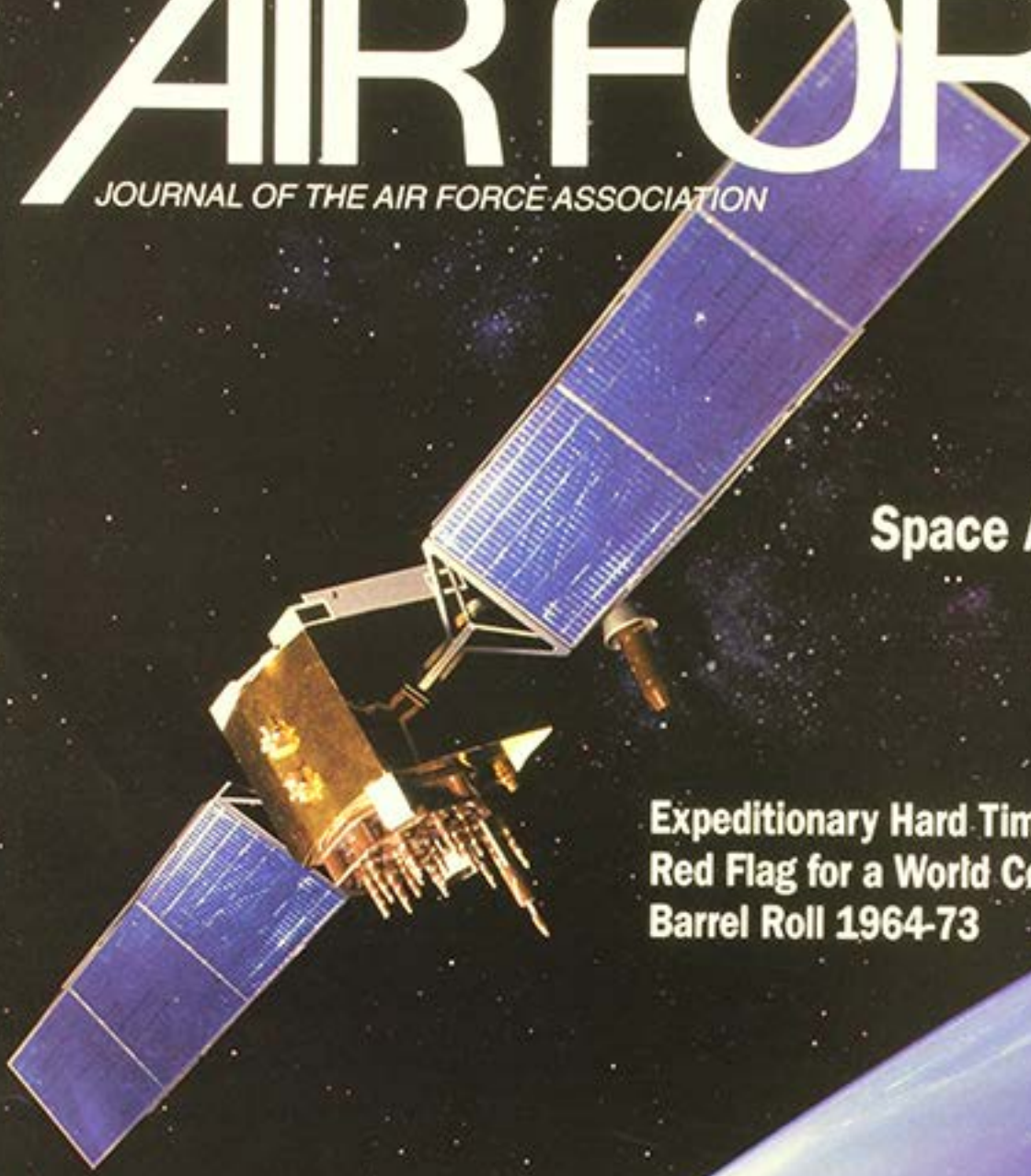
August 2006/$4

AIR FORCE MAGAZINE

JOURNAL OF THE AIR FORCE ASSOCIATION



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About the cover: GPS artist's conception by Erik Simonsen. See "Space Almanac 2006," p. 68.

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Editorial

By Robert S. Dudney, Editor in Chief

Back to Demolition Derby?

Critics frequently dispute USAF's claim that it needs to modernize its aircraft fleets. For anyone who may have harbored an honest doubt, though, the question was answered by a June exercise in Alaska.

Twelve super-sophisticated F-22s, in simulated combat, posted a startling 108-to-zero record against current-generation "enemy" fighters, reported Gen. John D.W. Corley, USAF's vice chief of staff. Against the same foes, older F-15s and F/A-18s did one-tenth as well as the Raptor.

In Corley's view, the event not only exposed the limitations of "legacy" aircraft but also showed the US could meet its defense needs with small, high-tech forces, be they fighters or other types of Air Force aircraft.

For all that, problems remain. Air Force leaders know that, when it comes to modernization, the hard part may just be starting.

The armed forces are entering what officers believe will be the bleakest period of fiscal belt-tightening in a decade. The Office of Management and Budget, alarmed by huge federal deficits, was poised to throw the brakes on spending, with consequences for the Air Force.

The Pentagon's 2008 budget, only recently projected to hit $464.2 billion, could be slashed, along with every other budget in the new six-year defense plan.

Deep cuts seem to be a foregone conclusion. Deputy Secretary of Defense Gordon England says the services may take "double-digit" cuts—that is, reductions of $10 billion or so.

The Air Force, as a result, should prepare itself for budget combat. Apparently, it is doing so. One operations officer at Air Force headquarters, Maj. Gen. Roger W. Burg, recently declared, "The Air Staff is focused on one thing, and it's spelled c - u - t - s."

Predictably, many are arguing that the Air Force should be forced to slow down its modernization. They cite several reasons.

One is the mounting cost of the Global War on Terrorism. The Congressional Research Service said in a recent report that, as of Sept. 30, the government will have spent nearly $437 billion on military and foreign aid funding in Afghanistan and Iraq. At the current pace, the bill will pass half a trillion dollars next year.

The claim is that the Air Force and the Navy must sacrifice to help finance this spending, which goes mostly to Army and Marine Corps accounts. Because their equipment is wearing out, billions are needed for replacements.

The Air Force should prepare itself for budget combat.

Moreover, there are competing modernization priorities, notably those of the Navy. In a June 24 letter to Secretary of Defense Donald H. Rumsfeld, 16 Senators urged a dramatic increase in shipbuilding, starting with a boost from $8.9 billion today to $14 billion next year.

The lawmakers claim today's 280-ship fleet is too small. They note that spending on warships has declined by 17 percent in the past five years and must go back up soon.

USAF is further threatened by what Loren B. Thompson, a defense analyst with the Lexington Institute, sees as complacency about American airpower. Because of its successes in recent years, he argues, "the political system has come to take airpower for granted."

As a result, politicians generally sense no urgent need to procure new air systems and see many reasons to spend money elsewhere.

Without question, USAF's case for its program at least matches and perhaps exceeds that of the other services.

For one thing, the war has taken a toll on Air Force hardware. It has flown 239,000 sorties over Iraq and 144,000 over Afghanistan, not to mention 44,000 missions guarding US cities.

Every day, airmen fly more than 200 sorties across Southwest Asia. In addition, Predator and Global Hawk UAVs are in constant flight. C-130s carry out some 100 missions each day. Tankers depart on a wartime mission every two minutes, 365 days a year.

The fleet is old. Since 1973, the average age of USAF aircraft has risen from eight to 24 years. The average KC-135 tanker is 45 years old and was bought during the Eisenhower Administration. With B-52 bombers, the story is much the same.

Compounding the problem is Congress' reluctance, for political reasons, to let the Air Force part with its ancient aircraft.

The Air Force wants to decommission more than 1,000 old, maintenance-intensive, aircraft—17 percent of the fleet—and use the savings to buy modern aircraft. However, it is prohibited by law from retiring 347 aircraft, 51 of which do not even fly, and lawmakers stand ready to protect others.

"We cannot afford to keep all of our legacy aircraft and still provide the combatant commanders with what they need to win this war," warned Corley.

What will happen next is anybody's guess. In the most recent budgetary demolition derby, which played out during 2004-05, Air Force leaders managed to protect the service's aircraft plans and stay within OMB-prescribed spending limits only by means of a radical expedient: It agreed to cut 40,000 active duty, Guard, Reserve, and civilian personnel spaces over five years.

Air Force leaders are understandably loath to repeat such a painful step, leading to press speculation that USAF might instead choose to terminate a major program, if that is needed to meet budget targets. Frequently cited as candidates are several expensive space systems.

Corley points out that the existing Air Force program was determined during the recent Quadrennial Defense Review, where it was debated at length by service leaders, combatant commanders, and civilian officials.

"I think it's important to stress that this is not an Air Force wish list," the general notes.

Those are important words. Air Force officials should repeat them at every opportunity. They should hope that others listen. They should also prepare for a rough ride. ■

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Letters

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Morality of Airpower

In regard to the Robert S. Dudney editorial "Of Airpower and Morality," *[June, p. 2],* I agree with everything that he says. I also agree that, due to space limitations, he cannot properly [deal with all of] the charges of A.C. Grayling. I understand that enough time has passed for someone like A.C. Grayling to pop up with his new book *Among the Dead Cities: The History and Moral Legacy of the WWII Bombing of Civilians in Germany and Japan.*

Because most of the participants have died off, they cannot refute or argue with these charges. Grayling is making these charges for two reasons. He considers our actions in World War II to be immoral and unjust and he wants to use them to pillory our war fighters (pilots) of today, every time a precision munition goes astray.

Let me begin by saying that *all* war is immoral and unjust. However, civilization has come to justify a war of self-defense.

All of A.C. Grayling's arguments ignore the following:

- When we entered World War II, there was a great deal of doubt about our ability to win or to prevail.
- Hitler, Mussolini, and Tojo all laughed at the Geneva Convention and entered into treaties with no intent on keeping their side of the bargain.
- When they fought, they used Blitzkrieg (Lightning War) and were committed to winning at all costs (total war). If someone had come along and placed nuclear weapons or any advanced weapons in their hands, there would be no argument or second thoughts about using them on us.
- In short, we were in a battle for our lives with people who were immoral and evil.
- In their minds, the more civilian casualties that they were able to cause, the bigger their success would be. There were no "rules of engagement" or restrictions (of civilization—self-handicaps) placed upon them by lawyers or even their own morality.

We were fighting immoral, evil foes who never thought twice about killing us or committing atrocities. Under these circumstances and remembering how we were attacked at Pearl Harbor, most airmen and American citizens had no problem with the morality of how we defended ourselves.

A.C. Grayling's accusation of war crimes is extremely *"ex post facto"* moralizing and wrong to boot. If he had lived through WW II or taken part in the air campaign, he would not be arguing this way. In fact, one could argue that it is this *ex post facto* moralizing that is interfering with our ability to prosecute wars today. If we fight a war today, one could argue against limited warfare with limited objectives because it results in places and "conflicts" like Korea and Vietnam.

In summary, I have to agree with Mr. Dudney and I must say that truth and history is on your side and against A.C. Grayling and any one else who tries to rewrite history in this fashion.

I agree that modern airpower is already tightly constrained. I am not [arguing] and will not argue for disposing of all the rules. I think that when we fight wars, they should be total, and we need to go back to the successful model of how a war should be prosecuted from WW II.

Timothy Forde
Westfield, Mass.

Robert S. Dudney's editorial in the June issue of *Air Force* Magazine is both right on and timely both for our air forces and ground and sea forces. For Mr. Grayling to say, 'The area-bombing campaigns of the Second World War were, as a whole, morally criminal," and to [suggest that] "city bombing was unneeded, ineffectual, disproportionately savage, unhumanitarian, offensive to

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Western morals, illegal" shows a total lack of appreciation for reality. Obviously he has not read *The Goebbels Diaries (1942-1943),* edited and translated by Louis P. Lochner. In his diaries, Goebbels wrote time and time again that Germany could not long withstand the bombing raids by British and American bombers.

In warfare it is not practical to fight winning campaigns, whether on the ground, on the seas, or from the air (or space), without endangering civilian populations and even deliberately selecting targets knowing that civilians will be killed. And in "total war," as Goebbels used to refer to it, the entire civilian population would be involved. I hope that would be the case if America's homeland is ever attacked. And it is obvious that in Iraq, even if civilians are friendly to American troops, there are many individuals hidden among the civilian populace for the specific purpose of doing harm to our forces.

Col. John N. Elliott,
USAF (Ret.)
Sun City West, Ariz.

Robert Dudney's comments on the editorial page ("Of Airpower and Morality") are very much on point and correct. A.C. Grayling's analysis concluding that the strategic bombing of Germany and Japan during World War II constituted a "war crime" is typical of the left wing's historical revisionism that serves to justify the proposition that the only unlawful and immoral warfare is that which is engaged in by the United States and its allies.

Grayling [suggests] that *precision* bombing was permissible, but he fails to indicate that it was impossible without the tremendous casualties associated with daylight bombing. The Royal Air Force concluded that such casualties were unacceptable and switched to the less-accurate night operations.

Grayling also fallaciously concludes that, because the bombings had little impact, they were immoral. Had they been successful, they would have eliminated the ability for Germany to manufacture war materiel, by destroying the infrastructure, killing the factory workers, and disrupting the urban utilities and other supports needed to sustain a manufacturing operation.

Germany was able to continue industrial output because of Albert Speer's decentralization and hardening and because of German air defenses. The success of defensive countermeasures does not make the attack immoral or illegal.

The implications for today's military are clear. There are anti-American forces in the world who would like to achieve through the legal process that which they cannot achieve through military action: the elimination of the United States as a world power. The self-serving distortion of logic and history engaged in by Grayling is another step along that road.

This is another reminder why we cannot permit our forces to face trial in "international" courts, as has been proposed.

John R. Kachenmeister,
Viera, Fla.

Mr. Dudney did an excellent job of refuting A.C. Grayling's totally absurd assertions in his book *Among the Dead Cities: The History and Moral Legacy of the WWII Bombing of Civilians in Germany and Japan.*

I was especially incensed by Grayling's [obvious] hope that today's American and British airmen would face criminal prosecution. Just how absurd can a human possibly be? Considering the very nature of a precision weapon and the desire through it to limit death and destruction to a specific target, I would say that we are doing everything possible to prevent noncombatant deaths. Wouldn't it have been great if we had today's smart weapons in WW II when our selfless airmen were dying by the hundreds every day while trying to put bombs on target in a vastly more hostile environment than we might face today?

This Grayling fellow has it all wrong and should be ashamed for even thinking airpower in World War II and to this very day is immoral. He should be thankful that because of those airmen he has the right to be stupid in public. Otherwise he might be speaking a language other than English.

Col. Frank Alfter,
USAF (Ret.)
Phoenix

Mr. Dudney's editorial "Of Airpower and Morality" strikes a blow for common sense while capturing the dynamic and sophomoric irrelevance of the European intellectual left. Well done.

However, I disagree with the article in one important area. Conventional airpower is best used to create an effect. Thus, it is best employed as the result of centralized planning/control and decentralized execution. May I cite some examples of the effect of airpower in World War II?

In the European Theater:

■ The Battle of Britain saved England, and it enabled the Royal Navy to remain in England. Consequently, Germany would lose the Battle of the Atlantic coincident with losing the Battle of Britain. US airpower, based in England, arrived over Europe beginning on 17 August 1942 at Rouen, France. Effect:

The buildup of US ground forces for the invasion of Europe (most of which sailed across the Atlantic) could proceed relatively unmolested by German air and naval forces.

■ The strategic bombing campaign targeted cities because the Industrial Revolution brought industry to the city where labor was plentiful. German leadership was so concerned about its centers of industrial production (centers of gravity) that substantial numbers of Luftwaffe squadrons were withdrawn to defend the Fatherland. Truly, the successful Allied invasion at Normandy was the result of tenacious and courageous ground troops. Equally important, the Eighth Air Force daylight bombing campaign caused the withdrawal of Luftwaffe assets to Germany for homeland defense. On June 6, 1944, at Normandy the Luftwaffe flew a pitiful 319 counterinvasion sorties, versus 5,000 Allied fighter sorties. Effect: The Normandy landings were virtually unopposed by the Luftwaffe or German Navy.

■ During the Battle of the Bulge (Dec. 19-25, 1944), US and Allied bombers carpet-bombed Luftwaffe airfields, enabling 16,000 sorties in five days to be flown in direct support of US ground forces in "The Bulge" against *Wehrmacht* and SS Armies. The German defeat was the result of US Army troops who refused to surrender and the suffocating effect of the Eighth and Seventeenth Air Forces and our Allies on German ground forces. Effect: German forces were crushed and unable to stop Allied ground forces from entering Germany several weeks later.

Nazi propaganda minister Joseph Goebbels summed it up best: "Again and again, we return to the starting point of our conversation. Our whole military predicament is due to enemy air superiority."

In the Pacific Theater:

■ US Army Air Forces raids on mainland Japan (beginning on 18 April 1942) forced the retention of Japanese air defense aircraft in Japan for homeland defense. Later, USAAF raids burned out the Japanese industrial heartland, while B-17 bombers sank Japanese shipping destined to support its far flung garrisons. Effect: Allied airpower made the Allied island hopping campaign possible.

■ So devastating was the Allied air bombardment that Japanese Prince Fumimaro Konoye stated (in a 1945 postwar interrogation), "The thing that brought about the determination to make peace was the prolonged bombing by the B-29s."

The most powerful force on the face of the earth is a constitutionally restrained military. No member of the US armed forces wants to contribute to wanton collateral damage. Yet, it is not the fault of the soldier, sailor, airman, or marine that despots only respond to military force. The issue of collateral damage is dwarfed by immense acts of barbarism so prevalent in our world then and now. To the sophomoric Euro leftist, I address the following: US and Allied strategic airpower, tanks, infantry, and artillery stopped The Holocaust. The Nazis would never surrender power in the absence of Allied infantry, supported by Allied airpower, occupying the German homeland. Recently, allied airpower stopped "ethnic cleansing" in the former Yugoslavia. The lesson of World War II, of Korea, of Vietnam, of Desert Storm, of the former Yugoslavia, of Afghanistan, of Operation Iraqi Freedom, and of the next conflict is that airpower is best used to create an effect.

To those wonderful guys who lived and died in the B-17, B-24, B-25, B-26, B-29, ... thank you for your service and for your service to your service. You guys did it right.

Lt. Col. Tom Brannon,
USMC (Ret.)
Navarre, Fla.

The June 2006 issue has a very interesting editorial headlined "Of Airpower and Morality," regarding the morality of World War II area bombing. The article starts off with the statement, "It must infuriate World War II bomber veterans for critics to suggest they are war criminals." Having served with the 6th Bomb Group, a B-29 group based on Tinian in WWII, I can state that I, for one, have never felt like a war criminal, and here is why.

In Japan we faced a fanatic enemy determined to fight to the finish regardless of the losses to their own military and civilian populations. The area incendiary bombing efforts of Twentieth Air Force and the shock of the two atomic bombs resulted in a capitulation of the emperor with no invasion losses on either side.

Would it have been more moral to forego these area bombing missions and let our POWs die in prison while our ground forces were faced with the horror of invading and somehow subduing the Japanese civilians and armed forces? Does anyone really believe that the losses on either side would have been less had we launched an invasion of Japan with the ultimate goal of capturing or killing all who opposed our forces?

If anything makes me furious it is philosophy professors who come up with theories about how we should have done things differently. Too bad

they could not have participated in the real thing before they accused those who did so of being immoral.

Virgil Morgan
President, Sixth Bomb Group Assn.
Everett, Wash.

Regarding Professor A.C. Grayling: What (if any) military background does the professor have?

Has he ever held a command? Has he ever had the responsibility for the lives and safety of a crew? I, for one, am sick of "academics" who presume to pass moral judgment on men who have "been there" and who had to make hard decisions in real time. There is something very wrong in allowing our students to be influenced by academics who probably dislike, nay, hate, men they do not understand.

Capt. Morris Ratliff,
USAFR (Ret.)
Gulf Breeze, Fla.

Thank you for publicizing the morality issue of mass killings by US military aircrews in your editorial in the June issue of *Air Force* Magazine.

I have the answer.

In 1967, I briefed my commanding officer that I was ready to kill a million civilians in a pre-emptive attack on Moscow.

As a B-52 bombardier, I aimed and dropped over 35,000 bombs in Vietnam, Laos, and Cambodia, killing untold and uncounted civilians.

So I struggled with the morality of killing civilians for 30 years. Finally VA doctors educated me that mass killing of civilians is morally correct if you are following your commander's orders and your American duty to your comrades and countrymen.

That's the answer: Follow your orders and follow your American duty.

Publicize this answer as a comfort to our aircrews. It has comforted me.

Capt. Ken Sampson,
USAF (Ret.)
Miami

The Totally Integrated Air Force

This article shows a service with a mature and appreciative overall feeling toward its reserve components *["The Totally Integrated Air Force," June, p. 36]*. It is a shame the Navy and Marine Corps don't feel that way about their air reserve components. Despite being activated for the war in Iraq (apparently against the wishes of active duty admirals), the F/A-18 squadron (at Carswell Field, Tex.), VFA 201, is being deactivated as an economy move, despite distinguished service in the Middle East. Rumors abound that their two other F/A-18 reserve units will be disbanded. According to a recent article in the Naval Aviation Foundation magazine, the Marine Corps will disband their three reserve F/A-18 units (despite two of them being activated for the GWOT). No associate unit activity here, just good old-fashioned "your services are no longer needed" to a pool of vastly experienced people. It would be great if these reports were wrong, but past experience shows a Navy with a condescending attitude toward their reserve components. A retired Navy friend told me stories of how, in the '70s, the active duty Navy put F-4 Phantoms into their reserve flying units kicking and screaming that the "part-timers" couldn't hack it (yet they flew Rhinos for almost 20 years). To their credit, there are Navy and Marine Corps Reserve fighter aggressor units, but they fly mostly '60s-vintage and great Northrop F-5 Tigers. [They have] an outstanding MiG-21 simulator, but it can't simulate the MiG-29 or new Chinese J-10 fighter anywhere as well as an F/A-18 or F-16. The F-5 can't deploy to a carrier either. Maybe some of these displaced Hornet drivers will be welcome in [Air National Guard and Air Force Reserve] F-16, A-10, F-15, B-2 associate, or other units.

Eric Renth
Spring Branch, Tex.

Space and Counterspace

John Tirpak's excellent piece "Space and Counterspace" *[June, p. 42]* notes among other things that the Air Force Research Laboratory has had two projects, the XSS-10 and XSS-11, to "explore rendezvous, proximity, and station-keeping techniques with very small satellites." As a photo caption puts it, "The XSS-11 experiment is a satellite that can rendezvous with a target and inspect it."

This modern technology exploration calls to mind an Air Force space system development program in the early '60s at the then-new Air Force Space Systems Division: the SAINT (Satellite Interceptor) program, or Program 621A, in which I was a junior project officer.

The unmanned SAINT was being developed to rendezvous with a target satellite and inspect it with various sensors. An Atlas D/Agena B combination was selected for the launch vehicle. The Agena B would maneuver the SAINT's Final Stage Vehicle (FSV) into a coorbit with the target satellite and then be jettisoned. The autonomous FSV would inspect the target over a period of time while station-keeping with it at a short distance.

The prime contractor was RCA.

The SAINT program was terminated by Secretary of Defense Robert McNamara early in December 1962, just shortly before its planned first launch later that same month.

AFRL's current satellite inspection initiatives assuredly use very significantly improved technologies and need consider dramatically changed military space circumstances. At the same time, I think that the SAINT program of old is an admirable albeit truncated early bit of our USAF space history.

Richard Boverie
West Palm Beach, Fla.

Treating Khobar's Wounded

[Regarding Rebecca Grant's article, "Death in the Desert," June, p. 48]: I was a flight surgeon and triage officer at Khobar Towers during the attack 10 years ago. This attack produced many casualties, with 19 airmen losing their lives. Many more lives would have been lost except for the exceptional training and implementation of self-aid and buddy care by both wounded and nonwounded airmen. As expected, medical personnel coordinated efforts to care for the wounded. More important, however, were the airmen without formal medical training, who relied on basic first aid training given to all airmen. Medical personnel are not always at the site of the attack. For lives to be saved, care must be rendered within seconds or minutes of when the injury occurs. Further, after the initial treatment of injuries, these "buddies" can monitor the wounded for signs of shock. The airmen of the 4404th, with conviction and honor, performed all these actions. From the airman holding an intravenous bag to the pilot assisting as we sutured wounds, all performed immeasurably.

In my medical training, I was adequately prepared to treat patients with injuries. I was not prepared for the magnitude and importance of the self-aid and buddy care that snapped into motion after the blast. The actions of these airmen exemplify the courage and honor of all our troops, and I was honored to have seen this firsthand.

R. Morris Treadway Jr., M.D.
Raleigh, N.C.

On Course for Tankers?

The article entitled "Charting a Course for Tankers" by John A. Tirpak was fair and balanced but, most of all, timely *[June, p. 64]*.

The KC-135 was a superior airplane, with seven series produced by Boeing and another 42 derivatives that can be identified by suffix and prefix—some designations being duplicate but the

mission was different. The Boeing KC-97 Stratofreighter (Model 367) design was massaged by Boeing's engineers to come up with the Model 367-80 (the famed airplane that rolled twice over the Sea Fair Hydroplane Races in Seattle). This was a $16 million private investment by the company that resulted in a two-year test program. A four-engined, piston-powered, straight-winged transport was morphed into a four-engined, jet-powered, swept-winged airplane. The 367-80 had the same fuselage diameter as the KC-97. When the Air Force looked at the airplane, they asked for a wider fuselage to meet its requirements. What came next was the Boeing Model 717 that was one foot larger in diameter than its predecessor. This airplane received the USAF designation of KC-135. A total of 820 -135s of all variants were built at Boeing's Renton plant. Of these, 732 were KC-135s.

The KC-135 is a perfect match for SAC's bomber force. The tankers permitted high-altitude air refueling at comparable airspeeds, thereby shortening the refueling times in a safer operating envelope for both airplanes.

Boeing had developed the flying boom for air refueling and first installed the system on KB-29Ps. The same basic boom design was later installed on the KC-97s and KC-135s. The reason for boom refueling is that it provides greater offload capability than the probe and drogue system—the latter being adequate for tactical aircraft but not large bombers and transports.

Today, both the Air Force and Boeing are recovering from the tanker lease fiasco, from which a number of lessons have been learned by both parties. Now is the time to apply these lessons in light of history and a fuzzy view of the future.

Firstly, a tanker airplane is a national asset whose use must be at the direction of the sovereign nation. USAF and the nation cannot risk having a foreign-built tanker in its inventory. Remember Operation El Dorado Canyon during which the US performed retaliatory strikes against Libya.

Then-President Ronald Reagan authorized a raid on Libya. Operational planners had their hands full in determining the targets and available aircraft for a strike on Libya. A B-52 raid was out of the question for both political reasons and the potential dilution of SAC's EWO posture. A pair of aircraft carriers in the Mediterranean Sea were able to launch A-6s only against Benghazi. The best available USAF aircraft to work in concert with the Navy was the F-111F Aardvark supported by EF-111A Raven (AKA Sparkvark) jammers. For USAF to pull off such a long strike with these aircraft, extensive refueling support and diplomatic clearances were required. When the Americans asked France and Italy for overflight permission for such a raid, they were denied. Hence, the 1,800-mile overflight resulted in a 3,200-mile flight along the western seaboard of Europe, entry near Gibraltar, for the final leg into Tripoli. Four refuelings were required on the outbound route. Should a foreign nation build the next tanker, they could well tell the United States not to use the airplane for specific missions. We could call their bluff but risk losing future logistical and technical support.

Secondly, there is a proposal being floated for a two-airplane buy. While this may sound good in the politically correct environment, it lacks technical and economic rationale. The C/KC-97 program was for 888 airplanes, while the KC-135 order was for 820 airframes. Today such large orders will never be repeated due to sheer economics.

According to John Tirpak's article, the new tanker buy would be in the 520 to 640 range. A split order would drive up the unit cost over a smaller number of airframes from each company. These costs involve engineering, system integration, flight testing, production tooling, spares, and ground support equipment, plus different subcontractors. Then there would be different training requirements for both aircrews and maintainers. Afterwards there would be two aircraft management teams and repair/modification depots.

In this era of tight budgets, USAF and the nation cannot afford a foreign or a split tanker buy. These facts must be thoroughly briefed to members of Congress, lest we fall into a geopolitical, technical, and economic abyss.

Alwyn T. Lloyd
Bellevue, Wash.

The RAND Corp. report underlines the fact that USAF should not rely on only one type or model of tankers. That does not mean that Airbus—sorry, the Northrop Grumman KC-330—should be chosen by the US Air Force as a complement to the Boeing KC-767.

Relying on two types of tankers is not new. For more than 20 years, USAF has relied on both the KC-135 and the KC-10.

Boeing is offering many "all-American" options to USAF top brass: a tanker version of the 767, 777, and C-17. The planes, the technology, the workers, and the plants are there in the US.

Time is running out. The KC-135s are getting older, and the delays are giving time to Airbus to develop the KC-330 and the first-ever European flying boom. United Kingdom and Australia have bought, respectively, 12 and five Airbus A330 tankers mainly because the KC-767 was not yet selected by USAF.

On top of that, what kind of security screening will DOD have over plants and employees of European—not to say mainly French and German—suppliers of the Airbus A330 tanker offered by Northrop Grumman? Should the US armed forces have to rely on foreign suppliers, especially French ones, for spare parts and support?

Philippe Cauchi
Infoaero
Outremont, Québec
Canada

How could RAND recommend Boeing 747s and 777s and Airbus A340-500s and A340-600s as tankers? All these aircraft are too heavy and large to operate from all but the world's most developed airports. Probably only 50 tankers in this class could be effectively employed. Any new tanker should not be heavier and not much larger than the KC-10. The Boeing 767 and the Airbus A330-200 and A340-200 are the only in-production airliners that are real options. The Boeing 787 could be included with a different tanker/transport fuselage using the same wing and landing gear from the Boeing 787-8 (KC-787). Note: The KC-135 and Boeing 707 share the same wing, landing gear, and other components, but have different fuselages. Relative to the KC-10, the KC-787, A330-200, and A340-200 all have 20 percent longer wing spans. The KC-787 is 18 percent lighter, the A330-200 is 10 percent lighter, and the A340-200 is seven percent heavier than the KC-10. The KC-767 has seven percent less wingspan and is 43 percent lighter than the KC-10. The KC-767 has a 19 percent greater wingspan and 60 percent greater cargo volume and is 24 percent heavier than the KC-135R. The KC-767 could use more of the world's airports and provide more booms for the same cost than any other of the above options. Was the Boeing 737-600. with a 737-800 wing, or the Airbus A319 evaluated by RAND to provide more booms and more operational airports?

David A. Carlson
Melbourne, Fla.

Jollys to the Rescue of Misty FACs

In reference to your article on the Misty FACs, June 2006 *["A Day in the Life of the Misty FACs," p. 84]:* The crewman who welcomed Capt. Charlie Neel aboard Jolly 04 was flight engineer SSgt. Bob Baldwin, who then made the call all aircraft commanders wanted to hear, "The survivor's on board, let's get the hell out of here."

We may have come in fast; I know we left fast. I landed and put the aircraft in a slight left yaw to provide a better view for the flight engineer and for the survivor to have an easy access to the door. I recall that Captain Neel was able to pull himself hand over hand along the refueling probe, which expedited his time to the cabin door. The other crew members were myself (the rescue crew commander, Walter "Rich" Blackwell), copilot Capt. Joe Bowers, second flight engineer Sergeant Bowers (no relation), and pararescue Sgt. Marty Roepstorff. A combat photographer was also on board.

Captain Gruters was assisted on board Jolly 07 by Sergeant Hindman (pararescue) who entered the water, and flight engineer SSgt. Elmer Holden, who pulled him aboard. The other crew members on Jolly 07 were rescue crew commander Maj. Arthur Anderson and copilot Capt. Ernie Betancourt.

The F-4 Gunfighters had taken care of the boats coming from shore and suppressed much of the gunfire. There was, however, small-arms fire being directed at Jolly 07, the helicopter closest to shore. Captain Betancourt stated that the rounds were falling short of the helicopter during the pickup. Jolly 04 was about 30 to 40 clicks seaward from Jolly 07, and numerous large columns of water were coming up outboard of Jolly 04, probably from mortar fire. Both Jollys completed their recoveries and egressed out to sea, out of range of the hostile fire.

Lt. Col. Walter R. Blackwell,
USAF (Ret.)
Prescott, Ariz.

Airpower Classics

In the June 2006 "Airpower Classics" article about the B-24 Liberator *[p. 96],* Mr. Boyne indicated that Liberators made their Pacific combat debut in November 1943. According to the book *They Fought With What They Had,* by Walter D. Edmonds, Liberators first saw action in Java on Jan. 17, 1942. These were three LB-30s (export version of the Liberator) flown by the 11th Bomb Squadron of the 7th Bomb Group. In those dark days against heavy odds, three LB-30s operating from Singosari were staged through Kendari (Celebres) to bomb a Japanese-held airfield at Langoan. After their bomb run, the formation was attacked by five Zeros, and two of the Liberators were forced down with the claim of one Zero. A handful of LB-30 Liberators continued to fly various combat missions until the fall of Java, around the beginning of March 1942 when the survivors were evacuated to India or Australia. Mr. Edmonds' book provided a fascinating account of the very tough fighting that the Army Air Forces endured in the Southwest Pacific in the first four months of the war and underscores some very hard lessons that the US learned about air superiority and the employment of offensive airpower.

Col. William P. Thornton,
USAF (Ret.)
Warner Robins, Ga.

Corrections

The aircraft pictured in the photo on p. 155 of the May 2006 USAF Almanac should have been listed as an EC-130 Compass Call.

In the item "Emergency Lighting," ("AFA National Report," April, p. 93), the P-40 is, of course, a Warhawk.

C-27J SPARTAN

Joint Cargo Aircraft Program Requirements:

	C-27J Spartan	Competition
Self-deployable, pressurized, multi-purpose cargo aircraft	✓	?
Payload requirements: 463L pallets	✓	?
CDS bundles	✓	?
Troops	✓	?
Day/Night, Adverse weather, IFR/VFR	✓	?
Air speed requirement: 300 KTAS	✓	?
Mission radius: 600 NM	✓	?
Operate from short unimproved runways such as sod, clay and gravel	✓	?
Must communicate with civil agencies	✓	?
Rapid reconfiguration: Pallets to Troops to MEDEVAC	✓	?
Survivable: Integrated ASE suite plus numerous redundant systems	✓	?
State of the art tactical communications and navigation avionics	✓	?

The C-27J Spartan will play a key role in providing responsive aerial sustainment and critical resupply support for the maneuver force to maintain operational momentum.

GMAS & the C-27J Spartan: The Best Value and Only Military-Off-The-Shelf Solution for the Joint Cargo Aircraft.

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Washington Watch

By John A. Tirpak, Executive Editor

Compensation Reforms You May Not Like; Pay More for Tricare, They Said; Army and Air Force—Together on JCA ....

Pay and Benefits, Civilian-Style?

Sweeping reforms to the military compensation system may be in store if the Pentagon acts on recommendations that would abolish many decades-old benefits—such as extra allowances for having a family—and replace them with ones more like those used in industry, such as 401K plans.

The changes would, for example, make it less financially punitive for people not seeking a long military career to leave after a decade in service, while at the same time allowing careers longer than 35 years in certain specialties. They would also require bigger payments from under-65 retirees in the Tricare system.

The reforms were proposed in late spring by the Defense Advisory Committee on Military Compensation. The blue-ribbon commission was empaneled by President Bush to look at how to make military pay and benefits more effective at attracting and keeping high-quality people—and also to make it easier to part with people who either don't want to continue a military career or who aren't good performers.

The group concluded that the government should adopt many common industry practices to better manage military personnel.

The seven-member panel of former flag officers and other military experts spent more than a year studying the elements of military compensation. They titled their 150-page report "Completing the Transition to an All-Volunteer Force." Such reviews are required every four years by law. At the time the commission was empaneled, new ideas were considered essential because the Army was failing to meet its recruiting quotas.

The military pay system "can be improved," the group said, because the system in place, largely unchanged since the inception of the all-volunteer military in 1973, is hampered by "lack of choice and ... inflexibility."

The group wants to provide bigger rewards for those who excel and are quickly promoted by making pay based on time in grade rather than on years of service. Under the current system, an early promotion only provides a year or two of extra pay; afterward, pay is normalized to that of others at one's rank. Changing the pay tables such that they're based on time in grade would create greater incentives to get promoted "below the zone" for regular promotion, and pay tens of thousands of dollars more to high achievers over time. (See "Action in Congress: Time-in-Grade Pay Table," p. 25.)

The current system pays "an immediate lifetime annuity" or pension to anyone who leaves after 20 years of service, and this benefit is "generous by civilian sector standards," the group said. Members tend to "lock in" to a military career after eight to 12 years of service because there is no pension benefit at all for leaving short of 20 years. As a result, some people stay longer than they want to—or should.

By contrast, the benefits of staying past 20 years aren't that great, causing many talented people to leave who could offer many more years of good service, the panel said. "Careers beyond 20 years [are] unusual and careers beyond 30 years rare," it noted.

USAF photo by A1C Heather R. Salazar

"Youth and vigor occupations" see high attrition.

Moreover, the system is tough on those in combat forces—what the panel called "youth and vigor occupations"—because the services don't want to induce people in those fields to stay if they can't be offered a 20-year career.

The system doesn't offer "a graceful way for large numbers in the combat arms to stay beyond six or eight years of service and exit prior to 20 years."

To correct this, the commission suggested that, for the short term, buyouts should be offered to members with more than 10 years' service. This would pay off, especially in those fields where "changed circumstances have resulted in an excess supply" of people. Taking a buyout would be voluntary.

For the long term, the panel suggested that 401K-style portable retirement savings plans should be offered to members, with contributions by both the member and government.

More significantly, the panel urged that no military retirement plan start paying out until age 60. This measure alone would go a long way toward paying for the other, richer incentives suggested by the panel.

