 2006 QDR, some officials argued for removing all B-52 bombers from the nuclear mission.

The mission survived but the debate, in conjunction with expected future cuts in the size of the US nuclear arsenal, raises the distinct possibility that one leg of the nuclear triad (long-range bombers, Trident submarines, and intercontinental ballistic missiles) could become expendable for either political or financial reasons.

This problem recently was spotlighted in a paper published by the Mitchell Institute for Airpower Studies. Written by Northrop Grumman analysts Dana J. Johnson, Christopher J. Bowie, and



USAF photo by TSgt. Lee A. Osberry Jr.

Airmen from the 5th Aircraft Maintenance Squadron run through weapons loading procedures during a nuclear surety inspection at Minot.

Robert P. Haffa, it was released in December.

“The aging ALCM calls into question the value of the B-52 fleet, while the modernized but very small B-2 force is assuming a niche role,” wrote Johnson, Bowie, and Haffa. “In short, the United States will soon field a de facto nuclear dyad.”

According to CRS, “most discussions about the bomber force focus on how many bombers, and what types of bomber weapons, the United States needs to bolster its conventional long-range strike capability. There is little, if any, discussion about the role that bombers may play in either nuclear deterrence, or, if deterrence fails, in the launch of US nuclear weapons,” the report reads.

Air Force leaders readily concede that the upcoming QDR and accompanying Nuclear Posture Review, coupled with the outcome of ongoing arms reduction talks between the United States and Russia, will have a lot to say about the future of the nuclear cruise missile and strategic bomber force.

The Air Force is betting that its new Global Strike Command will bring greater coherence to the strategic nuclear role, and act as a much needed internal advocate for a next generation nuclear cruise missile and bomber. Global Strike Command will take responsibility for long-range bombers from Air Combat Command in February and assumed oversight of the ICBM force from Air Force Space Command this past December.

The service also plans to designate one of its B-52 wings to focus almost entirely on training and exercising for the nuclear mission for one-year intervals on a rotational basis.

To succeed, Global Strike Command will have to elevate the prominence of the strategic bombing leg of the nuclear triad once again to a level many experts believe it has not had since the elimination of the Strategic Air Command in 1992, following the end of the Cold War.

Weaknesses Can Be Strengths

The current proliferation of rogue states with small arsenals of weapons of mass destruction actually plays to the strength of the bomber leg of the strategic triad.

“The long-standing argument for a nuclear triad is that each leg has different strengths and weaknesses,” noted the CRS’ Woolf. “The current environment, where the threat is likely to be a handful of nuclear facilities or WMD sites that you want to threaten discreetly, plays to the bomber’s strengths.”

A bomber armed with nuclear cruise missiles is very survivable, it keeps a human in the loop, and it provides the flexibility to threaten relatively small, individual targets. Johnson, Bowie, and Haffa laud the merits of the triad, and state that they prefer to maintain the three distinct delivery methods. In their

paper, though, they argue that, realistically, the decline of the air-based leg may be irreversible.

They consequently recommend that the US phase the B-52 out of the nuclear role as ALCMs are retired from service, and begin concentrating funding and attention on maximizing conventional long-range strike capabilities.

The Air Force should “divest any planned investments dedicated to keeping the B-52 in a nuclear role and put them into a new conventional bomber,” the authors wrote. This divestiture would also include research and development dedicated to a new nuclear-capable cruise missile.

“Although conventional long-range strike capabilities will be even more important in the emerging security environment, the research and development of a new nuclear cruise missile and a new nuclear bomber do not appear to be prudent investments in an era of nuclear force reductions.”

This conclusion is vigorously contested by bomber advocates who note the ALCM can be modernized and improved even beyond a service life extension. The diversity of the bomber leg of the triad also protects the US deterrent from any possible revolution in ballistic missile defenses, which could conceivably reduce the effectiveness of both ICBMs and SLBMs.

Further, bomber advocates note, a next generation long-range strike system is garnering support for a wide variety of reasons. The cost of giving it a nuclear capability would be but an incremental addition to the overall cost of the program.

Bowie acknowledged that it may make sense for the Air Force to design its next generation bomber in such a way that nuclear missions could be added to its repertoire at a later date, if warranted.

“Even the bomber’s weakness of being relatively slow in comparison to ICBMs can be a strength,” said the CRS’ Woolf.

“In the buildup to a crisis with a rogue state that doesn’t involve the threat of a first strike, you may want time to ratchet up pressure slowly, and the bomber is the only leg of the triad that you can recall once its in the air,” she said. “But if the Pentagon wants to retain the bomber leg of the nuclear triad it’s going to have to develop a new nuclear cruise missile soon.” ■

James Kitfield is the defense correspondent for National Journal in Washington, D.C. His most recent article for Air Force Magazine, “The Ups and Downs of Foreign Bases,” appeared in the June 2009 issue.

Living in the

Manned and unmanned QF-4s make for spectacular targets.

Photography by Greg L. Davis



Bull's-Eye



A QF-4E aerial target over the Gulf of Mexico, near Tyndall AFB, Fla. Old Phantoms, dating back to the 1960s and 1970s, continue to serve in a weapons test capacity, although their days, even as targets, are numbered.

The 82nd Aerial Targets Squadron provides a vital service in the testing of munitions—something to shoot at. F-4 Phantoms, many of which saw service in Vietnam and the 1991 Gulf War, fly missions both from Tyndall AFB, Fla., and the 82nd ATRS' Det. 1 at Holloman AFB, N.M. Reconfigured as targets (the "Q" designator) by BAE Systems, most still carry a pilot to take the controls if something goes awry. Those QF-4s that might be hit by a weapon fly unmanned. [1] A QF-4E on a training sortie near Tyndall. The orange fin and wingtips—sometimes Day-Glo green or yellow—denote a target.



[2] This F-4E went to the Davis-Monthan AFB, Ariz., Boneyard in 1991, but was resurrected as a target. It will fly as such until it reaches its limit of flying hours and is marked for "death row"—condemned to live-fire tests. [3] Safety pilot Tom Mudge, a contractor, clears for traffic. [4] Another QF-4E taxis out.





2



1



3



4



5

[1] A row of QF-4s at Tyndall. Most were F-4Es and F-4G Wild Weasels; the next batch converted to drones will be former RF-4C tactical reconnaissance airplanes. [2] A few QF-4s are nicely maintained in a high-gloss Southeast Asia (SEA) camouflage used during the Vietnam War, and are flown in "heritage" displays at air shows. The tail flash denotes its current assignment.

[3] The 82nd ATRS badge. [4] The QF-4 at left in this image is still wearing its European One green camouflage from the Cold War era. [5] In this stock footage sequence, a QF-4 meets its messy but honorable end at the hands of a test air-to-air missile. Death row aircraft are scavenged for parts before their final missions. This helps to keep the others flying.

[1] A wide-angle shot of the Tyndall flight line reveals two heritage-marked aircraft at left. **[2]** 82nd commander Lt. Col. J. D. Lee is briefed before a mission flying a QF-4. He flew operational F-16s. QF-16s are in the 82nd's future as the Phantom supply draws down. **[3]** Some of the test gear and dummy missiles carried by QF-4s, with a late-SEA marked aircraft. **[4]** Most tests are not fatal for the drone, and are flown to calibrate radars and provide a tracking target. Sometimes drones test munitions not yet deemed safe for operational aircraft to fire. The 82nd provides targets for surface-based air defense units from the other services, as well. **[5]** A SEA-marked Phantom, replete with shark mouth, along with one still wearing its unique two-tone gray scheme from the former Bergstrom AFB, Tex. **[6]** An F-4's tail hook is deployed in a systems check.





[1] This manned QF-4 on final approach at Tyndall passes the “drone-way” runway used by unmanned targets, called NoLOs—for No Live Operators. The added distance from flight line operations affords a further degree of safety. [2] This weary Phantom’s squadron badges have all but disappeared. [3] Past meets

present: A SEA-marked QF-4 awaits taxi clearance as two F-22A Raptors take off. Tyndall is also home to the F-22 pilot schoolhouse. [4] The 82nd ATRS belongs to the 53rd Weapons Evaluation Group, an Air Combat Command organization. [5] The roundel indicates this tattered QF-4 once wore the European One

green paint scheme. [6] A sunset sortie over the Gulf of Mexico, this QF-4’s likely resting place. QRF-4C models are now being delivered, but the Phantom’s USAF career is slated to wind down in 2012, as the QF-16 begins to take its place as the primary realistic, full-scale target. ■



Here's a surprise: In eight years of constant operations since the Sept. 11, 2001 terrorist attacks, the US Air Force has lost more than 160 aircraft to accidents and enemy action.

These losses have accumulated quietly because they have occurred in ones and twos. USAF has also been flying its fighters and airlifters at rates much higher than expected, accelerating the wear and tear on its old air fleet.

Inadequate budgets, meanwhile, have made it possible for USAF to buy few, if any, replacements for aircraft lost or retired because of their age, soaring maintenance costs, or safety concerns.

The cumulative impact has been a significant reduction in the total air fleet and a growing concern about the Air Force's future ability to meet the demands of combat in Afghanistan and Iraq, not to mention those generated by USAF's other global responsibilities.

Years of constant operations have taken a serious toll on USAF's fleet.

USAF photo by ATC Miranda Moorer



The Aircraft Losses Mount

By Otto Kreisher

The Air Force “has some concerns with the continuing and ongoing operations we’ve got in the AOR,” said Col. Valentine J. Dugie, referring to the US Central Command area of operations that includes both Iraq and Afghanistan.

“We’re trying to manage through that with the assets that we have, to do the mission that we need to do,” added Dugie, director of operations, integration, and resources on the Air Staff.

The demand on manned Air Force aircraft is increasing, particularly for the airlift and tanker force. The push to get 30,000 additional ground forces and their equipment into Afghanistan in six months, and the growing use of intratheater airlift to supply remote outposts because of the mountainous terrain and lack of roads, will place even greater demand on the shrinking fleet this year.

Aircraft attrition comes in several forms. Perhaps the most dramatic examples have been the 26 aircraft destroyed in combat or through accidents in the Central Command theater. Those losses include many different platforms from both the combat and mobility fleets, with C-130s being a specific source of concern.

When aircraft destroyed in accidents outside the war zone are included, the Air Force has lost “a little over 160”

Lost: 68 Fighters Since Sept. 11, 2001

2002	8 F-16	5 A-10	2 F-15		
2003	7 F-16	2 A-10	1 F-15	2 F-15E	
2004	2 F-16	1 A-10	2 F-15	1 F-15E	1 F-22
2005	3 F-16		1 F-15		
2006	8 F-16		1 F-15		
2007	6 F-16		4 F-15		
2008	3 F-16		4 F-15		
2009	2 F-16			1 F-15E	1 F-22
Total	39 F-16	8 A-10	15 F-15	4 F-15E	2 F-22

aircraft since 9/11, Dugie said. One hundred eighteen were manned aircraft, the rest, UAVs.

Gray Areas

The losses directly linked to the conflict began with Operation Enduring Freedom. On Dec. 12, 2001, a B-1B bomber returning from a combat mission to Afghanistan crashed in the Indian Ocean near Diego Garcia. Losses have continued apace, and include an F-15E that crashed last July 18 during coalition operations in eastern Afghanistan.

A Navy ship rescued all four of the B-1’s crew members. The Strike Eagle’s pilot and weapon systems officer died.

The cost in airmen’s lives has been even more tragic than the cost in equipment, and the men and machines have proved equally hard to replace. Overall, 103 Air Force personnel had died supporting the battles in Iraq and Afghanistan by December 2009, more than half of them on the ground.

Most of the aircraft losses were in accidents outside the combat theater, however, often the consequence of the risk involved in realistic training for combat.

Examples include the midair collision Feb. 20, 2008, of two F-15Cs during training over the Gulf of Mexico, destroying both aircraft and killing one pilot. Last year, two F-16s collided Oct. 15 during night training over the Atlantic, resulting in the loss of one fighter and its pilot and severe damage to the other jet aircraft.

Some losses can be attributed to the fact that the average age of Air Force aircraft is the oldest in its history. Front-line fighters, including F-15s, are 25 years old—as is the fleet overall.

Several F-15Cs have been lost due to structural failures in flight, including one that broke in half during training maneuvers.

But even two F-22 Raptors, the only new fighter the Air Force has been able to buy since 9/11, have been destroyed in test flights. In all, 68 fighters have been lost—almost an entire wing’s worth of aircraft.

The training accidents get into a fiscal “gray area,” Dugie said. Even though they are not actual combat sorties, they often involve direct preparations for combat deployments—which can warrant funding for replacements

Far left: A B-52 taxis on the airfield at Andersen AFB, Guam. Left: 392nd Air Expeditionary Group maintainers inspect damage to an A-10 hit by an Iraqi missile.



USAF photo by SSGT. Shane A. Cuomo



Airmen at Andersen watch as both pilots safely eject from a B-2 bomber as it crashes shortly after takeoff in 2008.

in the supplemental appropriations that Congress has used to pay for the wars.

“We have gotten Congressional support for replacing some of those losses of aircraft,” the colonel said, specifically for new C-130Js to replace old Hercules, and HH-60s to replace the seven CSAR and medevac helicopters lost since 2001.

“The challenge we have is on the CAF [combat air forces] side, the fighters and bombers,” Dugie added. “We are no longer buying brand-new F-16s, F-15Cs and Ds, or A-10s. So every loss ... is a potential loss in overall capability.”

Much of that attrition has been offset by use of what are called backup inventory aircraft (BIA), which are aircraft added to a squadron beyond its normal operational allocation.

A fighter squadron that has 12 to 24 operational aircraft assigned usually has two or three more listed as BIA. They can be used to replace an airframe that goes into extended maintenance, he explained, or as replacements for destroyed assets. “A lot of our tactical aircraft losses, we replace with the BIA aircraft,” he said.

But there is a limit to that resource and the Air Force is conducting an analysis to determine “where we stand as far as BIA,” Dugie said.

At the same time, “the Air Force is in the process of trying to recapitalize, modernize, some of its fighter fleet.” To do that, service leaders want to “retire some of those legacy platforms and replace them with new ones.”

“It’s no surprise to anyone that recapitalization of our forces, of our geriatric

Types of Manned Aircraft Lost Since 9/11	
Fighter	68
Bomber	4
Airlift	6
SOF	11
Helo	7
Trainer	18
Recon	2
Other	2
Total Airframes Destroyed	118

Note: Does not include unmanned aircraft.

Air Force, is a huge priority,” Lt. Gen. David A. Deptula, deputy chief of staff for intelligence, surveillance, and recon-

naissance, said at an Air Force Association breakfast in December.

Examples include phasing out F-15Cs as F-22s become available, and the plan to eventually replace F-16s and A-10s with the F-35 Joint Strike Fighter, which still is in developmental testing.

However, using up the backup inventory raises concerns about balancing assets and operational risk.

If the service runs out of backup aircraft, the Air Force would “start eating into our seed corn, getting into actual capability loss and degradation,” Dugie said.

Based on the initial analysis, Dugie said, the Air Force has “probably not” reached the point where its combat capability declines with every aircraft that is lost. “But it really gets into a balancing act ... on what you need to do to continue an operation.”

On top of the actual losses from accidents and battle damage, the Air Force has suffered the effective loss of 35 aircraft because the intensified operational tempo is burning up the maximum flight hours in many of its aircraft much faster than expected.

That accelerated use began long before 9/11, Dugie noted, and forces aircraft into early retirement.

“If you really look at this, we have been in there [the Central Command] conducting operations, whether they be combat or monitoring missions, with a lot of these aircraft since Desert Shield and Desert Storm,” in 1990 and ’91, he said.

Just since Fiscal 2007, the records show the Air Force has been flying five to 10 percent “over and above what we normally would fly in a year’s time.”



Avionics specialists perform maintenance on an F-15E. Four Strike Eagles have been destroyed since 9/11.



An F-15E lands at Bagram Airfield while two F-16s prepare for takeoff from the flight line at the Southwest Asia base.

Consistently overflying programmed hours has had the effect of eliminating what the Air Force calls “aircraft equivalents.” The cumulative impact of using up the service life on a group of aircraft is exactly the same as losing a number of individual aircraft to accidents or attrition.

“On the CAF side, that equates to about 15 airplanes, and on the MAF [mobility air forces] side, about 20,” Dugie said.

Hardest hit of the combat platforms are the A-10s and F-16s. The most heavily ridden mobility assets include C-130s and tankers, he said.

The tankers, of course, are key to maintaining the strategic airlift to the distant war zone and the long-duration fighter patrols in theater, which require multiple in-flight refuelings.

Soaring maintenance costs and safety concerns directly attributable to the tanker’s age forced the Air Force to send the last of its oldest KC-135Es, to the boneyard last September.

“Having to retire the Es took a very big chunk out of the refueling side of the house. ... The remaining portion of the fleet has to take up that slack,” Dugie said.

Gen. Arthur J. Lichte, then commander of Air Mobility Command, said the retirements left USAF with 474 tankers, but the service needs a minimum of 520 and could use up to 640.

Unfortunately, the KC-X replacement program has been delayed for nearly a decade—and getting the first new tanker could take another decade.

Overall, retirements and losses have led to a reduction of more than 600

active, Guard, and Reserve aircraft since 2001.

Dugie said the Air Force is “accelerating retirement of the oldest aircraft” in an effort “to realize our modernization, ... to try to free up dollars to be able to help with that recapitalization.”

The Navy tried a similar approach in the 1990s, retiring dozens of ships early, but never gained enough money to buy the required number of new ships, which are more expensive. As a result, the fleet shrank to the lowest level since just before World War I. The concern is that a similar thing could happen to the Air Force: DOD and Administration planners could “pocket” the money saved by retiring the old airplanes without actually funding their replacements. USAF’s plan of a few years ago to cut its end strength to pay for modernization failed in just that manner.

The Air Force announced last year that it intended to retire early a total of 254 of its oldest F-15s, F-16s, and A-10s.

Deptula noted that the fighter force is getting some relief from the rapid increase in the number of UAVs, or remotely piloted aircraft (RPAs), as he prefers to call them.

“The principal tasking for some of our fighter forces over the last 18 months has been for ISR, not for strike,” Deptula said.

The fighters are using their targeting pods for ISR in support of ground forces. “That’s a good thing,” the

general said, but suggested that mission should be done by RPAs instead.

Additional MQ-1 Predator and MQ-9 Reaper UAVs and the manned MC-12 ISR aircraft are increasingly filling in. Some of the aircraft being retired have become excess because better aircraft have arrived, such as the F-22s replacing F-15s.

“You don’t need a one-for-one trade,” Dugie said. “But you’ve got to take some risk to accelerate retirement of some of the older aircraft to fund and to man the other planes you’re trying to recap.”

Another issue the Air Force is struggling with because of the heavy operational commitment in Iraq and Afghanistan is training. “Aircrew training and maintaining proficiency is always a challenge, particularly when you look at the AOR and the way they operate there,” Dugie said.

One way the Air Force is dealing with the problems of “tired iron,” is to move increasingly to training with simulation, which has gotten so good that the service can perform multiship exercises and “distributed mission operations” with different types of aircraft and even tactical controllers on the ground.

In some cases, “I’ve got nobody in the air. Everyone’s in a simulator,” he said. Most of the fighter missions in the combat theater are considered “not supportive of training folks to meet their wartime mission,” he said.

Although the pilots become proficient in a narrow window of their overall mission tasking, such as close air support, they are doing nothing to maintain their skills in others missions, like air-to-air or suppression of enemy air defenses.

When a squadron returns from up to half a year in the theater, “they are not currently qualified to go out and do their full wartime mission.”

Regaining that full mission qualification could take three to six months, Dugie said—and because some fighter squadrons are on a “one-to-one dwell,” they would be returning to the theater in 180 days.

“From an Air Force perspective, the future is going to be interesting, as well as challenging,” said Dugie in understated fashion. “We’re doing the best we can.” ■

Otto Kreisher is a Washington, D.C.-based military affairs reporter and longtime contributor to Air Force Magazine. His most recent article, “Is CSAR Really Nothing ‘Special’?” appeared in the November 2009 issue.



THE COST OF SCHWEINFURT

One of every five B-17s that set out from England was lost.

By John T. Correll

HAD it not been for ball bearings, Schweinfurt might have remained a small town in Bavaria and escaped the notice of history. However, it was there in 1883 that a local mechanic, Friedrich Fischer, invented the machine that made possible mass production of ball bearings. In 1906, his son founded the Kugelfischer firm, which became the cornerstone of the industry.

World War II created a huge demand for ball bearings. The German aviation industry alone used 2.4 million of them a month. Production was concentrated in Schweinfurt, where five plants turned out nearly two-thirds of Germany's ball bearings and roller bearings. Between 1922 and 1943, the surge in manufacturing tripled the population of Schweinfurt to 50,000.

In the summer of 1943, US and British planners for the Combined Bomber Offensive identified the ball bearings industry as a key "bottleneck" target, the destruction of which could clog up war production

and potentially shorten the war. The British Air Ministry since 1943 had been trying to persuade the Royal Air Force to bomb Schweinfurt, but Air Marshal Arthur T. "Bomber" Harris, chief of RAF Bomber Command, was adamantly opposed.

The RAF determined early in the war that it could not precisely hit individual targets and took heavy losses in trying. It switched in 1942 to area bombing at night, targeting German cities in support of a national policy of "dehousing" German citizens and workers. Harris dismissed ball bearings and other bottleneck objectives as "panacea targets."

Top: B-17s drop their bombs on Schweinfurt, Germany, on Aug. 17. Right: As explosives hit the facilities at Schweinfurt, bombs from a higher-flying B-17 plummet past the photographer.



He claimed that RAF bombers would not be able to find a town the size of Schweinfurt at night, much less bomb the factories. His objections were more a reflection of what Harris did not want to do than of actual RAF capabilities and limitations.

On the other hand, Schweinfurt was exactly the sort of target the US Eighth Air Force was eager to strike to demonstrate the value of daylight precision bombing, to which the Army Air Forces was deeply committed. The British wanted the United States to blend its bomber forces into the RAF's night area bombing campaign. To their vexation, "the Americans were determined to fight in an American way and, as far as possible, under American command," sniffed British historian Noble Frankland.