Anyone who served at least 10 years would be vested, and anyone who stayed 40 years would retire at full pay based on the high-three average of basic pay.

Tricare for ... Later Life

When it comes to military health care, the advisory panel argued for keeping the system as it is for active duty personnel—that is, providing full coverage. Retirement health benefits, however, would still only be offered for those who serve at least 20 years. The commission found that the military health benefit is better than that offered by civilian employers and is an effective recruitment and retention tool.

The Tricare retiree health plan has problems, the group said. For one thing, the benefit doesn't mean much to junior and mid-career members, so it's not a big recruiting tool. Meanwhile, it's an expensive benefit for the Defense Department.

Increasingly, those who retire before age 65 are switching to the Tricare system because the cost of premiums hasn't been raised for 11 years, and some companies are actually paying their ex-military employees cash bonuses if they decline the company health plan and switch to Tricare. (See "Action in Congress: ... And Ways to Curb Them," December 2005, p. 24.) The panel sees this as an indirect subsidy to civilian employers of ex-military retirees.

As a solution, the panel wants Tricare premiums for under-65 retirees raised so they are more comparable with that charged by civilian health care insurers, and they should grow at a rate comparable to that experienced in the civilian sector.

The practice of paying more benefits or allowances to members who have families is "a remnant of paternalism carried over from an earlier era," the panel found. Some military people with families get 25 percent more compensation than single members with no dependents. Mostly this has to do with housing allowances, but there are many other family perks: People without families, for instance, don't get a family separation allowance when serving overseas.

There is "no evidence" that this difference in benefits produces a better or more effective service member, the group found. The disparity "weakens the linkage between pay and performance." It also may encourage members to marry and have children earlier than they might, putting a heavier burden on the military support system.

The group said the distinction should be abolished and everyone should be paid at the "with dependents" rates. It also said that all members should get a basic allowance for housing and pay fair market rental rates to the government if they live in government-furnished housing. This would equalize to the lower ranks—that often have no dependents and live in barracks or dormitories—the advantages enjoyed by more senior members who choose to live off base.

Special and incentive pay—bonuses and the like—only represent about three percent of total compensation, yet the various categories are numerous, complex, and inefficient, the panel said. It wants the Secretary of Defense to have the authority to target these benefits as needed, without special approval from Congress on each one. Also, the incentives should be grouped into a smaller number of categories to simplify who gets them and provide better visibility into where the money is going and whether it is yielding the desired results.

The commission said that reservists on active duty should get the same pay and benefits as their active duty counterparts, period. If they don't want to participate in Tricare, they should get a stipend or cash payment to offset their personal health insurance.

Because reserves are locally organized, incentives may be offered to keep units adequately staffed in under-represented areas.

The panel also wants quality-of-life programs to undergo rigorous periodic evaluations to see if they "represent the best use of resources in meeting the demands" of families and the services. Benefits such as golf courses and base exchanges should only be offered where there is no reasonable alternative outside the gate. The commission said the Defense Department shouldn't "crowd out" local businesses by undercutting them on base.

Air Force, Army Shake Hands Over JCA

The Air Force and Army have signed a deal that will guide their joint acquisition of a new, small aircraft to supply far-flung troops and special operations forces and provide emergency airlift in disaster response. It wasn't an easy deal to cut, and there may still be some heavy turbulence ahead for the project.

The memorandum of agreement on the Joint Cargo Aircraft program was signed in June by the two services' vice chiefs of staff: Gen. John D.W. Corley for the Air Force and Gen. Richard A. Cody for the Army. They agreed to use the same airplane for their two missions: respectively, intratheater lift and urgent, short-haul supply missions.

The two services were directed to pursue a joint program last fall by Defense Department leadership, which saw an opportunity to save money by killing two requirements with one stone. Training, parts, and maintenance could be consolidated. The services agreed.

There are rough spots, though. The Army wanted a replacement for its small Sherpa and Huron fixed-wing aircraft almost right away; it needed something in service by 2008, but agreed to delay initial capability until 2010, which is when the Air Force wants to have its first versions.

Noting the joint program—and the Air Force's later in-service need—Congressional authorizers zeroed the Army's Fiscal 2007 request for the program. (See "Aerospace World: Panel Cuts Army's JCA Budget," July, p. 20.) The Army has said the cut could slow the program two years. In early July, the two services were working to try to get the $109 million request restored.

The deal makes the Army the lead service on the project, and the Air Force agreed to the requirements spelled out by the Army before the two programs merged. Under that plan, the Army will buy 75 of the airplanes and the Air Force 70.

However, special USAF needs will be analyzed in a joint analysis of alternatives which is to be done in about a year. That analysis could conceivably call for something larger to meet USAF's unique requirements. Later buys—not specified—could be a different or upgraded airplane.

The agreement says that the services agree to buy an aircraft that is now available, not requiring much development.

The two branches also differed on acquisition philosophy. While the Army wanted to get a contractor to provide the whole capability—the airplanes, as well as their maintenance and upgrades—the Air Force wants to develop an organic logistics capability for the aircraft.

Gen. Bruce Carlson, head of Air Force Materiel Command, told reporters in late June that USAF doesn't want to "find ourselves behind the eight ball" in the future, unable to provide depot maintenance on the airplane because it lacks the knowledge needed to order parts or replace wiring. Without an organic logistics capability, the service would be at the mercy of a supplier who could charge whatever he wanted. Carlson also said the Air Force would probably keep the airplane for decades.

US Army photo by Spc. Kate A. Hoit

Army Sherpas are on their last legs.

In his job, he has to "deliver and sustain warfighting capability," and the JCA structure as it stood in June didn't allow him to fulfill that mission, he said.

Providing the tech data is costly and goes beyond mere manuals, but involves rights, patents, and licenses.

Still, Carlson said he believed the issue would be resolved.

"I think we have an agreement that we're going to add the requirement for tech data" in industry proposals, he said. Competitors would have to submit revised proposals, but on this issue, USAF is "putting our foot down," Carlson said. He added that getting the tech data up front will be easier than trying to buy it "three years from now."

The agreement between the services said their aircraft could be part of a "common user pool" in theater, with either service able to use an aircraft if the other didn't need it at that time. This would reduce the number of airframes required.

Both services want an airplane able to take off and land in less than 2,000 feet. Former USAF Chief of Staff Gen. John P. Jumper likened the requirement to that of the C-7 Caribou used to supply Special Forces in remote areas during the Vietnam War.

Both services also see a role for the aircraft in disaster relief such as last year's hurricane Katrina, when they could have used a small airplane able to use short airstrips.

There are three industry teams readying proposals for the JCA contract, and in June, Lockheed Martin said it would offer a smaller version of the C-130J for the mission. While the Air Force would benefit from having an aircraft able to use parts and training common to its C-130 fleet, Army officials said such an airplane would be too large for their needs.

Despite the bumps, USAF is committed to going ahead with the project.

Corley, at a June Capitol Hill seminar, said he and Cody have complete understanding of each other's service needs for the JCA and will do whatever's necessary to work out the differences.

"There's no daylight between us," Corley said.

Second Thoughts on C-130J Data

Data that saved the C-130J from termination last year were the best available at the time and weren't contrived to keep the program going, service officials said in June.

When Defense Secretary Donald H. Rumsfeld pulled the C-130J back from termination in May 2005, he did so because data on the project offered by the Air Force showed that it would actually cost more to cancel the program—and get no more airplanes—than to simply finish out the multiyear contract and get about 60 of the new airlifters. (See "Washington Watch: Rumsfeld Retreats From C-130J Termination Plan," July 2005, p. 12.)

However, a Pentagon inspector general report issued in June asserted that the "termination cost estimate was unsupported" by Air Force data and that Rumsfeld wasn't given enough information to make a good call on the issue.

The IG said that, while the Air Force claimed it would cost $1.78 billion to kill the C-130J, the service couldn't substantiate about $1.1 billion of that figure—in effect, overstating the termination costs.

Gen. Bruce Carlson, head of Air Force Materiel Command, addressed the issue with reporters in late June. He said circumstances had changed between the time the estimate was made and the time the IG reviewed the issue, and that what was initially offered by USAF was a good faith estimate.

"The implication ... that somebody lied to Secretary Rumsfeld is just not true," Carlson said. "We gave the best data we had at the time. And the Secretary knew that; he knew that there was a chance that things would change."

USAF photo by TSgt. Dave Ruttner

C-130J cost estimates are in dispute.

The C-130J, Carlson noted, was bought as a commercial, off-the-shelf item and not as a government-developed item. As a result, Lockheed Martin was able to streamline its subcontracting system by buying parts from the most efficient vendors. Some of those vendors were very small, Carlson said, sometimes "literally in a garage someplace."

Going back and rounding up data from such contractors—there were "hundreds" of them, Carlson pointed out—was difficult. In making the deadline for Rumsfeld's decision, not everything could be nailed down. Moreover, the C-130's cost was linked to other programs such as the F-22, and overhead costs that the two programs shared, complicating estimates.

"Between the time the data was handed over and the decision was made, and the DODIG looked at the program, there were a lot of changes," Carlson asserted. "A lot of things were in flux. How many airplanes were we going to buy, would the Australians buy, were the Canadians going to rent, all those things were in flux.

"This was a very, very fluid program, and everyone knew that there was risk associated with that decision. I think the Secretary went into it with his eyes wide open," he added.

The profusion of small contractors on the program has also slowed the process of converting the C-130J to a more typical military contract, as was decided shortly after Rumsfeld decided to keep it. (See "Aerospace World: C-130Js Put on Military Contract," April, p. 16.)

"There's really no motivation for them to produce all this data, which, in a competitive market, they would never do," he explained. "They just bid on price and they won the contract, so why should they do the specs and provide all this costing data? They only made maybe $100 a part or something, and so it's just a very difficult and time-consuming process for them to go back [and] gather all the cost data that they probably threw in the garbage."

To accomplish that "and make sure it's rational and supportable and not just made up, is really a hard thing to do," he explained.

Carlson said that changes have been made in the acquisition system, but not as a result of the C-130J issue.

"We've made changes in our program offices, but it's not because we think somebody's lying. It's changes in how we process data, how fast can we get data, how can we be more responsive."

He added, "If we had to make that study again, and had to advise the Secretary, I don't know what the recommendation would be, but we would do our very best to get the best data." ■

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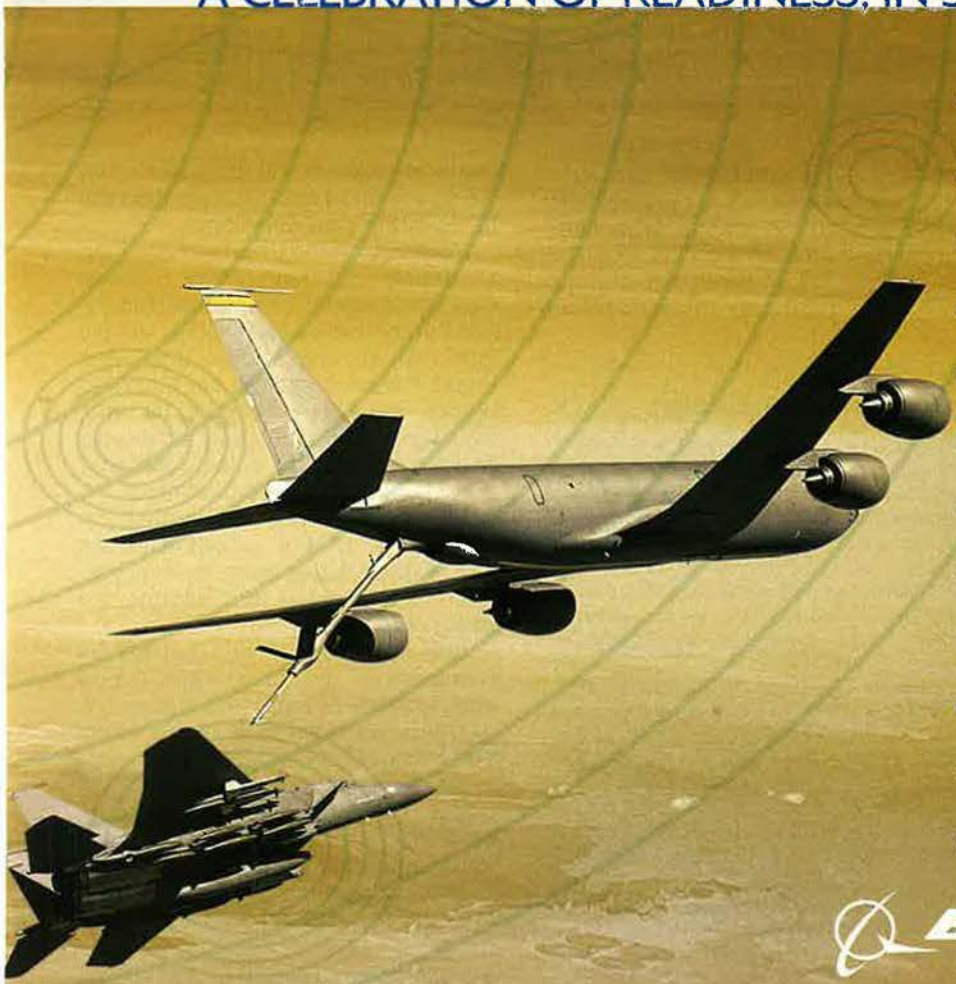

We're proud to salute the United States Air Force on two remarkable milestones: the 25th anniversary of the KC-10 and 50th anniversary of the KC-135. These two aircraft, both built and sustained by Boeing, remain the cornerstone of America's strategic refueling capability. Their enduring performance and continued readiness is a testament to the commitment of their crews and all who support them.

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Aerospace World

By Breanne Wagner, Associate Editor

No Rush for Guard Seat on JCS

The Defense Department voiced opposition to seating a National Guard general on the Joint Chiefs of Staff. It called on Congress to wait for a formal commission studying the idea to issue its report. However, a Guard support organization urged lawmakers to press ahead, claiming the Pentagon is prejudiced against giving the Guard greater authority.

The issue was taken up at a June hearing of the House Armed Services Committee considering legislation that would elevate the chief of the National Guard Bureau to four-star status and also give his organization broad new procurement powers aimed at meeting domestic needs, such as equipment needed to deal with natural disasters.

Both the House and Senate are working on the National Defense Enhancement and National Guard Empowerment Act of 2006.

Deputy Defense Secretary Gordon England noted that the Commission on the National Guard and Reserves is looking at the issue and asked that Congress hold off until the commission offers its findings "in the spring of next year." England asserted that the legislation would make profound changes in the structure of the military and that such changes should be made carefully. He noted that the Goldwater-Nichols law that restructured the military in 1986 took more than four years to hammer out and asked that Congress allow DOD to take the time to make the best decisions.

However, retired Brig. Gen. Stephen M. Koper, president of the National Guard Association of the United States, told the committee that DOD is "deeply mired in an institutional bias" and doesn't want to elevate the Guard to higher status. The new law, he said, would give the Guard "a seat at the table and a relative voice in the decisions" that affect the Guard's readiness.

England acknowledged to the committee that DOD's record with the Guard does "leave room for improvement," but insisted that reforms are being made.

The commission was tasked by Congress to look at how the Guard and Reserve operate and make suggestions on how to improve them. The commission, which began work in March, has already identified three issues: command and control structure, the shift from "strategic" to "operational" force, and equipment woes.

The final commission report is due to Congress in March 2007.

USAF photo by TSgt. James Arrowood

SSgt. Brian Gaylor of the 77th Fighter Squadron, Shaw AFB, S.C. conducts a preflight check of an F-16 before it leaves for a mission in support of Operation Dynamic Weasel. The exercise features various aircraft simulating combat operations in Southwest Asia.

Five Years of War on Terror Has Cost $437 Billion

The cost of the war on terror will reach $437 billion by the end of Fiscal Year 2006 on Sept. 30, according to the Congressional Research Service.

In a recent report, CRS said current spending plans through the end of Fiscal 2006 will stand at $436.8 billion in military and foreign aid expenses attributable to the war on terror. That total includes $7.1 billion in 2003 funding that "may or may not" have been spent on war expenses, the report notes.

The total includes $69 billion in additional dollars from the latest supplemental funding bill. War costs are rapidly approaching half a trillion dollars, as the above totals do not include $50 billion in supplemental "bridge" funding that is expected early in Fiscal 2007.

Measuring total budget authority for defense operations, reconstruction, security enhancements, foreign aid, and new veterans benefits since 9/11, CRS reports the cost of the war has increased annually. Operations Noble Eagle, Enduring Freedom, and Iraqi Freedom cost $31.4 billion in 2001 and 2002; $81.2 billion in Fiscal 2003; $94.3 billion in Fiscal 2004; $107.2 billion in Fiscal 2005; and $122.2 billion this year.

Iraq has consumed the lion's share of the funding: $318.5 billion. The OEF cost has come to $88.2 billion, and "enhanced security" since 9/11 has required $26.2 billion. CRS said it was "unable to locate" the destination for $3.9 billion in Fiscal 2003 dollars.

Angry Veterans Sue the VA

Angry over the theft of their personal data, veterans on June 6 filed a class-action lawsuit in the US District Court in the District of Columbia against the federal government, saying that their privacy rights were violated during the May data breach. (See "Action in Congress: Stolen VA Data Recovered," p. 24.) The vets sought damages of $1,000 per person.

They demanded that Veterans Affairs disclose names of all those affected and bar VA workers from using important data until safeguards are in place.

In response to the theft, the VA has introduced new security measures, including restricting sensitive data. Unauthorized software and data are being erased from VA laptops. Employees are no longer allowed to put VA information on personal computers.

The VA spent $7 million to mail letters to 17.5 million people whose Social Security numbers were compromised. The agency was spending $200,000 per day to maintain a call center for those affected; by mid-June, the bill had reached $7 million and was still climbing.

The VA call center can be reached at 1-800-333-4636. Additional information is available at www.firstgov.gov.

Photo by Dane Penland via Warren Thompson

In early June, the Smithsonian's Udvar-Hazy Museum placed its Northrop P-61C Black Widow on permanent display. Pictured (l-r) are Bob Bolinder (pilot), Louis Bost (radar operator), John Myers (chief test pilot at Northrop during the P-61 era), Al Farnsworth (pilot) and Avery Miller (radar operator)—all veterans deeply involved with the aircraft during its tenure in the military.

Airmen Can Check Data Online

Airmen can check the Air Force Personnel Center Web site to see if their personal information was compromised during the data theft. The Web site is located at http://ask.afpc.randolph.af.mil.

Retired personnel and dependents are not included in this AFPC database for the recent theft.

Air Force, NRO Reaffirm Close Relationship

The traditional relationship between the National Reconnaissance Office and the Air Force—complicated by the reorganization of the US intelligence community last year—was reset on June 7 when Gen. T. Michael Moseley, USAF Chief of Staff, and Donald M. Kerr, director of the National Reconnaissance Office, signed a "statement of intent" to improve cooperation between the two outfits.

Under the agreement, USAF will assign a two-star general to the NRO, with that officer to serve as the NRO director's principal military advisor and commander of the agency's uniformed airmen. This officer, who had not been named by late June, will be third in command at the NRO.

The pact also calls for the reconnaissance office to assign a civilian to Air Force Space Command to serve as AFSPC's deputy director of operations, and for a joint AFSPC-NRO board to oversee assignment of Air Force space officers.

The changes are expected to be complete by the end of the year.

When Kerr was named NRO director last year, he was the first person to hold that position who was not also a top Air Force official. (See "The Split-Up in Space," April, p. 80.) Kerr, a CIA veteran, was later given a newly created Air Force position.

The Air Force has been "working very closely" with the NRO "over the last several months to see if there weren't ways, given our common responsibilities, [to] more closely cooperate and collaborate," said Lt. Gen. Frank G. Klotz, AFSPC vice commander at a June 20 briefing announcing the agreement. "We look forward to what is already a good collaborative, cooperative working relationship with the [NRO] becoming that much closer."

The goals of the agreement are to improve the acquisition and operation of the NRO's classified reconnaissance satellites and to strengthen the Air Force's core group of space professionals. The Air Force supplies roughly half the NRO's personnel.

"I think increasingly what you're going to see ... is more movement back and forth of Air Force officers and noncommissioned officers between the Air Force and the NRO," said Klotz. "I think this is going to be the wave of the future."

—by Adam J. Hebert

Crew Faulted for C-5 Crash

Crew mistakes caused the April 3 crash of a newly upgraded C-5 Galaxy at Dover AFB, Del., an Air Force investigation found.

A series of errors contributed to the crash, but the chief causes were that the pilots were approaching the runway too low and slow, and when they tried to make corrections, they attempted to throttle up an engine they had shut down. Flap settings were also incorrect. The accident board investigating the crash faulted the pilots for their complacency in the landing.

The airplane had recently received the Avionics Modernization Program, or AMP, upgrade, which gave the C-5 "glass cockpit" displays and instrumentation. The new hardware apparently did not contribute to the crash.

The giant aircraft broke into three sections—nose, fuselage, and tail. No one was killed, but three crew members, among the 17 on board, were badly injured. (See "Aerospace World," May, p. 18.)

The board determined that the C-5 made a normal takeoff and initial climb from Dover, but an engine warning light prompted the air crew to turn off the No. 2 engine and return to base. While making a faulty approach, they tried to power up the shut-down engine, and left another, working engine at idle. Coming in too low, the aircraft hit a utility pole and

Persistence Paid Off in Killing of Zarqawi

The killing in June of the most-wanted terrorist in Iraq drew into sharp focus the Air Force's overarching contribution to the war effort.

Abu Musab al-Zarqawi, the head of al Qaeda in Iraq, was responsible for the deaths of thousands of Iraqi civilians and coalition troops, directing many suicide bomber attacks and the placement of improvised explosive devices on Iraqi roadsides. Coalition intelligence had been pursuing him for more than two years, but he had always managed to slip away. He met his end when an Air Force F-16 released two bombs into his reinforced safe house on June 7.

The F-16—one of a pair overhead at the time—was just one element of a "24/7 umbrella" of Air Force monitoring and strike assets over Iraq. On that day, there were 54 close air support and 15 intelligence, surveillance, and reconnaissance sorties over the country, most of which were carried out by USAF crews.

The 24-hour presence paid off when a tip came in from an unidentified al Qaeda insider identifying Zarqawi's location. Shortly thereafter, the F-16 struck.

The F-16s, one active duty and one Air National Guard, were equipped with a range of weapons for a variety of contingencies. They were on a routine air patrol when the tip came in.

"We outfit all our fighters in the [area of operations] with the appropriate munitions to allow us to strike a wide variety of targets, on call, as required," explained Lt. Gen. Gary L. North, head of US Central Command Air Forces.

The aircraft also carried a Litening targeting pod, "which allows the pilot to ... case the house, and then magnify the picture that he wants to see," North said.

There is typically so much air traffic over Iraq that the presence of the F-16s likely didn't tip off anyone in the safe house, North said. "If I was on the ground, I would not think anything" of the aircraft overhead, he added.

"We knew exactly where he was," North said. "We took our time to make sure everything was correct." Once commanders had "100 percent assurance" that Zarqawi was present, the order came to shoot, he explained.

The attacking F-16 first released a 500-pound GBU-12 Paveway II laser guided bomb. Video footage recorded through the pod showed the bomb causing a massive explosion, seemingly destroying the house. Just to be sure, the pilot then released a 500-pound GBU-38 satellite guided Joint Direct Attack Munition, which also hit the target squarely.

Gen. John D.W. Corley, Air Force vice chief of staff, said on June 14 that he was proud of the Air Force team.

"Not just the pilot ... and those that trained him to be able to accomplish this critical mission ... but also the intelligence troops who got extremely timely and perishable information to the right individuals ... and our tanker aircraft that allowed his F-16 to remain airborne ... and the decision-makers who diverted the aircraft from a counter-IED mission ... and the maintenance professionals who made sure that F-16 got airborne ... and the weapons troops that loaded the bombs on the airplane ... and our satellite operators who made sure the GPS constellation was running that guided the second bomb to impact ... and our strategic airlifters that made sure the first bomb's laser guidance kit got to theater. I'm proud of them all."

When ground forces arrived minutes later, Zarqawi was found to be still alive, the only survivor of the attack. North said the safe house had been "very well constructed" with reinforced concrete.

Zarqawi was put on a stretcher but attempted to roll off it, so he was tied to it by US and Iraqi ground troops. However, he had been gravely injured. A CENTCOM spokesman said Zarqawi "died almost immediately thereafter from the wounds he received from the air strike."

—by Adam J. Hebert

DOD image

This video image from the mission's Litening targeting pod shows a 500-pound bomb scoring a direct hit on the building housing Zarqawi.

pancaked into the ground short of the runway. Only two engines were running when the Galaxy crashed.

There were three pilots in the cockpit, with a combined 10,000 hours in the C-5. In addition, there were two flight engineers aboard with more than 12,000 flight hours combined.

The pilots were taken off flying status pending the results of disciplinary hearings at the 512th Airlift Wing at Dover.

Firm Joins Tanker Competition

A private tanker company has joined the upcoming competition to offer aerial refueling solutions to the Air Force.

Omega Air Refueling, Alexandria, Va., announced plans on June 12 to compete in the Air Force's upcoming tanker competition, previously thought to be a duel between Boeing and the Northrop Grumman-EADS team.

Omega, a subsidiary of Ireland-based Omega Air, plans to offer 60 modified DC-10s for the service's tanking requirements. Omega promises up to 20 tankers over three-and-a-half years, with an option for 40 additional airplanes.

However, the proposed solution would not meet the Air Force's full requirement, which is to replace the capability of 500 KC-135 Stratotankers. The company admits that the proposal is a stopgap measure to quickly meet tanker needs, according to the Chicago *Tribune*.

If Omega won the contract, the company would provide refueling service in an outsourcing scheme instead of leasing or selling aircraft. Omega would give the Air Force the option to pilot its private tankers in combat missions, to reduce the hazard to Omega's pilots.

This is not a new endeavor for the company, which currently uses a Boeing 707 airframe to refuel Navy and Marine Corps aircraft.

Final proposals are expected in the fall. The Air Force plans to award its contract in summer 2007.

Raptor Makes Highest Release

An F-22A Raptor made its highest and fastest bomb release yet in a test over White Sands Missile Range, N.M., in May. A 1,000-pound, satellite guided Joint Direct Attack Munition was dropped from 50,000 feet while the Raptor was flying at Mach 1.5.

The JDAM traveled nearly 28 miles before hitting its target. It was not equipped with any range-extending devices, such as pop-out wings.

The test demonstrated the F-22's ability to release air-to-ground munitions from very high altitude and its ability to strike ground targets at standoff range.

US Navy photo by Photographer's Mate 3rd Class Jordan R. Beesley

The Air Force has taken delivery of 71 F-22s from prime contractor Lockheed Martin; another 107 are on order.

KC-135 Marks 50th Anniversary

A ceremony marking the 50th anniversary of the KC-135 Stratotanker's first flight was held at March ARB, Calif., in June.

The 452nd Air Mobility Wing held the event, which commemorated the KC-135's entire history, ranging from early jet aerial refueling operations to variants for intelligence, surveillance, and reconnaissance.

The KC-135, developed in tandem with Boeing's first jetliner, the 707, first flew in August 1956. The first production aircraft was delivered to Castle AFB, Calif., in June 1957. The last KC-135 was delivered to USAF in 1965.

The KC-135 was the first aerial tanker that could fly fast enough to service the Air Force's new fleet of jet aircraft in the 1950s and 1960s. It extended the range of bombers, airlifters, and fighters alike and has seen nonstop use in the 50 years since. In the 1980s, some of the fleet received new engines and other improvements, converting them to KC-135R models. Replacing the Eisenhower-vintage aircraft with a new generation of tankers has been hotly debated for the past five years, but a new program is expected to get under way this fall.

Americans Don't Blame Troops

Americans view the deaths of Iraqi civilians as isolated events and believe that the military is doing its best to avoid civilian casualties, according to an AP-Ipsos poll.

US Navy photo by Chief Photographer's Mate Todd P. Cichonowicz

At top, a USAF B-2 leads a formation of other aircraft participating in Exercise Valiant Shield over the Philippine Sea in June. Above, the same formation flies over USS* Kitty Hawk, Ronald Reagan, *and* Abraham Lincoln *carrier strike groups. Valiant Shield focuses on integrating US military forces.

The poll, conducted in early June, found that 63 percent of Americans believe civilian killings are isolated incidents and not part of a broad, intentional pattern.

The poll was taken in the wake of allegations that marines murdered 24 Iraqi civilians in Haditha, Iraq, in November 2005. Seventy-six percent of those questioned said they were following news reports about troops killing unarmed civilians.

Sixty-one percent of those polled give troops the benefit of the doubt and said the military is doing all it can to avoid such deaths.

The poll also found that Americans oppose the war, with 59 percent saying it was a mistake to go to war, a significant increase from 34 percent recorded in December 2004.

Only 44 percent said a stable government is likely to emerge in Baghdad.

The survey of 1,003 adults had a three point percentage of error.

USAF To Get Mini-UAVs?

Battlefield Airmen may be adding another weapon to their inventory: a miniature, hand-launched, unmanned aircraft.

Called the Battlefield Air Targeting

Micro Air Vehicle, or BATMAV, the drone will give airmen the chance to see over hills and beyond their line of sight in real time and in low light. The Air Force wants the new UAV to be portable and launchable by one person, as well as durable and field-repairable.

One BATMAV system will include two micro air vehicles, one laptop ground control station, day and night cameras, and an operator's kit with batteries, repair materials, and instructions. The service wants to buy 221 BATMAV systems through 2009.

A request for proposals was issued in May.

Missing WWII Airmen Identified

Two Army Air Forces airmen and an Army soldier carried as missing in action since World War II were identified, the Defense Department announced in June.

The servicemen are 2nd Lt. Robert H. Cameron of Elkhart, Ind.; Cpl. George E. Cunningham of Rich Hill, N.Y.; and Army Medical Corps Capt. Vladimir M. Sasko of Chicago.

Cameron was buried at Arlington National Cemetery on June 9, and Sasko was buried in December 2005 in Chicago. Cunningham's funeral plans were unconfirmed in late June.

On Dec. 10, 1944, Cameron and Cunningham were flying a C-47 "Gooney Bird" from Dobudura, New Guinea to Hollandia, with three passengers on board, including Sasko. The crew called for a weather report. A nearby pilot replied that the weather was bad and that he was changing course. There was no further communication with the C-47 crew.

Search teams from the Royal Australian Air Force were unable to find the crash site.

In 1979-80, search teams from the US Army's Central Identification Laboratory, Hawaii, found the accident site and identified remains of 2nd Lt. Stanley D. Campbell and Cpl. Carl A. Drain.

The Joint POW/MIA Accounting Command, successor to CILHI, returned to the site in 2004 and recovered remains of Cameron, Cunningham, and Sasko.

JPAC scientists used mitochondrial DNA and dental remains to positively identify the servicemen.

Refueling in SWA Is Faster

A new ground system deployed in Southwest Asia is allowing USAF crews to cut aircraft refueling time in half—and with half the personnel.

The transportable equipment, called Fuels Operational Readiness Capability Equipment, or FORCE, supplements the large fuel bladders located some distance from the flightline. It can directly refuel an airplane or it can be used as a refueling fill-stand for fuel trucks.

Fuels technicians can now fill up two fuel trucks at a time, instead of just one.

The system has cut aircraft refueling time almost in half. It now takes 24 minutes to refuel a C-17 Globemaster instead of 42 minutes. It requires a two-person team operating a two-piece system, rather than four people operating four pieces of equipment.

The system was first tested in late 2005 at Ali Al Salem AB, Kuwait; testing was completed in May.

The Air Force wants eventually to replace old fuel equipment with 81 FORCE sets capable of receiving and delivering 400,000 gallons of fuel each day.

C-130s Aid Indonesian Relief

The Air Force sent two C-130 Her-

The War on Terrorism

Operation Iraqi Freedom—Iraq

Casualties

By July 17, a total of 2,547 Americans had died in Operation Iraqi Freedom. This total includes 2,540 troops and seven Defense Department civilians. Of those fatalities, 2,015 were killed in action by enemy attack, and 532 died in noncombat incidents.

There have been 18,874 troops wounded in action during OIF. This includes 10,246 who returned to duty within 72 hours and 8,628 who were unable to quickly return to action.

Balad Air Base Sets New Record

Balad AB, Iraq, set a new record in May, with 1,300 cargo aircraft flying into the base. Balad beat its previous record by more than 100 for the number of aircraft that fly in and out of a single-runway airport.

Second only to Heathrow Airport in London, Balad is among the busiest airports in the single-runway category. Heathrow and Balad only use one runway at a time, even though they have more than one, classifying them as single-runway airports. Balad ranks No. 1 in the Department of Defense for most single-runway operations.

Balad is also the busiest cargo hub in Iraq. Airmen there move as much cargo as major airlift wings in the US—with less than 100 airmen—according to the Air Force. Major Air Mobility Command hubs in the US have up to 500 airmen.

The increase of in-theater cargo airlift missions has decreased the number of Army convoys needed on the ground. The 777th Expeditionary Airlift Squadron at Balad moves the equivalent of 30 Army trucks of cargo per day aboard its C-130s. Since January, the 777th EAS has moved more than 13,000 truckloads of people, equipment, and cargo, according to the Air Force.

Since October 2004, the base has been a central hub for airlift missions in Iraq. The 332nd Air Expeditionary Wing is the first Air Force wing to forward-base a C-130 squadron in a combat zone.

Operation Enduring Freedom—Afghanistan

Casualties

By July 17, a total of 314 Americans had died in Operation Enduring Freedom, primarily in and around Afghanistan. The total includes 161 troops killed in action and 153 who died in nonhostile incidents such as accidents.

A total of 815 troops have been wounded in Enduring Freedom. They include 319 who were able to return to duty in three days and 496 who were not.

Mountain Thrust Marks Upsurge in Air Strikes

Coalition forces made 750 airstrikes in May during Operation Mountain Thrust in southern Afghanistan. The operation marked a significant uptick from the 660 air strikes conducted in May 2005.

Mountain Thrust was conducted in response to a spring offensive by insurgents in southern Afghanistan, mostly in the Oruzgan, Helmand, and Kandahar Provinces. The operation is an ongoing campaign to stop enemy forces and destroy their safe havens.

Since the operation began, coalition forces have relied on a variety of aircraft, including the A-10 Warthog, B-1B bomber, Predator, French Mirage 2000, and the British RAF GR-7A. The B-52 bomber was used early in the operation, but has since been replaced by the B-1B.

cules cargo aircraft and medical personnel to Indonesia in June after a 6.2 magnitude earthquake hit near Yogyakarta on May 27.

Pacific Air Forces airmen deployed immediately after Indonesian officials asked for help. They formed the 374th Air Expeditionary Group. The C-130s transported relief supplies for humanitarian assistance and disaster relief operations. Also deployed were experts in surgery, shock trauma, lab work, x-ray, preventive medicine, and dentistry. The medical personnel came from PACAF units on Guam and Marine units on Okinawa, as well as from the hospital ship USNS *Mercy.*

The earthquake was estimated to have killed more than 5,000 people, with 6,500 seriously injured and 100,000 homeless.

Russian Rival to the F-22?

Russia will start flight-testing a fifth generation fighter—the equivalent of the F-22—next year and begin production in 2009, Russian officials claimed in June.

Russian Air Force chief Gen. Vladimir Mikhailov said several "experimental" examples of the new I-21, built by Sukhoi and a successor to the Su-27 Flanker family, will fly in 2007 with placeholder engines while the production-version engines complete development.

Sergei Ivanov, Russian Defense Minister, said production of the I-21 will commence in 2009 "with a new engine." The remarks of the two defense officials were carried by Novosti, the official Russian news and information agency.

Mikhailov earlier had compared the new fighter to the F-22 and F-35, claiming that it has stealth, advanced integrated avionics, and high maneuverability. He has suggested the I-21 will be an alternative for countries that don't want to buy the American F-35.

Russia has made grandiose pronouncements about fifth generation fighters before. It rolled out the MiG I-44 in 1994, claiming it to be a fifth generation fighter, but its appearance suggested that it was not at all stealthy, and its performance was judged comparable to the Su-27. The project was abandoned in 1997.

Since then, Russia has been experimenting with a forward-swept-wing derivative of the Flanker, called the S-37 Berkut.

2nd Woman Joins Thunderbirds

A second woman has been selected to fly with the Thunderbirds, the Air Force's aerial demonstration team.

Capt. Samantha Weeks of the 12th Fighter Squadron at Elmendorf AFB, Alaska, will join the team for the 2007 season as Thunderbird No. 6, opposing solo. Her selection follows by just a year the appointment of Maj. Nicole Malachowski, who is the Thunderbirds' first female pilot. She began her tour with the 2006 season, as Thunderbird No. 3, right wing. (See "Aerospace World," August 2005, p. 18.) Other women have served as Thunderbirds in the past, but not as one of the six demonstration pilots.

The Thunderbirds are based at Nellis AFB, Nev., and fly F-16s. Pilots who apply for the elite flying team must have more than 1,000 hours of fighter time and be recommended by their commanders.

USAF photo by SrA. Brian Ferguson

A pararescueman from the 33rd Expeditionary Rescue Squadron, stationed at Kandahar, keeps watch from an HH-60 Pavehawk helicopter flying over Afghanistan in June. The 33rd ERQS deployed from Kadena AB, Japan, and is the first squadron to have a combat search and rescue mission and a medevac mission.

Senior Staff Changes

RETIREMENTS: Brig. Gen. Bruce E. **Burda,** Maj. Gen. Tommy F. **Crawford.**

PROMOTION: To Lieutenant General: Maurice L. **McFann Jr.**

CHANGES: Brig. Gen. (sel.) Edward L. **Bolton Jr.,** from Materiel Wg. Dir., Space Launch & Range Systems Prgm. Office, SMC, AFSPC, Los Angeles AFB, Calif., to Dep. Dir., Systems Engineering, NRO, Chantilly, Va. ... Brig. Gen. (sel.) Theresa M. **Casey,** from Dep. Command Surgeon, ACC, Langley AFB, Va., to Dir., Medical Modernization, Office of the Surgeon General, USAF, Falls Church, Va. ... Brig. Gen. Gregory A. **Feest,** from Dep. Dir., Air, Space, & Info. Ops., Flying Tng., AETC, Randolph AFB, Tex., to Dir., Log., Instl., & Mission Spt., AETC, Randolph AFB, Tex. ... Maj. Gen. Stanley **Gorenc,** from Dir., Operational Capability Rqmts., DCS, Air, Space, & Info. Ops., P&R, USAF, Pentagon, to AF Chief of Safety, USAF, Pentagon ... Brig. Gen. (sel.) Garbeth S. **Graham,** from Command Surgeon, AFSPC, Peterson AFB, Colo., to Cmdr., 79th Medical Wg., AF District of Washington, Andrews AFB, Md. ... Brig. Gen. (sel.) Byron C. **Hepburn,** from Medical Cmdr., 60th Medical Gp., AMC, Travis AFB, Calif., to Command Surgeon, AMC, Scott AFB, Ill. ... Maj. Gen. Timothy C. **Jones,** from Dir., P&P, ACC, Langley AFB, Va., to Spec. Asst. to the DCS, Strat. P&P, USAF, Pentagon ... Maj. Gen. (sel.) Mark T. **Matthews,** from Commandant, AFIT, AETC, Wright-Patterson AFB, Ohio, to Dir., P&P, ACC, Langley AFB, Va. ... Lt. Gen. Maurice L. **McFann Jr.,** from AF Chief of Safety, USAF, Pentagon, to Cmdr., Allied Air Component Command Headquarters, Izmir, Turkey ... Maj. Gen. (sel.) Marshall K. **Sabol,** from Dir., Manpower, Orgn., & Resources, DCS, Manpower & Personnel, USAF, Pentagon, to Dir., Operational Capability Rqmts., DCS, Air, Space, & Info Ops., P&R, USAF Pentagon ... Brig. Gen. Paula G. **Thornhill,** from Principal Dir., Spec. Plans, Near Eastern & South Asian Affairs, Office of the Dep. USD for Near Eastern & South Asian Affairs, Pentagon, to Commandant, AFIT, AETC, Wright-Patterson AFB, Ohio.

SENIOR EXECUTIVE STAFF CHANGES: Mary C. **Puckett,** to Chief, Weapon Systems Susta nment Div., DCS, Log., Instl., & Mission Spt., USAF, Pentagon ... Ranae P. **Woods,** to Assoc. Dep. Asst. Secy. (Cost & Economics), Office of the Asst. SECDEF, Financial Mgmt. & Comptroller, Pentagon. ■

USAF photos by TSgt. Cohen A. Young

to South Korean military. Six of those 10 missions have been transferred, and the other four are slated for transfer by the end of 2006, according to American Forces Press Service.

Defense Secretary Donald H. Rumsfeld has expressed his support for South Korea's interest in taking over defense operations, saying that the time has come for it to claim more responsibility.

USAF Lets Big JASSM Contract

The Air Force awarded Lockheed Martin a $440 million Joint Air-to-Surface Standoff Missile contract on June 15.

The contract provides for testing, development, and sustainment. It includes integration of the JASSM on F-15s, JASSM integration, and some foreign military sales.

Work was scheduled to be completed by May 2012. ■

CSAR-X Award Coming Soon

The Air Force is expected to select a contractor in the competition for a new fleet of combat search and rescue helicopters (CSAR-X) this month and announce the winner next month. Secretary of the Air Force Michael W. Wynne will make the choice.

Competitors include Boeing, with the CH-47 Chinook; a Sikorsky-Rockwell Collins team offering the HH-92—a derivative of the H-60 Blackhawk family—and the team of Lockheed Martin, AgustaWestland, and Bell Helicopter, offering the US101, a derivative of the European EH101. The US101 was selected by the Marine Corps as the next Presidential helicopter.

Lockheed Martin CSAR-X program Vice President Daniel Spoor told reporters in late May that the company expected to submit its proposal on June 19 and make one more revision before a final proposal in July.

The contract award was initially slated for spring 2006, but was delayed when the Air Force revised its requirements, asking for more capability sooner.

Seoul Inches Toward Command

The South Korean military will be in charge of joint wartime operations on the peninsula in about five years, said South Korean President Roh Moo-hyun in early June.

Since the 1950s, joint defense of South Korea has been commanded by a US officer and a joint staff. South Korea regained peacetime command of its military forces in 1994.

In 2003, the two countries' military leaders decided to transfer 10 tactical and operational missions from the US

June 25th marked the 10th anniversary of the 1996 terrorist bombing of the Khobar Towers military billet in Saudi Arabia—an attack that killed 19 USAF airmen and wounded hundreds. Family and friends of the 19 held a memorial at Arlington National Cemetery. At top, Lt. Gen. Stephen G. Wood presents Gold Medals of Remembrance to (l-r) Kevin Johnson Jr., son of SSgt. Kevin J. Johnson; Rafael Haun, son of Capt. Leland T. Haun; and Chris Nguyen, son of TSgt. Thanh V. Nguyen. Above, a memorial wreath stands between the headstones of MSgt. Michael G. Heiser and A1C Brian W. McVeigh.

Index to Advertisers

News Notes

■ The Air Force and the Air Force Association named the 2006 Outstanding Airmen of the Year in June, recognizing 12 enlisted airmen for superior leadership, job performance, community involvement, and personal achievements. They are: SSgt. Timothy A. Bishop, SrA. Polly-Jan Bobseine, SSgt. Daniel F. Dierickx, SSgt. Jeffery M. Hansen, SMSgt. Michael T. Lemke, SMSgt. Henry Parker III, SrA. Eric J. Pena, SSgt. David L. Plachno, TSgt. Bradley T. Reilly, SrA. (now SSgt.) Elizabeth E. Sewell, TSgt. Billy D. Tramel Jr., and MSgt. Renee L. Williams. The 12 airmen will be honored in September at AFA's Air and Space Conference in Washington, D.C.

■ The Air Force Research Laboratory is testing a new blended wing-body aircraft that may get fuel mileage up to 30 percent better than a conventional airplane. The X-48B aircraft, powered by three turbojet engines, has a flying-wing type shape that gives it more lift and decreases drag. A research team comprised of AFRL, Boeing's Phantom Works, and NASA has completed 250 hours of wind tunnel tests at Langley AFB, Va.

■ USAF awarded Boeing a $150 million contract on June 16 to buy and integrate new weapons on the B-52 bomber. The Miniature Air Launched Decoy (MALD) is so far the only confirmed weapons system under the contract. Depending on future contract modifications, other systems may include the Joint Air-to-Surface Standoff Missile-Extended Range, a jammer version of the MALD, Small Diameter Bomb, and Boost Phase Interceptor. Work is scheduled to be completed by December 2020.

■ The 2005 Lance P. Sijan Air Force Leadership Award was presented to four airmen for outstanding leadership on June 13 at the Pentagon. The award was named after Capt. Lance P. Sijan, the first Air Force Academy graduate to receive the Medal of Honor. The airmen are: Lt. Col. Gerald Ven Dange, Capt. William Dains, MSgt. Ramon Colon-Lopez, and SrA. Grailin Blamer.

■ Seven airmen were selected for the first-ever missile warning advanced course to be held at the National Security Space Institute, Colorado Springs, Colo., in July. Designed to develop experts in the missile warning and defense field, the 13-week course was to focus on sensor physics, threat systems, air-, land-, sea-, and space-based sensors, and missile warning. After finishing the class, these airmen will be able to teach others about missile defense systems.

■ Airmen are now responsible for viewing their duty history online and requesting changes, additions, or deletions through the virtual military personnel flight, effective May 30. After logging onto the personal services delivery transformation Web site, click on "duty history," or log onto http://ask.afpc.randolph.af.mil/psd.

■ USAF awarded contracts worth $102.8 million on May 26 for research and development of the Global Positioning System modernized user equipment program to develop a user receiver card. Separate contracts were awarded to Interstate Electronics Corp., Anaheim, Calif. ($37.2 million), Rockwell Collins ($27.9 million), and Raytheon ($37.7 million). Work is scheduled to be completed in October 2007.

■ Active duty personnel can fill out their retirement applications online, effective May 22. They will be processed at the Air Force Contact Center in San Antonio. The self-service retirement application, as well as step-by-step instructions, can be accessed on the virtual military personnel flight at http://ask.afpc.randolph.af.mil/psd. May 22 was the last date paper applications would be accepted and processed.

■ McDonnell Douglas was awarded a $70 million contract June 1 for integration of the Joint Direct Attack Munition on USAF aircraft. Work is to be completed in April 2011.

■ Airmen from Hickam AFB, Hawaii, deployed to Fiji on June 14 for a medical humanitarian exercise with the Fiji Ministry of Health and Fiji School of Medicine, delivering health care to remote villages. The US military team, comprised of internal medicine, public health, and dental specialists, was scheduled to return to Hickam in early July.

■ Northrop Grumman was awarded a $60.6 million contract May 24 for long-lead parts and advance procurement of five Global Hawk aircraft, three mission control elements, support segment-support equipment, and initial spares. Work is to be completed by March 2007.

■ Thirty-three active duty military personnel, reservists, and civilians participated in African Lion 2006 in the Sahara desert from late May to early June, providing medical care during humanitarian visits to more than 9,400 Moroccans. Half the team traveled to villages and half stayed at the Guelmim Military Hospital. The two groups treated an average of 700 to 1,300 patients per day in medical specialties ranging from dermatology to pediatrics.

■ Gen. T. Michael Moseley, Air Force Chief of Staff, was knighted during a ceremony at the British Embassy on May 30 for his contributions to US-UK relations while he was commander of the air wars in Afghanistan and Iraq. Moseley was named an honorary "Knight Commander" and became a member of the Order of the British Empire. Gen. Jimmy Doolittle and Gen. Carl Spaatz also received the honor.

USAF photo by Brian Gavin

Boeing launched a National Reconnaissance Office satellite on a Delta IV rocket from Vandenberg AFB, Calif., on June 27. It marked the first West Coast Delta IV launch and carried both medium and heavy payloads. The rocket is part of the Evolved Expendable Launch Vehicle program. The Delta IV rocket lofted the NROL-22, a classified spy satellite. It also marked the first time an NRO satellite was launched on a Delta IV.

Action in Congress

By Tom Philpott, Contributing Editor

Return of the Wayward Laptop; Senate-House Clash Brewing; HERO and Taxes .....

Stolen VA Data Recovered

The government in late June recovered a stolen laptop computer and external hard drive. The hard drive contained sensitive data for up to 26.5 million veterans benefits beneficiaries, including 1.1 million active duty and 1.1 million Guard and Reserve members.

An analyst with the Department of Veterans Affairs had taken the computer home and reported it stolen in a burglary. It was not immediately clear if the sensitive information, which included names, birth dates, and Social Security numbers, had been copied or misused in any way.

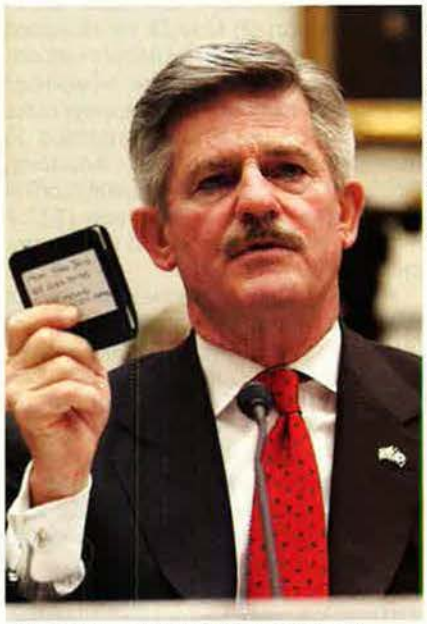
Veterans Affairs Secretary R. James Nicholson said at the end of June there had been no reports of identity theft stemming from the burglary. Officials also said no VA health records or detailed financial information were lost.

Nicholson ordered every VA employee to complete privacy and cybersecurity training and to sign a statement vowing to protect sensitive and confidential information. He had a letter sent to veterans affected, explaining the incident and what safeguards to take to protect themselves.

Senate Defense Bill Completed

The Senate on June 22 passed its 2007 defense authorization bill. Senate provisions affecting personnel would:

- Allow reserve component members to use Montgomery GI Bill education benefits for up to 10 years after leaving service. Reserve MGIB now expires when members complete their service obligations. The restriction crimps the usefulness of the benefit in wartime when lengthy mobilizations and tours limit opportunities to attend college or vocational schools.
- Lower the age-60 start of retirement benefits for the National Guard and Reserve. An adjustment would be based on the length of member activation for war or other contingency operations. The amendment would reduce reserve retirement age by three months for every 90 days of activation since September 2001. Retirement could not begin before age 50.
- Expand Tricare eligibility for drilling reserve personnel. This amendment would lower member cost shares under a three-tiered premium formula approved last year for the Tricare Reserve Select benefit, available to drilling reservists who continue to serve. (See "Action in Congress: Pay and Benefits," February, p. 32.)
- Accelerate full restoration of retired pay to military retirees rated "unemployable" by the VA. A few years ago Congress voted to end immediately the ban on "concurrent receipt" of both military retirement and VA disability compensation for retirees rated 100 percent disabled. Excluded from that move, and kept under a formula that phases out the retirement offset, were about 20,000 retirees rated "IU" or unemployable. The Senate voted to make the effective date retroactive to Jan. 1, 2005, instead of the currently planned 2009.



AP photo by Pablo Martinez Monsivais

Nicholson says bullet was dodged.

Top Conference Items

The House and Senate took different paths on important personnel issues in passing their defense bills. Key differences for a House-Senate conference committee include:

- Reserve Tricare—The House would open a premium-based Tricare Standard to all drilling reservists. The Senate would enhance the current triple-option Tricare Reserve Select program.
- Reserve MGIB—Only the Senate proposes that reservists be allowed to use education benefits for up to 10 years after leaving service.
- Concurrent Receipt—The Senate has a provision to allow full concurrent receipt of IU disabled retirees. The House is silent on the issue.
- Survivor Benefit Plan—The Senate proposes to end a dollar-for-dollar "offset" in Survivor Benefit Plan payments that surviving spouses experience when they also qualify for VA Dependency and Indemnity Compensation, and to move the so-called SBP paid-up rule effective date to October 2006 from October 2008. Premiums would end on the effective date for 70-year-old retirees who have paid for at least 30 years.

Thumbs Down

When conferees meet to iron out these differences, they will have the Bush Administration's positions to consider. In a Statement of Administration Policy sent to Senators in June, the White House's Office of Management and Budget urged rejection of several personnel initiatives still alive in the defense bill.

OMB criticized the Senate plan to repeal the SBP-DIC offset which exists, it said, to avoid "duplication of two fully funded federal government benefits."

"The current compensation package for survivors—which includes SBP, DIC, an enhanced death gratuity, and increased life insurance benefits—provides a reasonable level of income," OMB said. Ending the offset also would cost up to $8 billion over 10 years, the White House estimates.

Vet Housing Benefits

President Bush has signed into law a bill to improve housing opportunities and job benefits for disabled veterans.

The Veterans' Housing Opportunity and Benefits Improvement Act of 2006

authorizes VA grants of $2,000 to $14,000 to help families adapt their homes for temporary housing of severely disabled veterans.

Previously, such grants were available only to severely disabled veterans who own their own homes. Ignored were young veterans with life-altering injuries who live with their parents, said Sen. Larry Craig (R-Idaho).

IRA Opportunity Restored

The Heroes Earned Retirement Opportunities Act signed by the President May 28 allows service members to make Individual Retirement Account contributions even while assigned to combat zones.

The act changes the tax code to ensure that combat assignments don't preclude personnel from contributing to IRAs because they have no taxable income.

IRA contributions are limited to $4,000 or an individual's taxable income, whichever is less. An exception is now allowed, retroactive to tax year 2004. Service members who were unable to make IRA contributions in 2004 and 2005 have three years from the date the bill was signed to do so.

Income earned by enlisted members and warrant officers in combat zones is tax exempt. For commissioned officers, the tax exclusion is capped at the level of maximum enlisted basic pay, plus any imminent danger pay received, for any month in a combat zone.

Officer Promotions

A provision in the Senate defense authorization bill would require automatic removal of officers from service promotion lists one year after promotions are blocked by the Senate Armed Services Committee.

It is one of several changes aimed at ending variations across the services in the way they screen officers for promotion, delay promotions when adverse information surfaces, and remove or keep names on promotion lists after the Senate has declined them.

The Navy for 16 years has kept one officer's name on its captains' promotion list. In that status, the officer can remain indefinitely on active duty, protected from force reductions, selective early retirement boards, even mandatory retirement.

Unemployable Veterans

The Government Accountability Office, in a new report and in Veterans Disability Benefits Commission testimony, said VA needs to tighten its awarding of Individual Unemployability, the IU rating.

Because of weak oversight, some veterans get more compensation than warranted, and VA is ineffective in moving seriously disabled veterans toward productive working lives. The number of disabled veterans rated IU had jumped in recent years. From Fiscal 1997 through 2005, veterans rated unemployable tripled from 71,000 to 220,000. Total IU payments during the same period rose from $857 million a year to $3.1 billion.

Time-in-Grade Pay Table

Defense officials are studying ways to redesign the military basic pay table to tilt monetary rewards more toward performance with less emphasis on length of service.

The idea is endorsed by the Defense Advisory Committee on Military Compensation, a panel of pay experts whose final report was released in early June. DACMC recommends that Congress replace the time-in-service pay table, designed in 1949, with a "time-in-grade" table. The change could make basic pay a more effective compensation tool. (See "Washington Watch: Pay and Benefits, Civilian-Style?", p. 12.)

This and other DACMC recommendations serve as the starting point for a comprehensive look at military compensation being conducted by the Pentagon's 10th Quadrennial Review of Military Compensation. Retired Air Force Brig. Gen. Jan D. Eakle is the QRMC director.

In an interview, Eakle said a time-in-grade pay table has merit. As "a more permanent recognition" of performance, such pay would deepen financial rewards for service members who are advanced ahead of their peers. Under the current time-in-service pay table, officers and enlisted members promoted a year ahead of peers enjoy extra pay—but only for that year. "After that, the difference vanishes," said Eakle.

A time-in-grade table could double the lifetime pay advantage of early promotion, according to DACMC estimates. Today, an enlistee who advances to E-5 a year ahead of peers, and stays a year ahead through future advancements, will earn an extra $22,000 in basic pay over a 30-year career. If pay table steps were based on time in grade, however, that one-year head start would be worth about $45,000.

The difference would be greater for officers. Under the current pay table, an officer promoted to O-4 a year early would realize a $20,000 difference in basic pay over a career. With time-in-grade pay, the difference would be $64,000.

Every branch of service and the Joint Staff have representatives involved in the QRMC review. ■

Harold Brown's "Invisible" Aircraft

For some time, there had been whispers—and a few press leaks—about a strange breed of aircraft, one "invisible" to radar. Then, in August 1980, the Department of Defense went public with sensational news. Secretary of Defense Harold Brown confirmed the existence of "stealth" technology and claimed the US could build aircraft "that cannot be successfully intercepted with existing air defense systems." He went on to say, "We have demonstrated to our satisfaction that the technology works."

In time, the F-117 and B-2 would turn "stealth" into a household term, but, in 1980, Brown's words caused an uproar. Critics argued that the Carter Administration disclosed the information as part of its Presidential campaign strategy. Brown said he confirmed the stealth program because it was no longer possible to deny it, given the detail in recent press leaks.

"Statement on Stealth Technology"

Secretary of Defense Harold Brown
DOD News Conference,
Washington, D.C.
Aug. 22, 1980

Find the full text on the Air Force Association's Web site
www.afa.org
***Air Force* Magazine**
"The Keeper File"

I am announcing today a major technological advance of great military significance. This so-called "stealth" technology enables the United States to build manned and unmanned aircraft that cannot be successfully intercepted with existing air defense systems. We have demonstrated to our satisfaction that the technology works.

This achievement will be a formidable instrument of peace. It promises to add a unique dimension to our tactical forces and the deterrent strength of our strategic forces. At the same time, it will provide us capabilities that are wholly consistent with our pursuit of verifiable arms control agreements, in particular, with the provisions of SALT II.

For three years, we have successfully maintained the security of this program. This is because of the conscientious efforts of the relatively few people in the executive branch and the legislative branch who were briefed on the activity and of the contractors working on it.

However, in the last few months, the circle of people knowledgeable about the program has widened, partly because of the increased size of the effort, and partly because of the debate under way in the Congress on new bomber proposals. Regrettably, there have been several leaks about the stealth program in the last few days in the press and television news coverage. In the face of these leaks, I believe that it is not appropriate or credible for us to deny the existence of this program. ... I am gratified that, as yet, none of the most sensitive and significant classified information about the characteristics of this program has been disclosed. ...

In sum, we have developed a new technology of extraordinary military significance. We are vigorously applying this technology to develop a number of military aircraft, and these programs are showing very great promise.

We can take tremendous pride in this latest achievement of American technology. It can play a major role in strengthening our strategic and tactical forces without in any way endangering any of our arms control initiatives. And it can contribute to the maintenance of peace by posing a new and significant offset to the Soviet Union's attempt to gain military ascendancy by weight of numbers. ...

The general description of stealth technology includes ideas, designs that are directed also at reducing detectability by other means. Radar is the means that is best able to detect and intercept aircraft now. It's no accident that the systems that exist are radar systems. But stealth technology extends beyond radar. ...

Stealth technology is applicable against anything that is detected and attacked through detection by radar. But how practical it is for various kinds of vehicles is another matter. ...

[Future Soviet air defense systems] are the ones that we are talking about. The ones that are now in development and could be deployed during the rest of this decade are the kinds of detection systems that we believe that this will be able to render effective. It will always be the case that whenever there is a major new development of military technology, a measure let's call it, there will be countermeasures and there will be counter-countermeasures. We've been looking at both of those. Our judgment is that the balance is strongly tilted in the direction of penetration by this technology and that there will be later fluctuations around that new equilibrium point. ...

There have been flight tests. ... We also do not intend to make the details of the program, including the appearance of the vehicles, public. ... It's hard to believe that you can have things operational for very long and not let some things get out, but we're going to try to keep that kind of detail secret as long as we possibly can. ...

It's too soon to say what the precise mix of our capabilities in the 1990s will be, but it is not too soon to say that by making existing air defense systems essentially ineffective, this alters the military balance significantly. ■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The Air Expeditionary Force may not be broken, but some weak spots need patching.

Expeditionary—and Seriously Extend

USAF photo by SSgt. Tony R. Tolley

F-15Es from Seymour Johnson AFB, N.C., taxi at Balad AB, Iraq.

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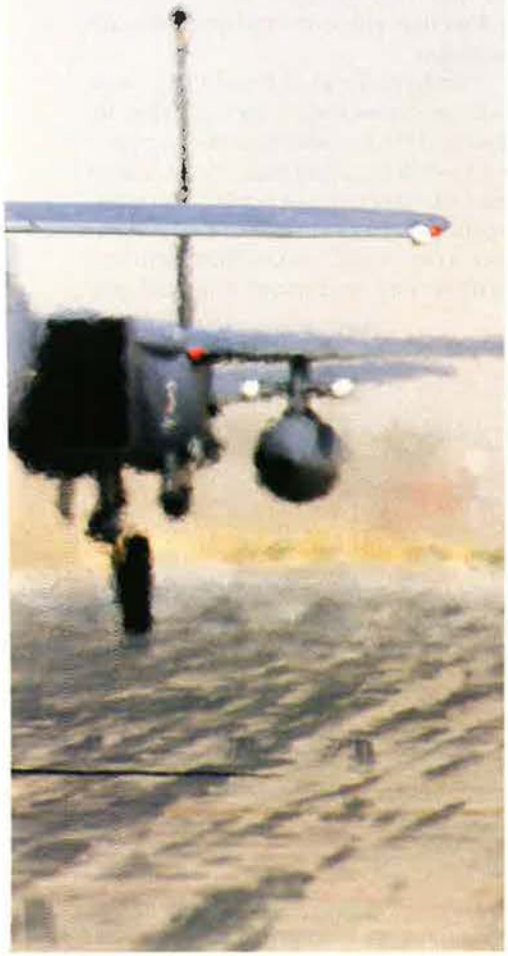
By John A. Tirpak, Executive Editor



The age of expeditionary airpower hasn't always been a smooth ride. Because of the stress and strain caused by frequent overseas duty, the Air Force has tried to limit deployments of airmen to no more than 120 days in any given 20-month period.

Success, however, remains somewhat elusive.

There have been some improvements. However, Air Force officials note, the service continues to see a steady rise in the number of airmen whose expeditionary duties extend beyond the notional 120-day goal. That, they say, is worrisome.

These officials do not believe that the expeditionary Air Force concept, unveiled in 1999, is broken or beyond repair. Nor, they argue, is it in need of a complete overhaul.

Even so, the problem is serious enough to prompt service officials to take another look at the Air and Space Expeditionary Force (AEF) structure and operation, with an eye toward fixing problems left unaddressed in earlier reforms.

Col. Brian T. Kelly, commander of the Air Force's AEF Center, located at Langley AFB, Va., reports, "Requirements are on somewhat of an upslope." He went on to say the AEF structure is healthy and functioning much as was intended when it was set up back in the 1990s.

Designed to serve as a force management tool during constant contingencies short of major war, the AEF, said Kelly, naturally is going to come under greater stress during a major combat operation—or two.

Numbers Going Up

Kelly reported that the number of people breaking the Air Fore deployment goal is increasing. It was 20 percent two years ago, when the goal was 90 days; it is now 26 percent, and the goal is now 120 days. (See "The Expeditionary Force Under Stress," July 2005, p. 30.)

In June, there were 24,559 people deployed as part of AEFs to more than 100 locations worldwide. That figure is about 25 percent higher than was the case in the pre-9/11 era.

Over the last two years, the Air Force also has added about 4,000 people to the ranks of those deploying with the AEFs. Most of the add-ons have been sent to backfill missions that have been performed by Army or Marine troops either needed elsewhere, or by those who need to return to home bases for training or rest.

"We're supporting [US Central Command] requirements, and, yes, some of them are what would be traditional Army or Marine roles," Kelly reported.

Those roles range from driving trucks on dangerous Iraqi roads to performing civil affairs functions aimed at shining up the US image in Afghanistan. The jobs are called ILOs, or "in lieu of" Army and Marine troops.

Some of the extended deployments stem from the fact that airmen need extra training for these tasks, which are sometimes not their regular specialties.

Kelly noted that the Air Force troops were specifically requested by USCENTCOM under a program called Joint Sourcing Solutions. CENTCOM will request specialists in related fields if the primary specialists are overtaxed. Legal specialists, for example, are among those sent for "stabilization operations," which is how the AEF Center prefers to describe the "hearts and minds" civil affairs functions.

Some of the 4,000 are performing "blue" missions, too, Kelly said. Among those are tactical airlift crews that stepped in to fly some of the cargo around Iraq that had been going by truck convoy. The convoys have been plagued by insurgent-placed improvised explosive devices. Putting some of the convoy load onto airlifters has helped reduce IED casualties.

The AEFs are not the whole deployment story. Above and beyond the AEFs, there are about 8,000 to 10,000 Air Force people "on other types of temporary duty or ... forward-based for other things," Kelly noted. The demands of theater commanders have also made it necessary to send some airmen overseas on one-year temporary duty assignments. There are about a thousand of these special TDY cases, and many are headquarters staff or other experts who cannot be spared after just a few months; their on-site expertise is required to effectively conduct planning and missions.

When they come back, these special TDY airmen are exempt from the AEF rotation for six to 12 months, depending on the job they are going to next, but after that, they are back on-call.

A Goal, Not a Requirement

Col. Jim Ogden, chief of the AEF matters division of the Air Staff, said that

USAF photo by MSgt. Lance Cheung

An F-15E takes on fuel over the mountains of Afghanistan. The Air Force has made a fine art of being able to pick up and move to austere bases and operate for extended periods.

while the 120-day goal is the standard, USAF is supplying people to meet the needs and requests of the combatant commander.

"If the operational requirement calls for it, the deployment could be 180 days or 365," Ogden said. The length of the deployment depends on the skills and experience required, he added.

The AEF "is how we present forces to the COCOM," Kelly said. "It gives us better visibility into the force." When US Central Command chief Gen. John Abizaid asks for a capability, "we are better at knowing where it is" due to the extensive work that has been done to catalog the skills and education of USAF personnel, Kelly said. "The AEF makes the Air Force healthier."

Together with the Navy, the Air Force is supplying about one-third of the overall force deployed to the CENTCOM area of operations, Ogden noted.

The shape of the AEF today is far evolved from its origins in 1999, when the Air Force recognized the time had come to institutionalize its new "expeditionary" status. In those early days, more than two-thirds of Air Force personnel didn't deploy because they were not in the "library" of people who could be called on to meet requirements. The system at that time was chiefly aimed at giving airmen more predictability in their lives, with greater warning of when deployments would come and how long they would last. It was a response to constant, back-to-back deployments to meet contingencies such as the wars in the Balkans and the aerial blockade of Iraq, known as Operations Northern and Southern Watch.

Today, the AEF library contains more than 85 percent of all Air Force active duty personnel. Much of the remainder is deemed exempt from deployments. Those individuals tend to be in Joint assignments, in school, in recruiting, or in the missile launch business, Kelly said. However, their skills are still known and cataloged, and they can be pulled to a deployment if necessary.

Forces in certain places don't typically rotate on the AEF schedule. Combat forces in South Korea, for example, stay put.

While the AEF team has contemplated rotating combat forces in Korea, it "doesn't do much for us," since they would have to be replaced by something else, Ogden said. Army units have rotated out of Korea into the CENTCOM theater, but USAF combat units have not been requested.

The AEFs are 10 combat outfits with roughly comparable combat capabilities. Deployed in pairs, they typically have about 12,500 people and about 130 aircraft, ranging from fighters to airlifters to search and rescue helicopters.

An AEF cycle begins when its constituents come off a deployment. The airmen go home for a period of rest and reconstitution, then go into a period of training and professional military education. After about 18 months—under ideal conditions—the constituent units begin to prepare for the location to which they'll deploy by studying intelligence and honing their skills or learning new ones. Soon after, they go to their deployment location, and most can anticipate spending four months there. Then, the cycle begins again.

Compressed Cycles

For certain specialties, however, the cycle is compressed. Those in specialties needed by the COCOM for 180 days or more are grouped into "bundles," rather than pairs, and follow a different schedule.

For the purposes of the AEF, the most-stressed career fields—the ones typically pulling 180-day deployments—are vehicle operators, signal analysts, pavement and construction equipment operators, security personnel, and medical personnel. They are the people most involved with setting up, maintaining, and pro-

USAF photo by SSgt. Bryan Bouchard

These Air Force troops in Southwest Asia are performing missions normally handled by the Army or Marine Corps. Some 4,000 airmen are engaged in such work.

USAF photo by A1C Michael S. Dorus

At Andersen AFB, Guam, four F-16s line up to launch. The F-16s share ramp space with a B-1 bomber and Navy cargo aircraft.

tecting expeditionary airfields, running an expeditionary base, and caring for wounded troops.

Kelly noted that, over the years since Operation Enduring Freedom began, the career fields under the greatest stress haven't changed much. However, he noted that one specialty that is rapidly joining the ranks of those most in demand is explosive ordnance disposal. They are the troops working to disarm and neutralize the IEDs.

"All the services are 'all-in' with their IED capabilities," Ogden noted.

As requirements shift, some other fields occasionally feel the pinch of longer tours, but not permanently. Office of Special Investigations personnel and logistics personnel will have surges of requirements forcing 180-day tours or one-year TDYs.

Of the whole AEF deployed population of 24,559 airmen, between 16 and 18 percent are in the Air National Guard or Air Force Reserve.

It was widely anticipated—even by some former top Air Force officials—that the AEF schedule, or indeed the whole construct, would fall apart under the demands of constant deployment in wartime. That hasn't happened.

"The health of the AEF isn't measured in terms of the number of folks deploying longer than 120 days," Ogden said.

"The construct itself holds up very well: five pairs [of AEFs] to respond to the full spectrum of conflict. But the demand sets change over time," he said.

Certain parts of the Air Force, Ogden said, "are always stressed, when supply and demand are mismatched." However, he said, "The system can handle that. It can reset and respond to the full range of requirements."

The biggest adjustment so far took place in 2004, when the AEFs, which had been on a cycle of 90 days deployed every 15 months, went to a cycle of 120 days every 20 months. The changes produced benefits in that trained troops stayed in place longer, with an increase in vital experience. The change reduced the number of unit swaps—thereby reducing transportation costs and sorties—and was welcomed by a majority of troops, who were happy to have five months more time at home station in exchange for 30 more days deployed at a time.

Wanted: Less Turbulence

The Air Force is "constantly" looking at ways to revamp or reset the AEF so that it continues to function with as little turbulence to the force as possible, Ogden reported. He said that a summit of AEF and personnel chiefs at the O-6 level was held in March at the Pentagon.

They determined that, for the near term, the Air Force should "retain the current AEF construct," while focusing on improving the "depth and health" of the force pool in high-demand specialties.

For the long term, the group decided to request a study from the RAND Corp. under Project Air Force. The study has not begun yet, but has been "nominated" to be done in Fiscal 2007, Ogden said. RAND would study the AEF in the context of "Adaptive Planning and Global Force Management."

The combat forces assigned to each AEF are as comparable in capability as possible. The advance of technology over the last seven years has made this comparability easier to achieve.

Jeff Williams, with Air Combat Command's AEF staff, said modernization programs have substantially improved the capabilities of F-16s to the point where they have nearly all the potency of F-15Es in the attack role.

Targeting pods, particularly, "have allowed us to substitute F-16s for F-15Es" in precision attack, he said.

He noted, "We used to have F-16CJ

USAF photo by Capt. Mark D. Gibson

Mechanics work on an A-10 at Bagram AB, Afghanistan. Even former USAF leaders predicted the AEF construct would not survive in wartime, but it has held up.

USAF photo by Capt. Chris Watt

Airmen in Romania load a C-17 with equipment for Afghan troops. The number of troops deployed longer than 120 days is edging up. Mobility troops are among the busiest.

and F-16CG," which were the identifiers for F-16s that could carry high-speed antiradar missiles and those with night and precision attack capabilities, respectively. Now, with the Combat Configuration Implementation Program, "that will make these platforms identical in capability," Williams said. "Before, we might have sent some of both, but now, either one can do both jobs."

He also noted that F-15s and F-16s equipped with advanced targeting pods can perform a mission similar to that of the Predator surveillance drone, by offering real-time streaming video feeds to ground or headquarters forces. (See "Eyes of the Fighter," January, p. 40.)

"We do have a mix out there, but for what's being requested right now, either can do the job," Williams noted. Similarly, Global Hawk and U-2 intelligence-surveillance-reconnaissance platforms are becoming more closely matched in what they can bring to an AEF.

Component commanders "used to ask for a specific platform," Kelly noted, but they "don't have to do that as much with NTISR," or nontraditional ISR capabilities such as the Sniper and Litening advanced targeting pods.

The F-22, when it becomes more widely deployed, "will be fantastic" at offering multiple capabilities in strike, air-to-air, and ISR capabilities, Kelly said.

It is precisely because the Air Force is upgrading its equipment that personnel cuts announced in the Fiscal 2007 budget—about 40,000 full-time equivalents over the next five or six years—as well as a planned 10 percent reduction in airframes will not unravel the AEF. (See "The New Air Force Program," July, p. 30.)

Less "Density" in AEFs

The Quadrennial Defense Review "will drive some force structure changes," Ogden acknowledged, but "a reduction in platforms does not necessarily drive a degradation in capability. There will be less density in AEF pairs," but they should be able to get the job done, he said.

"The AEF is not a force-sizing device," regardless of the size of the Air Force as a whole, he said.

There have been complaints for several years that the AEF takes too many people away from home base, leaving too few people or machines to get steady-state training and operations done, but "that is the nature of a nation at war," Kelly said. When there are ongoing combat operations, "we ... tend to tilt toward the warfighter ... and meeting his needs." He added that there have been some studies suggesting that steady-state operations at home base can be accomplished with as little as 30 percent of the overall force, leaving plenty of margin still for the AEF to draw more people.

In the next year or so, demands will begin to bite especially hard on the force as initial tranches of airmen are separated in the first rounds of USAF's overall personnel cutbacks. There will be fewer airmen to draw on, and many will have done a long series of extended deployments.

"Next year, or the year after that, there will be challenges for the AEF," Kelly forecasted. For that reason, the Air Force will have to succeed in its efforts to modernize its forces, so that it can accomplish the same tasks with fewer people and machines.

However, Kelly also noted that operations in Iraq and Afghanistan are probably not permanent and that the surge will eventually taper off.

"Will we keep the same requirements [for personnel]? I don't see it. The demands will be going down in the next couple of years, ... [although] I don't want to be too optimistic." In the meantime, "we will work hard at presenting the force that's required."

The difference that will bring success lies with the Guard and Reserve, Kelly said.

"The big thing is that this is a Total Force effort, and we're better at it than the other services. We're working to keep tour lengths reasonable, ... but we are always looking to see if we can do it better."

Getting the Total Force aspect right is "a priority for DOD," Ogden said.

It seems that the Guard and Reserve will play a bigger role in the future. Gen. John D.W. Corley, vice chief of staff, said at a June symposium on Capitol Hill that the reserve components have "helped us, in terms of the AEF [because] we are integrated, not separate. We think we can do more in terms of the AEF ... to continue to use the assets of the Guard and Reserve and keep them whole and viable."

The Air Force has taken steps to ensure that the reserve components have moved "from a strategic reserve—the old, monolithic threat, bipolar world—... into part of the operational force." The Air Force will continue to become "more interdependent" with the Guard and Reserve, he said, but that will require ensuring that they have "the right tools" to do the job.