Without Excessive Losses

Eighth Air Force B-17s had been flying from England since September 1942, but seldom on large missions or with anything better than mediocre results. Maj. Gen. Ira C. Eaker, commanding Eighth Air Force, had been unable to mount big raids. Many of his aircraft and aircrews were diverted to operations in North Africa and more than half of his remaining resources were assigned to attacking German submarine pens—a high priority for the British—even though bombing had little effect on these hardened facilities.

Eaker was under considerable pressure to deliver a strategic success. In August 1943, he was at last able to put together enough B-17s for a large mission that would launch almost 400 bombers in a deep double strike against the ball bearings at Schweinfurt and the Messerschmitt factories at Regensburg.

The mission, postponed once for bad weather, was reset for Aug. 17. The strike force was divided into two parts. The Third Air Division, led by Col. Curtis E. LeMay, would take off first and bomb Regensburg, 430 miles inside occupied Europe.

The First Air Division, led by Brig. Gen. Robert B. Williams, would take off nine minutes later for Schweinfurt. Williams had the larger force, 230 B-17s compared to 146 for LeMay.

Both divisions would follow the same route for most of the way, but beyond Frankfurt, the First Division would swing off toward Schweinfurt. The plan was for both divisions to reach their targets about the same time, the nine-minute interval between them offset by the location of Schweinfurt, which was 75 miles closer than Regensburg. The first bombs were to fall on Schweinfurt at

10:12 a.m., and on Regensburg one minute later.

Although the Messerschmitt plant was important—producing up to 400 Me 109 fighters a month—it was not the main target. By going first, LeMay's division was supposed to lure away the German fighters to give Williams a better shot at Schweinfurt.

Williams would face the brunt of the German fighters on the return trip, while LeMay's B-17s, carrying extra fuel in "Tokyo tanks," continued southward over the Alps and the Mediterranean to land at bases in Algeria. US and British medium bombers would provide additional diversion by attacking targets along the Channel coast about the same time the B-17s were taking off.

Never before had B-17s ventured so deep into Germany, and they would be without fighter escort for most of the way. British Spitfires could go with them only as far as Antwerp in Belgium. American P-47 Thunderbolts would have to turn back at Eupen, about 10 miles short of the German border.

In the 1930s, the Army Air Corps had concluded that well-armed bombers could protect themselves. Development of a long-range fighter lagged. The P-51 Mustang, which could go all the way with the bombers to the most distant targets, would not be available until December 1943.

In October 1942, Eaker still held that "the B-17 with its 12 .50-caliber guns can cope with the German day fighter, if flown in close formation" and that "a large force of day bombers can operate without fighter cover against material objectives anywhere in Germany, without excessive losses."

Most of the bombers on the Regensburg-Schweinfurt mission were B-17Fs. Their guns provided overlapping cones of fire from the waist and from the top, belly,



Fires spread through the target city during the Oct. 14 raid.

and tail turrets, but the B-17F did not have the nose turret that came on the B-17G. Handheld guns firing to the sides from "cheek" blisters did not close the gap.

"We definitely lack firepower in the nose of the B-17," LeMay said. The Luftwaffe knew this and exploited the advantage of the head-on, 12 o'clock attacks.

All of this was offset, according to the briefings, by the concentration of German interceptors in a "fighter belt" near the coast. The best fighters, single-engine Me 109s and Focke-Wulf 190s, were supposed to be there. Inland, the bombers should expect only slower and less-maneuverable twin-engine fighters like the Me 110, which was built for night operations. Eighth Air Force was unaware that the Luftwaffe had recently switched to a strategy of defense

B-17 Losses: Regensburg and Schweinfurt

	Initial Bomber Force	B-17s Across the Coastline	B-17s Lost	Pct Lost
Regensburg	146 B-17s	139	24	17.26
Schweinfurt I	230 B-17s	222	36	16.21
Schweinfurt II	317 B-17s 60 B-24s	291	60	20.61
All 3 Missions	693 B-17s 60 B-24s	652	120	18.4

Some B-17s aborted before reaching the continent. The 60 B-24s had trouble making rendezvous with the strike force and were diverted to other targets.



German armaments minister Albert Speer (left), shown here with Field Marshal Erhard Milch (center) and German aircraft designer Wilhelm Messerschmitt, was sure the Allies would follow up the Schweinfurt-Regensburg raids with even more crippling blows to the industrial complex.

in depth and had brought back Me 109s and FW 190s from the Russian front to protect Southern Germany.

On the morning of Aug. 17, a thick fog covered East Anglia, where the B-17 bases were. LeMay's division had been scheduled to launch at 5:45 a.m. At the insistence of VIII Bomber Command, takeoff was delayed for an hour, then for an additional half-hour. Further delay would mean running out of daylight before reaching the landing bases in Africa. Fortunately, LeMay had drilled his crews for a month in bad weather instrument takeoffs and the first bomber was in the air at 7:15 a.m.

The Schweinfurt crews, not proficient in instrument takeoff, were stuck on the ground. They finally launched five hours later than planned, more than four hours—instead of nine minutes—behind LeMay's division, which was almost to Regensburg before the first Schweinfurt bomber took off.

LeMay flew as copilot in the lead B-17. His division formed up at bombing altitude before leaving England. Seven B-17s aborted and 139 crossed the Dutch coastline at 9:35 a.m. Enemy resistance was relatively light in the fighter belt, but when the fighter escorts turned back at Eupen, the Me 109s and FW 190s swarmed and kept coming, sometimes in packs of 25.

Lt. Col. Beirne Lay Jr., copilot on a B-17 named *Picadilly Lily*, drew on the experience to depict the harrowing losses of the big mission in the book and movie, *Twelve O'Clock High*, which he wrote with Sy Bartlett. "Near the IP [the initial point for the bomb run] one hour-and-a-half after the first of at least 200 individual fighter attacks, the pressure eased off, although hostiles were nearby," Lay said in a December 1943 article for *Air Force Magazine*.

The relentless fighter attacks were difficult to bear, especially for those aircrew members who could not shoot back, said Hayward S. Hansell Jr., who in 1943 was a brigadier general and chief planner for Eighth Air Force. Gunners could relieve some of the pressure by firing back, but that "was entirely lacking to the pilots and bombardiers and navigators," Hansell said. "They had somehow to rise above the personal danger surrounding them and place the accomplishment of the mission above personal survival."

Speer Gets Nervous

The bombs began falling on Regensburg at 11:43 a.m., and they clobbered the target. They got not only the main factory buildings but also wiped out 37 Me 109s just off the assembly line. In addition, they destroyed most of the jigs for the secret Me 262 jet fighter then in development. Lost production amounted to 800 to 1,000 Me 109s before full output was restored several months later. The B-17s turned south and, after an average of 11 hours in the air, landed at their bases in North Africa.

The medium bombers made their diversionary attacks along the Channel coast at midmorning, too late to help LeMay and too early to be of much benefit to Williams.

Because of the five-hour fog delay, Williams and the First Division made a change that would have repercussions later. The original plan was for them to fly past Schweinfurt, turn, and attack from the east. This added 17 minutes to their approach, but it allowed them to make their bomb run at midmorning with the sun at their backs. However, because of the long delay, they would arrive at Schweinfurt in the afternoon rather than in the morning. The sun would be more to

the west than to the east. If they stuck to the plan, they would spend 17 dangerous and unnecessary minutes in the target area and they would be attacking into the sun. Consequently, they switched directions to make the bomb run from west-to-east rather than east-to-west.

The first of the Schweinfurt B-17s took off at 11:20 a.m. and a procession of 222 aircraft crossed the coast of the continent. The German fighters were refueled, rearmed, and waiting. Williams lost only one bomber in the fighter belt, but the Luftwaffe shot down 23 between Eupen and Schweinfurt, and several more over the target.

Williams himself took over a machine gun in a cheek blister and fired it until the barrel burned out.

The strike force reached Schweinfurt at 2:59 p.m. Bombing accuracy was not as good as hoped for. Among other complications, the leading groups reached the initial point a few minutes late and the following groups were close on their heels.

Some of the crews were confused by the change in direction of approach to the target. The first three groups had clear bomb runs but the other six had problems and many of their bombs fell wide.

The division then had to fly back through the German defenses on the return trip, and was under sustained fighter attack for much of the way.

The strike on Schweinfurt is often characterized as unsuccessful. Most of the heavy equipment at the factories survived, and the damage done was temporary. Part of the problem, according to Hansell, was that less than a third of the bombs dropped were 1,000 pounders. The others were lighter and had limited effect on the targets. But even so, and despite the operational fumbles, the raid dealt Schweinfurt a hard blow.

The German armaments minister, Albert Speer, said in his memoirs that the bombing caused a 38 percent drop in ball bearing production. Speer could not relocate the industry immediately because he could not afford to stop production during the move. Output was so sparse that plants using ball bearings sent men with knapsacks to pick up as many bearings as were available each day. Stocks were sufficient to cover only six to eight weeks. After the raid, Speer said, "we anxiously asked ourselves how soon the enemy would realize that he could paralyze the production of thousands of armament plants merely by destroying five or six relatively small targets."

Eighth Air Force had limited means of assessing the strike and had no real idea

of how effective the bombing had been. In any case, Eaker did not have enough bombers to mount another mission right away. Official statements put an optimistic face on the raid but the War Department was alarmed by the casualties.

For the day, LeMay's losses had been 24 aircraft, and Williams lost 36. Many others were so damaged they would never fly again. Of the 601 crewmen lost, 102 were killed. Most—381 of them—were taken prisoner, while others evaded capture, were interned, or were rescued from the sea.

B-17 gunners claimed to have shot down 288 German airplanes and the fighter escorts claimed another 19. In actuality, the Luftwaffe lost between 25 and 35 fighters.

"We destroyed a mere fraction of the German planes claimed and awarded," LeMay said.

Intelligence reported that the Germans were rebuilding furiously at Schweinfurt and scrambling to obtain ball bearings from other sources, including Sweden. Eighth Air Force would be going back to Schweinfurt. LeMay, without doubt the best combat commander in Eighth Air Force, had been promoted and moved up. He would not be along this time.

On the day of the mission, Oct. 14, there was again fog in the morning, but it lifted. At 9 a.m., a British Mosquito reconnaissance aircraft flying high over Germany reported that the weather was clear.

The strike force consisted of 317 B-17s in two divisions, commanded by Col. Budd J. Peaslee and Col. Archie J. Old Jr. Sixty B-24s were also assigned, but they had trouble in making rendezvous and were diverted to other targets in the Frisian Islands.

B-17s began taking off shortly after 10 a.m. and 377 bombers were soon in the air over England. However, aborts reduced the number to 291 B-17s before they reached the coastline of the Netherlands. The P-47 escort fighters turned back between Aachen and Duren, just inside the German border. The Luftwaffe attacked in large numbers and from all directions. The official Army Air Forces history described the Luftwaffe fighter attack as "unprecedented in its magnitude" and "in the severity with which it was executed." The Allies estimated that the Luftwaffe had 800 fighters in Europe. In fact, there were 964, and they were still pressing the bombers as Schweinfurt came into view.

Out front in the leading B-17 was Lt. Col. T. R. Milton, operations officer of the 91st Group. He went on to become a four-star general and a longtime columnist for *Air Force Magazine*, but

this day his thoughts were on whether he would survive. He led the bombers over Schweinfurt at 2:39 p.m.

Accuracy was much better than in August, and the three largest ball bearings factories were hit numerous times. According to Speer, the bombs this time destroyed 67 percent of Schweinfurt's production capacity.