Reflecting on the fact that the Air Force has been deployed to Southwest Asia for more than 15 years straight, and has learned valuable lessons from that long deployment, Corley asserted that "the AEF construct has served us extremely well." The "AEF construct is the right one. My [view] is that it will continue to support us, ... [and] there is room for growth for all our partners on this." ■

By Tamar A. Mehuron, Associate Editor

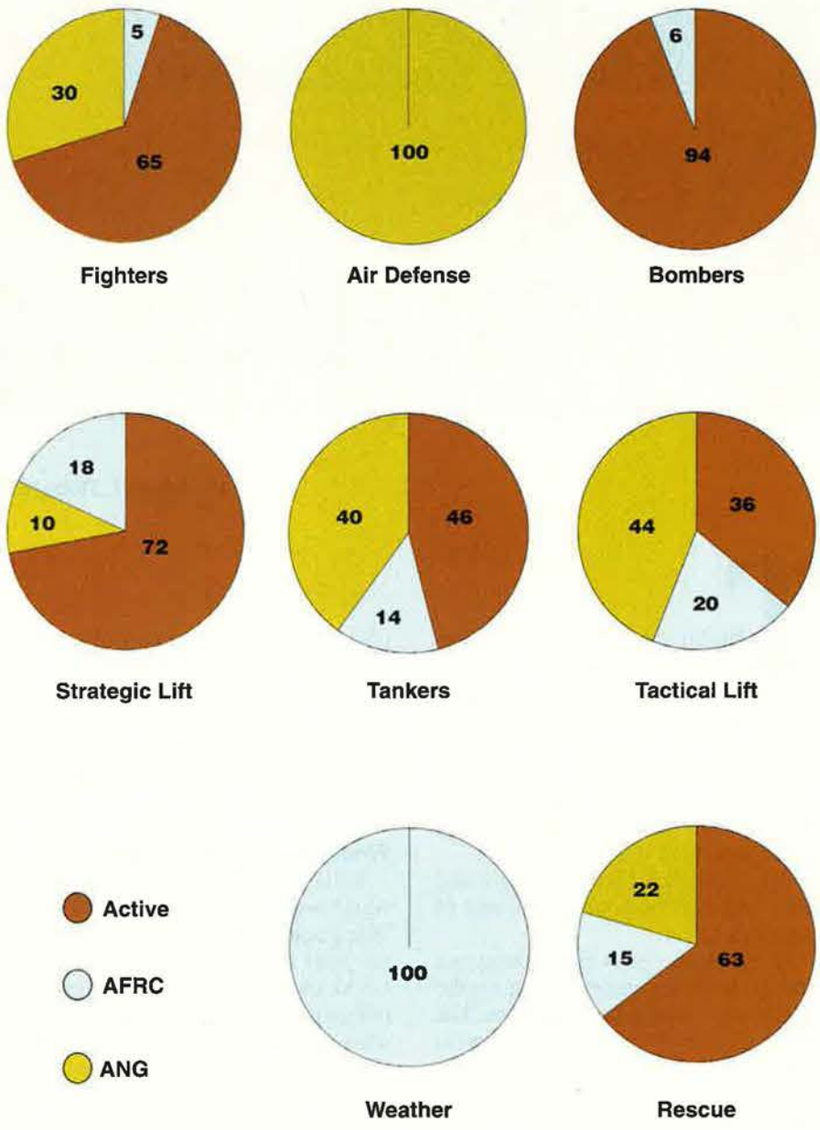
The Total Force Iron List

For many decades, a significant portion of the Total Air Force's aircraft have been flown and maintained by the two air reserve components—the Air National Guard and Air Force Reserve Command. They are big components. In fact, ANG, with 107,000 members, and AFRC, with 74,000 members, are themselves among the largest air forces in the world. The active duty Air Force has 357,400 members.

These graphics prepared by the Defense Department depict how the aircraft on the Air Force "iron list" are apportioned among the three parts of the Total Air Force.

In two categories—stateside air defense and air weather operations—ANG and AFRC, respectively, provide 100 percent of the iron. They also have control of large portions of Total Air Force tanker, tactical airlift, and fighter assets. Only in the cases of heavy bombers and long-range airlifters does the active force far surpass the holdings of the reserve components.

The graphics, however, do not show the contribution of ANG and AFRC to the air and ground crews that fly and maintain active force aircraft. In the strategic airlift category, because of the use of associate units, reserve components provide 53 percent of the aircrews. As new technologies expand mission areas such as space, information warfare, command and control, and UAVs, the Guard and Reserve contribution could well increase.



Source: DOD

By changing its worldwide basing, the Air Force is striving to break out of the Cold War straitjacket.

PRESENCE, Not Permanence

By Adam J. Hebert, Senior Editor

The Air Force is packing its bags and leaving Iceland, closing out more than 50 years of US military operations on that island nation. A contingent of F-15s—the last in a long line of air superiority fighters kept at NAS Keflavik—departs this month. An Air Force rescue helicopter squadron will move elsewhere in Europe.

All 2,200 US Air Force and US Navy personnel will be gone by the end of September.

Iceland is the latest but certainly not the only or last example of change in the Air Force's overseas basing posture. The service continues to adjust its structure to a world where the threats have changed, flexibility is key, and forces no longer are expected to fight in place.

Under a new basing plan announced in 2004, the US over the next decade will bring home 60,000 to 70,000 troops and close and consolidate overseas bases and facilities that no longer are needed. Most of the returning troops will be soldiers based in Germany or South Korea. While not many airmen will return, the system in which they operate will change dramatically, as can be seen in the case of Iceland.

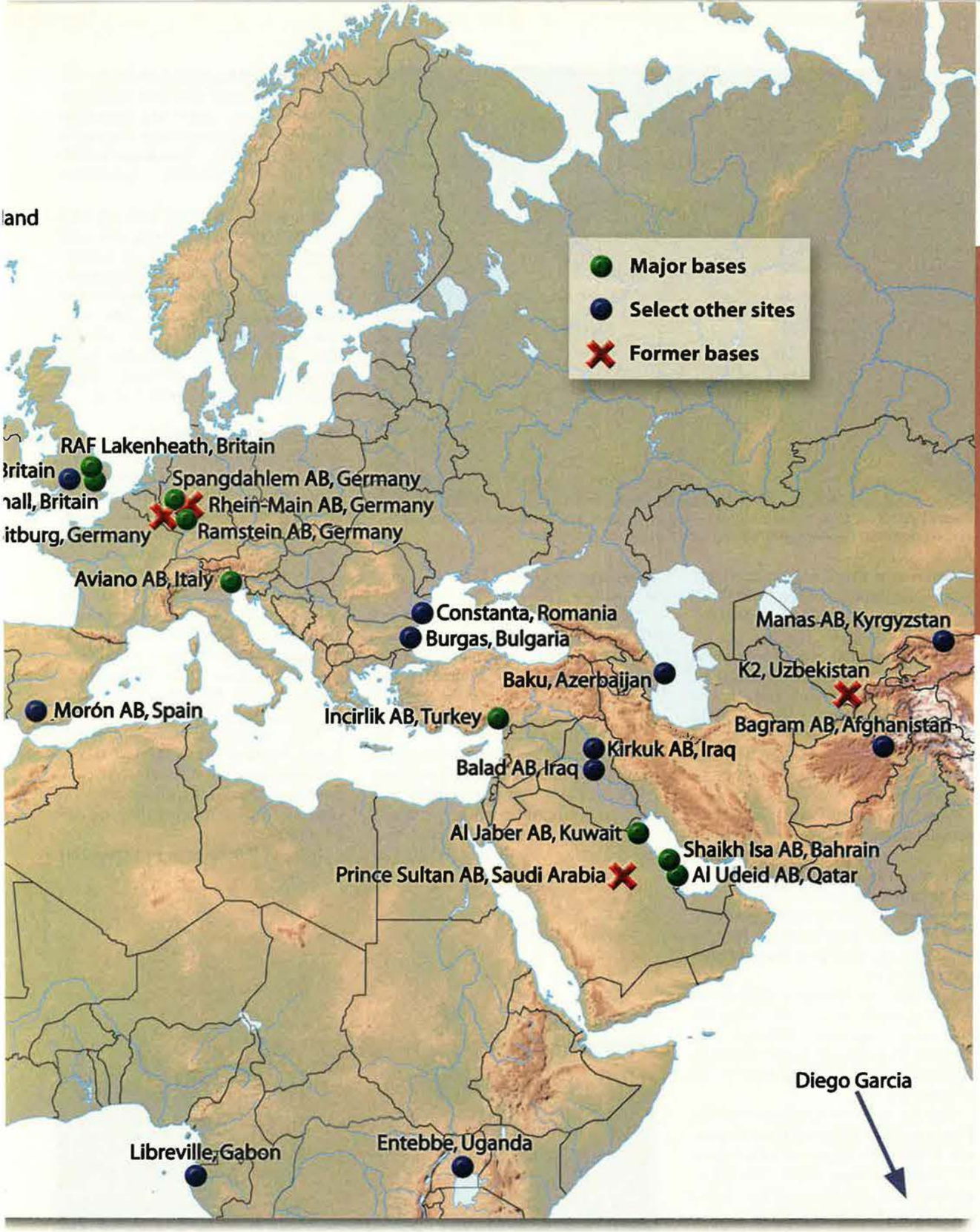
In the Cold War, Iceland was a highly strategic location, ideal for defending the North Atlantic against the depredations of Soviet naval forces and long-range Soviet bombers.

When the Cold War Ended

To the US military, however, Iceland's significance died along with the Cold War, around 1990. Top Air Force officials for years had been dropping hints that USAF should leave the island in order to redeploy forces to more important locations. The move also will save roughly $260 million per year, about what it costs to keep US forces at Keflavik.

Officials emphasize that the US still will live up to its NATO treaty obligation to defend Iceland, as that nation has no military forces of its own. However, it won't garrison forces there anymore.

The Air Force won't be bringing home large numbers of airmen, but is constantly updating its basing structure. "At the conclusion of the Korean War, US forces were stationed overseas in



The Air Force maintains a sizeable network of overseas bases, ranging from large permanent installations to part-time cooperative security locations. Here are some operating locations in Europe, Southwest Asia, and Africa. The listing is not exhaustive.

USAF photo by MSgt. Richard Freeland

Above is an F-16 from the 8th Fighter Wing at Kunsan AB, South Korea. This prosperous northeast Asian nation still hosts a huge US presence.

a posture that would remain relatively unchanged throughout the Cold War," Pentagon officials wrote in a September 2004 report on global basing.

Although the number of troops based overseas was dramatically reduced after the 1991 Persian Gulf War, "forces remained concentrated in Cold War theaters—Western Europe and Northeast Asia," while the Middle East and the Western Pacific grew in strategic importance.

There are currently no plans to build permanent new Air Force bases overseas, so the demand for new locations will be met with temporary bases, while the enduring bases will frequently get even larger. Overseas USAF operating locations will, paradoxically, become both larger and more permanent, smaller and temporary.

In 2004, the Pentagon initiated its global posture review, to guide the US military presence overseas. The Defense Department is now defining its overseas operating locations in one of three ways.

The big bases such as Ramstein AB, Germany, Osan Air Base in South Korea, and Kadena AB, Japan, are now known as "main operating bases." They host permanently stationed combat forces and offer robust infrastructure.

"Forward operating sites" are locations kept "warm" with a limited US military presence that can be quickly ramped up if needed. These on-call facilities include Soto Cano AB, Honduras; RAF Fairford in the United Kingdom; and Paya Lebar Airfield in Singapore.

"Cooperative security locations" are sites the US has scoped out in advance but that have little or no permanent US presence. Sometimes referred to as "lily pads," CSLs include the airfields at Dakar, Senegal; Entebbe, Uganda; and Libreville, Gabon.

"We want to have our forces where people want them," noted Defense Secretary Donald H. Rumsfeld in 2004. "We have no desire to be where we're not wanted." This philosophy was reinforced the following year, when Uzbekistan notified the US that it wanted the Americans out of Karshi-Khanabad Air Base, which had been supporting Operation Enduring Freedom operations in nearby Afghanistan. (See "Aerospace World: US Out of Uzbekistan," September 2005, p. 30.)

Remaining "wanted" often means moving out of urban areas, reducing overall force levels, or consolidating troops at the largest locations. Moves such as these "strengthen our relationships by reducing the frictions—accidents, incidents, and the like—associated with normal military activities in urban settings," noted Ryan Henry, DOD's policy chief.

The Ramstein Waypoint

In Germany, Rhein-Main Air Base, once considered the "gateway to Europe," was recently vacated, with the property returned to the German government for an expansion of Frankfurt Airport. Meanwhile, Ramstein has proved to be a valuable stopover point on the way to the Middle East and is being updated. "It's one strategic airlift flight from the United States to Ramstein, unrefueled," noted Gen. Charles F. Wald, then deputy commander of US European Command. "It works out just perfectly."

Tens of thousands of Germany-based soldiers are returning to the United States, but officials say "bean counting" the numbers does not demonstrate combat capability or US commitment.

In Japan, 8,000 marines will probably

USAF photo by TSgt. Justin D. Pyle

SrA. Brandon Hashida awaits a taxiing C-130 in Dakar, Senegal. Cooperative security locations such as Dakar have a minimal or no permanent US presence but can serve as valuable contingency operating locations.

USAF photo by MSgt. John E. Lasky

More than 50 years of US Air Force presence in Iceland will end when F-15s based at NAS Keflavik go home at the end of this month. Iceland's strategic military importance faded with the end of the Cold War.

vacate several operating locations on the island of Okinawa, including Marine Corps Air Station Futenma. "This would enable the return of significant land in the densely populated areas south of Kadena," noted an October 2005 security planning document endorsed by Rumsfeld, Secretary of State Condoleezza Rice, and their Japanese counterparts.

The departing marines will likely consolidate on Guam, though plans have not yet been finalized. US and Japanese air forces will themselves link up at Yokota, currently a US-only base. Japan's Air Defense Command will be collocated with the headquarters for 5th Air Force at Yokota, near Tokyo, strengthening coordination for air and missile defense operations.

In South Korea, soldiers scattered across a patchwork of camps and forts near the Demilitarized Zone will consolidate in two large "hubs" in the central and southern parts of the country. The headquarters for US Forces Korea will move out of downtown Seoul to a new location near Osan Air Base, and the future USFK force will be 12,000 troops smaller than before.

These moves place the US troops away from both North Korean artillery and, as the DOD report put it, "the increasing congestion and sprawl of the greater Seoul area."

Improvements in precision attack and battle management capabilities, featuring the Air Force, will increase combat power in Korea, despite the one-third reduction in soldiers.

This is "not intuitively obvious," noted Lincoln P. Bloomfield Jr. in a Naval War College paper this year. North Korea, however, "certainly grasped that the United States was increasing its precision-strike power around the Korean peninsula while reducing its own forces' exposure to DPRK firepower amassed just north of the Demilitarized Zone." North Korea responded by denouncing the American reconfiguration.

The Host-Nation Problem

Utility is also key. Forces are useless if they cannot be employed, and recent history has shown that host-nation priorities are not always the same as those of the United States. In 2003, Turkey refused to let the Army's 4th Infantry Division traverse its territory at the beginning of Operation Iraqi Freedom, and the Air Force had to perform the first-ever C-17 airdrop from Aviano AB, Italy, to help open a northern front.

Negotiations with Turkey about access rights did not end there. Senior defense officials have said DOD is interested in moving some F-16s from Spangdahlem AB, Germany, to Incirlik AB, Turkey, but this would require permission for "more flexible use" of Incirlik. Moving an F-16 squadron to Incirlik "remains an option that could be exercised in the future," Air Force officials recently wrote in response to query, "if US strategic requirements and Turkish national policy align."

Political hang-ups such as these are avoided when bases are on US territory, which is one of the many reasons that Guam is considered so valuable an operating location in the Pacific. (See "Airpower for a Big Ocean," July

USAF photo by MSgt. Dave Ahlschwede

SSgt. Olga Valery (on the right) patrols Camp Sarafovo, Bulgaria, with a Bulgarian military policeman.

USAF photo by MSgt. John E. Lasky

Ramstein AB, Germany, has developed into a strategic hub for the US Air Force. In the background, C-17s from McChord AFB, Wash., await their next mission.

2004, p. 36.) The Air Force wants to establish a global strike task force at Andersen AFB, Guam, including 12 tankers and three Global Hawk unmanned reconnaissance aircraft. Those permanently assigned aircraft could be joined by two squadrons of fighters that would deploy to the island on a rotational basis. All of these assets would be in addition to the firepower already available from the B-1, B-2, and B-52 bombers that have been regularly deploying to Guam.

When US territory is not available, a good ally is the next best thing, and the US has long benefited from its close military relationship with the United Kingdom.

The UK's island of Diego Garcia in the Indian Ocean has frequently hosted US bombers for combat operations, and RAF Fairford has served as an occasional base for expeditionary bomber operations from just after World War II through Iraqi Freedom. Fairford (along with Andersen and Diego Garcia) is one of three forward operating locations for B-2 stealth bombers.

During the Cold War, the military was expected to fight in place. Forces, whether they are based in the United States or overseas, are now expected to deploy to hot spots. This makes operating locations near major airlift bases and seaports attractive, and sites close to high-priority areas in the Middle East and Asia are at a premium.

No matter where US troops call home, "we think that they'll need to move, ... [so] the mobility aspects are very important," said a senior defense official in a 2004 background briefing about the global posture review.

The Congressionally chartered Overseas Basing Commission warned in its August 2005 final report that it is "concerned" that "adequate strategic sealift, airlift, and pre-positioned equipment and stocks do not exist and that the current intratheater airlift [capability] is overstressed. ... Mobility assets are inadequate to meet projected lift demand."

Pushing South and East

The Air Force often seeks bases with an eye on minimizing the mobility burden. European Command's push "south and east" has generated a lot of attention, but the US is not moving into Bulgaria and Romania simply because those nations support US policy. These nations, bordering the Black Sea, are hundreds of miles closer to Iraq and Afghanistan than Ramstein is. That allows the Air Force to efficiently set up mobility "air bridges" to the Middle East.

At Mihail Kogalniceanu Airfield in Constanta, Romania, a full range of USAF C-5, C-17, C-130, and C-141 cargo aircraft steadily resupplied forces heading into Iraq during early days of OIF.

Farther south, KC-10 tankers and C-17 transports set up shop at Burgas Airport and Camp Sarafovo in Bulgaria. From Bulgaria, the mobility aircraft established an air bridge to Iraq and simultaneously were closer to the midpoint of the deployment route to the "Stans" for Enduring Freedom.

The Air Force remains on the lookout for new staging bases. "There could be locations [in the Caspian Sea region] that we could, for a very short period of time, land and operate out of, or use as a stop-off point," Wald said last year.

The airfield at Baku, Azerbaijan (2,000 miles east of Ramstein), is "very appealing to get some minimal repair to," Wald said, so that the Air Force could "land and be able to proceed back through the Stans into Afghanistan."

Bases supporting current operations in the Central Command area of responsibility remain busy.

In May, a fleet of 20 Predator unmanned aircraft racked up 2,250 flying

USAF photo by MSgt. John E. Lasky

At Mihail Kogalniceanu Airfield, Romania, A1C Ian Hoagland (far right) consults with Romanian Air Force Pvt. Ciprian Bistieru as they set up a laser module used for high-speed voice and data transmission.

Changing the Global System, One Base at a Time

The Air Force and the Department of Defense constantly update overseas basing structures, but the changes tend to occur in only one place at a time, with less fanfare than happens with changes in domestic basing.

Clark Air Base in the Philippines, Bitburg AB, Germany, and Howard AFB, Panama—to name just three—were all closed in the 1990s, during the same period that the Middle East was rising in importance to the Air Force.

"During the first half of the 1990s, the United States closed or turned over to host governments about 60 percent of its overseas military installations and returned nearly 300,000 military personnel to the United States," DOD noted in its global basing report.

The scale of the changes by 2004 was massive, but more needed to be done.

"There are only 230 major US military bases in the world," noted a senior defense official in a 2004 background briefing, but the US was operating from "5,458 distinct and discrete military installations around the world. ... We don't need those little pieces of property anymore."

The remaining bases tended to be a legacy of World War II and the Korean War. They served the Air Force well during the Cold War but in many cases became strategically obsolete in the 1990s.

The global basing review that began in 2004 was described by then-Pentagon policy chief Douglas J. Feith as "the most thorough restructuring of US military forces overseas since the major elements ... were set in 1953."

The Pentagon report states that by 2014 the number of foreign operating locations will be cut by more than one-third. The number of official overseas "bases, installations, and facilities" maintained by DOD will fall from 850 to 550.

In Europe, 43 bases will have been closed by the end of this year, but the enduring installations such as Ramstein are being modernized. In South Korea, 59 facilities will be closed by 2008, and forces will consolidate in brand-new quarters near Osan. In Japan, aside from 8,000 marines relocating to Guam, other "candidate facilities" have been identified for possible closure on Okinawa. Meanwhile, Kadena and Yokota Air Bases are planning for new bilateral training and basing arrangements.

hours from Balad AB, Iraq, alone—the equivalent of having three MQ-1 aircraft airborne around-the-clock for the entire month. Predators remain "the most requested asset in theater," said Capt. Fred Atwater, expeditionary reconnaissance squadron commander at Balad.

In June, an F-16 dropped two bombs that leveled a safe house containing Abu Musab al-Zarqawi, the al Qaeda terrorist leader. A pair of F-16s was already airborne as part of the "24/7 umbrella" of coverage over Iraq when the target was located, explained Lt. Gen. Gary L. North, the US Central Command Air Forces commander.

Yet even in Iraq, the center of attention in the region, "we're looking at reducing the number of bases," said Gen. T. Michael Moseley, Air Force Chief of Staff. "We have 18 [bases] that we're flying airplanes off of right now, [and] I see that number coming down."

"But I don't see the air and space component leaving soon," Moseley added.

The New Requirement

In the Middle East, the United States seeks to "maintain a posture of 'presence without permanence,' " Henry wrote this year. The United States is attempting to support a war without "unduly heavy military footprints" in Middle Eastern nations.

Because of host nation sensitivities, the Air Force closed up shop at Prince Sultan AB, Saudi Arabia, as soon as operations at the prominent base were no longer needed. Much of the USAF presence moved to facilities in nearby Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates, but the Air Force tries to keep a low profile and stresses that it stays in the Gulf Cooperation Council nations at the invitation of the hosts.

Afghanistan is similarly busy, where Bagram Air Base continues to receive an average of 650 transient aircraft a month—in addition to a long-term contingent of A-10, C-130, EA-6B, and Army aircraft at the base.

Officials point out that the Air Force presence in the CENTCOM area is indefinite and probably long-term but not necessarily permanent. "Our intention would be to stay as long as the host nations will have us," Maj. Gen. Allen G. Peck, deputy air commander for CENTCOM, recently told wire service reporters.

Another area currently generating interest is Africa, where basing options are not so good. Sub-Saharan Africa is within the so-called "arc of instability" that stretches across the Middle East to South and Southeast Asia. It is within this arc that the US is concerned about unstable governments, floundering economies, vast expanses of poorly governed areas, and the potential for breeding grounds for terrorism. (See "Swamp of Terror in the Sahara," November 2004, p. 50.)

Unfortunately, finding suitable bases for contingency access into Africa is not easy. "Despite the vastness of a combined 56 nations, quality operating locations are few and far between, limited in capability, and often inaccessible" for political reasons, noted Capt. Anthony J. Principi and Mitchell L. Reed, in the *Air Force Journal of Logistics*.

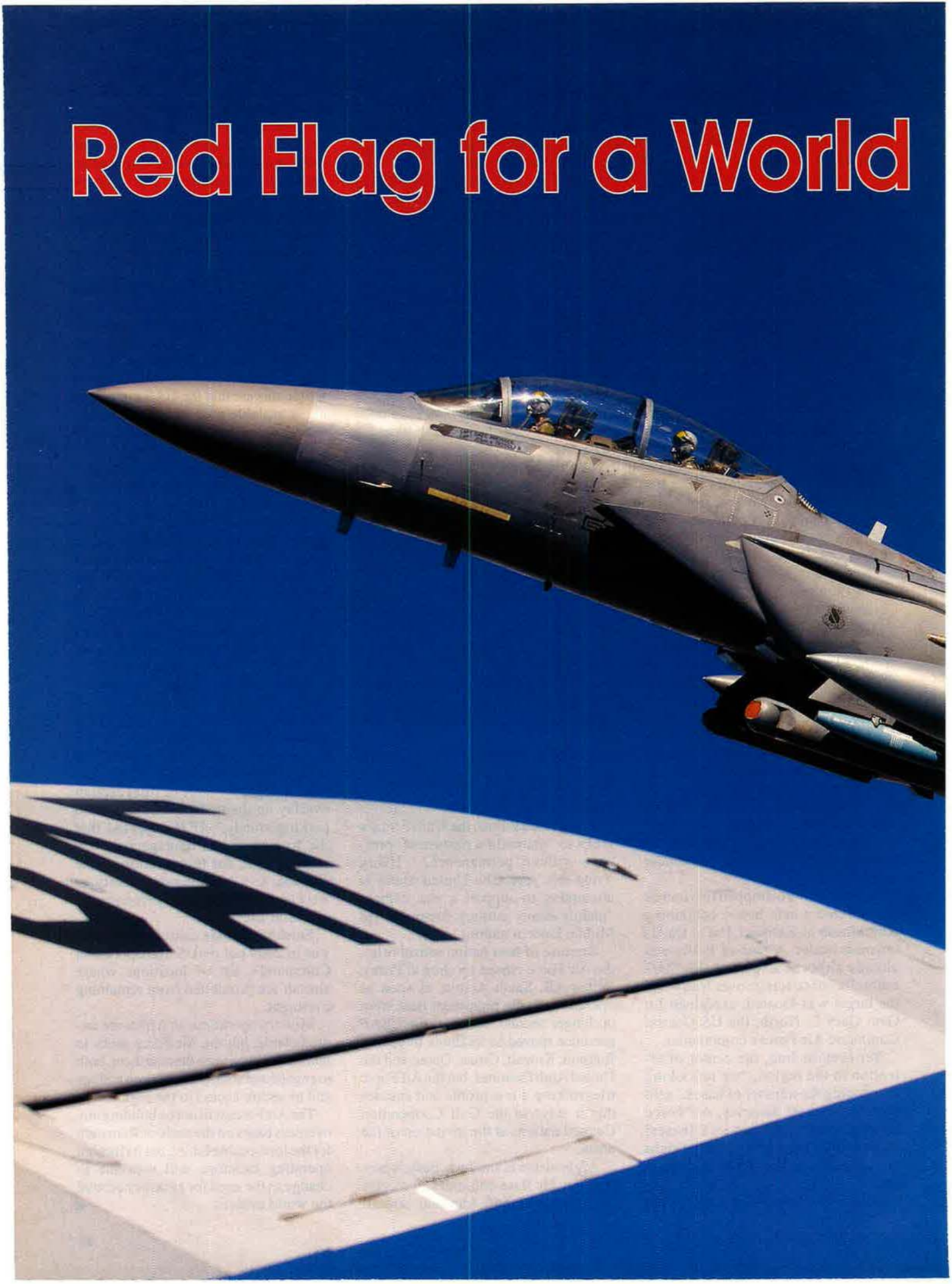
For example, Dakar, Senegal, is frequently cited as an example of a CSL/lily pad location. In 2003, Dakar was used as a staging area for the Air Force relief mission to Liberia, but the airfield was in bad shape. "Considering the degraded state of [the] asphalt overlay on the taxiway and allocated parking stands," *AFJL* reported that the foreign object damage risk was so great that, for the duration of the mission, C-9 Nightingale operations were limited to "absolutely emergency-essential use" only.

Entebbe, Uganda, also cited as a CSL, was in 2004 put on US Transportation Command's list of locations where aircraft are prohibited from remaining overnight.

Military operations in Africa are unpredictable, but the Air Force seeks to maintain solid ties on the continent, both to engage and strengthen African nations and to secure access to the region.

The Air Force will not be building any overseas bases on the scale of Ramstein for the foreseeable future, but its foreign operating locations will continue to change as the need for airpower around the world evolves. ■

Red Flag for a World



Coalition

The February Red Flag in Nevada featured Air Force, Navy, Marine Corps, British, and Australian forces, with more than 130 aircraft and 2,500 troops taking part.

Photography by Richard VanderMeulen

Over the Nevada desert, an F-15E waits off the wing of a KC-135 tanker for its turn to take on fuel.

The Air Force's premier realistic training exercise, Red Flag, played out in an unusual way in the skies over Nellis Air Force Base and the Nevada Test and Training Range this winter. For the first time, dedicated "aggressor" F-15s took part. Air Force, Navy, Marine Corps, and foreign forces honed their skills for upcoming deployments.

Red Flag's hallmark is realistic combat in a controlled environment, featuring battles against skilled opponents. The opportunity to engage dissimilar aircraft using enemy tactics is also important and is often a change for units that typically fly against others from the same unit.

Taking off at right is an F-15E of the 90th Fighter Squadron, Elmendorf AFB, Alaska.

Afterburners lit, this F-111 of the Royal Australian Air Force takes off and has not yet closed its landing gear door. The RAAF is the last air force still flying the F-111. Nations such as Australia come to Red Flag for the opportunity to fly with the US and to take advantage of the vast Nellis range.

At right, an F-16C from Cannon AFB, N.M., takes off with an assortment of air-to-air missiles hung on its wings.

Experience in Vietnam showed that young combat pilots—lieutenants competent in their aircraft but without flying experience in a composite strike force—were most likely to be shot down during their first 10 missions. A Red Flag priority is giving inexperienced pilots the equivalent of their first 10 combat missions in a dynamic and stressful—but controlled—environment.

At left is one of the new 65th Aggressor Squadron F-15s in its distinctive markings.

Below, an Australian F-111 tucks under a KC-135R from the Washington Air National Guard's 141st Air Refueling Wing. CMSgt. Don Roberson looks on through the boom operator's window during his final sortie prior to retirement.

Above, an E-3 AWACS based at Tinker AFB, Okla., helps control and guide the numerous and diverse Blue force aircraft.

Above, an A-10 with a 2,000-pound laser guided bomb under its fuselage heads off to the section of the Nellis range devoted to live-fire training.

Three Nellis-based HH-60 helicopters (left) helped perform the twice-daily combat search and rescue operations that are part of Red Flag.

Red Flag gives airmen an opportunity to train with rarely seen aircraft, a fact which participants say is one of the key benefits of the exercise. (See "Red Flag With a Difference," August 2005, p. 38.) As younger airmen quickly learn, the missions get progressively difficult.

At right, a pair of B-2 stealth bombers taxi at Nellis after a mission.

Once completely nocturnal, the F-117 stealth fighter at left prepares to take off in broad daylight. The Nighthawks from Holloman AFB, N.M., flew both day and night sorties at this Red Flag. Visible in the background are several Marine Corps F/A-18 Hornets.

The B-2 Spirit of Kitty Hawk *(below) departs Nellis on a rare daytime mission. The stealth bombers, based at Whiteman AFB, Mo., flew one- and two-ship missions in Red Flag.*

Above, F-22 Raptors of the base's 422nd Test and Evaluation Squadron.

Above, an aggressor F-16 soars above the Nevada desert. Top right, Lt. Col. Patty Morales of the Washington Air National Guard adjusts the power of her KC-135 as Blue Force "friendly" aircraft call for the tanker.

Right, a B-2 Spirit is silhouetted against the sky as it departs for a night mission. Below, an Alaska-based F-15 heads out on full afterburner.

At left, Maj. Greg Nolting (l) lowers the landing gear and Capt. Mike Harris manages the KC-135's power settings during final approach to Nellis.

The need for realistic combat makes quality aggressors important. The F-15 was added as an adversary aircraft this year to better replicate advanced foreign aircraft and to give USAF pilots a wider range of "enemies" to contend with.

Right, an F-15 aggressor in a desert camouflage paint scheme takes off in front of a flight line full of F-15E Strike Eagles.

At left, an F-16 sports the distinctive green and brown aggressor's "lizard" paint scheme. This Viper is armed with AIM-9 Sidewinder missiles on its wingtip and carries a data link pod.

Below, a Royal Air Force Tornado GR4 launches on a mission. The British and Australian participants were allowed the rare opportunity to participate in a Red Flag exercise featuring stealthy aircraft.

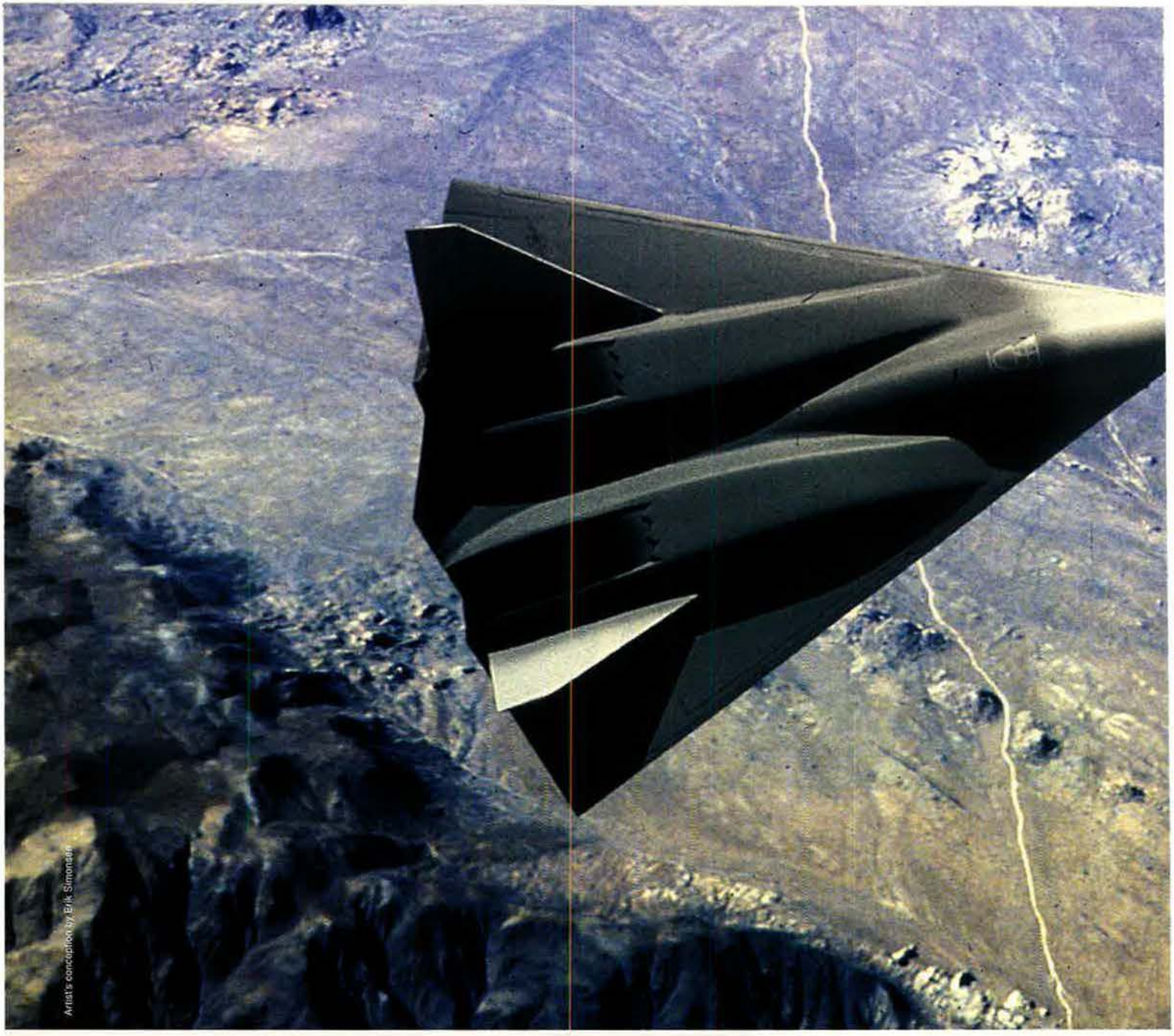
During this Red Flag, one of the tankers had to return to base for a mechanical problem. Above, Maj. Bill Nixon relays the new plan to the boom operator.

Capt. David Michaud, above, bends to his task in his Red Flag Aggressor F-16. The 64th Aggressor Squadron fields 12 F-16s. The newly reconstituted 65th Aggressor Squadron flies F-15s.

Top right, an RAF Tornado employs thrust reversers. Middle right, an F-15C makes its final approach with its landing gear and speed brakes extended.

A B-2 Spirit (right) touches down at Nellis. The base is surrounded by vast mountain ranges and largely uninhabited deserts.

At left, an F-16 takes off against a spectacular backdrop. Nellis helps keep the Air Force's combat skills sharp through its host organizations of Red Flag and permanent test and tactics development missions. ■



Tomorrow's Combat Ad

With technologies like these, USAF will sharpen its fighting edge.

Above is an artist's conception of a long-range, unmanned high-speed strike aircraft. New technologies make such an aircraft possible.

The United States Air Force may well be in the first stages of yet another technological great leap forward.

Today, service leaders say that they see prospects for startling advances in propulsion, stealth, sensors, computation, and unmanned flight, to name a few areas. The new technologies could start working their way into systems within a decade.

When that happens, Air Force officials suggest, it will radically alter the way the service fights its wars, much as the revolutions in stealth, precision, and reliability in the 1980s transformed USAF operations of the past two decades.

vantages

By John A. Tirpak, Executive Editor

As was the case then, the new revolution will bestow on the Air Force some dramatic combat advantages.

Today, USAF's individual aircraft are optimized for range, speed, or payload but do not feature all three attributes. Future technological gains could blur the distinctions; the prospective engine and airframe concepts could blend all three capabilities into a single machine.

Moreover, such aircraft could feature powerful sensors similar in concept to those used by insects; indeed, they might be at least partially organic in composition.

In the future, aircraft probably will be equipped with potent directed energy weapons able to neutralize all electronic devices in a target area without harming humans or physical structures such as hospitals or offices. They will also be superaccurate and instantaneous in their effect.

Future aircraft might be substantially stealthier than those of today, even able to make in-flight changes to their shape and appearance.

These glimpses of the future are offered by Gen. Bruce Carlson, head of Air Force Materiel Command at Wright-Patterson AFB, Ohio. In that command, Carlson oversees USAF research and development efforts.