America's "Waterloo"

Unfortunately, the Oct. 14 casualties were the highest yet. Of the 291 B-17s that left England that morning, 60 were shot down for losses of more than 20 percent.

At such a rate, an aircrew member on a heavy bomber would have odds of completing no more than five missions before he would be shot down. He had virtually no chance of finishing his 25-mission combat tour and going home.

That loss rate and level of risk to the aircrews were not acceptable. For the rest of the year, Eighth Air Force struck only targets that were within range of the escort fighters. It did not attack Schweinfurt again until February 1944, when long-range fighters were available.

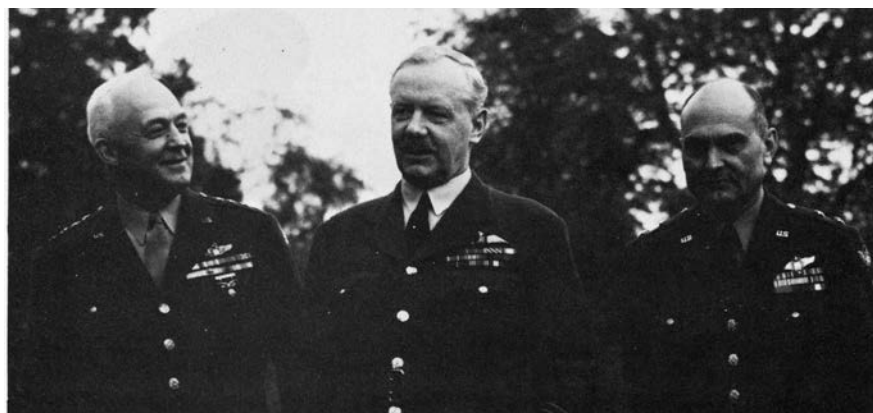
For its part, RAF Bomber Command did not attack Schweinfurt until after the

One of the most quoted lines from the US Strategic Bombing Survey said that "there is no evidence that the attacks on the ball bearing industry had any measurable effect on essential war production." Less noticed was the judgment of the Survey that the outcome might have been different had Eighth Air Force been able to follow up on the 1943 attacks.

"The Allies threw away success when it was already in their hands," Speer said. "As it was, not a tank, plane, or other piece of weaponry failed to be produced because of lack of ball bearings." In Speer's opinion, "The war could largely have been decided in 1943 if instead of vast but pointless area bombing the planes had concentrated on the centers of armaments production."

Schweinfurt did not discredit either daylight precision bombing or the bottleneck targeting strategy. In regard to those issues, the evidence was more positive than negative. Despite some operational errors, the strikes—just two of them—had a dramatic effect on ball bearing production, and had the effort been sustained would have devastated the German industrial base.

What the Schweinfurt experience did disprove was the notion that bomber formations could defend themselves when



Gen. Hap Arnold (left) and Gen. Ira Eaker (right) confer with British Air Marshal Arthur Harris.

third raid by Eighth Air Force. By then, the Germans had dispersed the ball bearings industry and it was no longer a good candidate for bottleneck targeting.

Frankland, historian of the RAF Bomber Command, dismissed Schweinfurt as "America's Waterloo." Others have emphasized the shortcomings of the operation as well. US historian Alan J. Levine said that "ball bearings as a target system had proven a false trail and the fortunes of Eighth Air Force had reached their nadir."

confronted by a force like the German air force.

In early 1944, Eighth Air Force changed its strategic emphasis to an all-out effort to destroy the Luftwaffe, and within months, the Luftwaffe was no longer an effective fighting force. The Allies were able to conduct the D-Day invasion in June 1944 without interference from the air. British and American bombers were free to attack at will, and with that, the war entered its final phase. ■

John T. Correll was editor in chief of Air Force Magazine for 18 years and is now a contributing editor. His most recent article, "A Habit of Heroism," appeared in the January issue.

The nation's armed forces are edging toward what may prove to be a laser revolution.

Fighting With Light

By Jeremy Singer

Air Force Research Laboratory photo

Directed energy systems—in particular, the laser—could soon dramatically strengthen American armed force capabilities in a wide variety of tactical scenarios. Already, lasers are being used for targeting, range-finding, communications, and the like, but developers are moving swiftly toward applications with destructive power.

The armed forces may actually be on the cusp of a laser revolution. These weapons show promise for missions as diverse as direct attack, air defense, base defense, and countering improvised explosive devices.

Advocates believe they are just scratching the surface of the true capabilities of lasers. For its part, Air Force Research Laboratory envisions lasers integrated onto a variety of tactical platforms after the technologies mature.

Most of the attention with tactical lasers focuses on the solid-state variety, which offers shooters a nearly unlimited magazine, officials from

the AFRL's directed energy group at Kirtland Air Force Base in New Mexico said.

In fact, according to Dan Wildt, vice president of directed energy systems at Northrop Grumman Aerospace Systems in Redondo Beach, Calif., solid-state lasers could allow Air Force pilots to strike far more targets in a single flight than they can today with limited bombs and rockets.

Laser advocates also prize the weapons' speed and precision compared to kinetic munitions. Literally moving at the speed of light, lasers can strike a target nearly instantaneously after an order is given, though the beam may need to be held on the target for several seconds to achieve the desired effect.

Aircraft are another possible laser target, though somewhat more difficult to hit. Boeing last year used a system called the Mobile Active Targeting Resource for Integrated Experiments, or Matrix—a mobile, trailer-mounted test bed—to destroy five UAVs in testing at the Naval Air Warfare Center in China

An unmanned aerial vehicle is tracked and hit by the high-energy laser from Boeing's Matrix system in a test last summer.

Lake, Calif. Boeing also used a laser-equipped Avenger ground vehicle to shoot down a UAV during those tests.

Laser precision may be particularly useful against the tiny, inexpensive UAVs that can be employed as sensors or weapons by adversaries who lack significant airpower, said Lee Gutheinz, Boeing's program director for high-energy laser/electro-optical systems in Albuquerque. The small UAVs present a heat signature difficult to follow with the infrared sensors on anti-aircraft missiles.

After development costs are paid, the cost per laser shot is "relatively small," according to AFRL. The cost advantages would be enormous, and would invert the current situation requiring expensive anti-aircraft missiles to target cheap drones. UAVs may cost a small fraction of the \$50,000 or greater cost of an anti-aircraft missile,

Gutheinz said, but operational laser weapons could shift the air defense cost advantage back to the United States.

The technology is so new that development of a battlefield-ready laser system might cost more than that of a new kinetic gun. But because the “ammunition” is so inexpensive, the life cycle cost of operating the directed energy system would likely be far less than a traditional weapon, Gutheinz contended.

Boeing reported that it spent nine months and under \$1 million to put the Laser Avenger test bed together for a counter-IED demonstration, and about \$1.5 million to upgrade it to shoot at UAVs. If the military asked Boeing for an operational version of the system, it could be ready within 18 months, and perhaps in as few as 12 months, Gutheinz said.

Other strike missions that could take advantage of a laser’s surgical precision include stopping—but not

destroying—ground vehicles with minimal collateral damage. Boeing has been exploring this capability with the Advanced Tactical Laser.

During testing in August and September at White Sands Missile Range, N.M., with a C-130H aircraft carrying a high-power chemical laser, Boeing struck an engine component under the hood of a stationary vehicle, and hit the fender of a moving vehicle.

Ready for Prime Time

A laser may not strike with the killing power of a .50 caliber shell to the hood of a vehicle, but it could disable a vehicle long enough for troops to determine whether its occupants are terrorists. It could do this without killing them, Gutheinz said.

If passengers exit a laser-disabled vehicle and show definite signs of being enemy combatants—such as by carrying rocket-propelled grenade

launchers—the military could follow up the laser with a kinetic strike to kill the insurgents.

If, on the other hand, it turns out that the passengers are not threats, the only downside is “having to write a check to replace the engine,” he said.

Industry officials feel tactical lasers are ready to move out of the research and development realm and onto the battlefield. “They’re ready for prime time,” Gutheinz said. The US military and its allies, for example, use the Multiple Integrated Laser Engagement Systems XXI to replicate weapon fire during training and combat experiments.

MILES XXI is considered a safe means of allowing both dismounted troops and those in ground vehicles to realistically shoot at each other during force-on-force battles. Lockheed Martin, the MILES XXI developer, would like to migrate this capability to aircraft as well, Scott Conover, director of ground and maritime business development at Lockheed Martin Simulation, Training, and Support in Orlando, Fla., said in December.

However, some national security experts believe that no matter how promising lasers appear, they will have difficulty finding room in a tightened Pentagon procurement budget.

“The services have never been super committed, and they’re willing to let it sit and wallow in research and

Left: A Vigilant Eagle ground-based laser protection system. Below: A time-lapse photograph of Vigilant Eagle as it diverts a threat from its target during field testing.



Raytheon photos



Above and right: Boeing's Laser Avenger system integrates a directed energy weapon with an Avenger air defense system. Laser Avenger can detonate unexploded ordnance or an improvised explosive device while troops stay inside the vehicle.

development—that's the reality of it," said James J. Carafano, a defense and homeland security expert at the Heritage Foundation in Washington, D.C.

Industry may have yet to develop the perfect system, but the Pentagon should consider beginning to deploy prototypes to develop laser tactics, techniques, and procedures, he said.

Lasers could play a significant role, for example, in the vexing base-defense mission by knocking down incoming mortar fire. Raytheon is working to upgrade its Phalanx system (used today aboard Navy ships and in a land-based configuration to protect forces in Iraq's Green Zone) to equip it with lasers, according to Michael W. Booen, Raytheon vice president for advanced missile defense and directed energy systems in Tucson, Ariz.

Using lasers to counter enemy mortar fire could dramatically extend the range of the defensive systems, thus requiring fewer of them, said Booen, a retired Air Force colonel who once oversaw the Airborne Laser program.

By using solid-state lasers, US forces can take advantage of generators already in place on the ground or aboard a ship, thus reducing the logistics burden—and cost—associated with kinetic defensive weapons, Booen said in December.

Raytheon used a solid-state laser to shoot down 60 mm mortar fire at White Sands Missile Range during testing in 2006. This capability remains in the research and development stage.

Boeing and Northrop Grumman, meanwhile, are working on competing versions of a system

targets. Lasers have "almost unlimited potential" to reduce collateral damage, though avoiding international criticism for US military operations is likely a lost cause, added Carafano.

"Had laser systems been available for these applications, the amount of casualties would have been greatly reduced" in strikes against targets in Afghanistan, an AFRL official said. In some instances, lasers can be a valuable military asset without killing anyone. In cases such as the NATO air strike on Radio Television Serbia in Belgrade during Operational Allied Force in 1999 that unintentionally killed 16 civilians, laser weapons could have allowed NATO to negate the station by surgically destroying its antennas and transmitter equipment without harming civilians, an Air Force official said.

The Air Force has seen ample evidence on video where a kinetic weapon has



called the High Energy Laser Technology Demonstrator to defend troops from rockets, mortar fire, and artillery shells.

Almost Unlimited Potential

For starters, lasers could be mounted on tactical aircraft and special operations helicopters to protect them from heat-seeking missiles. The laser's speed-of-light capability could provide an enormous advantage in reacting to incoming surface-to-air missiles.