Protecting S&T Funding

Carlson, in an extensive interview with *Air Force* Magazine, said that he is satisfied with the service's level of spending on science and technology and believes the Air Force's effort will yield necessary advances at a manageable rate.

"Of course," said the general, "we can spend as much money as our senior leaders want to give us." However, he went on to say, "I am happy with our S&T funding. ... I think the Air Force and the Department of Defense have done a remarkable job over the last few years, especially as we're in a wartime environment, protecting the S&T budget."

In its Fiscal 2007 budget presented in February and now being weighed by Congress, the Air Force sought $2.1 billion for science and technology work. Roughly $1.7 billion of that amount would be expended on broad research efforts. The rest is needed to fund classified programs and high energy lasers.

The requested spending level, if approved, would represent a one-year jump of 11.5 percentage points. However, USAF officers say that fact should be kept in perspective; last year's outlay was much lower than that of the previous year. Over the three-year 2005-07 period, the "composite real growth" in S&T funding is 2.6 percent, they note.

USAF's goals are ambitious. Terry J. Jaggers, the Air Force's deputy assistant secretary for science, technology, and engineering, said the service believes that it should commit not less than 15 percent of its S&T money to basic research. These efforts are "game changing opportunities for technological superiority," he told a House Armed Services Committee panel.

Another goal, said Jaggers, is to spend not less than 30 percent of S&T funds on advanced technology developments, which are short turnaround projects aimed at directly assisting American forces in the field.

Carlson credited his predecessor, Gen. Gregory S. Martin, with developing an Air Force "vision" for S&T efforts that sharpens the focus on solving the service's real-world problems and developing capabilities that would dramatically enhance its effectiveness. Programs deemed not having any direct bearing on the service's missions have either been reduced or discarded.

Research projects have to match some aspect of the Air Force's new desire to be able to "anticipate, find, fix, target, track, engage, assess, anytime, anything, anywhere," Carlson said.

As a result, all programs have been evaluated with an eye toward whether they fit in any of those categories. If a project did not further any of those capabilities, said Carlson, "we got rid of it."

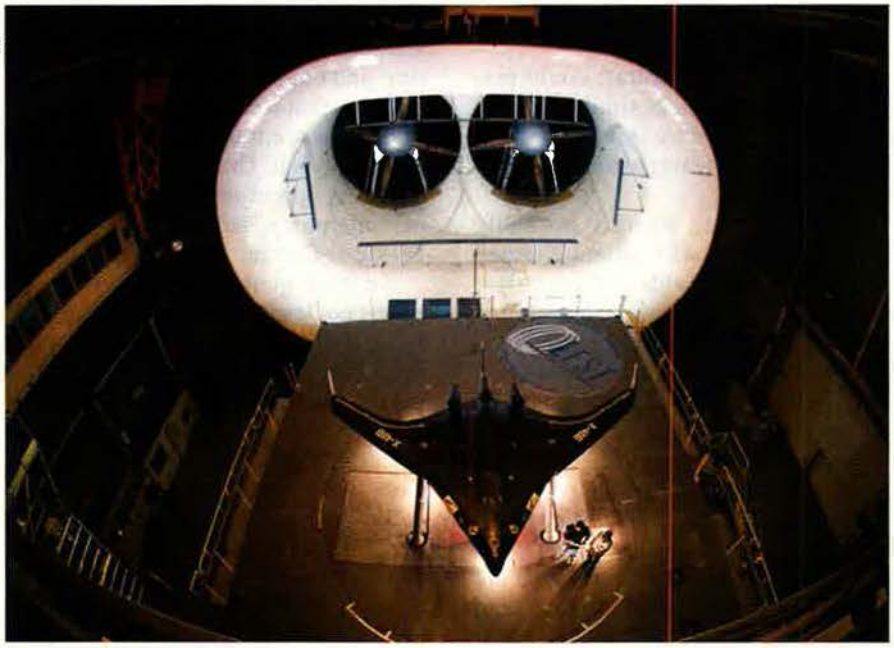
The major commands and users set the priorities, and that has made it easier to prevent the addition of features and tasks the users didn't intend.

Eight Challenges

The requirements of "the kill chain" have been translated into eight "focused long-term challenges," Carlson said. The eight S&T investment areas have been given highly descriptive titles, which are:

- Anticipatory command, control, and intelligence
- Unprecedented proactive surveillance and reconnaissance
- Dominant difficult surface target engagement/defeat
- Persistent and responsive precision engagement
- Assured operations in high threat environments
- Dominant offensive cyber-engagement
- On-demand theater force projection, anywhere

Boeing photo



Wind tunnel engineers test the X-48 blended wing body shape. New engines, fuels, and "morphing" technology could lead to a wide variety in aircraft shapes in the next decade. Some may even change shape in flight.

■ Affordable mission generation and sustainment

The re-stacking of research priorities has allowed AFMC to form "a lot closer partnership with the using command," Carlson said. The logic of the challenges, he noted, is that they allow technical problems to be identified.

"If you know what the technical challenges are," said the AFMC chief, "you can say, 'OK, we want to attack this one four or five different ways because there's high risk, while [another] one we might want to attack only one or two ways, because it's lower risk.'"

He added, "We're essentially able to map everything we're doing in the labs back to this vision."

Even as it sharpens its focus on these few areas, the Air Force is plugging in with other service and government research agencies, all with a goal of eliminating duplicative projects or picking up and developing promising ideas those other agencies aren't pursuing, Carlson explained.

"We have a little better situational awareness on what's going on out there in the S&T world," said Carlson. "The key is to figure out what others are doing, and then how you can piggyback on what they're doing, [and] focus your [research and development] dollars on those things that then provide you the highest payoff."

Asked to identify some of the biggest payoff efforts, Carlson pointed to propulsion projects with enormous potential for the service.

The X-51A project is an effort to develop a vehicle that can achieve a speed of Mach 7 using standard jet fuel, Carlson noted. The vehicle uses a scramjet—a supersonic combustion ramjet—which will fly within the next three years.

"This connects right back to our vision," Carlson said. A vehicle that can operate at Mach 4.5 to Mach 6.5 can go "about 600 miles in 10 minutes" and would likely affect the choice and design of the next long-range strike system. Another project is in the works, using hydrogen fuel, that could propel a vehicle at speeds of up to Mach 12, he said.

Asked why USAF would want to travel within the atmosphere at such speeds, rather than simply perform a suborbital ballistic maneuver, Carlson noted that "there may be policy or legal implications of going to space, so we're working hard to get us to do greater than Mach 7 without going into orbit."

Fast Reaction

The Pentagon is contemplating mounting conventional warheads on some Minuteman or Trident ballistic missiles, as a way to obtain a very quick precision strike on a time-sensitive target thousands of miles away. However, Russian President Vladimir Putin warned in May that the launch of such a weapon could easily be misinterpreted as a nuclear strike and trigger a "full retaliatory response." (See "Washington Watch: Back to the Future Cold War," July, p. 12.)

Aside from the propulsion challenges, Carlson pointed out that materials have yet to be invented that can withstand the multithousand-degree

Next, the One-Size-Fits-All Engine

Next generation engines will be able to reconfigure themselves in flight to adapt to demands of the mission, at some times having the high-bypass characteristics of a big airliner engine and at others the low-bypass characteristics found in the power plant of a fighter.

High speed, long range, long loiter—one engine may be able to do it all.

The research is being done under the Versatile Affordable Advanced Turbine Engines, or VAATE, project. It's a follow-on to the Integrated High Performance Turbine Engine Technology, or IHPTET, program that ran from 1987 until just a few months ago. The goal of IHPTET—to double the power of the F100 and F110 series engines that equip the F-15 and F-16—was never reached, although those engines and their derivatives gained 20 percent more thrust and efficiency, achieved through improved rotor, fan blade, and fluid dynamics technologies. The program also solved early teething problems with those engines in high cycle fatigue.

Under VAATE, the Air Force will look beyond just the engine and incorporate inlets and exhausts, as part of an overall, holistic approach to propulsion. Stealth considerations also will be an intrinsic part of the project.

There will be little that the F-15 and F-16 can gain from VAATE—their engines are close to being "maxed out" in performance—but the F-22, F-35, and future aircraft will benefit substantially. The Air Force is also partnering with engine companies on the project, sharing knowledge and expenses. Materials, fan blade design, cooling systems, fuel efficiency, flow control, and the big trick of altering the engine's configuration will be the early focus of the program. Some of these initiatives have already gained the F135 engine—which powers the F-35 Joint Strike Fighter—a single-digit increase in power.

Program officials report that a VAATE variable engine could be ready in 2013—soon enough to be available to power a new long-range strike aircraft, which is to be fielded by 2018.

temperatures caused by air friction at sustained high Mach speeds.

"When you get up above Mach 7, you either have to have an ablative coating, something that will just burn off, or you've got to come up with some new materials," he said.

He reported that the Air Force Research Lab is pursuing the goals of developing resilient materials that are 75 percent lighter than steel and 33 percent lighter than aluminum, but just as strong. Success also would mean a huge advance in space access, since "every pound you take out of the materials, that translates to about an 11-pound reduction in gross liftoff weight."

The biggest potential advance in propulsion, however, lies within a project called VAATE, for Versatile Affordable Advanced Turbine Engines. The VAATE program seeks to develop what is called a variable-cycle or adaptive-cycle engine. The power plant would be capable of changing its configuration in flight, to give optimum performance when high speed is desired, and can shift back to a different configuration when long range or fuel-miserly loiter is preferred.

In other words, Carlson said, the engine would have "the characteristics of a high-bypass fan," such as those used on airliners, "with the characteristics of a low-bypass fan," such as used in fighters.

"And so, what that means [is], in a long-range strike platform, just by changing out the engine, you could get a 50 percent increase in mission and a five-times increase in loiter time," Carlson noted. For high-speed dash, "we think you could reduce the time to target by about 80 percent."

A short takeoff and vertical landing (STOVL) version, called the Compact Efficient Direct-Lift Engine, is also being explored.

The Quadrennial Defense Review stated that the Air Force should field a new long-range strike capability by 2018, and Carlson said both the VAATE and the scramjet programs "have off-ramps" to a potential long-range strike program.

Because it isn't known yet whether that new program will be manned or unmanned, AFMC also is working to demonstrate the aerial refueling of an unmanned aircraft, as well as "sense and avoid autonomous maneuver" capabilities in an unmanned aircraft, Carlson said.

New and Improved Yet Not Quite Perfect Fuels

What happens when you fly a Global Hawk surveillance UAV to 13 miles altitude? Among other challenges to the mission is the fact that some of the fuel freezes, limiting the aircraft's time on station. To combat that, AFRL is doing research to use additives and other techniques to keep the fuel liquid even at temperatures of 60 degrees below zero, according to William Harrison, chief of AFRL's fuels branch.

Harrison's shop is also looking at the opposite extreme—making fuel stable even when it's heated to very high temperatures. The "plus-100" additive has been in the field a number of years already, but Harrison said AFRL is looking at going "even higher." This is not only important to avoid unwanted combustion, it's useful because fuel is employed to cool the electronics on aircraft such as the F-22, whose avionics generate tremendous heat. The heated fuel can also make for more efficient burning in an aircraft's engines, improving range and top speed.

AFRL is also working on alternative fuels that could reduce dependence on foreign sources of oil. The Assured Fuels Program is studying efficient ways to convert coal or biomass to a usable liquid fuel. There will be a demonstration of the technology this year on a B-52 aircraft, one engine of which will be powered by natural gas made by the conversion process. Harrison said the jet fuel could potentially be produced for $45 to $60 a barrel, "compared to the $106 a barrel we're paying right now."

UAVs Surge Ahead

The Air Force is "rounding the bend" on unmanned aerial vehicles, Carlson observed, and he believes that UAVs are about to make a big leap in capability.

The unmanned aircraft are about to "come of age," he said, because "we're getting past" all the problems that made them unattractive, such as the tendency to crash.

In fact, the technology emphasis now is how to use UAVs as "a swarm," controlled by computer and operating cooperatively. The command and control of such groups of vehicles is very complex, Carlson added. "It has to be done by computers. It can't be done by one guy. And we're beginning to make breakthroughs in that area."

Carlson, noting that the QDR anticipated that UAVs could be as much as 45 percent of the Air Force's strike fleet in the coming years, said he doesn't consider such a figure unrealistic.

"We're going to see an explosion [of missions and vehicles] in this mission area," he said.

He added that observers should be prepared to see "more exotic shapes than we've seen in the past" in UAVs, but performance will be tied more to "big jumps" in propulsion rather than airfoils.

Shaping has a lot to do with stealth, and Carlson said there's no apparent limit on how stealthy an aircraft can be. The issue is effort and expense.

From one generation of stealth to the next, explained Carlson, "the amount

USAF photo

Here is the business end of the Airborne Laser. While electric lasers are developing apace, their power doesn't compare with chemical lasers like that on the ABL. Directed energy holds huge promise for fast engagement of targets.

The Birth of a New, High-Speed Pathfinder

The Air Force doesn't have a high-Mach hypersonic wind tunnel. In order to test high-Mach scramjet engines, the service has embarked on the X-51A project. This scramjet-powered X-plane, which picks up where NASA's X-43 Hyper X program left off, will be lofted to high speed by an Army ATACMS booster, then fly on its own, using the same JP-7 fuel that once powered the SR-71. The craft will accelerate to about Mach 6.5 at 90,000 feet, where it will cruise for a few minutes, then make a controlled—but self-destructive—ocean impact at Mach 2. Tests are planned for 2008-09, and as many as five vehicles may be flown.

The X-51A isn't a prototype for an aircraft or missile, but a derivative vehicle, able to cover 690 miles in about 10 minutes, and might make a good long-range strike system, according to Robert A. Mercier, deputy for technology with AFRL's propulsion directorate aerospace propulsion division.

With such a weapon, "one airplane could hold a significant amount of territory at threat." It might also make a good weapon for use against time-critical targets, Mercier asserted.

It was "not an accident" that the X-51A is sized at about 14 feet length, because that's the size that will fit on the internal rotary launchers of America's bombers, according to Charles Brink, AFRL's scramjet engine demonstrator program manager. He said the X-51A has potential to become an advanced concept technology demonstrator, much as the early Predator and Global Hawk unmanned vehicles were. The scramjet technology, if successful, could also provide the basis of a single stage to orbit spacecraft, in conjunction with other engines and boosters.

of science required ... has gotten more and more difficult. ... It's not just a linear progression." The B-2's level of stealth was "maybe twice as hard" to accomplish as that in the F-117, and the F-22 "five times as hard," he said. In the next generation, "it might be 10 times as hard."

However, "we're working on that," said Carlson, adding that there may be a theoretical limit to how stealthy an aircraft can be, "but we don't see it right now. We think we can go another generation ... and do it in a reasonable amount of time ... if we're willing to dedicate the time and the effort to solve those problems." He said his organization could "demonstrate that technology ... soon."

He also said that AFRL has many projects under way to improve the reliability, maintainability, and performance of today's stealth materials, particularly those that will be used on the F-35. On the F-22, work is aimed at making the materials last longer, prevent icing, and shed moisture, among other efforts.

Painful, but Not Permanent

The Air Force Research Lab has built a man-portable directed energy weapon that can cause pain but not permanent damage. However, Carlson said this is only an early byproduct of ongoing directed energy weapon research.

"It feels like [when] you stick your hand on a hot stove," Carlson said. "It just makes you decide to not do whatever it is you're doing."

However, the trick will be to put such weapons on aircraft and work out the problems of aiming them properly to only create the desired effects, "so you know you're not going to fry someone's brain." Such a system might only be five years away and could be useful causing crowds to disperse or to cause an advancing ground force to retreat.

"Then, a little bit farther out, are the directed energy weapons that allow you to do things like fly over an area and shut down everything that's electrical or computer oriented ... without hurting anything else." Carlson said that it would be accurate to think of such a weapon as able to deliver a focused electromagnetic pulse, which produces the same effect.

The Air Force has high hopes for lasers powered by electricity. Such devices could soon be used for self-defense of aircraft and sensor-blinding functions.

"Quite frankly," Carlson observed, "the limit on that front is not the laser, it's the other stuff: the pointing mechanism, the fast reaction, and the sort of [concept of operations] of how you do that without shooting something else, ... how ... you aim it. It's all that stuff that's really hard."

However, he doesn't see electric lasers equaling the power of chemical lasers as a "weapon class" device anytime soon.

The Air Force thinks electric lasers are "very, very good" for low power, short-range functions, especially since they don't require large quantities of chemicals and plumbing as the YAL-1 Airborne Laser does. But Carlson said the two types aren't going to "trade places ... in the next three or four years."

Carlson admitted that one area of technological advance that hasn't paid off as expected is in the area of hyperspectral imagery. In this endeavor, sensors survey an area of interest in multiple wavelengths—infrared, millimeter wave radar, sound, infrasound, etc.—in order to see and characterize objects even through camouflage.

The concept was "harder ... than we thought," Carlson said. "It just takes a lot of power or bandwidth—or both—to do this, and then there are other technical challenges with cooling and miniaturizing things." Although "it sounded really good when we started, ... the basic science and engineering challenges associated with it were tough."

Hyperspectral imagery was expected to be available now, but Carlson said it will start to appear in "pod" form on high-flying Global Hawk UAVs or as a suite on satellites "in the next ... three to four years." The project is called Spectral Infrared Remote Imaging Transition testbed, or SPIRIT.

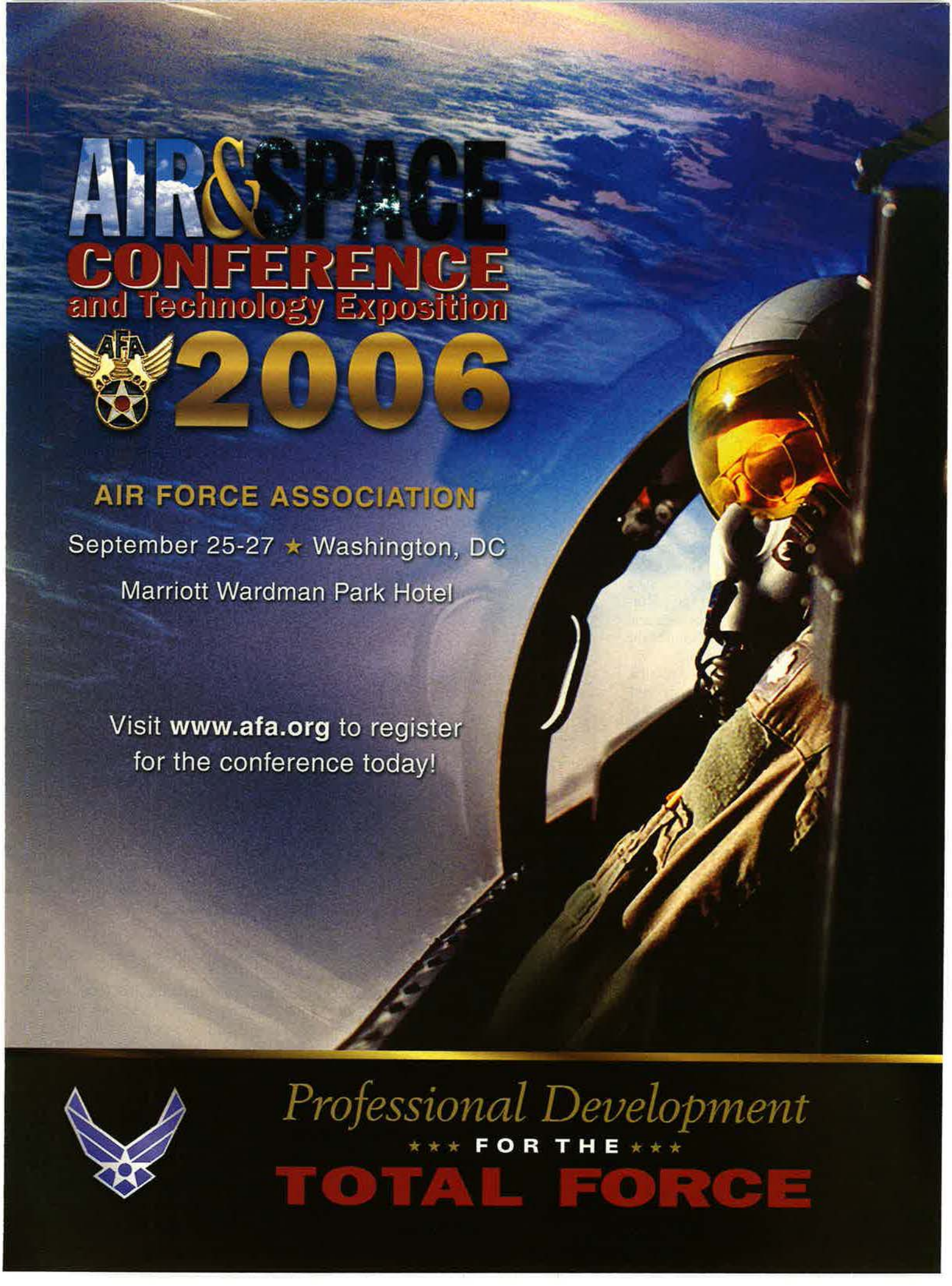
At that point, "we're going to see near-real-time day/night detection in camouflage, in concealed targets. We're going to be able to identify materials through spectral analysis. It's going to give us the capability to do much better enhanced combat assessment."

Carlson is particularly impressed by the potential of biomimetics, which he described as "the combination of nanotechnology and biotechnology." By studying and imitating the functions of biological systems, the Air Force hopes to develop new ways of detecting the presence of nuclear, chemical, or biological weapons.

Besides detecting weapons of mass destruction, a biomimetic device could be injected into a pilot to monitor his health fatigue. It could also be incorporated into protective coverings like a chem-bio suit to accurately assess its effectiveness.

If "the tag says it's good for 14 hours of exposure, how do you know? If the toxicity is much greater than forecast—if it wore out in 10 hours—it would be nice to know that," Carlson said.

Biomimetics may also be the means by which there could be an interface between biological or organic devices and the silicon devices that serve as the brains of today's electronic devices. It represents a means to "make ones and zeroes" out of biological data. ■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In 1962, the United States began a "secret war" in Laos. The operation wasn't revealed until 1970, by which time it consumed half of all US attack sorties in Southeast Asia.

Barrel Roll

By John T. Correll

In early 1961, the hot spot of leading concern in Southeast Asia was not Vietnam but Laos.

The new US President, John F. Kennedy, rated Laos as "the most immediate of the problems that we found upon taking office" in January. On March 23, Kennedy held a news conference, nationally televised, to talk about Laos. He pointed out the communist advance on a large map. The Pathet Lao insurgents, supported by the Russians and the North Vietnamese, had captured the northeastern part of the country.

"Laos is far away from America, but the world is small," Kennedy said. "The security of all Southeast Asia will be endangered if Laos loses its neutral independence. Its own safety runs with the safety of us all, in real neutrality observed by all."

In itself, Laos had little strategic importance. It was remote and landlocked, with a population of only two million. However, it shared borders with six other countries and had traditionally served as a buffer zone between the more powerful neighboring states.

The real concern about Laos was that the insurgency would spread and destabilize the rest of the region. "If the communists [are] able to move in and dominate this country, it would endanger the security of all and the peace of all of Southeast Asia," Kennedy said.

He described the situation as "grave," but the crisis seemed to taper off peacefully in May 1961 when the warring factions reached a cease-fire. In 1962, a Geneva agreement, signed by 14 nations, established a neutral coalition government and ordered all foreign military personnel out of Laos.

The American assistance and advisory group, about 750 people, left promptly, but no more than 40 of the 7,000 North Vietnamese troops in Laos ever went home. Pathet Lao strength increased after the cease-fire, and the civil war resumed full tilt.

Thousands of ancient stone jars dot the plains in the center of Laos.

Following the advice of his political staff, Kennedy chose to meet North Vietnam's violation of the Geneva accord with covert measures rather than open confrontation. The subsequent "secret war" in Laos grew from that decision. Clandestine assistance evolved to direct participation in combat, with American pilots flying air support for the Laotian ground forces.

In the meantime, the US focus in Southeast Asia shifted to Vietnam. Laos was relegated to a secondary priority, and the objectives in Laos changed. The main goal had become to deny the North Vietnamese use of the Ho Chi Minh Trail in southern Laos as an infiltration route. US airpower staved off defeat for the weak Laotian government. In return, the Laotian government acquiesced in US aerial interdiction of the trail.

The air war in northern Laos was

designated "Barrel Roll." When the operations there peaked in 1969, US airmen were flying 300 strike sorties a day.

Incredibly, the cloak of official secrecy imposed in 1962 remained in place. There were sporadic reports of it in the newspapers, and Congress knew about it, but the government did not publicly acknowledge that Americans were fighting a war in Laos until 1970.

Barrel Roll differed from the fighting elsewhere in the theater in almost every respect and to such an extent that it effectively amounted to a separate war.

Land of a Million Elephants

Everything about Laos staggered the imagination.

It was a 600-year-old monarchy, known for reasons long since forgotten as the "Land of a Million Elephants." The king was a figurehead and con-

Above, a map of Laos and neighboring countries shows the capital cities and headquarters of opposing sides of the conflict in Laos—the government, at Vientiane, and the Pathet Lao insurgency, at Sam Neua. Also on the map, the Plain of Jars was the main battleground and strategic crossroads of Laos.

Photos via Warren Thompson

This A-1 Skyraider was stationed at Udorn AB, Thailand. US Ambassador William Sullivan, dubbed "field marshal" for his power struggles with military leaders, believed propeller aircraft were well-suited for the war in Laos.

fined his activities to the royal capital at Luang Prabang. The government ran from the administrative capital at Vientiane.

Each faction in the civil war was headed by a prince of the royal blood. Prince Souvanna Phouma, a neutralist/centrist, was the Prime Minister. His half brother, the "Red Prince" Souphanouvong, was the founder and head of the Pathet Lao.

Northern Laos consisted mainly of mountains. Most of the level terrain was in the Mekong River valley, along the border with Thailand, and around the historic Plaine de Jarres, the PDJ or Plain of Jars, in the middle of the country. Only four percent of the land was arable. The road system was limited and there was no railroad.

The strength of the Pathet Lao was in the east, adjacent to North Vietnam. Their capital was at Sam Neua. The government's strength was in the west. The main battleground was PDJ, a rolling grassland 500 miles square, where hundreds of huge stone jars from ancient times dotted the landscape. The PDJ was the strategic crossroads of Laos. (See "The Plain of Jars," June 1999, p. 78.)

Neither the regular Laotian forces nor the Pathet Lao were noted for their fighting qualities. North Vietnamese troops stiffened the spine of the Pathet Lao, and the best forces on the government side were Hmong hill tribesmen, trained and supported by the CIA (whose cover name in Laos was "Controlled American Source").

The CIA's proprietary airline, Air America, established a network of about 200 "Lima Sites," rough airstrips in the mountains where light aircraft could land with supplies and equipment for the guerrilla units. The sites also were used as staging bases for forward operations.

The charismatic leader of the Hmong was Maj. Gen. Vang Pao, a former lieutenant colonel in the Laotian Army who inspired loyalty from both his irregular forces and his American advisors and allies. He relocated his Hmong followers from their homes in the north to mountain strongholds near the PDJ. By 1968, the Hmong infantry had 40,000 soldiers.

Vang Pao's power base was the military headquarters at Long Tieng, just south of the PDJ, in a valley surrounded on three sides by mountains. CIA and Air Force aircrews, operating undercover, joined him there, but the base was never called by name. It was always referred to as "Alternate." Vang Pao's civil headquarters, Sam Thong, was Lima Site 20. To avoid as much attention as possible, Long Tieng was dubbed 20-A, or 20-Alternate.

The ground war waxed and waned with the weather. During the annual dry season, from September to May, the Pathet Lao advanced. When the wet season came, the monsoon rains turned the roads to mud. The advantage shifted to the weaker government forces, which had the advantage of air support and mobility. Neither side was strong enough to decisively defeat the other.

Water Pump

After the North Vietnamese violated the 1962 Geneva agreement and joined the Pathet Lao in a renewed insurgency, Prime Minister Souvanna Phouma asked the United States for aircraft and supplies for the Royal Laotian Air Force. Deliveries of T-28s began in August 1963. Helicopters and light transports came later.

In April 1964, the Air Force sent a detachment of air commandos under Project Water Pump to train Laotian aircrews in counterinsurgency tactics

A-1 Skyraiders, such as the one shown here at a Southeast Asia airfield, had long loiter times, delivered close air support with great accuracy, and could fly from short airstrips.

Photos via Warren Thompson

and assist with aircraft maintenance. They were based at Udorn in northern Thailand, with forward operating locations at Wattay airfield in Vientiane and elsewhere in Laos. The air commandos trained not only Laotians but also Thai and Air America pilots as well.

There was no US military command in Laos. The Geneva agreement prohibited it, so under the "Country Team" policy, military matters were directed by the US ambassador in Vientiane. William H. Sullivan, who was ambassador from 1964 to 1969, was especially vigorous in the exercise of his authority. Military leaders, with whom he often clashed, called him the "field marshal."

Military Assistance Command Vietnam was not in the control chain for northern Laos. US Pacific Command in Hawaii held control of airpower in Barrel Roll, exercising direction through Pacific Air Forces and 7th Air Force in Saigon. Strike missions had to be approved by the ambassador. (See "Disunity of Command," January 2005, p. 34.)

The CIA had been operating in Laos since 1955, and in the absence of a US military presence, took the early lead in supporting the Vientiane government in the civil war. The Air America headquarters was at Udorn, but its paramilitary officers were with Vang Pao at Long Tieng and at other locations in Laos.

In May 1964, Air America pilots in T-28s with Laotian markings attacked targets on the PDJ. Some of the Water Pump pilots also secretly flew combat missions in support of the Laotian Army and Vang Pao's guerrillas.

Also in May, US jet aircraft began flying "Yankee Team" reconnaissance missions in Laos over the Ho Chi Minh Trail and the PDJ. Two of the aircraft were shot down over the PDJ, and Air Force F-100s struck an anti-aircraft site there in response.

Water Pump commandos, enlisted airmen, and nonrated officers performed as forward air controllers for air strikes in Laos from 1964 until the spring of 1967. Using the call sign "Butterfly," they flew in Air America aircraft, spotting targets for T-28s as well as for jet aircraft diverted from North Vietnam to targets in Laos.

Eventually, the Water Pump contingent was folded into Project 404, a program under which US military personnel wearing civilian clothes were assigned as additional "attaches" to the embassy in Vientiane.

Barrel Roll Begins

In August 1964, US ships in the Tonkin Gulf were attacked by North Vietnamese patrol boats. The Air Force moved into Southeast Asia in strength, and in November, a Viet Cong mortar attack at Bien Hoa, South Vietnam, killed four Americans and destroyed or damaged a number of aircraft.

Reprisal strikes, flown by Air Force and Navy aircraft against targets in the Laotian panhandle on Dec. 14, were designated Operation Barrel Roll. Rolling Thunder, the air war against North Vietnam, began in March 1965. In April, strikes against the Ho Chi Minh Trail in the Laotian panhandle were designated as Operation Steel Tiger.

From then on, "Barrel Roll" meant the air war in northern Laos. The term referred both to the operations and to the geographic area in which they were conducted.

The United States was fighting in four separate theaters. There was a basic "in-country" war in South Vietnam, an air war in North Vietnam, an air campaign against the Ho Chi Minh Trail, and the civil war in Laos. Of the four, Barrel Roll had the lowest priority. Some sorties were allocated specifically for Laos, but most of the Barrel Roll strikes were by fighters that had been diverted, by

At top, a USAF T-28 sits on the runway at Nakhom Phanom AB, Thailand. In April 1964, the US sent air commandos to train Laotian aircrews in counterinsurgency tactics and to assist with aircraft maintenance. Above, a PC-6 Turbo Porter sits among other aircraft at Udorn. These airplanes were flown by Air America in support of CIA operations.

Aircraft such as this O-1 performed forward air control tasks. Water Pump commandos, enlisted airmen, and nonrated officers served in the FAC role from 1964 until the spring of 1967.

weather or other reasons, from targets in North Vietnam.

Sullivan, the "field marshal," locked horns constantly with Gen. William W. Momyer, the commander of 7th Air Force from 1966 to 1968. Sullivan wanted more airpower dedicated to northern Laos. He also wanted a wing of propeller aircraft based at Nakhon Phanom Air Base in Thailand and placed under his operational control.

Momyer, who was as strong minded as Sullivan, refused. Momyer wanted central control of airpower to the extent possible. Others—especially the Army commanders in South Vietnam—were also clamoring for more air support. Until the bombing halt in North Vietnam in 1968, there were not enough sorties available to meet all demands.

Sullivan agreed with the view, prevalent among the air commandos, that propeller aircraft were better suited than jet aircraft for the war in Laos. Such vintage airplanes as the A-1 Skyraider had long loiter times, delivered close air support with great accuracy, and could fly from short airstrips. Air Force leaders believed that high-performance jet aircraft would be needed as the air defenses improved and anti-aircraft guns put slow movers at risk. Before it was over, nearly every kind of strike aircraft the Air Force had in Southeast Asia flew in Barrel Roll. Forty years later, the question of jet aircraft versus slow movers is still generating arguments.

The nonrated Butterfly FACs were replaced by Air Force pilots known by their call sign, "Raven." The Ravens were officially assigned to the special operations wing at Nakhon Phanom, but they were "on loan" to the air attache in Vientiane and flew from Long Tieng and other forward bases.

The Ravens wore civilian clothes, scorned traditional standards of discipline and behavior, and sometimes seemed to identify more with the Hmong and Air America than they did with the Air Force. They frequently grated on the nerves of the mainstream forces, but it was universally conceded that they were very good in the battle area. The Ravens worked both strikes by the Laotian T-28s—sometimes flying some of the missions themselves—and by US fighters.

In one of the stranger twists in a strange war, the chief of the Laotian Air Force led an air strike by 20 T-28s on the general staff headquarters near Vientiane in a befuddled takeover attempt in October 1966. It failed, and the general and his pilots fled to exile in Thailand.

Both sides had their innings in the ground war. In August 1966, Vang Pao pushed to Nam Bac, within 45 miles of the North Vietnamese border. In July 1967, the North Vietnamese struck Luang Prabang airfield, destroying about a dozen T-28s of the Laotian Air Force. The strategic situation remained a stalemate.

"It was, in effect, the sort of warfare the North Vietnamese were fighting against our American units in South Vietnam," Sullivan said. "On the map, it never showed any great permanent territorial gains, but it certainly prevented Hanoi from consolidating its annual effort into any lasting conquest."

Barrel Roll Intensifies

The war changed character in 1968. In the Tet Offensive in January, the North Vietnamese and Viet Cong attacked bases all over South Vietnam. In Laos, the North Vietnamese and Pathet Lao also stepped up the attack, overrunning Lima Site 85, a secret US Air Force radar bombing facility near the North Vietnamese border, on March 11. (See "The Fall of Lima Site 85," April, p. 66.)

Photo via Warren Thompson

This Laotian Air Force T-28 was based at Korat AB, Thailand. In late 1966, the LAF chief led a failed takeover of the general staff headquarters near Vientiane. He and his pilots then fled in exile to Thailand.

US Attack Sorties 1968-1973

Location	Nov 1968-July 1970		Aug 1970-March 1972		April 1972-Feb 1973		Total	
	Sorties	%Total	Sorties	%Total	Sorties	%Total	Sorties	% by country
South Vietnam	239,952	48.8%	38,767	18.8%	80,921	53.9%	359,640	42.4%
North Vietnam	867	0.2%	1,702	0.8%	44,431	29.6%	47,000	5.5%
Cambodia	9,266	1.9%	25,065	12.2%	5,479	3.6%	39,810	4.7%
Laos Steel Tiger	186,755	38%	118,038	57.4%	12,087	8.0%	316,880	37.4%
Laos Barrel Roll	54,986	11.2%	22,179	10.8%	7,251	4.8%	84,416	10.0%
Total	491,826		205,751		150,169		847,746	

Until the halt of US bombing of North Vietnam in 1968, only a handful of strike sorties were allocated to Barrel Roll. After the bombing halt, however, the number of strikes in northern Laos increased sharply, even though operations in South Vietnam and in the Laotian panhandle had a higher priority. With "Vietnamization," the war began winding down. There were fewer total sorties flown, but Barrel Roll continued to get a significant share of them until 1972, when the airpower effort was redirected to respond to North Vietnam's "Easter invasion." With the resumption of bombing of North Vietnam in April 1972, operations in northern Laos diminished.

Source: Col. Perry L. Lamy, Air War College, 1995.

President Johnson announced a partial halt to the bombing of North Vietnam March 31 and a complete halt on Nov. 1. The Air Force had some 700 attack aircraft at bases in Thailand and South Vietnam. Air strikes that would otherwise have been flown against North Vietnam could be diverted elsewhere.

Most of the suddenly available sorties were allocated to South Vietnam and to interdiction of the Ho Chi Minh Trail, but northern Laos also got a sharp increase. Between 1965 and 1968, US sorties in Barrel Roll had averaged 10 to 20 a day. The tempo then rose sharply, peaking at 300 sorties a day at one point in 1969.

The enemy was more formidable as well. North Vietnamese army strength in Laos varied, but reached 70,000 in 1969. Combined with the Pathet Lao, that amounted to a communist force total of about 110,000, including support troops and combat engineers.

In 1969, the North Vietnamese broke their pattern of retreating with the onset of the annual rainy season. In June, they captured the PDJ and put pressure on Vang Pao's base at Long Tieng. In August, supported by a surge of strike sorties, Vang Pao counterattacked in an operation called "About Face" and—for the first time since 1960—seized the entire PDJ. Holding it proved to be more than the Hmong could manage, though, and in January 1970, the North Vietnamese recaptured the PDJ.

As the enemy rushed reinforcements and equipment to the PDJ in early 1970, officials in Washington took alarm. "That threatened Souvanna and our relations with him," said Henry A. Kissinger, then the national security advisor. "If he abandoned his acquiescence in the bombing of the Ho Chi Minh Trail, Hanoi's logistic problem would be greatly eased, exposing us in South Vietnam to growing peril.

"Worse, if the North Vietnamese troops reached the Mekong, the war would lose its point for Thailand. Bangkok would then be under pressure along the hundreds of miles of the river dividing a plain without any other obstacles. We would almost certainly be denied use of the Thai air bases, essential for our B-52 and tactical air operations in Vietnam," Kissinger said.

For the first time, the United States used B-52 bombers in northern Laos, flying 36 sorties against North Vietnamese and Pathet Lao positions on the PDJ in February 1970. Nevertheless, the enemy remained strong enough to put Long Tieng under siege in March.

The CIA reinforced Vang Pao with mercenaries redeployed from southern Laos, and US and Laotian aircraft flew mission after mission against the enemy positions. Strikes by American gunships were especially effective. Two weeks later, the North Vietnamese and the Pathet Lao gave up the offensive and pulled back, lifting the pressure on the Long Tieng stronghold.

The Secret War Revealed

Eventually, the secrecy became preposterous. From 1968 to 1970, half of the US attack sorties flown in all of Southeast Asia were flown in Laos. Even though reports of the war popped up periodically in major newspapers, the government continued to deny it.

Reporters were seldom allowed to visit the bases in Thailand from which most of the Barrel Roll missions originated. Just in case, though, public information officers had a canned statement to read. "At the request of the Royal Laotian government, the United States has since 1964 been conducting reconnaissance flights over Laos escorted by armed aircraft," it said. "By agreement with the Laos government, the escort fighter aircraft may return fire if fired upon."

If a reporter should ask the Air Force about Air America, there was a canned response for that, too: "I suggest you ask Air America." The security was not perfect. Anyone looking at the Udorn base newspaper, for example, could determine the placement of the Air America bowling team in the league standings.

After the 1968 elections brought a Republican Administration to office, Congress—which had been in on the secret all along—began clamoring for disclosure.

"We have been at war in Laos for years, and it is time the American people knew more of the facts," Sen. Stuart Symington (D-Mo.) said in 1969. Symington had previously visited Nakhon Phanom and other bases in Thailand and was fully briefed.

"This was the culmination of a campaign extending over many months in the Senate and in the media to get at the 'truth' in Laos," Kissinger said. "The issue was not to obtain the facts—they were widely known—but to induce the government to confirm them publicly, which was quite a different matter. The Senate Foreign Relations Committee had substantially full knowledge from its staff investigations as well as from its classified hearings. Similarly, the

Photo via Warren Thompson

In the background, a T-28 is silhouetted against the darkening sky. In July 1967, the North Vietnamese struck Luang Prabang airfield, destroying about a dozen T-28s belonging to the Laotian Air Force.

media had given the public a reasonably accurate picture. The issue for us was to what extent an official acknowledgment of our operations in Laos would wreck what was left of the 1962 accords, give Hanoi a pretext for further stepping up its aggression in northern Laos, and fuel even more passionate controversy at home. Our role in Laos had been 'secret' in three Administrations of two parties precisely because each President wanted to keep it limited."

On March 6, 1970, President Nixon issued a lengthy statement on "the situation in Laos," in which he acknowledged that US aircraft were flying combat missions in northern Laos and against the Ho Chi Minh Trail in the Laotian panhandle.

The White House staff got some of their facts wrong in the statement, which said that no American stationed in Laos had ever been killed in ground combat. As it turned out, some 27 Americans had been killed there in the past year alone. The story of the secret war was finally out, but the controversy was far from over.

End of the Line

Vang Pao and the Hmong launched their last major offensive with the onset of the rainy season of 1971. Aided by Thai mercenaries paid by the CIA, they captured the PDJ in July, only to lose it again to the North Vietnamese in December. It no longer mattered in the long run because the war was on a downhill slide.

The United States, having adopted a policy of "Vietnamization," was steadily turning responsibility for the war over to the South Vietnamese government and drawing down its own forces in Southeast Asia. In 1971, only half as many US strike sorties were available as had been in 1969.

The war moved into its final phase with the North Vietnamese Army's "Easter invasion" of the south in 1972. Some of the US aircraft that had left the theater returned, but that did not mean an increase in sorties for Barrel Roll. The bombing of North Vietnam resumed with Operation Linebacker I in May 1972, creating a new priority that further reduced the allocation of airpower for Laos. The Linebacker II bombing of Hanoi and Haiphong pushed the peace talks toward their conclusion.

Laos was supposedly provided for in the Paris peace agreement, signed Jan. 27, 1973. Both sides promised to respect the 1962 Geneva accords and withdraw their troops from Laos. Souvanna Phouma and the Pathet Lao set Feb. 22 as the date for the cease-fire to take effect.

As before, the United States stopped its bombing operations on schedule and the North Vietnamese violated the truce. At Souvanna's request, US aircraft flew several more support strikes, but the final missions were against targets south of the PDJ on April 17.

Operation Barrel Roll was over. During its nine-year run, 131 US military aircraft had been lost in northern Laos. Air America operations continued until June 1974.

A coalition government was set up in Vientiane with Souvanna Phouma as its head, but that was a temporary expedient. When the North Vietnamese moved into Saigon for their final victory in 1975, the Pathet Lao—supported by more than 50,000 North Vietnamese troops who were still in Laos—seized power.

Souvanna Phouma "retired." King Savang Vatthana abdicated, bringing the 600-year-old Laotian monarchy to an end. It was replaced Dec. 2, 1975 by the Lao People's Democratic Republic. Officials of the former government were sent to labor camps for "re-education." Military personnel above the rank of lieutenant were considered war criminals. Vast numbers of Hmong crowded into refugee camps in Thailand. Vang Pao, flown out on an American C-130, came to the United States, living first in Montana and then in California.

Air America went out of business June 30, 1976. Upon its liquidation, the CIA returned more than $20 million to the US Treasury.

Aftermath in Laos

The new regime in Laos ruled with communist fervor. The practice of Buddhism was curtailed in 1976. Even today, monks get political training to ensure their teaching is in step with government policy.

In 1977, the former king and his family were imprisoned in a cave in a remote area of Laos. They later died there from lack of adequate food and medical care.

In 1987 and 1988, Laos and Thailand fought a three-month border war, but tensions have since eased between the two nations.

A remnant of the Hmong forces, living in the mountains near the Plain of Jars, carries on an insurgent resistance against the Pathet Lao regime. The government has periodically conducted reprisals.

Unexploded bombs from the war are a hazard on the Plain of Jars, but parts of the PDJ have become a tourist attraction where visitors can see hundreds of the ancient stone jars that are still there. ■

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THE FAMOUS FLYING Lockheed Brothers

The three inventive brothers got things rolling in the 1920s and 1930s. Then they checked out.

Charles A. Lindbergh's 1927 New York-to-Paris flight produced an explosion of aviation activity, as designers brought forth a multitude of new and sometimes very unusual aircraft. One of these was the Vega, which made its first flight within two months of the historic transatlantic flight.

There was a stark contrast between Lindbergh's airplane, *Spirit of St. Louis*, and the Vega. Lindbergh's airplane, a highly modified version of the Mahoney-Ryan M-2, was from a bygone era. It combined a conventional steel-tube-and-fabric fuselage with a wood-and-fabric wing, held together with drag-inducing struts. In contrast, the streamlined, all-wood Vega sported a cantilever wing and a molded, partially load-bearing fuselage.

The basic Vega design would be transmuted into a series of remarkable aircraft. Moreover, the Vega introduced a new aviation company with an odd slogan: "It takes a Lockheed to beat a Lockheed."

The leader of this new firm was Allan H. Lockheed, one of three brothers who would become major American industrialists. These three—Allan and his brothers Victor and Malcolm—all began life with the surname "Loughead." Its origin was Scottish, but it was spelled in the Irish manner and was pronounced as "lock-heed." The pronunciation never changed, but the spelling changed twice. Victor was the first to adopt a new spelling; he went with "Lougheed." Only much later in life did Allan and Malcolm change the spelling to "Lockheed." (To simplify matters, the name hereinafter is spelled Lockheed.)

Victor was an automotive engineer, but he made his aviation bones as a writer, creating a stir with his 1909 *Vehicles of the Air.* In 1912, he published a second book, *Aeroplane Designing for Amateurs.* Victor also designed the Taft-Pierce-Lockheed V-8 engine, in 1911. The engine is now on display at the National Air and Space Museum's Udvar-Hazy facility in Chantilly, Va., just outside Washington, D.C. Later in life, Victor was editor of *Motor* magazine and continued working in aviation.

Malcolm and Allan began their working lives in San Francisco. Both were fascinated by automobiles. Malcolm started out in 1904 working for the White Steam Car distributor, where he conceived and later patented the hydraulic four-wheel

By Walter J. Boyne

Malcolm Lockheed (l) and Allan Lockheed take the controls of an early Lockheed flying boat. Three Lockheed brothers—Allan, Malcolm, and Victor—began their careers in aviation in San Francisco just after the turn of the century.

brake. Allan in 1906 went to work in a San Francisco automobile repair shop. He was adept behind the wheel and was hired by the Corbin automobile firm to demonstrate their cars in hill-climbing exhibitions.

Enter the Airplane

Meanwhile, Victor had been commissioned by an investor, James E. Plew, to obtain the rights to a tandem-wing glider. Plew's goal was to install an engine and thus create a powered aircraft to sell. He also ordered Victor to buy a Curtiss biplane. Victor enlisted Allan to work on the two-aircraft fleet in Chicago. Victor later had a long falling out with the other brothers. They reconciled shortly before his death in 1943.

Allan Lockheed, however, soon discovered the infeasibility of installing an engine in the glider, and he concentrated on making the Curtiss biplane airworthy. He also learned to fly in the same manner that he was to use designing airplanes—he just did it, without any formal training. Plew purchased a second Curtiss, and Allan, a natural pilot, soon became a featured performer at air shows.

Neither Allan nor Malcolm was an engineer, but both were craftsmen, and inevitably they began to build aircraft of their own. Their first, the Lockheed Model G, was the largest seaplane yet built in America. The Model G was fabricated in a garage near the San Francisco waterfront and made its first flight on June 15, 1913. That was the start of a long series of Lockheed successes.

Because it was the only aircraft flying in the Bay Area, the Model G created quite a sensation. The three-place biplane made lots of money for its owners. During the 1915 Panama-Pacific Exposition, the Lockheed brothers grossed $6,000 carrying more than 600 passengers.

Soon, Allan and Malcolm formed the Lockheed Aircraft Manufacturing Co. in Santa Barbara, Calif., and used the Model G to generate income while they concentrated on their second design, the F-1. It was an even larger flying boat. With twin engines, it was able to carry a pilot and nine passengers.

For this venture, the Lockheeds enjoyed some good fortune: They acquired the talents of 20-year-old engineer-draftsman Jack K. Northrop. (See "The Low-Drag World of Jack Northrop," October 2005, p. 76.) Another good hire was Anthony Stadlman, who later would loom large in Lockheed Aircraft Corp.

The F-1 was promising, and America's April 1917 entry into World War II prompted the brothers to seek a Navy contract for mass production. Allan went to Washington where he succeeded in impressing Lt. Cmdr. Jerome Hunsaker, then running the Navy's aircraft engineering section. Hunsaker authorized a Navy test program for the F-1 and gave Allan a contract to build two Curtiss HS-2L flying boats under license.

The small Lockheed plant was humming within a few months. The F-1 made a nonstop flight to San Diego on April 12, 1918, and work on the Curtiss boats proceeded smoothly.

Armistice and Pain

The Nov. 11, 1918 Armistice dashed hopes for larger contracts. However, the F-1 was converted to a land airplane for an unsuccessful attempt at a transcontinental flight. Rebuilt as a flying boat, it continued to make money for the Lockheeds, carrying sightseers and working with the movie industry.

Allan and Malcolm Lockheed, Northrop, and Stadlman joined forces to forge a new manufacturing method. The goal was to build a streamlined aircraft, eventually to be called the S-1, in large quantities and at low cost. Their concept featured use of a concrete mold in the shape of a fuselage half. Laminated, spiral strips of vertical grain spruce were placed in three layers into the mold. Each ply was coated with waterproof casein glue and bonded for hours under immense pressure. The two halves from the mold were connected to create a fuselage.

After designing and building their own engine, the brothers found that they had invested $30,000 in the S-1. It flew well, but it was too expensive to compete with the hundreds of cheap, war-surplus Curtiss Jennys and Standard trainers flooding the postwar market.

Thus ended the first Lockheed venture. Malcolm packed up and headed east to sell his patented hydraulic four-wheel brakes. He eventually sold the patent to Bendix Corp. Allan worked as the California distributor of his brother's brakes. He also dabbled in real estate.

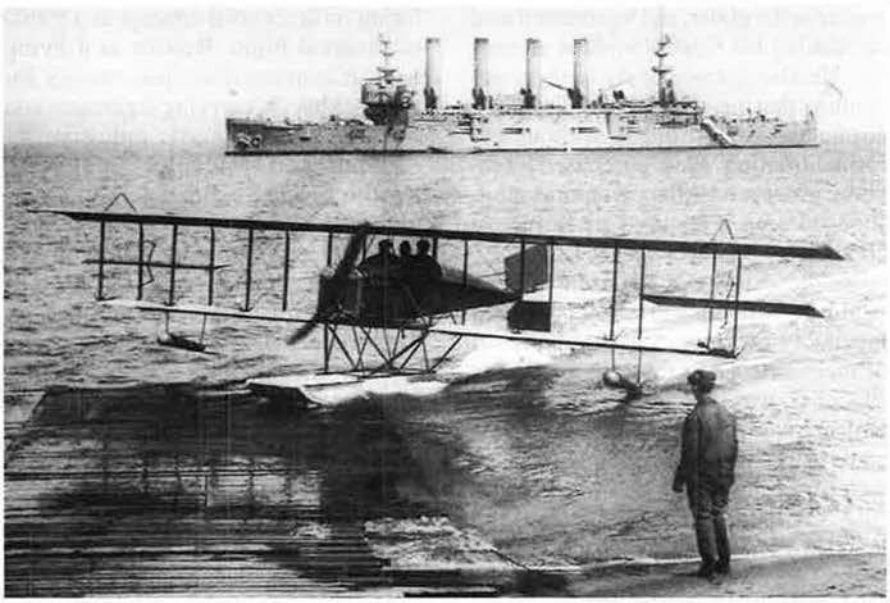
In 1926, however, Allan returned to aviation. He organized a new firm, the Lockheed Aircraft Corp., and set about building what would become the Vega. Allan's timing for the Vega was as good as the timing for the S-1 had been bad.

He had several factors working for him. First was the arrival of the Wright Whirlwind air-cooled radial engine. Second was the boom in the stock market, which made it easy to acquire financing for his venture. Third, Jack Northrop, who had been working at Douglas and moonlighting at Ryan, once again became available and joined Lockheed.

Northrop and Lockheed believed that the manufacturing techniques they had patented for their S-1 could be revived for an entirely new airplane. The molds could turn out six shells, or three fuselages, per week.

Extremely light and strong, the fuselage could accommodate engines of as much as 715 horsepower. It was clean and adaptable; one could cut virtually anywhere to create access hatches, doors, and so forth. Although

Photos courtesy of Walter Boyne



The Lockheed Model G, shown here, was the largest seaplane built in America at the time. Allan and Malcolm gave rides to paying customers to raise money for their next project, the F-1.

the fuselage had a standard length and diameter—for Lockheed had only the one mold—it was adaptable to a wide variety of wing placements, cockpit positions, and undercarriage types.

The Price of Adulation

On May 25, 1927, pineapple tycoon James D. Dole announced a pair of prizes: $25,000 for the first aircraft to fly from North America to Honolulu, and $10,000 for the second to make the flight. Coming just after Lindbergh's triumph, the announcement threw a barrel of gasoline on the aviation bonfire. The prize money was attractive, but what the contestants thirsted for was a taste of the adulation heaped on Lindbergh.

In their zeal to compete, many "Dole Derby" entrants overlooked a basic fact: No matter what kind of navigator he was, Lindbergh could hardly have missed Europe altogether. That was not the case with the Dole Derby contestants. They were launching from the US West Coast toward a tiny volcanic speck in the Pacific Ocean 2,439 miles away. Even a minor navigational error would prove disastrous.

Allan Lockheed wasn't wild about such a hazardous flight, but he remembered how quickly the S-1 project had swallowed up his $30,000. Thus he was quick to take advantage of an offer from George Hearst, son of the newspaper baron William Randolph Hearst, to buy the prototype Vega for $12,500. The airplane had cost $17,500 to build. However, the Vega's appearance in the Dole Derby would bring publicity on a scale that only a Hearst could provide.

Everywhere, it seemed, the Vega was featured in newspaper articles, many with cutaway drawings showing all of the expensive navigation, communication, and safety equipment installed for the flight. Orders began pouring in.

Hearst hired two competent airmen, pilot John W. Frost and navigator Gordon Scott, to crew the airplane, which was dubbed *Golden Eagle*. Tragically, the brand-new Vega disappeared on the flight, and its fate has never been learned. The Dole race cost many other lives as well and became a symbol of America's aviation hubris.

Despite the loss of the prototype in the Derby, the Vega itself became an instant sales success. Moreover, bad publicity from the loss of *Golden Eagle* was quickly offset by a long series of other famous flights.

Capt. George H. Wilkins ordered a Vega after seeing test flights of the prototype and partnered with Alaskan airmail pilot Carl B. Eielson to make an epic, danger-filled trans-Arctic journey in April 1928. The two flew from Point Barrow in northern Alaska across the Arctic to Spitzbergen, north of Norway. Wilkins was knighted, and Eielson was awarded the Harmon Trophy and the Distinguished Flying Cross. They proclaimed the advantages of the Vega's speed, strength, and comfort, and Lockheed was established as a going concern.

Ultimately, 129 Vegas were built, and they were flown by almost every famous American aviator of the time. Amelia Earhart in 1932 crossed the Atlantic in her bright red Vega. Other women pilots, including Bobbi Trout and Ruth Nichols, used the Vega to set records.

Record Speeds

Wiley H. Post flew a Vega on two epic round-the-world flights, the first in 1931 with Harold Gatty as navigator and the second a solo endeavor in 1933. Both flights were in a Vega he named *Winnie Mae*. Post reached speeds of 340 mph—far more than Allan Lockheed or Northrop had ever envisaged for the Vega.

Besides setting records, Vegas were used as airliners, for corporate flying,

The Lockheed Vega (above) was an instant success and eventually was flown by almost every famous American aviator of the day. The versatile airplane also was used as an airliner and an air ambulance.

and as air ambulances. Both Earhart's and Post's Vegas can be seen in the National Air and Space Museum.

Several variations of the basic Vega construct followed. One, the XP-900, was purchased by the Air Corps as the YP-24. It combined a new metal fuselage, a Curtiss engine, and the standard Lockheed wing and provided a top speed of 214 mph in 1931.

Under Allan Lockheed's guidance, the firm had done so well that it attracted the attention of the Detroit Aircraft Corp. (DAC), which proclaimed its intention to become the "General Motors of the air."

The Lockheed company had been changing through its success. Northrop left in June 1928. Lockheed's major financial backer, Fred Keeler, sought to make a huge profit by selling the company to the DAC. Unwilling to see the firm sold, Allan Lockheed himself left in 1929.

As it turned out, Keeler's sell-now instinct was dead on. Within three months of the sale came the stock market crash of October 1929 and the onset of the Great Depression, which sent the ambitious DAC holding company spiraling downward. Even in the Depression, the Lockheed Division of DAC continued to make a profit, but it could not save the overextended parent firm. DAC went into receivership in 1931, and, despite continuing sales and profits, Lockheed closed its doors on June 16, 1932.

On June 21, 1932, a consortium headed up by Robert E. Gross purchased the assets and the company started a new life, which continues to this day under the name Lockheed Martin Corp.

Gross determined that, although the new firm would for a while continue to construct the wooden Lockheeds, it would in the future concentrate on all-metal aircraft. There would be no place for Allan Lockheed.

After the original firm had been acquired by Detroit Aircraft in 1929, Allan had set up a new firm, the Allan Lockheed Corp. Working with some of his former associates, Allan created a new aircraft, the Olympic Duo-4.

The Olympic Duo-4 was essentially a Vega with twin Menasco engines mounted in a novel fashion. The two 275 hp engines were installed on their side and spaced with only 12 inches of clearance between their propellers. Allan's goal was to provide twin-engine reliability.

The airplane flew quite well, but it encountered considerable bad luck. It flew for the first time on March 18, 1931 and was lost when it collided with a photographic truck at the side of the runway. Allan gamely rebuilt it with bigger engines, but he sold none of this new type.

Photo courtesy of Walter Boyne

In 1937, Allan Lockheed formed the Alcor Aircraft Corp., in Oakland, Calif., to create a sleek new aircraft, the Alcor C.6.1 (shown here). This was the last airplane designed by a Lockheed brother. It was destroyed in a testing accident.

One More Try

In 1937, he formed the Alcor Aircraft Corp. in Oakland, Calif. Allan believed that there was a market for a twin-engine six-passenger feeder airliner. He brought Stadlman back into the company and hired Harold E. Webb as chief engineer.

They created a sleek, almost futuristic new aircraft, naming it the Alcor C.6.1. Despite its modern looks, the new airplane retained the conventional Lockheed wooden construction that had served so well for the Vega and its variants. This time, Allan designed a circular fuselage. The C.6.1 was tested extensively.

Allan Lockheed went to Washington to drum up some military sales, leaving behind strict orders that the airplane was not to be flown. Casserly and Webb nonetheless decided to make another test flight. The goal was to climb to 16,000 feet, then dive at a maximum speed of 300 mph before leveling out for the return flight home. During the dive, the left aileron ripped off and the two men were forced to bail out. Allan Lockheed's last airplane spiraled down, making several full circles before striking the surface of San Francisco Bay in such a flat attitude that it skipped like a well-thrown stone, tearing itself further apart with each skip.

The impact was described by one observer as "like a salvo of 16-inch shells." Both men survived with minor injuries, but it was the end of the road for Alcor—and for Allan Lockheed's attempts at producing aircraft.

Neither Malcolm nor Allan Lockheed took much consolation in their past achievements. Both constantly sought the next great opportunity, hoping to relive some of the passion of their early days. It was not to be.

Malcolm had sold his interest in his hydraulic brake firm for a good sum, but he evidently made poor investments. He tried gold mining, but turned to public assistance before his death on Aug. 13, 1958. Allan resumed selling real estate and consulting in aviation and maintained informal ties with the ever-growing Lockheed aeronautics firm. He died on May 28, 1969.

By that time, the firm that bore the Lockheed name had become an American giant. ■

Walter J. Boyne is a contributing editor of Air Force *Magazine. He is a former director of the National Air and Space Museum in Washington, is a retired Air Force colonel, and author. He has written more than 600 articles about aviation topics and 40 books, the most recent of which is* Roaring Thunder. *His most recent article for* Air Force *Magazine, "A Tale of Two Bombers," appeared in the July issue.*

Verbatim

By John T. Correll, Contributing Editor

Bad Force and Its Buddy

"To identify an organization truly unwilling to change, we need to look no further than Rumsfeld's beloved Air Force. Far from driving 'transformation' as he claims, the Defense Secretary has continued to buy hyper-expensive, virtually useless aircraft that were conceived in the 1980s to combat the Soviet Air Force. Rumsfeld's transformation program boils down to reducing our ground forces—the soldiers and marines who rescued him from a fiasco in Iraq, where progress has been made despite his incompetence—in order to send massive welfare checks to the defense industry."***—Ralph Peters, who bills himself as "a retired Army officer, strategist, columnist, and the author of 21 books,"*** **Washington Monthly,** ***June 2006.***

Forward Pass

"The war began on my watch—but it's going to end on your watch."***—President Bush, West Point commencement address, May 27.***

One of Each

"We have one Army, one Air Force, one Marine Corps, one Navy. To divide our Air Force, to divide our Army by having an additional member of the Joint Chiefs who represents a segment of both of those services would do a disservice."***—Marine Corps Gen. Peter Pace, Chairman of the Joint Chiefs of Staff, on proposal to make the director of the National Guard a member of the JCS,*** **The Hill,** ***May 18.***

Defensive and Peaceful

"China's military is defensive in nature, and we have no history of invading other countries and do not pose a threat to other countries. The US, as the world's largest military power, has no reason to criticize China on this issue."***—Chinese Foreign Ministry spokesman Liu Jianchao, Associated Press, June 6.***

Even More Peaceful

"We have not threatened to use force, nor have we used force against any country or government in the past 250 years. We've never done that in the past, and we'll never do it in the future. We wonder whether Israel or the United States can make the same statement."***—M.A. Mohammadi, press officer, Iranian Mission to the UN, letter to the*** **Washington Post,** ***June 12.***

Nix to Hicks

"Terror? What Terror? Feds Slash Our Funds to Boost Hicks in Sticks."**—New York Post** ***headline after 40 percent cut in 2006 counterterrorism funding for New York and Washington while funding was increased for other locations, June 1.***

That Airplane Looks Familiar

"During my first tour as Secretary of Defense in the mid-1970s, controversy engulfed the B-1 program. I actually approved the B-1 bomber back in the mid-1970s, and then it was canceled by the next Administration, but it was revived by the Administration after that. And interestingly, during the first months of Operation Eudring Freedom in 2001, that platform—the B-1B—that I had approved in 1976 and was designed for the Cold War nuclear strikes—dropped 40 percent of the weapons and 70 percent of the precision munitions that helped to defeat the Taliban and the al Qaeda in Afghanistan 25 years later."***—Secretary of Defense Donald H. Rumsfeld, Air Force Academy commencement, May 31.***

Love One Another

"What is most important for our country? The Defense Ministry knows what is most important. Indeed, what I want to talk about is love, women, children."***—Russian President Vladimir Putin, expressing alarm about a drop in the Russian population, offering cash incentives for women having more than one child, to fill the future ranks of the Russian armed forces, State of the Nation address, May 11.***

Flippin' Nightmare

"There would be a flippin' nightmare there shortly after a precipitous withdrawal."***—Ret. Army Gen. Barry McCaffrey on consequences of pulling US troops out of Iraq too quickly,*** **Atlanta Journal-Constitution,** ***May 31.***

NATO's Global Challenge

"If you look at the threats and challenges coming to NATO, these are of a global nature. Terrorism is of a global nature. Weapons of mass destruction proliferation is a global threat. Failed and failing states are happening on a global scale. ... NATO needs global partners to face those challenges."***—NATO Secretary-General Jaap de Hoop Scheffer,*** **Wall Street Journal,** ***June 13.***

No Scarf, No Goggles

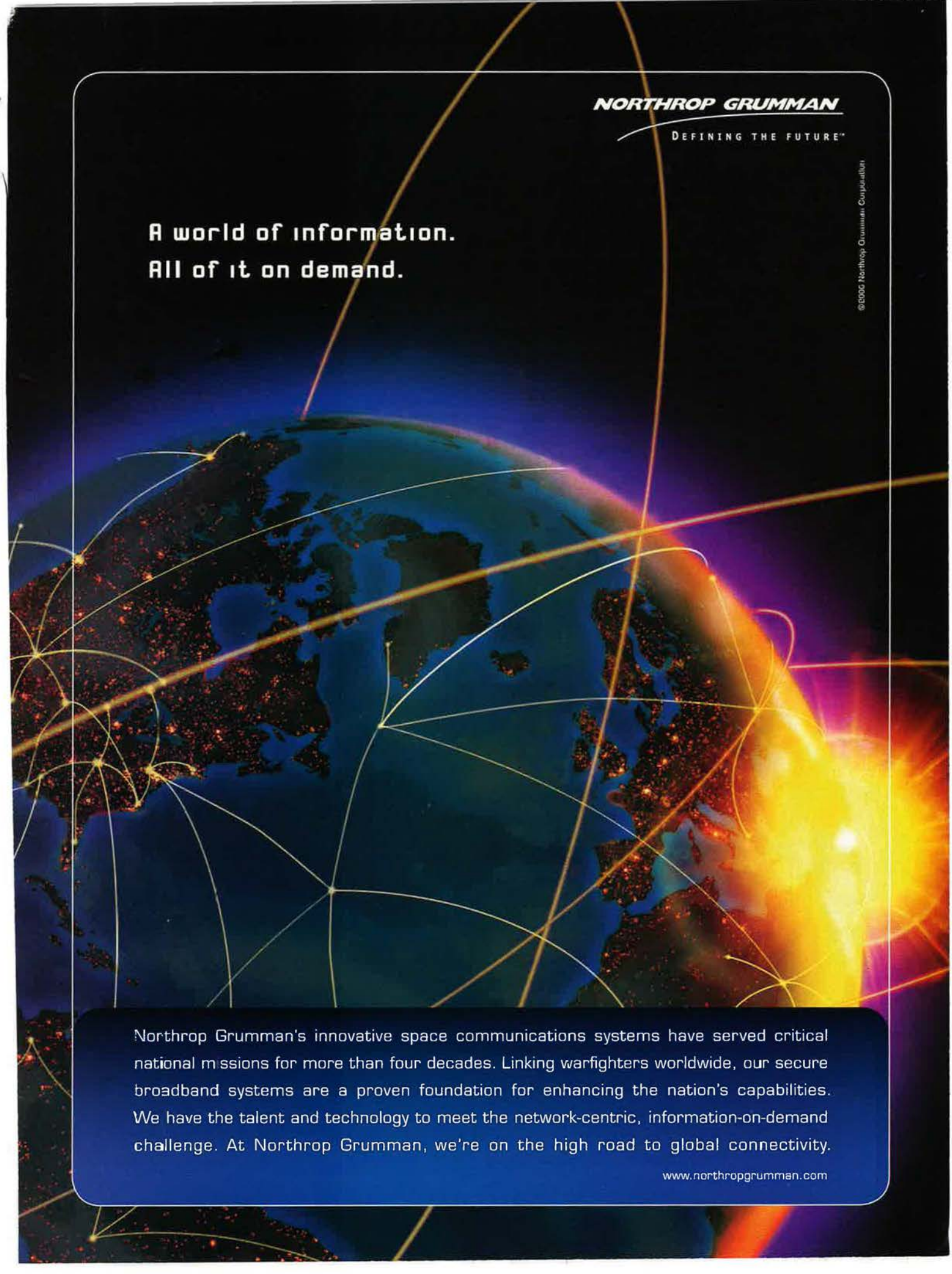
"Military aviation has never been about Top Gun, it's never been about glamour, it's never been about looking good at air shows. It's been about taking that machine and utilizing it as a weapon more effectively than the enemy. People will come around."***—USAF Col. John Harris, combat pilot and former commander of Predator operations, about unmanned aircraft and Air Force culture, London's*** **Daily Telegraph,** ***June 2.***

Destabilizing

"There is great concern this could be destabilizing in terms of deterrence and nuclear policy. It would be hard to determine if a missile coming out a Trident submarine is conventional or nuclear."***—Sen. Jack Reed (D-R.I.), member of the Senate Armed Services Committee, on proposal for a conventionally armed Trident II missile for fast global strike on time-urgent targets,*** **New York Times,** ***May 29.***

Rationale for Conventional Trident

"This really is a small, quick-strike capability. Why would you want it? So that you can respond within 60 minutes or so to something at very long ranges, very precisely, assuming you have very precise knowledge."***—Adm. Edmund P. Giambastiani, Vice Chairman of the Joint Chiefs of Staff, on requirement for conventionally armed Trident II, American Forces Press Service, June 8.*** ■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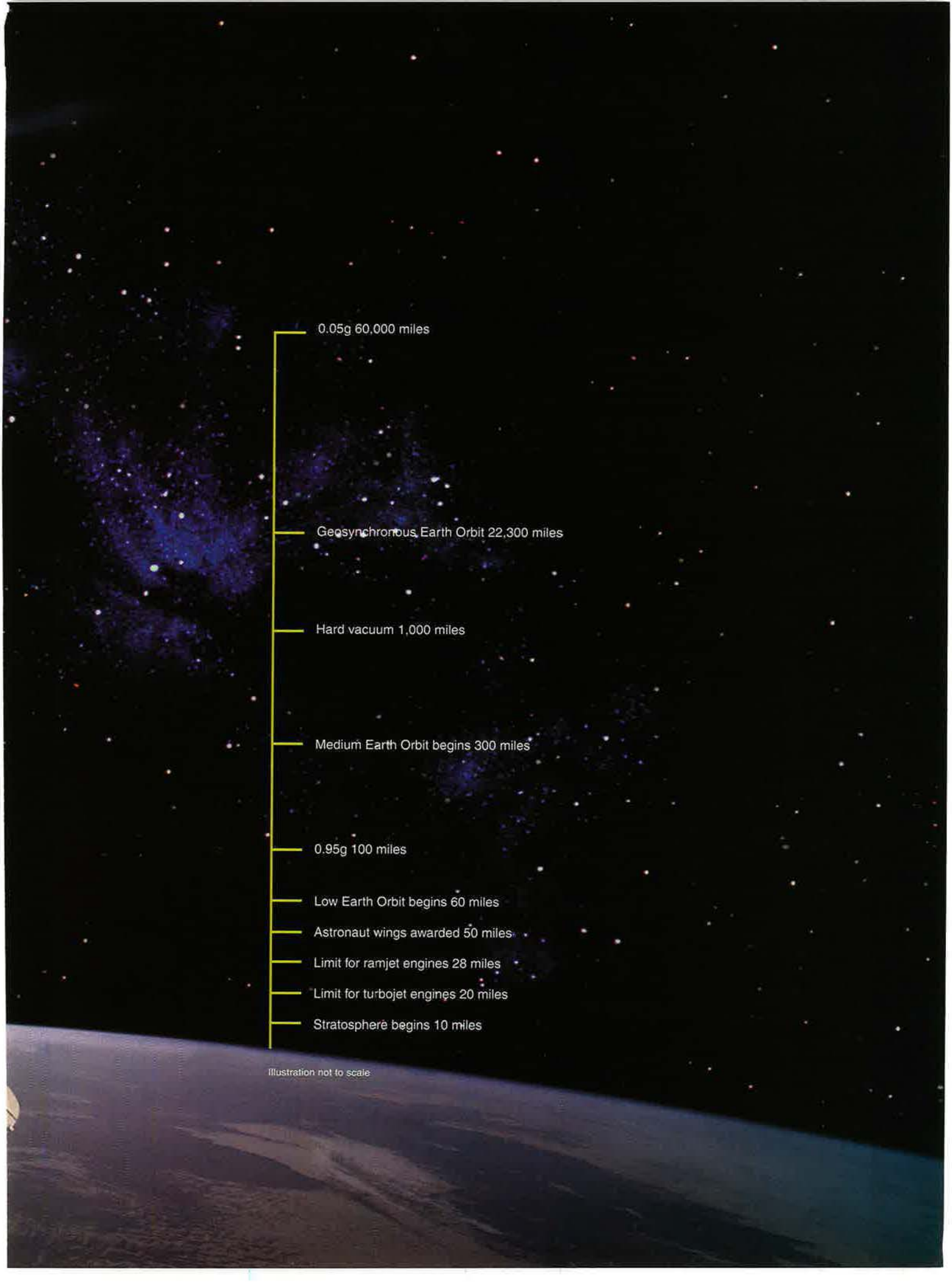
2006 Space Almanac

The US military space operation n facts and figures.

Compiled by **Tamar A. Mehuron,** Associate Editcr, and the staff of *Air Force* Magazine

Artist's conception by Erik Simonsen


0.05g 60,000 miles
Geosynchronous Earth Orbit 22,300 miles
Hard vacuum 1,000 miles
Medium Earth Orbit begins 300 miles
0.95g 100 miles
Low Earth Orbit begins 60 miles
Astronaut wings awarded 50 miles
Limit for ramjet engines 28 miles
Limit for turbojet engines 20 miles
Stratosphere begins 10 miles
Illustration not to scale

US Military Missions in Space

Space Force Support
Launch of satellites and other high-value payloads into space and operation of those satellites through a worldwide network of ground stations.

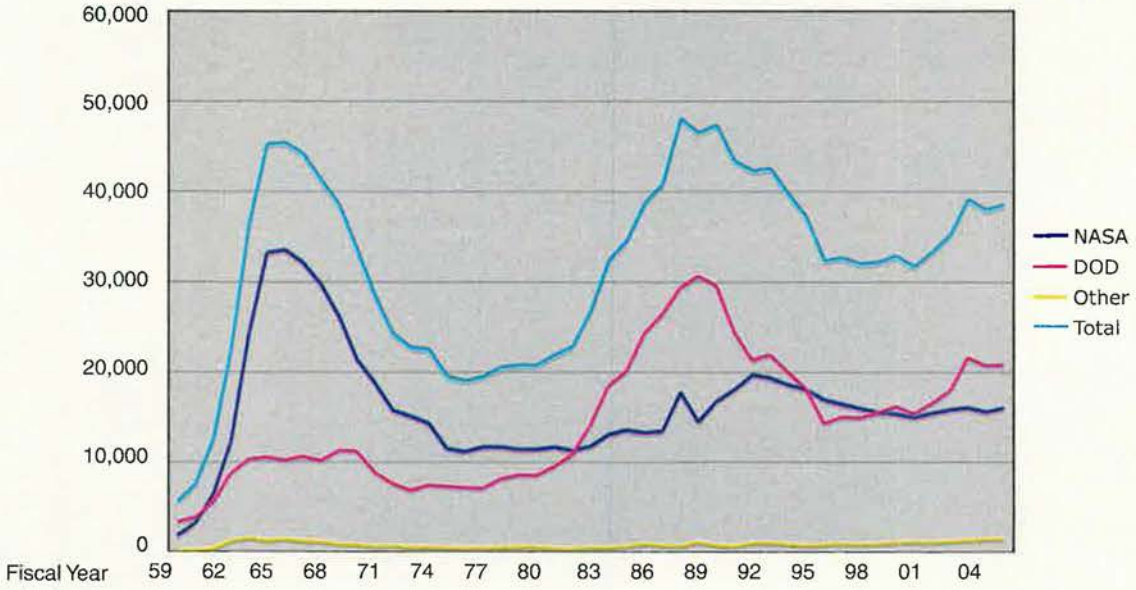
Space Force Enhancement
Provide satellite communications, navigation, weather, missile warning, and intelligence to the warfighter.

Space Control
Assure US access to and freedom of operation in space and deny enemies the use of space.