Similarly, eliminating the "time of flight" it takes for a bomb to fall or missile to reach its target can be key when it comes to reducing unintended civilian casualties or striking moveable

been headed toward an enemy target when additional individuals, sometimes civilians, have walked into the area at the last moment. This has sometimes resulted in unintended injuries and deaths.

Small boats—such as those used by terrorists in the attack on the Navy destroyer USS *Cole*—Somali pirates, and smugglers are other possible targets for lasers, said Carafano. Lasers could help with the difficult task of stopping a boat without harming hostages or human cargo on board, he wrote in 2008.

Northrop Grumman this year plans a Maritime Laser Demonstration to defeat small boat threats with a solid-state laser fired from a ship, Wildt said.



Boeing photo by Ed Turner

A C-130 carrying the Advanced Tactical Laser prepares for a test near Albuquerque, N.M.

Hitting communications antennas could also be attractive when facing heavily armored targets such as tanks. Gutheinz said taking away a tank's ability to communicate prevents it from sharing intelligence, calling in reinforcements, and coordinating its firing with its fellow forces.

Improvised explosive devices and other unexploded ordnance represent other targets that may be ideal for lasers. In a demonstration, Boeing destroyed 50 IEDs with a laser system mounted on an Avenger. The test last fall was sponsored by the Pentagon's Joint IED Defeat Organization at Redstone Arsenal in Huntsville, Ala.

Troops equipped with the Laser Avenger system would not have to get out of their armored vehicles or wait for an explosive ordnance disposal team to destroy an IED in order to continue their mission, according to Boeing.

Destroying IEDs may actually be the simplest application for the tactical lasers, said Gutheinz, a retired Air Force colonel who previously worked on laser programs with USAF and Aerospace Corp. Lasers can touch a small object from hundreds of meters away and blow it up with an explosion of only 30 percent of the IED's intended power. That sort of fizzled explosion is particularly desirable in urban areas or where collateral damage is a danger, he said.

For the military to take full advantage of lasers, it may need to evolve its current targeting mindset, said Loren B. Thompson, chief operating officer of the Lexington Institute, an Arlington, Va.-based think tank.

China is developing missiles that could strike US bases and carriers, and

lasers could be used to knock those missiles down early in flight. However, a better solution might be to use the lasers to blind the sensors that would guide the missiles, thus eliminating the need to intercept them, he said. Lasers could even be used to blind sensors with such surgical precision—and no explosion or obvious flight path—that it may be unclear to an adversary whether an equipment failure or attack had occurred.

Bring On Ground Capability

For all their potential, lasers are not a panacea and they face their own distinct disadvantages. In addition to difficulty penetrating concrete walls and heavily armored vehicles, lasers are hindered by atmospheric distortion and the need for clear sight lines.

Boeing has worked to address the latter two issues through the Aerospace Relay Mirror System, which ultimately could be carried aboard airships, other long-endurance aircraft, and satellites. The company in 2006 demonstrated a small-scale version of the mirror, held 100 feet off the ground by a crane, to relay a nonlethal beam to targets approximately two miles away.

AFRL is developing other directed energy applications beyond lasers. High power microwave energy beams that also travel at the speed of light and result in little collateral damage are one area of interest. The microwave energy beams are intended to disrupt electronic systems.

Raytheon is exploring this concept, to guard civilian aircraft, through the Vigilant Eagle program.

Vigilant Eagle is a ground-based system to protect against terrorist threats such as shoulder-fired missiles. It would defend the aircraft during takeoff and landing, when they are most vulnerable.

Vigilant Eagle uses infrared cameras to spot missiles and fires an electromagnetic beam that interferes with the rocket's guidance system in order to deflect it away from the aircraft.

This type of ground-based capability could protect about 80 percent of air traffic within 20 years for less than \$3 billion, according to a Raytheon fact sheet. Installing similar systems aboard aircraft would likely be far more expensive, due to logistics and modification expenses. Raytheon estimates onboard systems could cost more than \$30 billion for the same level of protection over a 20-year period.

Raytheon is in discussions with both the US Department of Homeland Security and foreign customers about Vigilant Eagle, but has yet to receive any commitments, Booen said.

The technology is promising, but budgets are tight and directed energy systems may need a push for successful systems to make it into the field. Carafano notes that UAVs were not in high demand either until the Pentagon "almost forced them" into the hands of users. Without a concerted push, the Pentagon risks ceding the advantages that come with lasers to a potential adversary, Carafano said. ■

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The most gifted and influential aeronautical researcher of his time knew a thing, or two, or three.

Richard Whitcomb's



USAF photo

In 1953, the Air Force had a problem: Its new jet-powered interceptor, Convair's F-102, was a dud.

Unlike earlier airplanes that relied on brute strength to push past the speed of sound, the dart-shaped F-102 had a "delta" wing and an afterburning engine that was supposed to allow it to slip across the sonic frontier. Dubbed the "1954 Interceptor" (a reference to its planned in-service date), the new F-102 was to scramble from US bases, climb to high altitude, and intercept incoming Soviet bombers, dashing if necessary to Mach 1.25 before blasting them from the sky.

On paper, it seemed a winner. High over the Mojave, flight tests were starting to show otherwise.

As the prototype YF-102 approached the speed of sound, it would begin to slow down, like a marathon runner hitting the 20 Mile wall. Even with its afterburner blasting away, the aircraft would top out at only Mach 0.98 before returning to Earth. It was



NACA photo

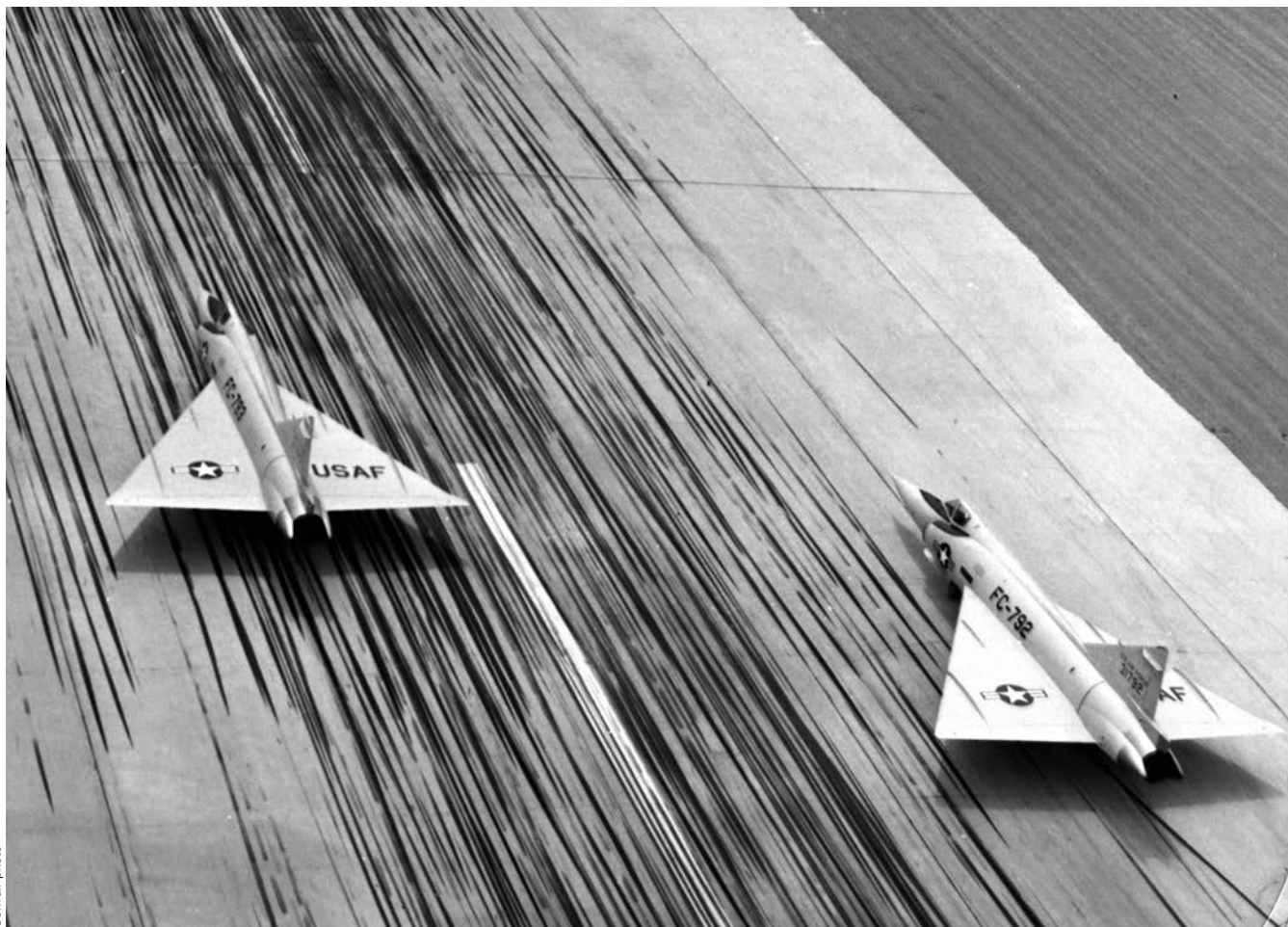
Whitcomb, below left, with an early wind tunnel model featuring the “wasp-waist.” His flash of genius led to the Area Rule, which made it possible to increase the speed of the experimental YF-102 (top left) 25 percent by the time it became the operational F-102A interceptor (below).

special insight into the physics of fluid flow. He initially used that intuition, not just quantitative analysis, when he derived his Area Rule theory. His intuition thus directly led to one of the most important design innovations in aviation history.”

Born in Illinois in 1921, Whitcomb came from a family attuned to technology and invention. His father, a mechanical engineer, had been a balloon pilot, and his grandfather was an inventor who had known Thomas Edison.

Triple Play

By Richard P. Hallion



Convair photo

clear that something was very wrong with Convair’s new delta. Could it be salvaged?

The answer was yes. The F-102 would require extensive redesign, delaying its introduction into service by two years, but it would become a Cold War mainstay, with approximately 1,000 serving from 1956 through 1976 in Air Force and Air National Guard interceptor squadrons (and in the militaries of Greece and Turkey as well).

That the F-102 didn’t remain an embarrassing failure was thanks to the genius of a young government engineer, Richard T. Whitcomb. Whitcomb, who died last October in Hampton, Va.,

at age 88, has been rightly acclaimed as the most gifted and influential aeronautical researcher of his time.

Incredible Insight

An aerodynamicist with the National Advisory Committee for Aeronautics (NACA, the predecessor of NASA), Whitcomb was a standout even in an agency known for the extraordinary quality of its scientific personnel.

“Dick Whitcomb wasn’t just another brilliant aerodynamicist,” notes former Air Force Chief Scientist and University of Maryland professor Mark J. Lewis, who knew him. “He had incredible intuition, giving him

Like many boys of his generation, Whitcomb was fascinated with flight and earned an engineering scholarship to Massachusetts’ Worcester Polytechnic Institute. Most engineering students aspired to work in industry, but Whitcomb was different: “I knew,” he said later, “that I wanted to go into research.”

As he approached graduation, he read a *Fortune* magazine article extolling NACA’s Langley Memorial Aeronautical Laboratory at Langley Field, Va. (now the NASA Langley Research Center at Langley Air Force Base). The article convinced him it “was the place to come for applied research.”