Space Force Application
Pursue research and development of capabilities for the probable application of combat operations in, through, and from space to influence the course and outcome of conflict.

US Space Funding

Millions of constant Fiscal 2007 dollars



Fiscal Year	NASA	DOD	Other	Total
1959	1,841	3,457	240	5,538
1960	3,205	3,892	298	7,395
1961	6,360	5,591	467	0
1962	12,221	8,827	1,353	22,401
1963	24,342	10,406	1,725	36,473
1964	33,241	10,597	1,412	45,250
1965	33,514	10,267	1,572	45,352
1966	32,106	10,706	1,357	44,169
1967	29,696	10,231	1,310	41,237
1968	26,139	11,341	1,028	38,508
1969	21,376	11,258	953	33,587
1970	18,768	8,879	746	28,393
1971	15,717	7,663	821	24,201
1972	15,082	6,910	655	22,647
1973	14,303	7,505	681	22,490
1974	11,494	7,357	658	19,510
1975	11,131	7,225	602	18,959
1976	11,640	7,157	607	19,405
1977	11,658	8,174	656	20,488
1978	11,411	8,624	712	20,747
1979	11,404	8,591	702	20,698
1980	11,668	9,594	576	21,839
1981	11,284	10,913	530	22,727
1982	11,766	14,216	666	26,648
1983	13,051	18,601	675	32,327
1984	13,561	20,160	781	34,502
1985	13,218	24,371	1,114	38,703
1986	13,421	26,460	893	40,774
1987	17,735	29,448	842	48,025
1988	14,454	30,706	1,287	46,447
1989	16,734	29,675	928	47,337
1990	18,019	24,554	795	43,369
1991	19,686	21,399	1,165	42,251
1992	19,337	22,009	1,169	42,515
1993	18,582	20,064	1,040	39,686
1994	18,053	18,253	877	37,182
1995	16,915	14,354	1,023	32,293
1996	16,457	15,075	1,084	32,616
1997	15,943	15,009	1,010	31,963
1998	15,521	15,569	1,058	32,147
1999	15,357	16,274	1,210	32,841
2000	14,926	15,426	1,258	31,611
2001	15,427	16,612	1,231	33,271
2002	15,831	17,965	1,365	35,161
2003	16,021	21,631	1,456	39,108
2004	15,559	20,765	1,590	37,914
2005	16,016	20,846	1,627	38,489
2006	16,085	21,724	1,672	39,481
Total	**$777,280**	**$706,332**	**$47,478**	**$1,531,090**

The Year in Space

July 22, 2005
Donald M. Kerr, former CIA official, takes charge of the National Reconnaissance Office ... Breaks 44-year tradition of Air Force undersecretary leading NRO.
July 29 Ronald M. Sega confirmed as new Air Force undersecretary ... Also serves as DOD executive agent for space.
September
Air Force Space Command provides unique low-light imagery from Defense Meteorological Satellite Program satellites to aid Hurricane Katrina recovery efforts.
Sept. 12
NRO lifts veil on Cold War electronic intelligence satellite called Poppy ... First launched in early 1960s ... Used to detect radar emissions from Soviet naval vessels.
Sept. 20
Two Russian GLONASS operators visit their Global Positioning System satellite counterparts at Schriever AFB, Colo. ... Landmark visit included discussion for possible integration of the two navigation and timing satellite systems.
Sept. 25
USAF launches first modernized GPS satellite ... GPS IIR-M is first in a series of eight GPS IIR satellites to be built by Lockheed Martin.
Sept. 29
USAF C-17 drops dummy QuickReach booster out its rear cargo door at 6,000 feet ... Test proves the 65.8-foot, 50,000-pound dummy would clear the aircraft.
Oct. 3
Air Force creates a new position—assistant to the Secretary of the Air Force for intelligence space technology—for NRO Director Donald Kerr.
Oct. 19
USAF launches last of Titan IVB heavy-lift expendable launch vehicles ... Launching from Vandenberg AFB, Calif., the Titan boosts a classified NRO payload into orbit.
Oct. 20
At Onizuka AFS, Calif., Air Force powers down Satellite Operations Center-52—better known as the "Blue Cube" ... Marks end of 36 years of 24-hour satellite command and control from Onizuka.
Oct. 24
Air Force Research Lab's Space Vehicles Directorate says a 220-pound microsatellite has rendezvoused several times with a Minotaur I launch vehicle upper stage.
Oct. 27
Iran launches its first satellite ... Built by Iran and Russia.
Nov. 1
Gen. Lance W. Lord, commander of Air Force Space Command, authorizes wear of a new space badge ... Goes to officer and enlisted space operators and acquisition personnel, replacing the space and missile badge and "pocket rocket" missile operator badge.
Dec. 28
Russian rocket boosts into orbit the first satellite that will form the European Union's Galileo global navigation system.
Feb. 23, 2006
Arnold Engineering and Development Center, Arnold AFB, Tenn., issues a request for information seeking industry input for creation of a Space Threat Assessment Test Bed.
March 8
AFSPC changes name of the Space Warfare Center at Schriever AFB, Colo., to the Space Innovation and Development Center.
March 10
AFSPC activates a unique space unit—the 3rd Space Experimentation Squadron—under the newly renamed SIDC ... Mission of 3rd SES is to develop operational concepts for space systems.
April 1
Gen. Lance W. Lord, AFSPC commander, retires from the Air Force after 37 years of service.
April 14
AFSPC's 527th Space Aggressor Squadron at Schriever AFB, Colo., is realigned to Air Combat Command ... Unit devises simulated attacks on space systems.
April 24
Space and Missile Systems Center at Los Angeles AFB, Calif., dedicates its new home as the Schriever Space Complex.
April 24
AFSPC marks 10th anniversary of the Midcourse Space Experiment satellite, a key space-based surveillance asset, since AFSPC took it over in 2000 from Ballistic Missile Defense Organization.
June 26
Gen. Kevin P. Chilton, former astronaut, takes command of Air Force Space Command.

Space and Missile Badges

CURRENT

Space Badge

Astronaut

Missile Badge

HISTORICAL

Space/Missile Badge

Missile Badge With Operations Designator

Air Force Space Command, Peterson AFB, Colo.

(As of July 1, 2006)

Commander
Gen. Kevin P. Chilton

14th Air Force
Vandenberg AFB, Calif.
Commander
Maj. Gen. William L. Shelton

- **21st Space Wing**
  Peterson AFB, Colo.
- **30th Space Wing**
  Vandenberg AFB, Calif.
- **45th Space Wing**
  Patrick AFB, Fla.
- **50th Space Wing**
  Schriever AFB, Colo.
- **460th Space Wing**
  Buckley AFB, Colo.

Space & Missile Systems Center
Los Angeles AFB, Calif.
Commander
Lt. Gen. Michael A. Hamel

- **Program Offices**
  DMSP
  Launch and Range
  Launch Programs
  MILSATCOM-Joint
  Navstar Global Positioning System-Joint
  Satellite and Launch Control
  Space Based Infrared Systems
  Space Radar-Joint (Chantilly, Va.)
  Space Superiority System

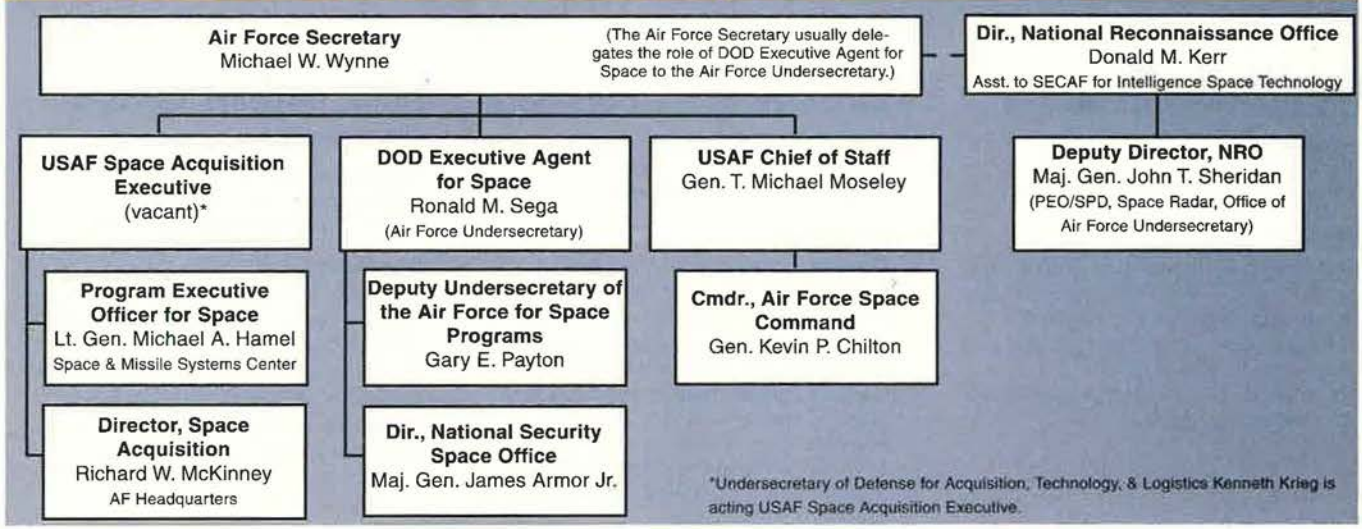
Space Innovation & Development Center
Schriever AFB, Colo.
Commander
Col. Larry J. Chodzko

20th Air Force
F.E. Warren AFB, Wyo.
Commander
Brig. Gen. Thomas F. Deppe

- **90th Space Wing**
  F.E. Warren AFB, Wyo.
- **91st Space Wing**
  Minot AFB, N.D.
- **341st Space Wing**
  Malmstrom AFB, Mont.

Staff map by Zaur Eylanbekov

Key USAF Positions in National Security Space



Space Leaders

(As of June 30, 2006. A = Acting)

US Space Command

Gen. Robert T. Herres	Sept. 23, 1985	Feb. 5, 1987
Gen. John L. Piotrowski	Feb. 6, 1987	March 30, 1990
Gen. Donald J. Kutyna	April 1, 1990	June 30, 1992
Gen. Charles A. Horner	June 30, 1992	Sept. 12, 1994
Gen. Joseph W. Ashy	Sept. 13, 1994	Aug. 26, 1996
Gen. Howell M. Estes III	Aug. 27, 1996	Aug. 13, 1998
Gen. Richard B. Myers	Aug. 14, 1998	Feb. 22, 2000
Gen. Ralph E. Eberhart	Feb. 22, 2000	Oct. 1, 2002

US Strategic Command

Adm. James O. Ellis Jr.	Oct. 1, 2002	July 9, 2004
Gen. James E. Cartwright, USMC	July 9, 2004	

US Space Command was inactivated Oct. 1, 2002, and its mission transferred to US Strategic Command.

Air Force Space Command

Gen. James V. Hartinger	Sept. 1, 1982	July 30, 1984
Gen. Robert T. Herres	July 30, 1984	Oct. 1, 1986
Maj. Gen. Maurice C. Padden	Oct. 1, 1986	Oct. 29, 1987
Lt. Gen. Donald J. Kutyna	Oct. 29, 1987	March 29, 1990
Lt. Gen. Thomas S. Moorman Jr.	March 29, 1990	March 23, 1992
Gen. Donald J. Kutyna	March 23, 1992	June 30, 1992
Gen. Charles A. Horner	June 30, 1992	Sept. 13, 1994
Gen. Joseph W. Ashy	Sept. 13, 1994	Aug. 26, 1996
Gen. Howell M. Estes III	Aug. 26, 1996	Aug. 14, 1998
Gen. Richard B. Myers	Aug. 14, 1998	Feb. 22, 2000
Gen. Ralph E. Eberhart	Feb. 22, 2000	April 19, 2002
Gen. Lance W. Lord	April 19, 2002	April 1, 2006
Lt. Gen. Frank G. Klotz (A)	April 1, 2006	June 26, 2006
Gen. Kevin P. Chilton	June 26, 2006	

Army Space & Missile Defense Command

Lt. Gen. John F. Wall	July 1, 1985	May 24, 1988
Brig. Gen. R.L. Stewart (A)	May 24, 1988	July 11, 1988
Lt. Gen. Robert D. Hammond	July 11, 1988	June 30, 1992
B.Gen. W.J. Schumacher (A)	June 30, 1992	July 31, 1992
Lt. Gen. Donald M. Lionetti	Aug. 24, 1992	Sept. 6, 1994
Lt. Gen. Jay M. Garner	Sept. 6, 1994	Oct. 7, 1996
Lt. Gen. Edward G. Anderson III	Oct. 7, 1996	Aug. 6, 1998
Col. Stephen W. Flohr (A)	Aug. 6, 1998	Oct. 1, 1998
Lt. Gen. John Costello	Oct. 1, 1998	March 28, 2001
Brig. Gen. J.M. Urias (A)	March 28, 2001	April 30, 2001
Lt. Gen. J.M. Cosumano Jr.	April 30, 2001	Dec. 16, 2003
Lt. Gen. Larry J. Dodgen	Dec. 16, 2003	

Army Space and Missile Defense Command was the Army Strategic Defense Command until August 1992 and the Army Space and Strategic Defense Command until October 1997.

National Reconnaissance Office

Joseph V. Charyk	Sept. 6, 1961	March 1, 1963
Brockway McMillan	March 1, 1963	Oct. 1, 1965
Alexander H. Flax	Oct. 1, 1965	March 11, 1969
John L. McLucas	March 17, 1969	Dec. 20, 1973
James W. Plummer	Dec. 21, 1973	June 28, 1976
Thomas C. Reed	Aug. 9, 1976	April 7, 1977
Charles W. Cook (A)	April 7, 1977	Aug. 3, 1977
Hans Mark	Aug. 3, 1977	Oct. 8, 1979
Robert J. Hermann	Oct. 8, 1979	Aug. 2, 1981
Edward C. Aldridge Jr.	Aug. 3, 1981	Dec. 16, 1988
Martin C. Faga	Sept. 26, 1989	March 5, 1993
Jimmie D. Hill (A)	March 5, 1993	May 19, 1994
Jeffrey K. Harris	May 19, 1994	Feb. 26, 1996
Keith R. Hall (A)	Feb. 27, 1996	March 27, 1997
Keith R. Hall	March 28, 1997	Dec. 13, 2001
Peter B. Teets	Dec. 13, 2001	March 25, 2005
Dennis D. Fitzgerald (A)	March 25, 2005	July 22, 2005
Donald M. Kerr	July 22, 2005	

Naval Space Command

RAdm. Richard H. Truly	Oct. 1, 1983	Feb. 28, 1986
Col. R.L. Phillips, USMC (A)	March 1, 1986	April 30, 1986
RAdm. D. Bruce Cargill	April 30, 1986	Oct. 24, 1986
RAdm. Richard C. Macke	Oct. 24, 1986	March 21, 1988
RAdm. David E. Frost	March 21, 1988	April 2, 1990
Col. C.R. Geiger, USMC (A)	April 2, 1990	May 31, 1990
RAdm. L.E. Allen Jr.	May 31, 1990	Aug. 12, 1991
RAdm. Herbert A. Browne Jr.	Aug. 12, 1991	Oct. 28, 1993
RAdm. Leonard N. Oden	Oct. 28, 1993	Jan. 31, 1994
RAdm. Lyle G. Bien	Jan. 31, 1994	Dec. 13, 1994
RAdm. Phillip S. Anselmo	Dec. 13, 1994	April 18, 1995
RAdm. Katharine L. Laughton	April 18, 1995	Feb. 28, 1997
RAdm. Patrick D. Moneymaker	Feb. 28, 1997	Sept. 10, 1998
Col. M.M. Henderson, USMC (A)	Sept. 10, 1998	Oct. 1, 1998
RAdm. Thomas E. Zelibor	Oct. 1, 1998	June 8, 2000
RAdm. J.J. Quinn	June 8, 2000	March 31, 2001
RAdm. Richard J. Mauldin	March 31, 2001	Dec. 10, 2001
RAdm. John P. Cryer	Dec. 10, 2001	July 11, 2002

Naval Space Command on July 11, 2002 ceased functioning as the Navy's primary space component. Its functions were transferred to the Naval Network Warfare Command.

Naval Network Warfare Command

VAdm. Richard Mayo	July 11, 2002	March 26, 2004
VAdm. James D. McArthur Jr.	March 26, 2004	

Major Military Commands With Space Functions

The Unified Command

US Strategic Command

Headquarters: Offutt AFB, Neb.
Established: June 1, 1992
Cmdr.: Gen. J.E. Cartwright, USMC

MISSIONS

Establish and provide full-spectrum global strike and coordinated space and information operations capabilities
Deliver operational space support and integrated missile defense
Provide global C4ISR and specialized joint planning expertise

The Service Components

Air Force Space Command

Headquarters: Peterson AFB, Colo.
Established: Sept. 1, 1982
Cmdr.: Gen. Kevin P. Chilton

MISSIONS

Operate missile-warning radars, sensors, and satellites; national space launch facilities and operational boosters; worldwide space surveillance radars and optical systems; worldwide space environmental systems; operate and test USAF ICBM forces for STRATCOM
Provide command and control for DOD satellites; ballistic missile warning to NORAD and STRATCOM; space weather support to entire DOD
Track space debris
Develop tactics, techniques, and procedures to integrate space capabilities with air, land, and sea capabilities
Produce and acquire advanced space systems

Naval Network Warfare Command

Headquarters: Norfolk, Va.
Established: July 11, 2002
Cmdr.: Vice Adm. James D. McArthur Jr.

MISSIONS

Operate and maintain the Navy's space, network, and information operations systems and services
Support warfighting operations and command and control of naval forces
Promote innovative technological solutions to warfighting requirements

US Military Payloads by Mission, 1958-2005

(Orbital only)

Applications	**353**
Communications	*126*
Weather	*44*
Navigation	*95*
Launch vehicle/spacecraft tests	*4*
Other military	*84*
Weapons-Related Activities	**46**
SDI tests	*11*
Antisatellite targets	*2*
Antisatellite interceptors	*33*
Reconnaissance	**440**
Photographic/radar imaging	*252*
Electronic intelligence	*49*
Ocean surveillance	*48*
Nuclear detection	*12*
Radar calibration	*40*
Early warning	*39*
Total	**839**

Major US Agencies With Roles in Space

Central Intelligence Agency

Headquarters: McLean, Va.
Established: 1947
Director: Gen. Michael V. Hayden, USAF

Mission

Provide national security intelligence to senior US policy-makers

Direct Space Role

Support the National Reconnaissance Office in designing, building, and operating satellite reconnaissance systems

National Geospatial-Intelligence Agency

Headquarters: Bethesda, Md.
Established: Nov. 24, 2003
Director: Vice Adm. Robert B. Murrett

Mission

Provide geospatial intelligence (analysis and depiction of Earth's physical features and geographic references) to aid national security operations

Formerly National Imagery and Mapping Agency (NIMA).

National Reconnaissance Office

Headquarters: Chantilly, Va.
Established: September 1961
Director: Donald M. Kerr

Mission

Design, build, and operate reconnaissance satellites
Acquire innovative technology
Provide systems engineering
Support monitoring of arms control agreements, military activities, natural disasters, and other worldwide events of interest to the US

National Security Agency

Headquarters: Ft. Meade, Md.
Established: 1952
Director: Lt. Gen. Keith B. Alexander, USA

Mission

Protect US communications
Produce foreign signals intelligence

Army Space & Missile Defense Command

Headquarters: Arlington, Va.
Established: Oct. 1, 1997
Cmdr.: Lt. Gen. Larry J. Dodgen

MISSIONS

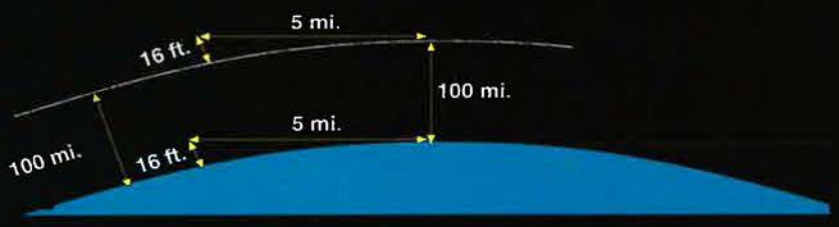
Serve as service component command to US Strategic Command
Serve as specified proponent for space and ground-based midcourse missile defense
Serve as Army's operational integrator for global missile defense
Oversee space- and missile-related R&D for Army Title 10 responsibilities

AFSPC Personnel Deployed by Unified Command

Total deployed	**857**
USCENTCOM	778
USEUCOM	19
USJFCOM	0
USNORTHCOM	42
USSOUTHCOM	16
USSOCOM	0
USPACOM	2
USTRANSCOM	0
Western and Southern Europe	
Germany	6
UK	0
Italy	0
Turkey	7
Spain	0
Other countries	4
East Asia and Pacific	
Japan/Okinawa	0
South Korea	0
Other countries	2
Africa, Near East, South Asia	
Saudi Arabia	4
Egypt	0
Other countries	774
Western hemisphere	
Canada	0
Other countries	58

Orbits

Orbits result from the mutual attraction of any two bodies with a force proportional to the product of their individual masses and inversely proportional to the square of the distance between them. The curvature of the Earth, on average, drops 16 feet below the horizontal over a distance of about five miles. A spacecraft circling above would "fall" that same amount over the same distance. It travels five miles in one second if gravitational pull equals one G. Therefore, spacecraft velocity of five miles per second (18,000 mph) produces perpetual orbit at sea level, unless the spacecraft's flight is upset by perturbations, such as solar wind or mechanical anomalies.

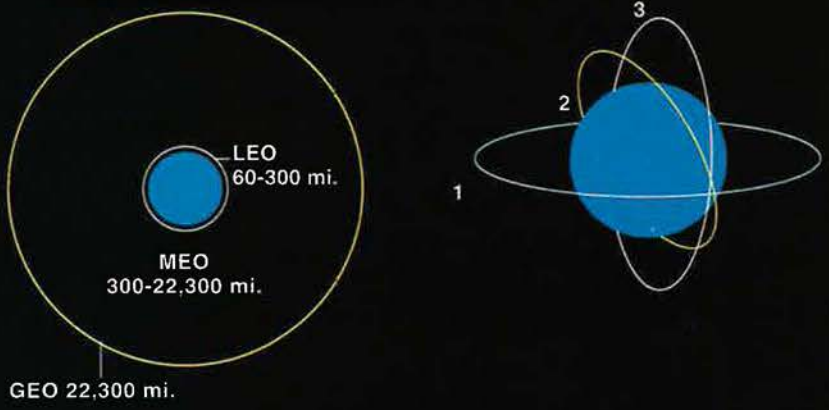


Orbital Altitude

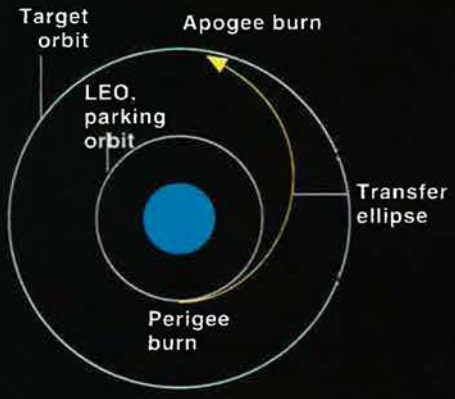
LEO Low Earth orbit
MEO Medium Earth orbit
GEO Geosynchronous Earth orbit
HEO High Earth orbit

Orbital Inclinations

1 Equatorial
2 Sun synchronous
3 Polar



Geosynchronous Transfer Orbit



It is common procedure to pick an initial "parking" orbit, usually at LEO, then boost payloads to higher altitude. Engines are fired first (at perigee) to reach the apogee of an elliptical transfer orbit and then are fired again to put the spacecraft into a circular orbit at that higher altitude.

Illustrations are not drawn to scale.

US Military/Civil Launches

(As of Dec. 31, 2005)

Year	Military	Civil	Total	Year	Military	Civil	Total	Year	Military	Civil	Total	Year	Military	Civil	Total
1958	0	7	7	1970	18	11	29	1982	6	12	18	1994	11	15	26
1959	6	5	11	1971	16	16	32	1983	8	14	22	1995	9	18	27
1960	11	5	16	1972	14	17	31	1984	11	11	22	1996	11	22	33
1961	19	10	29	1973	11	12	23	1985	4	13	17	1997	9	28	37
1962	32	20	52	1974	8	16	24	1986	4	2	6	1998	5	29	34
1963	25	13	38	1975	9	19	28	1987	6	2	8	1999	7	23	30
1964	33	24	57	1976	11	15	26	1988	8	4	12	2000	11	17	28
1965	34	29	63	1977	10	14	24	1989	11	7	18	2001	7	14	21
1966	35	38	73	1978	14	18	32	1990	11	16	27	2002	1	16	17
1967	29	29	58	1979	8	8	16	1991	6	12	18	2003	11	16	27
1968	23	22	45	1980	8	5	13	1992	11	17	28	2004	5	12	17
1969	17	23	40	1981	7	11	18	1993	12	11	23	2005	6	13	19
												Total	**589**	**731**	**1,320**

Data changes in prior years reflect recategorization from civil to military launches.

Sites for Space Launches, 1957-Present

As of Dec. 31, 2005

Launch Site	Operator	Total Launches
Plesetsk	Russia	1,553
Tyuratam/Baikonur, Kazakhstan	Russia	1,240
Vandenberg AFB, Calif.	US	634
Cape Canaveral AFS, Fla.	US	618
Kourou, French Guiana	ESA	178
JFK Space Center, Fla.	US	135
Kapustin Yar	Russia	101
Xichang	China	40
Tanegashima	Japan	38
Shuang Cheng-tsu/Jiuquan	China	38
Kagoshima	Japan	32
Wallops Flight Facility, Va.	US	30
Taiyuan	China	21
Edwards AFB, Calif.	US	20
Sriharikota	India	20
Pacific Ocean Platform	Sea Launch	18
Indian Ocean Platform	US	9
Palmachim	Israel	6
Hammaguir, Algeria	France	4
Svobodny	Russia	4
Woomera, Australia	Australia	4
Alcantara	Brazil	3
Barents Sea	Russia	2
Kodiak, Alaska	US	1
Kwajalein, Marshall Islands	US	1
Musudan ri	North Korea	1
Tennerife, Canary Islands	US	1
Total		**4,752**

What's Up There

As of Dec. 31, 2005

Country Organization	Payloads in Orbit: Satellites	Payloads in Orbit: Space Probes	Debris	Total
US	927	55	2,381	3,363
Russia*	1,358	35	1,780	3,173
People's Republic of China	51	0	277	328
France	43	0	202	245
India	31	0	103	134
Japan	89	7	25	121
European Space Agency	36	6	27	69
Intl. Telecom Sat. Org.	62	0	0	62
Globalstar	52	0	0	52
Orbcomm	35	0	0	35
European Telecom Sat. Org.	27	0	0	27
Canada	23	0	1	24
Germany	21	2	1	24
United Kingdom	23	0	1	24
Italy	11	0	2	13
Luxembourg	13	0	0	13
Australia	9	0	2	11
Intl. Maritime Sat. Org	11	0	0	11
Brazil	10	0	0	10
Sweden	10	0	0	10
Argentina	9	0	0	9
Indonesia	9	0	0	9
NATO	8	0	0	8
South Korea	8	0	0	8
Spain	8	0	0	8
Arab Sat. Comm. Org.	7	0	0	7
Mexico	6	0	0	6
Saudi Arabia	6	0	0	6
Czech Republic	5	0	0	5
Israel	5	0	0	5
Netherlands	5	0	0	5
Thailand	5	0	0	5
Turkey	5	0	0	5
Other**	41	3	0	44
Total	**2,969**	**108**	**4,802**	**7,879**

* Russia includes Commonwealth of Independent States (CIS) and former Soviet Union.

** Other refers to countries or organizations that have placed fewer than five objects in space.

US Satellites Placed in Orbit or Deep Space

(As of Dec. 31, 2005)

Year	Military	Civil*	Total	Year	Military	Civil*	Total	Year	Military	Civil*	Total	Year	Military	Civil*	Total
1958	0	7	7	1970	23	8	31	1982	8	9	17	1994	18	19	37
1959	6	5	11	1971	26	18	44	1983	16	12	28	1995	15	24	39
1960	12	5	17	1972	18	14	32	1984	17	16	33	1996	16	24	40
1961	20	12	32	1973	14	10	24	1985	13	17	30	1997	10	82	92
1962	35	20	55	1974	11	8	19	1986	7	4	11	1998	7	90	97
1963	33	22	55	1975	12	16	28	1987	10	1	11	1999	8	74	82
1964	44	25	69	1976	17	12	29	1988	11	9	20	2000	12	40	52
1965	49	39	88	1977	14	6	20	1989	15	9	24	2001	8	24	32
1966	52	47	99	1978	16	17	33	1990	22	16	38	2002	2	25	27
1967	51	34	85	1979	10	7	17	1991	17	18	35	2003	11	12	23
1968	35	26	61	1980	12	4	16	1992	12	17	29	2004	5	12	17
1969	32	27	59	1981	7	10	17	1993	12	18	30	2005	6	13	19
												Total	**827**	**984**	**1,811**

*Includes some military payloads.

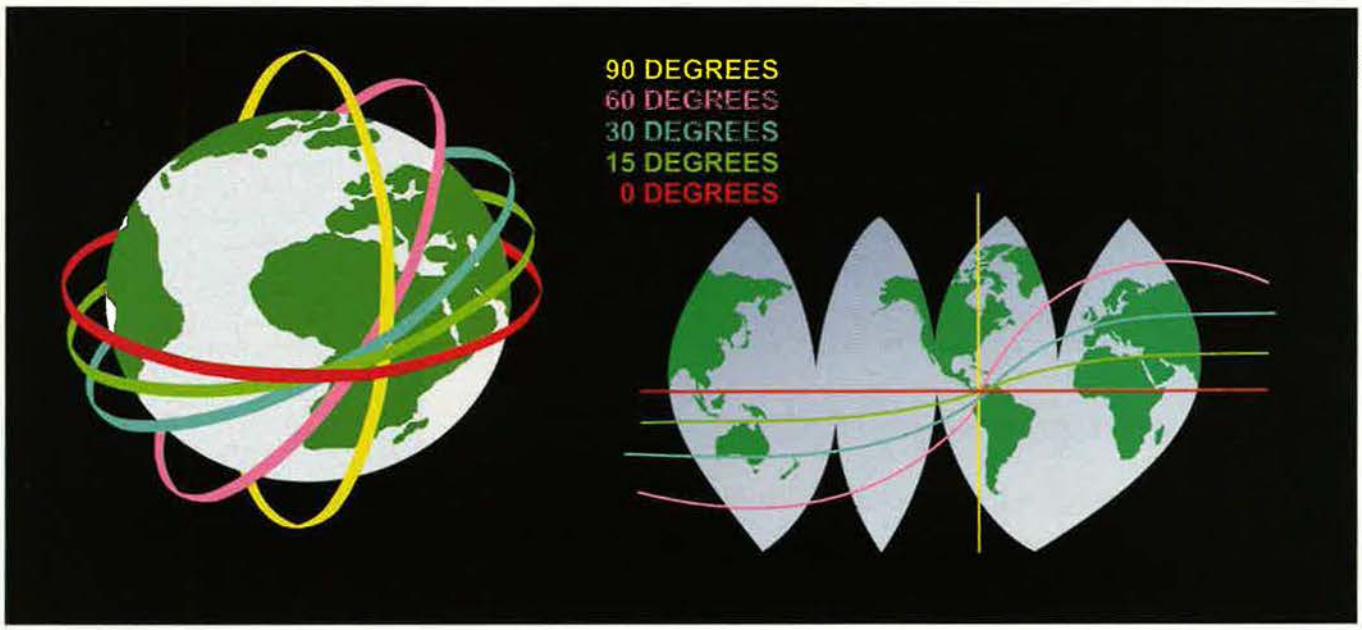
Air Force Personnel in Space

As of Sept. 30, 2005

	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05
Active Duty Air Force	**22,224**	**21,049**	**19,198**	**18,201**	**17,337**	**17,004**	**19,064**	**19,495**	**19,862**	**16,758**
Selected Guard and Reserve										
Air National Guard	0	0	285	285	354	354	519	519	649	653
Air Force Reserve Command	336	435	508	629	699	705	847	987	1,024	1,050
Total Guard and Reserve	**336**	**435**	**793**	**914**	**1,053**	**1,059**	**1,366**	**1,506**	**1,673**	**1,703**
Direct-hire Civilian	**4,758**	**4,740**	**4,354**	**4,140**	**4,351**	**4,665**	**6,325**	**6,333**	**6,396**	**6,541**

Satellite Inclination

Inclination is the angle between the Earth's equatorial plane and a satellite's orbital plane. A satellite at the wrong inclination—passing over the wrong spot on Earth—may hinder its ability to perform its mission.



DOD image

US Space Launch Sites

Alaska Spaceport
Location: 57.5° N, 153° W.
Type: Commercial.
Mission/operations: Polar and near-polar launches of communications, remote sensing, and scientific satellites up to 8,000 pounds.
Operator: Alaska Aerospace Development Corp.
Launches: Nine.
Launch vehicles: Athena I, suborbital.
History: Established in 1998; funded through AADC.

Cape Canaveral AFS, Fla.
Location: 28.5° N, 80° W.
Type: Military, civil, commercial.
Mission/operations: Geosynchronous launches for civil, military, and commercial missions and military ballistic missile tests.
Operator: USAF.
Launches: 618 (from 1957).
Launch vehicles: Athena I, II; Atlas II, III, V; Delta II, III, IV; Titan IV.
History: Designated in 1950 Operating Sub-Division #1; changed to Cape Canaveral Auxiliary AFB, then Cape Canaveral Missile Test Annex, Cape Kennedy Air Force Station, Cape Canaveral Air Force Station, Cape Canaveral Air Station, and, in 2000, back to Cape Canaveral AFS.

Florida Space Authority
Location: 28.5° N, 80° W.
Type: Civil, commercial.
Mission/operations: Florida, through FSA, developed, financed, or owns infrastructure at Launch Complexes 46 and 47 and manages a multiuser launch control facility, space experiments research and processing laboratory, and other facilities.
Operator: FSA.
Launches: Five.
Launch vehicles: Athena I, II; Super Loki; Terrier; Viper.
History: Established in 1989.

John F. Kennedy Space Center, Fla.
Location: 28° N, 80° W.
Type: Civil, commercial, military.
Mission/operations: Primary space shuttle facility.
Operator: NASA.
Launches: 135.
Launch vehicles: Pegasus, space shuttle, Taurus.
History: NASA acquired land in 1962; by 1967, Complex 39 was operational; modified in 1970s to accommodate space shuttle program.

Mid-Atlantic Regional Spaceport
Location: 38° N, 76° W.
Type: Civil, commercial.
Mission/operations: Maryland and Virginia cooperative. Launches to inclined and sun-synchronous orbits; recovery support for ballistic and guided re-entry vehicles; vehicle and payload storage and processing facilities; two commercial pads; suborbital launch rails for civil, commercial, and military scientific missions.
Operator: Virginia Commercial Spaceflight Authority.
Launches: 13 (since 1995).
Launch vehicles: Athena I, II; Black Brant; Falcon; Lockheed Martin HYSR; Minotaur; Orion; Pegasus; Taurus; Terrier.

Sea Launch
Location: Equator, 154° W, Pacific Ocean.
Type: Commercial.
Mission/operations: Heavy lift GTO launch services. Owned by an international partnership: Boeing, RSC Energia, Kvaerner ASA, and SDO Yuzhnoye/PO Yuzhmash.
Operators: Partners listed above.
Launches: 18.
Launch vehicles: Zenit-3SL.
History: Established in April 1995; demonstration launch March 1999.

Spaceport Systems Intl., L.P.
Location: 34.70° N, 120.46° W.
Type: Commercial, civil, military.
Mission/operations: Polar and near-polar LEO launches; small to medium launch vehicles up to one million pound thrust; payload processing facility for small and heavy satellites.
Operator: Spaceport Systems Intl.
Launches: Three.
Launch vehicles: Minotaur.
History: SSI, a limited partnership formed by ITT and California Commercial Spaceport, Inc., achieved full operational status of the spaceport in May 1999.

Vandenberg AFB, Calif.
Location: 35° N, 121° W.
Type: Military, civil, commercial.
Mission/operations: Launches into polar orbits; sole site for test launches of USAF ICBM fleet; basic support for R&D tests for DOD, USAF, and NASA space, ballistic missile, and aeronautical systems; facilities and essential services for more than 60 aerospace contractors.
Operator: USAF.
Launches: 634.
Launch vehicles: Athena I; Atlas II, III, V; Delta II, III, IV; Pegasus; Taurus; Titan II, IV.
History: Originally Army's Camp Cooke; turned over to USAF 1957; renamed Vandenberg Oct. 4, 1958.

Wallops Flight Facility, Va.
Location: 38° N, 76° W.
Type: Civil, military, commercial.
Mission/operations: Suborbital research launch site.
Operator: NASA
Launches: 30.
Launch vehicles: 14 suborbital sounding rockets.
History: Established in 1945, it is one of world's oldest launch sites.

AFSPC Squadrons by Mission Type
(As of Sept. 30, 2005)

Component	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05
Active force										
ICBM	14	14	14	14	14	14	14	11	11	10
Space operations	10	10	10	10	8	8	8	8	9	8
Space communications	1	1	1	1	1	1	0	0	6	7
Space warning	8	8	8	8	7	7	8	8	6	6
Space surveillance	6	6	6	6	6	4	3	3	3	0
Space launch	5	5	5	5	3	3	3	4	4	3
Range	2	2	2	2	2	2	2	2	2	2
Space control	1	1	1	1	2	3	3	3	3	5
Space aggressor	0	0	0	0	0	0	0	1	1	1
Total active force	**47**	**47**	**47**	**47**	**43**	**42**	**41**	**40**	**45**	**42**
Reserve forces										
ANG										
Space operations	0	0	0	0	0	1	1	3	4	3
Space warning	0	0	0	0	0	1	1	1	2	1
AFRC										
Space operations	3	3	3	3	4	4	4	4	4	4
Space warning	1	1	1	1	1	1	1	1	1	1
Space aggressor	0	0	0	0	0	0	0	1	1	1
Total reserve forces	**4**	**4**	**4**	**4**	**5**	**7**	**7**	**10**	**10**	**10**
Total all components	**51**	**51**	**51**	**51**	**48**	**49**	**48**	**50**	**57**	**52**

The Constellations

Multiple satellites working in groups to perform a single mission can provide greater coverage than a single satellite, enabling global coverage or increasing timeliness of coverage.