The winglet (seen here in testing on a KC-135) later became crucial to the C-17's performance. Seemingly simple, the winglet adds lift far beyond its cost in weight, and has been adopted on many airliners.

Accordingly, when a NACA recruiter visited Worcester Poly, Whitcomb recalled, "I was just waiting for the guy to hand me the papers."

Whitcomb joined NACA in 1943, the year when America's aeronautical community began planning its assault upon the then-fearsome "sound barrier."

The rocket and the jet now made supersonic flight a possibility. Perhaps an airplane could fly faster than sound, if it could first survive the intermediate transonic region with its much-feared sound barrier.

The transonic region was between Mach 0.75 and Mach 1.25. In that band, airplanes encountered compressible flow, shock waves streaming from their wings and bodies, loss of lift and rising drag, dangerous buffeting, and sometimes loss of control and even structural failure.

Whitcomb would prove his mastery over this treacherous and daunting arena but almost missed the chance. When he arrived at Langley, personnel staffers initially assigned him to the instrumentation branch.

With a surprising outspokenness for someone so young, he refused.

"I said, 'I don't want to work in instruments,'" he recalled. "'I want to work on aerodynamics.'" So they assigned him to the Langley eight-foot high-speed tunnel, run by John Stack. NACA's most forceful high-speed research enthusiast, Stack was energetic, insightful, charismatic, and destined to twice share the Robert J. Collier Trophy—the most prestigious of all American aviation accolades.

A Flash of Light

Chief among his many accomplishments was conceptualizing and developing the slotted throat wind tunnel, the most significant tunnel advance over the previous 25 years. Conventional wind tunnels "choked" near the speed of sound when shock waves streaming from models reflected back and forth across their test sections, producing misleading or incomprehensible results. The slotted throat tunnel removed this transonic "blind spot" via a ring of carefully placed longitudinal slots that dissipated flow-disturbing shock

waves, enabling much more accurate measurements as airflows neared and exceeded the speed of sound.

Whitcomb made the slotted throat tunnel his personal laboratory. In the early years of the postwar era, NACA aerodynamicists focused on the behavior of the swept wing. Whitcomb looked beyond its singular purity, studying instead the aerodynamic interaction of the wing and fuselage. He discovered their combined drag was greater than the sum of their individual drags measured separately.

Using photographic imaging, Whitcomb noted strong shock waves emanating where the leading and trailing edges of wings joined the fuselage, producing a performance-robbing "bunching" of air. It was as if the wave patterns of two boats intersected, becoming just one large pattern.

"The theoreticians," he later told one interviewer, "were at a loss as to how to handle this problem." All except one—Adolf Busemann, a scientist who had invented the high-speed swept wing in Germany before World War II, and who came to Langley with Project Paperclip afterward. At a staff seminar, Busemann joked that transonic flows were so constricted that aerodynamicists were like pipe fitters, finding how to fit flows around the vehicle.

One day in 1951, while Whitcomb contemplated his tunnel results and pondered Busemann's analogy, he had an insight like a flash of light: If a designer gave the bunching air a place to go, the flow would smooth out, and the drag would decrease. He later recalled the moment, saying, "I sat there at my desk, feet propped up, and suddenly it dawned on me, the basic idea of the Area Rule: Transonic drag is a function of the longitudinal development of the cross-sectional areas of the entire plane."

It was the latter insight—that drag was a function of the length of the entire airplane and not just the fuselage diameter at the wing-fuselage juncture—which separated Whitcomb's work from others who focused their research more narrowly.

The ideal supersonic shape was long and slender, with its cross-sectional area expanding gradually, reaching a maximum diameter and then contracting equally smoothly. Designers would have to pinch the fuselage at the wing roots, and lengthen the fuselage before and behind the wing as well,



Whitcomb with a wind tunnel model of a TF-8 configured with his supercritical wing (below), and NASA's flying version (left). His innovation has saved billions of dollars in fuel costs.

study team in 1945 had added to such beliefs.

Whitcomb's discovery enabled the Air Force's transonic force structure that was subsequently deployed for the Cold War and beyond. Proof that Area Rule also restored NACA to the service's good graces was evident in Whitcomb's receiving of the Air Force Exceptional Service Medal.

Whitcomb was not content to rest on this single laurel. Called into the

increasing its fineness ratio—the ratio of its length to its width.

Whitcomb broached this “rule of thumb” at the next NACA Langley technical seminar. After he finished, Busemann rose to his feet. “Some people come up with half-baked ideas and call them theories,” he said. “Whitcomb comes up with a brilliant idea and calls it a rule of thumb.”

A landmark, confidential NACA research memorandum issued in September 1952 was the result of comprehensive wind tunnel testing that followed. The memo's prosaic title—“A Study of the Zero-Lift Drag-Rise Characteristics of Wing-Body Combinations Near the Speed of Sound”—belied its revolutionary implications.

At just over 30, using a mix of intuition, experimentation, and borrowed theoretical analogy, Whitcomb had reshaped the airplane. Area Rule was—next to the swept and delta wings themselves—the most significant and most visible manifestation of transonic design.

Nicknamed “Coke Bottle” and “Wasp Waist,” Area Rule came just in time for the F-102. Weeks before its first flight, Convair engineers had learned from NACA tunnel tests that the F-102 likely would not exceed the speed of sound.

Whitcomb's confidential memorandum came afterward, followed shortly by the first F-102's disastrous performance in the skies over Edwards.

For Convair it was, literally, back to the drawing board. The F-102,

redesigned to conform to Area Rule principles with a lengthened fuselage and also modified wing leading edges, returned to Edwards in 1954, handily accelerating through the speed of sound.

Whitcomb's Area Rule had added 25 percent more speed to the design.

Area ruling also reshaped the Navy's F9F-9, which became the supersonic F11F-1 Tiger, and Vought's F8U-1 Crusader. It added sinuous curves to Republic's F-105 Thunderchief, McDonnell's F4H-1 Phantom II, and Northrop's tiny N-156, which spawned the T-38 Talon trainer and the F-5A Freedom Fighter.

Uncorking No. 2

Whitcomb received the 1954 Collier Trophy “for discovery and experimental verification of the Area Rule, a contribution to base knowledge yielding significantly higher airplane speed and greater range with same power.”

He had also redeemed the reputation of the NACA with the Air Force. Since 1941, when Gen. Henry H. “Hap” Arnold had been surprised to learn that Britain was more advanced in the field of jet propulsion, the agency had faced criticism for technological complacency. The appearance of German jets, the V-2 missile, and discovery of advanced German high-speed research by Theodore von Karman's technical



early design conferences for a proposed supersonic civil air transport, he returned to transonics when SCAT studies grew ever more complex and improbable.

“I said, ‘I’m going to quit the field,’” he recalled in 1973. “I’m going back where I know I can make things pay off,” and I went back to the region right near the speed of sound.” Shortly after, he uncorked his second great idea, the “supercritical wing.”

The supercritical wing had a largely flattop airfoil cross-section with its camber (curvature) well aft. It raised the wing's critical Mach number—the point where the accelerated airflow over the wing creates a shock wave. A jetliner cruising at Mach 0.82 with a conventional wing might, with a supercritical one, cruise at Mach 0.86 or even higher for the same expenditure of fuel. While this idea was exciting enough, it became one of vital strategic significance for both military



A swing-wing Transonic Aircraft Technology (TACT) F-111A configured with Whitcomb's supercritical wing. It delivered 50 percent better lift than the standard F-111A.

and airline operators in the oil crises of the 1970s.

Early tests on a modified trainer encouraged NASA to move to higher-Mach trials using an ex-Navy Vought TF-8A Crusader jet fighter. Flight tests began in 1971, and quickly demonstrated that the anticipated benefits of the wing were correct. The modified F-8 had 15 percent better transonic performance than a standard Crusader.

Tests indicated commercial airliners with supercritical wings would be more profitable than ones with conventional wings, saving the airline industry \$78 million per year in 1974 dollars—equivalent to \$342 million today.

In 1969, Whitcomb received NASA's Exceptional Scientific Achievement Medal. Four years later, President Nixon awarded him the National Medal of Science. In 1974, Whitcomb received a \$25,000 cash award for inventing the supercritical wing, and later that year, the National Aeronautic Association awarded him the 1974 Wright Brothers Memorial Trophy.

The supercritical wing was very quickly applied to a range of commercial aircraft, beginning with the Rockwell Sabreliner 65, the Canadair Challenger, and the French Falcon 50 business jet aircraft.

It had clear military value, and so was incorporated on the Boeing and

McDonnell Douglas YC-14 and YC-15 Advanced Medium Short Takeoff and Landing Transport test beds. It was evaluated for fighter and attack aircraft applications on a modified F-111A as part of the joint NASA-Air Force Transonic Aircraft Technology (TACT) program, as was a supercritical spin-off, the Mission Adaptive Wing.

The TACT F-111A had 50 percent more lift during maneuvering than a standard F-111A.

Building upon the earlier flight-test experience of the YC-15 program, and continued and lengthy wind tunnel studies at NASA and elsewhere, the McDonnell Douglas C-17A Globemaster III transport went a step further. It featured not only a supercritical wing, but another Whitcomb innovation—the wingtip winglet.

"I Shock People"

The winglet constituted the third of his innovations and was even more readily visible than area ruling. Aerodynamicists had long recognized that swirling wingtip vortices, a byproduct of the airflow's circulation around the wing, constituted a source of performance-robbing turbulence and drag. While

not the first to experiment with some sort of endplates located on wingtips, Whitcomb employed greater insight and intuition than his predecessors.

He developed a deceptively simple-looking fin that could reduce a transport's drag by a fifth. But would it work?

Tests in 1979 using a Boeing KC-135 Stratotanker loaned to NASA proved that winglets functioned better at reducing drag and increasing lift than merely extending an airplane's wingspan. The winglets increased its range by seven percent and revealed the power of the invisible vortices: The KC-135 returned from one flight with a winglet bent in a half-circle, a testimony of the strength and energy contained within the small horizontal tornadoes.

Since the late 1980s, winglets have become ubiquitous, visible to anyone living near an airport offering commercial and business jet aircraft service.

The general aviation and business airplane communities were the first to incorporate winglets, just as they were the first to adopt his supercritical wing. In 1979, Learjet introduced the Longhorn, a winglet-equipped series of its famed business jet aircraft. Gulfstream added them to its own line of business aircraft, and later Boeing and McDonnell Douglas adapted them for the 747-400 series jumbo jet and the MD-11.

Winglets were incorporated on the C-17 airlifter, together with a supercritical wing. The combination gives the C-17 better range and speed than would have been possible had it used a larger, conventional planform.

Whitcomb retired from NASA in 1980, convinced that no large challenges in aviation remained. Thereafter, he turned his interests toward broader questions in the physical sciences.

Asked in 2003 whether he advised young people to follow his footsteps, he replied, "I shock people. I say if you want to make an impact or have an effect, don't go into aeronautics. It's pretty well stabilized. No big things have come up in aeronautics since my inventions, and it has been 20 years since I left."

If many might disagree, most would concur that it will take an extraordinary breakthrough to match any one of his remarkable trio of transonic accomplishments. ■

Richard P. Hallion is an aerospace historian who served 11 years as the Air Force Historian and has written widely on aerospace technology and airpower topics. This is his first article for Air Force Magazine.

Keeper File

Horner's Anxious Moments

It was only a few months after the smashing US victory in the first Gulf War. Then-Lt. Gen. Charles A. Horner, the "air boss" of Operation Desert Storm under Gen. H. Norman Schwarzkopf, gave an eye-opening insider account of the conflict. To the outsider, the triumph over the forces of Saddam Hussein seemed like a walkover; for Horner and others who were there, it was anything but. Horner recalled the aftermath of the Aug. 2, 1990 Iraqi invasion of Kuwait as "some of the worst nights of my life," as he and others pondered the ease with which Saddam could have seized Saudi oil fields. Horner and his top aide, then-Brig. Gen. Buster C. Glosson, worried mightily about whether the F-117 stealth aircraft would survive. In short, Horner had sweated it out—more than anyone knew.

There was no certainty that Iraq would not continue its attack. There were no military forces other than some light Saudi National Guard units between him and the oil fields at Abqaiq, the oil production at Al-Jubail. And so it was a very tense, serious situation...

The buildup went very rapidly. The idea was we were to deter an Iraqi invasion of Saudi Arabia, and if an invasion did come, we had to be prepared to defend. General Schwarzkopf flew back to the States to push the forces over [and] left me over there to receive them, and we flew up to Riyadh and set up the headquarters.

Those were some of the worst nights in my life, because I had good information as to what the Iraqi threat was, and quite frankly, we could not have issued speeding tickets to the tanks as they would have come rolling down the interstate highway on the east coast. It was an opportunity the Iraqis did not take, but every night, we'd get more forces, and we'd sit down and get a game plan of what we'd do if we came under attack.

The first forces deployed were air defense forces. We brought F-15s. The Saudi Air Force was flying their AWACS and their F-15s, so we just fell in on their operations and had a more robust air defense as we went along.

Next, we brought in air-to-ground aircraft, and the role of these systems [was] we were going to trade space for time, if he attacked, and we would attack the forces, meanwhile falling back as far as the United Arab Emirates. ... The 82nd Airborne showed up very light, would not have been able to forestall the tanks, but would have given us the means to delay the onslaught. We brought in A-10s, the Marine Corps arrived, and of course, the carriers arrived in the Gulf.

Later, we were able to add more heavy forces, and the point where the issue is no longer really in doubt was when we got the 24th Infantry Division there with their tanks. Then we knew we could defend the Port of Dammam, which is just across from Bahrain, and that would allow us to bring our forces on board. ...

As we went on, in October and November, it became obvious that Iraq was not interested in negotiation and that at some point in time, there would be a decision made to eject them, and that's when the briefing was brought to the president of the strategic air campaign. ...

The decision on when to attack obviously, given the cutoff date of Jan. 15 that came from the UN resolution, was made based on moonlight and weather. We wanted as dark a night as possible, because [of] the F-117, the stealth fighter going into Baghdad. And we wanted good weather obviously for air operations. The 16th was picked, 3 o'clock in the morning our time. ...

We had the first two days of the war mapped out in detail; I mean, we knew each target, each sortie, what time it hit, where it refueled,

"Desert Storm"

Lt. Gen. Charles A. Horner, USAF
Address to Business Executives for National Security
Cannon House Office Building
Washington, D.C.
May 8, 1991

Find the full text on the
Air Force Magazine's Web site
www.airforce-magazine.com
"Keeper File"

what country would fly the sortie, what ... munitions—and all the detail was there. I would not let them prepare a third day. I said we have to learn how to manage chaos, because that's what war is, it's chaos. And so the first day of the war, while the nation was watching the bombs fall, the Black Hole guys came out of the Black Hole, and all the staff got to work and started planning for the third day, and using the intelligence inputs that we could generate. ...

I guess the biggest thing I worried about was loss of friendly aircraft. We had stealth technology, we had a lot of technical data about stealth technology, but I had no way of knowing that we wouldn't lose the entire fleet the first night. Those boys were going in there naked, all alone. We were betting everything on the data. As it turned out, they flew every night and we did not suffer any battle damage to any of the F-117 aircraft, but that had to be a big lump in my throat right there, as I watched them go over Baghdad the first two nights.

And I think you all saw on television the vast amounts of ground fire. My intelligence people told me that Baghdad was twice as heavily defended as any other target in the Soviet Union or in Eastern Europe. And I can believe it, looking at all the SAM sites and the guns on every building. So that paid off, but we had no way of knowing. We had no way of knowing how well our ECM [electronic countermeasures] would work because those are things you don't practice in peace.

We wanted to seize control of the air so we could do all of the other things. And that's a very individualistic thing. And your training comes to bear as much as your equipment and the courage of your pilots, and the robustness of your command and control. And so I worried about that.

There were a lot of questions about losses—what did you anticipate and what did you have—so on and so forth. Buster and I, about two days before the war started, we were sitting in the command center, and he said, what do you think the losses are going to be? And I wrote 39 down on a piece of paper. That meant I thought we'd lose 39 aircraft. As it was, we lost, I believe the number is about 41. ... I'd like to take credit for being brilliant. Actually, when I wrote 39 down, I thought we were going to lose 39 USAF aircraft. And in fact, I expected our [coalition] losses to be nearly 100 airplanes. ■

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MISSISSIPPI: Carl Nuzzo, 110 Little John Ln., Starkville, MS 39759 (662) 241-6597.
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By Frances McKenney, Assistant Managing Editor

Space Award in Los Angeles

At the November Air Force Ball sponsored by the **Gen. B. A. Schriever Los Angeles Chapter** in Beverly Hills, Calif., Maj. Gen. Stephen T. Sargeant received the Air Force Association's national space award.

Sargeant, who heads the Air Force Operational Test and Evaluation Center at Kirtland AFB, N.M., accepted the Gen. Thomas D. White Space Award from Air Force Association Chairman of the Board Joseph E. Sutter.

Sargeant "revolutionized space acquisition by leading the center to create and codify a new space operational test and evaluation model," the master of ceremonies, Patrick Coulter, told the audience. He said that Sargeant directs more than 800 military, civilian, and contractor personnel at a dozen locations. They carry out 70 major programs, 17 of them covering space, missiles, and missile defense.

The space award recognizes the year's outstanding contributor to the nation's progress in space. It is named for USAF's fourth Chief of Staff, who served from 1957 to 1961. The National Geographic Society established the award in 1961, but AFA has sponsored it since 1996.

Also at the Ball

Also at the 38th annual Los Angeles Ball, Lt. Gen. Larry D. James, 14th Air Force commander at Vandenberg AFB, Calif., was named a Gen. Bernard A. Schriever Fellow.

AFA's Vice Chairman of the Board for Aerospace Education S. Sanford Schlitt and Chris J. Kalivas, Schriever Chapter president, made the presentation.

Raytheon Vice President Jon C. Jones, the ball's general chairman, emphasized aerospace education, telling the audience that the Schriever Chapter sponsors 84 classrooms in the Visions of Exploration program. The joint AFA and *USA Today* newspaper program encourages students to study science, technology, engineering, and math.

Schlitt and Thomas Taverney, the chapter's chairman, later presented \$40,000—proceeds from this 2009 Air Force Ball—to AFA and the chapter's education foundation.



USAF photo by Lou Hernandez

AFA Board Chairman Joe Sutter (right) presents the Gen. Thomas D. White Space Award to Maj. Gen. Stephen Sargeant (second from left) at the Beverly Hilton Hotel. Joining them on stage were Thomas Taverney, Schriever Chapter chairman (left), and Lt. Gen. John Sheridan, Space and Missile Systems Center commander.

The audience at this black-tie affair included Secretary of the Air Force Michael B. Donley and Gen. C. Robert Kehler, the commander of Air Force Space Command.

Inspiration From a Wounded Warrior

In Indiana, an Army NCO wounded in Iraq delivered a message of inspiration to a meeting of the **Columbus-Bakalar Chapter** in November.

MSgt. Jeffrey E. Mittman grew up in Indianapolis and served in the first Gulf War and in Afghanistan. In July 2005, he was on his second tour of Iraq. As an advisor to an Iraqi unit, he was driving a Humvee to meet with the group, when an improvised explosive device detonated near his vehicle.

The explosion destroyed parts of Mittman's face, a finger, and most of his vision and teeth. He was unconscious for a month.

Since then, he has undergone more than 40 surgeries for facial reconstruction. Chapter President Robert J. Goedel learned of Mittman through an Army recruiter.

Goedel wrote afterward, "The chapter members who attended the meeting

came away with a new appreciation of the selfless spirit our warriors exhibit."

Mittman's visit to the Columbus-Bakalar Chapter was part of the Army Wounded Warrior Program. Mittman meets with at least 15 groups a year, to highlight the importance of supporting the military.

Pilot Partners

Golden Triangle Chapter officials in Columbus, Miss., co-sponsored a reception in November as part of a program to foster relations between Columbus Air Force Base, its student pilots, and the community.

About 30 specialized undergraduate pilot training students from Class 11-02 gathered at a pizza restaurant. Chapter President Lynda C. Nuzzo, VP Richard T. Johnson, Treasurer Michael A. Counihan, and Mississippi State President Carl W. Nuzzo were among those who served as hosts.

Appropos for the pilot trainees: The chapter donated a poster of a T-6 Texan II cockpit as a door prize. Second Lt. John Harris, 14th Operations Support Squadron, won this training aid.

The chapter and the local Chamber of Commerce team up for these receptions about every three weeks, to welcome each new batch of pilots arriving for the base's 15 SUPT classes.

Johnson organized this Pilot Partner Program in 2002 and said that the newcomers' reception brings the students together with at least two local businesses or civic organizations.

The goal is for the civilian partners to then attend milestone events during the pilots' training cycle: visitors day, track-select day, assignment night, and graduation, for example.

Johnson noted that this program encourages public understanding of the Air Force and the base's mission and showcases the community's support of the base and its pilot-training mission.

68 Roses: Pearl Harbor Remembered

With 68 American Beauty roses as the centerpiece, New York's **Long Island Chapter** hosted a Pearl Harbor remembrance ceremony at the American Airpower Museum at Republic Airport in Farmingdale, N.Y.

Afterward, an AT-6 warbird took off from the airport with the red roses—one for each year that has passed since Dec. 7, 1941—and one white rose to honor those who died in the Sept. 11, 2001 terrorist attacks. The airplane dropped the flowers in the water around the Statue of Liberty at 12:55 p.m., the East Coast time of the Pearl Harbor attack.

This annual "Dropping of the Roses" tradition was begun in 1970 by the late Joseph S. Hydrusko, a Massapequa, N.Y., resident. Hydrusko was a Navy seaman on the hospital ship *USS Solace* in Pearl Harbor when the Japanese bombed the battleships anchored there.

Recognition of Pearl Harbor survivors highlights the remembrance ceremony, and William G. Stratemaier Jr., chapter president, reported that five of these veterans attended, this year. The youngest was 85 years old; two of them were 91. They received a proclamation from President Obama and an AFA coin as part of the memorial service.

The event drew some 1,000 guests, including local elected officials and business leaders. Col. Thomas J. Owens II, commander of the 106th Rescue Wing, based at Francis S. Gabreski Arpt., N.Y., delivered the keynote address. Chapter members Cathy T. Ward and Alphonse A. Parise each received an AFA Exceptional Service Awards during the ceremony.

Stratemaier said the Dropping of the Roses serves as "a solemn and emotional tribute to all those who were lost that day."

More Chapter News

■ In Hot Springs, Ark., the **Lewis E. Lyle Chapter** meeting in November featured "Life on the Home Front," a program on America in World War II. Chapter Secretary Morris D. Cash said that local historian and genealogist Jeff Meek brought to his presentation wartime ration books, patriotic posters from that era, and a photo album. Meek, who has delivered this presentation at several venues, specializes in World War II history. For the Lyle Chapter meeting, he showed two videos, one on how US industry adapted for the war effort and another on how Americans adjusted: growing "victory gardens," queuing in long lines for rationed gasoline, and saving bacon fat to be reused in making munitions.

■ In Virginia, the **Northern Shenandoah Valley Chapter's** latest academic scholarship went to Randolph-Macon Academy senior Joseph Kurpiel. Chapter Secretary Kathleen S. Kays presented him with the award at a scholarship recognition assembly held during Family Weekend open house activities at the co-ed college-prep military school in Front Royal, Va. Among the other chapter members attending the

ceremony was Chapter Communications VP Stephen Pederson.

■ Thirteen California AFA chapters attended the Golden State's quarterly meeting in Los Angeles in November. California State President Martin W. Ledwitz, of the **San Gabriel Valley Chapter**, led the meeting. AFA Chairman of the Board Joseph E. Sutter, AFA Executive Vice President David T. Buckwalter, and newly elected AFA National Director Wayne R. Kauffman, of the **Gen. B. A. Schriever Los Angeles Chapter**, spoke to the gathering. Their topics ranged from updates on AFA to details on its 501(c)(3) tax status and upcoming events. Two new area leaders for the state were named: Christopher Underwood from the **Tennessee Ernie Ford Chapter** and Frank D. Walterscheid from the **Maj. Gen. Charles I. Bennett Jr. Chapter**.

■ **Prescott/Goldwater Chapter** members helped out at a Veterans Day Parade in Prescott, Ariz. They joined volunteers from the Arnold Air Society—an AFA affiliate—and its partner Silver Wings organization from Embry-Riddle Aeronautical University in Prescott and the University of Northern Arizona. Together, they escorted patients from

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an extended care facility, outside to view the parade. Chapter President Thomas Rowney noted that one of the high-profile volunteers was the Arnold Air Society national commander, cadet Jun Ko from Embry Riddle.

■ Kelly Jones was in charge—not only as AFA Texas state president, but also because he was driving. He was at the wheel of a Mustang GT convertible, the **Abilene (Tex.) Chapter's** entry in the city's Veterans Day parade. The chapter placed a giant AFA banner on the hood and Abilene Chapter signs on the car's two doors. Joining Jones to ride in the "parade float" were Chapter Treasurer William G. Zavatson, sporting an AFA ballcap, and John F. Nuding wearing his Air Force dress blues.

■ With Arizona State President Harry H. Bailey on hand to see her off, **Frank Luke Chapter's** Teacher of the Year, Joanne Henning, embarked on an incentive small-airplane ride provided by the 313th Civil Air Patrol Squadron at Goodyear Arpt., Ariz., in November. Henning, whom Bailey—from the Luke Chapter—had originally nominated for the award, teaches fourth grade at Glendale American Elementary School in Glendale, Ariz. AFA State and Chapter Teachers of the Year receive CAP membership, a requirement for participating in this incentive flight program. AFA chapters can sponsor other teachers for CAP membership. ■

At a reception to welcome pilot trainees to Columbus AFB, Miss., Golden Triangle Chapter President Linda Nuzzo (right) presented 2nd Lt. John Harris with a door prize: a training-aid poster showing the cockpit layout of the T-6 trainer.



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Reunions

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87th Aerial Port Sq Assn. June 3-6 at the Drawbridge Inn in Fort Mitchell, KY. **Contact:** Charles Hampton (859-468-8873) (the.87apsa@yahoo.com).

303rd BW. April 22-25 at Viscount Suites Hotel in Tucson, AZ. **Contact:** Don Bott (520-825-2056) (dmb@wbhsi.net).

525th FIS. June 4-6 in Colorado Springs, CO. **Contacts:** Bill Galvan (719-597-4905) (williamgalvan@msn.com) or

Frank Litt (817-294-1136) (flitt@sbc-global.net).

4080th SRW. May 27-29 at the Ramada Inn of Del Rio, TX. **Contact:** Laughlin Heritage Foundation Inc., P.O. Box 1348, Del Rio, TX 78841 (830-719-9380) (laughlinhf@stx.rr.com).

Pilot Tng Class 55-B. June 17-19 in Colorado Springs, CO. **Contact:** Dick Nemeth (703-280-5075) (dhnemeth@

verizon.net) (www.danbanks.net/index.htm).

Pilot Tng Class 56-I. June 3-7 at the Doubletree Hotel Crystal City in Arlington, VA. **Contact:** Richard Taylor, 5498 Aryshire Dr., Dublin, OH 43017 (614-766-6420) (taylor5498@earthlink.net).

Pilot Tng Classes 58-C/D. April 19-22 at Westward Look Resort in Tucson, AZ. **Contacts:** Phil Smith (952-833-0033) (phiglo34@aol.com) or Joe Young (928-505-2302) (joeyoung@unneedspeed.com) or Conrad McEachern (972-239-6448) (conradmceachern@tx.rr.com).

Seeking **434th FS** personnel, George AFB, CA, for a reunion in Branson, MO. **Contact:** Bob Thorpe (608-676-4925).



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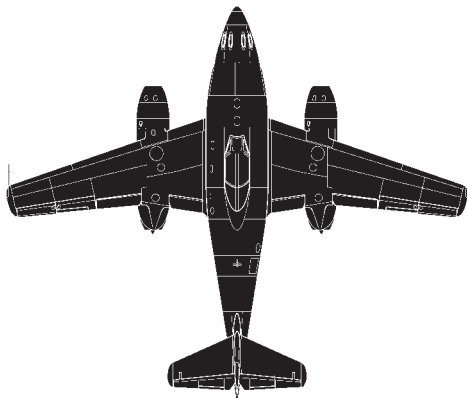
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Airpower Classics

Artwork by Zaur Eylanbekov

Me 262 Schwalbe



Unquestionably the most advanced fighter aircraft to reach operational service in World War II, the Me 262 featured blazing 540 mph speed—the result of jet engines. It had heavy, even if not ideal, armament. The all-metal Messerschmitt fighter, with its single spar wings, under-slung engines, and tricycle landing gear proved to be more capable than its main World War II competitor, the RAF's Gloster Meteor, and equal in many ways to the US Lockheed P-80, which debuted late in the war.

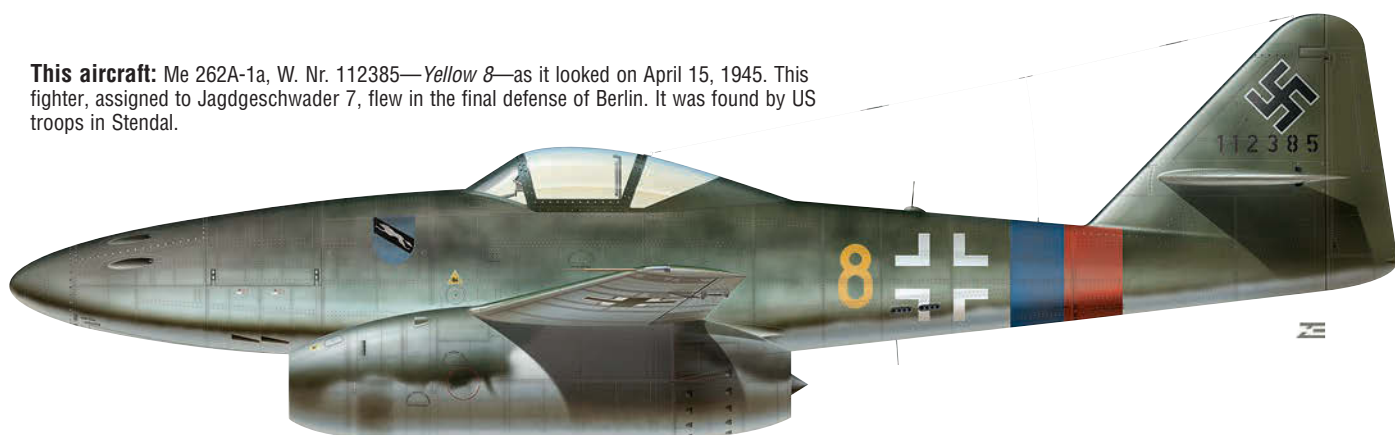
Initial production of the jet engine suffered from a shortage of exotic alloys. This eventually was offset by German ingenuity, but the necessary research effort delayed full production of the Junkers Jumo 004 engines until 1944. That power plant proved to be the fighter's Achilles' heel. Without extremely careful handling, it would flame out, and it had a service life of no more than 50 hours. After many arguments and delays, the Luftwaffe committed

to mass production, and Messerschmitt produced nearly 1,500 before the end of the war. Only about 300 saw active combat.

The Me 262's first victory came on July 26, 1944 when it engaged an RAF Mosquito, which was put out of action. Moreover, the superior performance of the aircraft was compromised by inadequate training of many pilots. However, in the hands of Luftwaffe veterans, the Me 262 was a formidable warplane. Had Germany done the necessary R&D on the jet engines, the Me 262 could have been introduced in the spring of 1943, and the air war in Europe might have turned out differently.

—Walter J. Boyne

This aircraft: Me 262A-1a, W. Nr. 112385—*Yellow 8*—as it looked on April 15, 1945. This fighter, assigned to Jagdgeschwader 7, flew in the final defense of Berlin. It was found by US troops in Stendal.



The Schwalbe was formidable.

In Brief

Designed, built by Messerschmitt ★ first flight on jet power alone July 18, 1942 ★ crew of one or two ★ number built 1,430 ★ **Specific to Me 262A-1a:** two Junkers Jumo 004 engines ★ armament four Mk 108 30 mm cannon; 24 R4M rockets; two bombs (on F/B model) ★ max speed 540 mph ★ cruise speed 400 mph ★ max range 652 mi ★ weight (loaded) 14,101 lb ★ span 40 ft 11 in ★ length 34 ft 9 in ★ height 12 ft 7 in.

Famous Fliers

Aces: Heinz Bar, Gerhard Barkhorn, Georg-Peter Eder, Heinrich Ehrler, Adolf Galland, Walter Krupinski, Walter Nowotny, Gunther Rall, Erich Rudorffer, Franz Schall, Walter Schuck, Johannes Steinhoff, Kurt Welter, Theodor Weissenberger. **Notables:** Harold E. Watson and others in famed US group "Watson's Whizzers."

Interesting Facts

Credited with 502 victories vs. 102 losses ★ started with non-swept wings ★ made first flight with one piston engine in nose ★ built in 30 variants, including reconnaissance, night fighter, and rocket-boosted types ★ used in attacks on Ludendorff Bridge at Remagen ★ nicknamed "Schwalbe" (Swallow) in fighter version, "Sturmvogel" (Stormbird) in bomber version ★ called "Turbo" by most pilots ★ influenced design of USAF F-86 fighter.

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