Navigation constellations provide simultaneous signals from multiple satellites to a location on the ground.

Communications constellations ensure at least one satellite is in line of sight of both ends of the communications link.

Weather and **reconnaissance** constellations generally contain both high and low altitude systems.

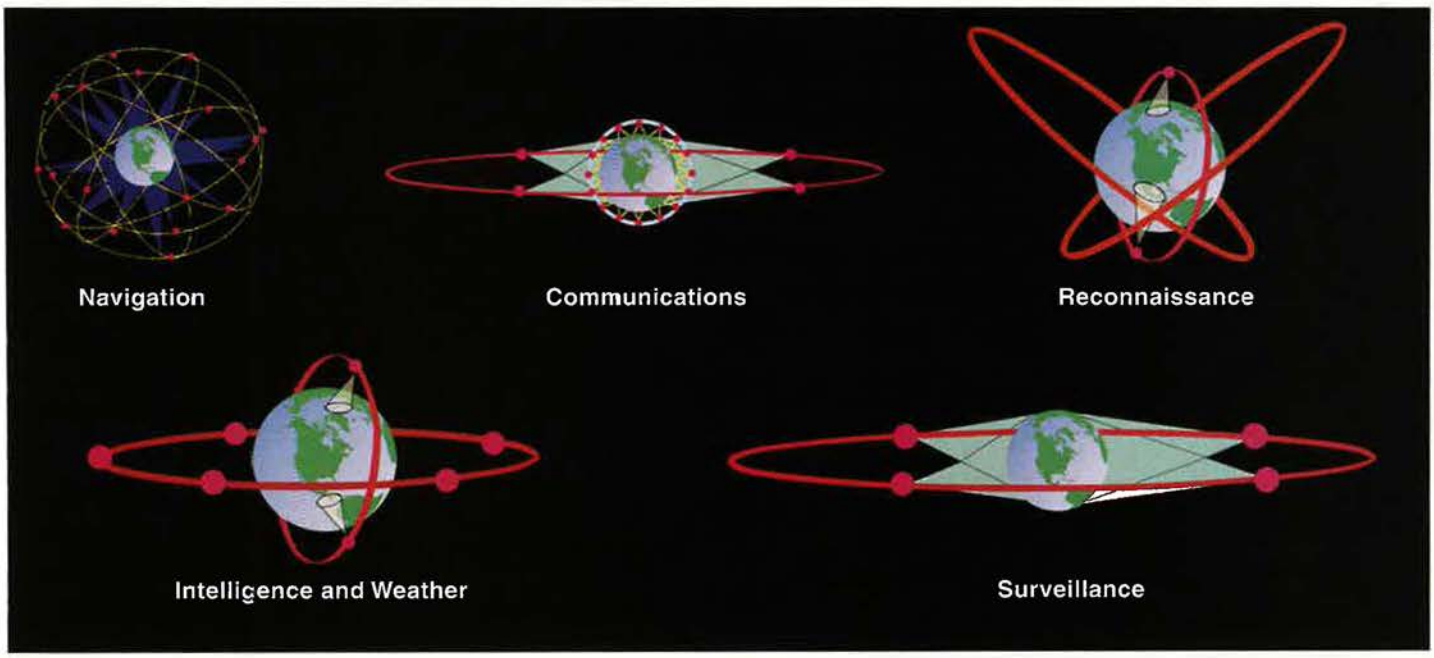
Some **surveillance** systems need continuous access to areas of interest, calling for high altitude, long dwell time orbits.

The Golden Age of NASA

Name	**Project Mercury**
Duration	**Nov. 3, 1958-May 16, 1963**
Cost	$392.1 million (cost figures are in then-year dollars)
Distinction	First US manned spaceflight program
Highlight	Astronauts are launched into space and returned safely to Earth
Number of flights	Six
Key events	**May 5, 1961** Lt. Cmdr. Alan B. Shepard Jr. makes first US manned flight, a 15-minute suborbital trip **Feb. 20, 1962** Lt. Col. John H. Glenn Jr. becomes first American to orbit Earth **May 15, 1963** Maj. L. Gordon Cooper Jr. begins flight of 22 orbits in 34 hours
Name	**Project Gemini**
Duration	**Jan. 15, 1962-Nov. 15, 1966**
Cost	$1.3 billion
Distinction	First program to explore docking, long-duration flight, rendezvous, space walks, and guided re-entry
Highlight	Dockings and rendezvous techniques practiced in preparation for Project Apollo
Number of flights	10
Key events	**June 3-7, 1965** Flight in which Maj. Edward H. White II makes first space walk **Aug. 21-29, 1965** Cooper and Lt. Cmdr. Charles "Pete" Conrad Jr. withstand extended weightlessness **March 16, 1966** Neil A. Armstrong and Maj. David R. Scott execute the first space docking **Sept. 15, 1966** Conrad and Richard F. Gordon Jr. make first successful automatic, computer-steered re-entry
Name	**Project Apollo**
Duration	**July 25, 1960-Dec. 19, 1972**
Cost	$24 billion
Distinction	Space program that put humans on the moon
Highlights	Neil Armstrong steps onto lunar surface. Twelve astronauts spend 160 hours on the moon
Number of flights	11
Key events	**May 28, 1964** First Apollo command module is launched into orbit aboard a Saturn 1 rocket **Jan. 27, 1967** Lt. Col. Virgil I. "Gus" Grissom, Lt. Cmdr. Roger B. Chaffee, and White die in a command module fire in ground test **Oct. 11-22, 1968** First manned Apollo flight proves "moonworthiness" of spacecraft **Dec. 21-27, 1968** First manned flight to moon and first lunar orbit **July 16-24, 1969** Apollo 11 takes Armstrong, Col. Edwin E. "Buzz" Aldrin Jr., and Lt. Col. Michael Collins to the moon and back Armstrong and Aldrin make first and second moon walks **Dec. 7-19, 1972** Final Apollo lunar flight produces sixth manned moon landing

US Manned Spaceflights

Year	Flights	Persons
1961	2	2
1962	3	3
1963	1	1
1964	0	0
1965	5	10
1966	5	10
1967	0	0
1968	2	6
1969	4	12
1970	1	3
1971	2	6
1972	2	6
1973	3	9
1974	0	0
1975	1	3
1976	0	0
1977	0	0
1978	0	0
1979	0	0
1980	0	0
1981	2	4
1982	3	8
1983	4	20
1984	5	28
1985	9	58
1986	1	7
1987	0	0
1988	2	10
1989	5	25
1990	6	32
1991	6	35
1992	8	53
1993	7	42
1994	7	42
1995	7	42
1996	7	43
1997	8	53
1998	5	33
1999	3	19
2000	5	32
2001	6	38
2002	5	34
2003	1	7
2004	0	0
2005	1	7
Total	**144**	**743**



DOD image

USAF photo

Athena II

USAF photo

Atlas V

Boeing photo

Delta II

Major US Launchers in US Military Use

Athena I
Function: lift low to medium weights.
First launch: Aug. 22, 1997.
Launch site: CCAFS, VAFB.
Contractor: Lockheed Martin.
Stages: two.
Propulsion: stage 1 (Thiokol Castor 120 Solid Rocket Motor), 435,000 lb thrust; stage 2 (Pratt & Whitney Orbus 21D SRM), 43,723 lb thrust.
Dimensions: length 62 ft, max body diameter 7.75 ft.
Weight: 146,264 lb.
Payload: 1,750 lb to LEO.

Athena II
Function: lift low to medium weights.
First launch: Jan. 6, 1998.
Launch site: CCAFS, VAFB.
Contractor: Lockheed Martin.
Stages: three.
Propulsion: stages 1-2 (Castor 120 SRMs), 435,000 lb thrust; stage 3 (Orbus 21D SRM), 43,723 lb thrust.
Dimensions: length 93 ft, max body diameter 7.75 ft.
Weight: 266,000 lb.
Payload: 4,350 lb to LEO.

Atlas V
Function: lift medium to heavy weights.
Variants: 400 and 500 series.
First launch: Aug. 21, 2002.
Launch site: CCAFS, VAFB.
Contractor: Lockheed Martin.
Stages: two.
Propulsion: (400 and 500 series) stage 1: one RD AMCROSS LLC RD-180 engine with two chambers, 860,200 lb thrust; stage 2: Centaur, one or two Pratt & Whitney RL10A-4-2 engines, 22,221-44,442 lb thrust. Strap-on solid rocket boosters, up to three (400), up to five (500).
Dimensions: (stage 1) length 106.2 ft, max body diameter 12.5 ft; (stage 2) length 41.6 ft, max body diameter 10 ft.
Weight: 741,061 lb-1.2 million lb.
Payload: (400 series) 27,558 lb to LEO, 10,913-16,843 to GTO; (500 series) 22,707-45,238 lb to LEO, 8,752-19,114 lb to GTO. (500 series supports 16.5 ft diameter payload fairing.)

Delta II
Function: lift medium weights.
First launch: Feb. 14, 1989.
Launch site: CCAFS, VAFB.
Contractor: Boeing.
Stages: up to three.
Propulsion: stage 1 (Rocketdyne RS-27A), 237,000 lb thrust; stage 2 (Aerojet AJ10-118K), 9,753 lb thrust; stage 3 (Thiokol STAR 48B SRM), 14,920 lb thrust; nine strap-on SRMs (Alliant Techsystems), 100,270 lb thrust.
Dimensions: length 125.2 ft, max body diameter 8 ft.
Weight: 511,190 lb.
Payload: 13,281 lb to LEO.

Delta IV
Function: lift medium to heavy weights.
Variants: Medium, Medium-Plus, and Heavy.
First launch: Nov. 20, 2002.
Launch site: CCAFS, VAFB.
Contractor: Boeing.
Stages: two.
Propulsion: stage 1 (Rocketdyne RS-68 (Heavy, two additional core engines), 650,000 lb thrust; stage 2 (Medium), P&W RL10B-2, 1,750 lb thrust.
Dimensions: (core booster, all versions) length 125 ft, max body diameter 16.7 ft.
Weight: (Medium) 64,719 lb; (heavy) 196,688 lb.
Payload max: (Medium) 2,508 lb to GEO, 20,075 lb to LEO; (Medium-Plus) 4,489-6,142 lb to GEO, 27,116-30, 575 lb to GEO; (Heavy) 13,837 lb to GEO, 48,264 lb to LEO. (Heavy supports 16.6 ft diameter payload fairing.)

EELV
Function: lift medium to heavy weights.
Note: Atlas V and Delta IV (see individual entries) are participating in USAF's evolved expendable launch vehicle (EELV) modernization program to cut launch costs by 25 to 50 percent. These systems replaced Atlas II, Titan II, and Titan IV launch vehicles.

USAF photo

Delta IV

Boeing photo

Space Shuttle

USAF photo

Taurus

Pegasus
Function: lift low weights.
Variants: Standard and XL.
First launch: (Standard) April 5, 1990; (XL) June 27, 1994.
Launch site: dropped from L-1011 aircraft.
Contractor: Orbital Sciences, Alliant.
Stages: three.
Propulsion: (XL) (all Alliant Techsystems) stage 1, 109,400 lb thrust; stage 2, 27,600 lb thrust; stage 3, 7,800 lb thrust.
Dimensions: length 49 ft, wingspan 22 ft, diameter 4.17 ft.
Weight: 42,000 lb.
Payload max: (Standard) 850 lb to LEO; (XL) 1,050 lb to GEO.

Space Shuttle
Function: lift heavy weights.
First launch: April 12, 1981.
Launch site: KSC.
Contractor: Boeing (launch).
Stages: delta-winged orbiter.
Propulsion: three main engines, 394,000 lb thrust; two SRMs, 3.3 million lb thrust.
Dimensions: system length 184.2 ft; span 76.6 ft.
Weight: 4.5 million lb (gross).
Payload max: 55,000 lb to LEO.

Taurus
Function: lift low weights.
Variants: Standard and XL.
First launch: March 13, 1994.
Launch site: CCAFS, VAFB, Wallops Island.
Contractor: Orbital Sciences.
Stages: four.
Propulsion: Castor 120 SRM, 495,400 lb thrust; stage 1, 109,140 lb thrust; stage 2, 26,900 lb thrust; stage 3, 7,200 lb thrust. (Stages 1-3, Alliant Techsystems)
Dimensions: length 89 ft, max body diameter 7.6 ft.
Weight: 170,000 lb max.
Payload max: 3,000 lb to LEO.

Major Military Satellite Systems

Advanced Extremely High Frequency Satellite Communications System
Common name: AEHF
In brief: successor to Milstar, AEHF to provide assured strategic/tactical, worldwide C2 communications with at least 10 times the capacity of Milstar II but in a smaller package.
Function: EHF communications.
Operator: MILSATCOM JPO (acquisition); AFSPC.
First launch: April 2008, planned.
On orbit: three (planned).
Orbit altitude: 22,000+ miles.

Defense Meteorological Satellite Program
Common name: DMSP
In brief: satellites that collect air, land, sea, and space environmental data to support worldwide strategic and tactical military operations. Operational control transferred to NOAA in 1998; backup operation center at Schriever AFB, Colo., manned by Air Force Reserve Command personnel.
Function: environmental monitoring.
Operator: NPOESS Integrated Program Office.
First launch: May 23, 1962.
On orbit: two (primary).
Orbit altitude: approx 575 miles.

Defense Satellite Communications System III
Common name: DSCS
In brief: nuclear-hardened and jam-resistant spacecraft used to transmit high-priority C2 messages to battlefield commanders.
Function: SHF communications.
Operator: AFSPC.
First launch: October 1982.
On orbit: five (primary).
Orbit altitude: 22,000+ miles.

Defense Support Program
Common name: DSP
In brief: early warning spacecraft whose infrared sensors detect heat generated by

Major Military Satellite Systems, Continued

a missile or booster plume.
Function: strategic and tactical missile launch detection.
Operator: AFSPC.
First launch: November 1970.
On orbit: classified.
Orbit altitude: 22,000+ miles.

Enhanced Polar System
Common name: EPS
In brief: next generation polar communications to replace interim polar system (see Polar Military Satellite Communications, below), which provides only a fraction of the polar communications capability required by aircraft, submarines, and other forces operating in the high northern latitudes. Pre-acquisition, system definition, and risk reduction efforts start in Fiscal 2006.
Function: EHF communications.
Operator: MILSATCOM JPO (acquisition); AFSPC.
First launch: circa 2013.
On orbit: none.
Orbit altitude: 22,300+ miles.

Global Broadcast System
Common name: GBS
In brief: wideband communications program, initially using leased commercial satellites, then military systems, to provide digital multimedia data directly to theater warfighters.
Function: high-bandwidth data imagery and video.
Operator: Navy.
First launch: March 1998 (Phase 2 payload on UHF Follow-On and continued on Wideband Gap-filler).
On orbit: three.
Orbit altitude: 23,230 miles.

Global Positioning System
Common name: GPS
In brief: constellation of satellites used by military and civilians to determine a precise location and time anywhere on Earth. Block IIR began replacing older GPS spacecraft in mid-1997; first modified Block IIR-M with military (M-code) on two channels launches in 2005. Next generation Block IIF with extended design life, faster processors, and new civil signal on third frequency launches in 2008. Generation after next GPS III with advanced antijam and higher quality data is slated for initial launch in 2013.
Function: worldwide navigation and precise time transfer.
Operator: AFSPC.
First launch: Feb. 22, 1978 (Block I).
On orbit: 28.
Orbit altitude: 12,600 miles.

Milstar Satellite Communications System
Common Name: Milstar
In brief: joint communications satellite that provides secure, jam-resistant communications for essentia wartime needs.
Function: EHF communications.
Operator: AFSPC.
First launch: Feb. 7, 1994.
On orbit: five.
Orbit altitude: 22,300 miles.

Mobile User Objective System
(also known as Advanced Narrowband System)
Common name: MUOS
In brief: next generation narrowband UHF tactical communications satellite to replace the UHF Follow-On Satellite (see below). Concept study contracts awarded in 1999; production award to Lockheed Martin in September 2004; initial launch in 2009.
Function: UHF tactical communications.
Operator: Navy.
First launch: 2009, planned.
On orbit: none.
Orbit altitude: 22,300 miles.

Polar Military Satellite Communications
(also known as Interim Polar and Adjunct Polar)
Common name: Polar MILSATCOM
In brief: USAF deployed a modified EHF payload on a host polar-orbiting satellite to provide an interim solution to ensure warfighters have protected polar communications capability. Polars 2 and 3 slated for availability in 2006 and 2007, respectively.
Function: EHF polar communications.
Operator: Navy.
First launch: 1997.
On orbit: one.
Orbit altitude: 25,300 miles (apogee).

Space Based Infrared System High
Common name: SBIRS High
In brief: advanced surveillance system for missile warning, missile defense, battlespace characterization, and technical intelligence. System initially will complement, then replace, Defense Support Program spacecraft (see p. 81).
Function: infrared space surveillance.
Operator: AFSPC.
First launch: 2008, planned.
On orbit: none.
Orbit altitude: 22,300 miles.

Space Radar
Common name: SR
In brief: spaceborne capability, providing deep look, all weather, day and night forward presence and situation awareness for the Intelligence Community and joint warfighters.
Function: track moving ground targets.
Operator: AFSPC.
First launch: 2015, planned.
On orbit: none.
Orbit altitude: LEO.

Space Tracking and Surveillance System
(formerly SBIRS Low).
Common name: STSS
In brief: infrared surveillance and tracking satellites to detect and track ballistic missiles from launch to impact. System is sensor component of layered ballistic missile defense system and will work with SBIRS High (see above).
Function: infrared surveillance.
Operator: MDA (acquisition); AFSPC.
First launch: 2007 for R&D, planned.
On orbit: none.

Transformational Satellite Communications System
Common name: TSAT
In brief: joint communications satellite being designed to provide Internet-like connectivity to warfighters. It will feature laser crosslink and greatly reduced transmission time to users on the ground. Intended to replace Advanced Extremely High Frequency system (see p. 81), it is slated for launch around 2014. Currently in design and risk-reduction phase.
Function: EHF communications.
Operator: MILSATCOM JPO (acquisition); AFSPC.
First launch: 2014, planned.
On orbit: none.
Orbit altitude: 22,300 miles.

UHF Follow-On Satellite
Common name: UFO
In brief: new generation satellites providing secure, antijam communications;

Artist's conception by Erik Simonsen

Global Positioning System

Major Military Satellite Systems, Continued

replaced FLTSATCOM satellites.
Function: UHF and EHF communications.
Operator: Navy.
First launch: March 25, 1993.
Constellation: four primary, four redundant.
On orbit: nine.
Orbit altitude: 22,300 miles.

Wideband Gap-filler System
Common name: WGS
In brief: high data rate satellite broadcast system (primarily commercial product) meant to bridge the communications gap between current systems—DSCS and GBS—and TSAT (see p. 81 and 82).
Function: wideband communications and point-to-point service (Ka-band and X-band frequencies).
Operator: AFSPC.
First launch: 2007, planned.
On orbit: none.
Orbit altitude: 22,000+ miles.

Dark and Spooky
A number of intelligence satellites are operated by US agencies in cooperation with the military. The missions and, especially, the capabilities are closely guarded secrets.

Most of the names of satellites, such as White Cloud (ocean reconnaissance), Aquacade (electronic ferret), and Trumpet (Sigint), are essentially open secrets but cannot be confirmed by the Intelligence Community.

Boeing illustration

Wideband Gap-filler System

Major Civilian Satellites in US Military Use

Geostationary Operational Environmental Satellite
Common name: GOES
In brief: in equatorial orbit to collect weather data for short-term forecasting.
Function: storm monitoring and tracking, meteorological research.
Operator: NOAA.
First launch: Oct. 16, 1975 (GOES-1).
Constellation: two, with on-orbit spare.
Orbit altitude: 22,300 miles.

Globalstar
Common name: Globalstar
In brief: mobile communications with provision for security controls.
Function: communications.
Operator: Globalstar L.P.
First launch: February 1998.
Constellation: 48.
Orbit altitude: 878 miles.

Ikonos
Common name: Ikonos
In brief: one-meter resolution Earth imaging. Slated for shutdown in 2007.
Function: remote sensing.
Operator: Space Imaging, Inc.
First launch: Sept. 24, 1999.
Constellation: one.
Orbit altitude: 423 miles.

Inmarsat
Common name: Inmarsat
In brief: peacetime mobile communications services, primarily by US Navy.
Function: communications.
Operator: International Maritime Satellite Organization.
First launch: February 1982 (first lease), Oct. 30, 1990 (first launch).
Constellation: nine.
Orbit altitude: 22,300 miles.

Intelsat
Common name: Intelsat
In brief: routine communications and distribution of Armed Forces Radio and TV Services network.
Function: communications.
Operator: International Telecommunications Satellite Organization.
First launch: April 6, 1965 (Early Bird).
Constellation: 28.
Orbit altitude: 22,300 miles.

Iridium
Common name: Iridium
In brief: voice, fax, data transmission.
Function: handheld, mobile communications.
Operator: Iridium L.L.C.
First Launch: May 5, 1997.
Constellation: 66 (six on-orbit spares).
Orbit: 485 miles.

Landsat
Common name: Landsat
In brief: imagery use includes mapping and planning for tactical operations.
Function: remote sensing.
Operator: NASA.
First launch: July 23, 1972.
Constellation: one.
Orbit altitude: 438 miles (polar).

National Polar-orbiting Operational Environmental Satellite System
Common name: NPOESS
In brief: advanced joint civil-military polar environmental satellite that provides weather, atmosphere, ocean, land, and near-space data. Managed by tri-agency (DOD, Department of Commerce, and NASA) integrated program office. Designed to replace USAF's DMSP and NOAA's Polar-orbiting Operational Environmental Satellite (POES) (see p. 84).
Function: worldwide environmental forecasting.
Operator: IPO (AFSPC for acquisition and launch; NOAA for operations).
First launch: 2010, planned.
Constellation: three.
On orbit: none.
Orbit altitude: 550 (LEO) miles.

Orbcomm
Common name: Orbcomm
In brief: potential military use under study in Joint Interoperability Warfighter Program.
Function: mobile communications.
Operator: Orbcomm Global L.P.
First launch: April 1995.
Constellation: 30.
Orbit altitude: 500-1,200 miles.

Pan Am Sat
Common name: Pan Am Sat
In brief: routine communications providing telephone, TV, radio, and data.
Function: communications.
Operator: Pan Am Sat.

Major Civilian Satellites in US Military Use, Continued

First launch: 1983.
Constellation: 21.
Orbit altitude: 22,300 miles.
*Merged with Intelsat 2005-06

Polar-orbiting Operational Environmental Satellite
(also known as NOAA-K, L, and M before launch; NOAA-15, 16, and 17, respectively, once on orbit).
Common name: POES
In brief: two advanced third generation environmental satellites (one morning orbit and one afternoon orbit) provide longer-term weather updates for all areas of the world. Final two spacecraft in this series are NOAA-N (slated for launch in 2005) and N Prime. To be replaced by NPOESS.
Function: extended weather forecasting.
Operator: NOAA (on-orbit); NASA (launch).
First launch: May 13, 1998 (NOAA-15).
Constellation: two.
Orbit altitude: 517 miles.

Quickbird 2
Common name: Quickbird 2
In brief: high-resolution imagery for mapping, military surveillance, weather research, and other uses.
Function: remote sensing.
Operator: DigitalGlobe.
First launch: Oct. 18, 2001.
Constellation: one.
Orbit altitude: 279 miles.

Satellite Pour l'Observation de la Terre
Common name: SPOT
In brief: terrain images used for mission-planning systems, terrain analysis, and mapping.
Function: remote sensing.
Operator: SPOT Image S.A. (France).
First launch: Feb. 22, 1986.
Constellation: three.
Orbit altitude: 509 miles.

Telstar
Common name: Telstar
In brief: commercial satellite-based, rooftop-to-rooftop communications for US Army and other DOD agencies.
Function: communications.
Operator: Loral Skynet.
First launch: November 1994.
Constellation: three.
Orbit altitude: 22,300 miles.

Tracking and Data Relay Satellite System
Common name: TDRSS
In brief: global network that allows other spacecraft in LEO to communicate with a control center without an elaborate network of ground stations.
Function: communications relay.
Operator: NASA.
First launch: April 1983.
Constellation: six.
Orbit altitude: 22,300 miles.

Major US Military Ground-Based Space Surveillance Systems

Air Force Space Surveillance System
Common name: Air Force Fence
In brief: continuous wave radars located across the southern US to track man-made objects in Earth orbit.
Function: space surveillance.
Operator: AFSPC.
Operational: March 31, 1959 (US Navy).
Unit location: Dahlgren, Va. (command & control); receivers in Arkansas, California, Georgia, Mississippi, and New Mexico; transmitters in Alabama, Arizona, and Texas.
Components: One command & control center, six receiver sites, and three transmitter sites.

AN/FPS-85 Phased-Array Radar
Common name: Eglin radar
In brief: active phased-array radar used in all weather to track man-made objects in Earth orbit.
Function: space surveillance.
Operator: AFSPC.
Operational: Jan. 29, 1969.
Unit location: Eglin AFB, Fla.
Components: AN/FPS-85 solid-state phased-array radar.

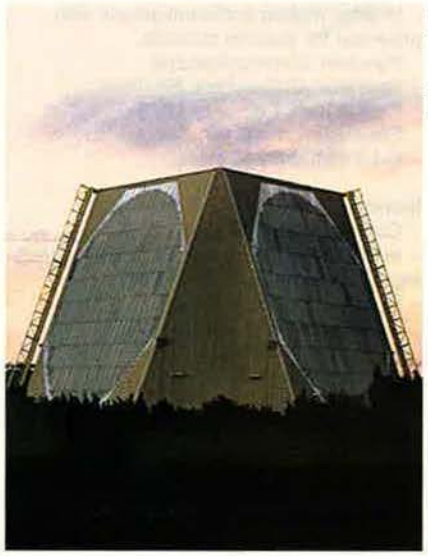
Ballistic Missile Early Warning System
Common name: BMEWS
In brief: phased-array radar used for tactical warning and attack assessment and tracking Earth-orbiting satellites.
Function: ballistic missile attack and space surveillance.
Operator: AFSPC.
Operational: 1959 (Trinidad, British West Indies); July 1, 1961 (Clear AFS, Alaska).
Unit location: Clear AFS, Alaska; RAF Fylingdales, UK; Thule AB, Greenland.
Components: (Clear AFS) AN/FPS-120 solid-state phased-array radar (SSPAR) with two faces; computers for radar control and data processing.

Ground-based Electro-optical Deep Space Surveillance
Common name: GEODSS
In brief: optical system that tracks objects such as Earth-orbiting satellites in deep space.
Function: space surveillance.
Operator: AFSPC.
Operational: June 30, 1982.
Unit location: Socorro, N.M.; Diego Garcia, Indian Ocean; Maui, Hawaii.
Components: three telescopes, low-light-level EO cameras, and high-speed computers.

Moron Optical Space Surveillance
Common name: MOSS
In brief: optical system that tracks objects such as Earth-orbiting satellites in deep space.
Function: space surveillance.
Operator: AFSPC.
Operational: June 1998.
Unit location: Moron, Spain.
Components: optical telescope and high-speed computers.

Pave Phased-Array Warning System
Common Name: Pave PAWS
In brief: Phased-array radar used to detect and track sea-launched and intercontinental ballistic missiles, as well as Earth-orbiting satellites.
Function: missile warning and space surveillance.
Operator: AFSPC.
Operational: August 1980.
Unit location: Beale AFB, Calif.; Cape Cod AFS, Mass.
Components: AN/FPS-115 phased-array radar; computers for radar control and data processing.

Perimeter Acquisition Radar Attack Characterization System
Common name: PARCS
In brief: Provides ICBM and SLBM warning and space surveillance of Earth-orbiting satellites in deep space.
Function: ballistic missile warning and space surveillance.
Operator: AFSPC.
Operational: 1977.
Unit location: Cavalier AFS, N.D.
Components: One AN-FPQ-16 single-faced, phased-array radar.



Raytheon photo

The AN-FPS-115 Pave PAWS phased-array warning system radar.

Milestones in Military Space

March 22, 1946. JPL-Ordnance WAC, first US rocket to leave Earth's atmosphere, reaches 50-mile height after launch from White Sands Proving Ground, N.M.
Oct. 4, 1957. USSR launches Sputnik 1, first man-made satellite, into Earth orbit.
Jan. 31, 1958. US launches its first satellite, Explorer 1.
Dec. 18, 1958. Project Score spacecraft conducts first US active communication from space.
Feb. 28, 1959. USAF successfully launches Discoverer 1 (of then-classified Corona program), world's first polar-orbiting satellite, from Vandenberg AFB, Calif.
April 6, 1959. The first military unit to be charged with conducting military satellite operations, USAF's 6594th Test Wing, is established at Palo Alto, Calif.
April 13, 1959. Air Force Thor/Agena A boosts into orbit Discoverer 2 satellite, first satellite to be stabilized in orbit in all three axes, to be maneuvered on command from Earth, to separate a re-entry vehicle on command, and to send its re-entry vehicle back to Earth.
Aug. 7, 1959. Explorer 6 spacecraft transmits first television pictures from space.
June 22, 1960. US launches Galactic Radiation and Background (GRAB) satellite, the nation's first successful reconnaissance spacecraft. It collects electronic intelligence (Elint) from Soviet air defense radars.
Aug. 18, 1960. Discoverer/Corona satellite takes first image of Soviet territory ever snapped from space.
April 12, 1961. Soviet cosmonaut Yuri Gagarin pilots Vostok 1 through nearly one orbit to become first human in space.
May 5, 1961. Lt. Cmdr. Alan B. Shepard Jr., aboard Freedom 7 Mercury capsule, becomes first American in space, climbing to 116.5 miles during suborbital flight lasting 15 minutes, 28 seconds.
Feb. 20, 1962. Project Mercury astronaut Lt. Col. John H. Glenn Jr., aboard Friendship 7 capsule, completes first US manned orbital flight.
May 15, 1963. USAF Maj. L. Gordon Cooper Jr. makes nearly 22 orbits in spacecraft Faith 7, becoming the first American astronaut to perform an entirely manual re-entry.
Oct. 17, 1963. Vela Hotel satellite performs first space-based detection of nuclear explosion.
March 18, 1965. First space walk conducted by Alexei Leonov from Soviet Voskhod 2.
June 4, 1965. Gemini 4 astronaut USAF Maj. Edward H. White II performs first American space walk.
June 18, 1965. USAF accepts Titan III, first Air Force vehicle specifically designed and developed as a military space booster.
Dec. 15, 1965. Crews of Gemini 6 and Gemini 7 rendezvous in space. Navy Capt. Walter M. Schirra and USAF Maj. Thomas P. Stafford in Gemini 6 maneuver to within a foot of Gemini 7 crew.
Jan. 25, 1967. Soviets complete first successful fractional orbital bombardment system test, deorbiting Kosmos 139 satellite re-entry vehicle to an impact point within Soviet Union.
July 3-4, 1967. Air Force, Army, and Navy conduct first satellite-based tactical communications.
Oct. 20, 1968. Soviet Kosmos 249 spacecraft carries out first co-orbital antisatellite test,exploding Kosmos 248 target satellite into cloud of debris.
July 20, 1969. At 10:56 p.m. EDT, Apollo 11 astronaut Neil A. Armstrong puts his foot on the surface of the moon, becoming the first human to do so.
November 1970. USAF launches first classified Defense Support Program satellite, whose infrared sensors provide space-based early warning of missile launches.
April 19, 1971. First space station, Salyut 1, goes aloft.
Feb. 22, 1978. Atlas booster carries first Global Positioning System Block I satellite into orbit, paving way for a revolution in civil, commercial, and military navigation.
April 12-14, 1981. Space shuttle performs its first orbital flight and becomes first reusable spacecraft to land back on Earth.
Aug. 30, 1983. USAF Col. Guion S. Bluford Jr. becomes the first African American in space, as a mission specialist aboard *Challenger*.
Sept. 13, 1985. First US antisatellite intercept test destroys Solwind scientific satellite by air-launched weapon.
Jan. 17, 1991. What USAF calls "the first space war," Operation Desert Storm, opens with air attacks.
Jan. 13, 1993. USAF Maj. Susan J. Helms, flying aboard space shuttle *Endeavour,* becomes first US military woman in space.

Major Space Treaties and Laws

Long Title	Nickname	Entry Into Force
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water	Nuclear Test Ban	Oct. 10, 1963
Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies	Outer Space Treaty	Oct. 10, 1967
Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space	Rescue Agreement	Dec. 3, 1968
Convention on International Liability for Damage Caused by Space Objects	Liability Convention	Sept. 1, 1972
Convention on Registration of Objects Launched Into Outer Space	Registration Convention	Sept. 15, 1976
Agreement Governing the Activities of States on the Moon and Other Celestial Bodies	Moon Agreement	July 11, 1984

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Space Terms

Aerospace. A physical region made up of Earth's atmosphere and the space beyond.

Apogee. The point of greatest distance from Earth (or the moon, a planet, etc.) achieved by a body in elliptical orbit. Usually expressed as distance from Earth's surface.

Atmosphere. Earth's enveloping sphere of air.

Boost phase. Powered flight of a ballistic missile—i.e., before the rocket burns out.

Burn. The process in which rocket engines consume fuel or other propellant.

Circumterrestrial space. "Inner space" or the atmospheric region that extends from 60 miles to about 50,000 miles from Earth's surface.

Constellation. A formation of satellites orbiting for a specific combined purpose.

Deep space. All space beyond the Earth-moon system, or from about 480,000 miles altitude outward.

Eccentric orbit. An extremely elongated elliptical orbit.

Ecliptic plane. The plane defined by the circle on the celestial sphere traced by the path of the sun.

Elliptical orbit. Any noncircular, closed spaceflight path.

Exosphere. The upper limits of Earth's atmosphere, ranging from about 300 miles altitude to about 2,000 miles altitude.

Ferret. A satellite whose primary function is to gather electronic intelligence, such as microwave, radar, radio, and voice emissions.

Geostationary Earth orbit. A geosynchronous orbit with 0° inclination in which the spacecraft circles Earth 22,300 miles above the equator and appears from Earth to be standing still.

Geosynchronous Earth orbit (GEO). An orbit at 22,300 miles that is synchronized with Earth's rotation. If a satellite in GEO is not at 0° inclination, its ground path describes a figure eight as it travels around Earth.

Geosynchronous transfer orbit (GTO). An orbit that originates with the parking orbit and then reaches apogee at the GEO.

Ground track. An imaginary line on Earth's surface that traces the course of another imaginary line between Earth's center and an orbiting satellite.

High Earth orbit (HEO). Flight path above geosynchronous altitude (22,300 to 60,000 miles from Earth's surface).

Ionosphere. A region of electrically charged thin air layers that begins about 30 miles above Earth's atmosphere.

Low Earth orbit (LEO). Flight path between Earth's atmosphere and the bottom of the Van Allen belts, i.e., from about 60 to 300 miles altitude.

Magnetosphere. A region dominated by Earth's magnetic field, which traps charged particles, including those in the Van Allen belts. It begins in the upper atmosphere, where it overlaps the ionosphere, and extends several thousand miles farther into space.

Medium Earth orbit (MEO). Flight path between LEO and GEO.

Mesosphere. A region of the atmosphere about 30 to 50 miles above Earth's surface.

Orbital decay. A condition in which spacecraft lose orbital altitude and orbital energy because of aerodynamic drag and other physical forces.

Orbital inclination. Angle of flight path in space relative to the equator of a planetary body. Equatorial paths are 0° for flights headed east, 180° for those headed west.

Outer space. Space that extends from about 50,000 miles above Earth's surface to a distance of about 480,000 miles.

Parking orbit. Flight path in which spacecraft go into LEO, circle the globe in a waiting posture, and then transfer payload to a final, higher orbit.

Payload. Any spacecraft's crew or cargo; the mission element supported by the spacecraft.

Perigee. The point of minimum altitude above Earth (or the Moon, a planet, etc.) maintained by a body in elliptical orbit.

Period. The amount of time a spacecraft requires to go through one complete orbit.

Polar orbit. Earth orbit with a 90° inclination. Spacecraft on this path could pass over every spot on Earth as Earth rotates under the satellite's orbit (see orbital inclination).

Rocket. An aerospace vehicle that carries its own fuel and oxidizer and can operate outside Earth's atmosphere.

Semisynchronous orbit. An orbit set at an altitude of 12,834 miles. Satellites in this orbit revolve around Earth in exactly 12 hours.

Stratosphere. That section of atmosphere about 10 to 30 miles above Earth's surface.

Sun synchronous orbit. An orbit inclined about 98° to the equator and at LEO altitude. At this inclination and altitude, a satellite's orbital plane always maintains the same relative orientation to the sun.

Thermosphere. The thin atmosphere about 50 to 300 miles above Earth's surface. It experiences dramatically increased levels of heat compared to the lower layers.

Transfer. Any maneuver that changes a spacecraft orbit.

Troposphere. The region of the atmosphere from Earth's surface to about 10 miles above the equator and five miles above the poles. This is where most clouds, wind, rain, and other weather occurs.

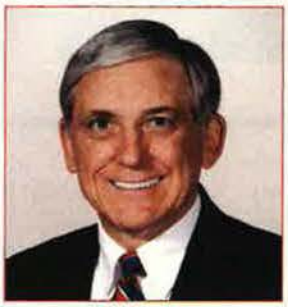
Van Allen belts. Zones of intense radiation trapped in Earth's magnetosphere that could damage unshielded spacecraft.

Acknowledgements

This almanac was compiled by *Air Force* Magazine, with assistance and information from Glen Asner, NASA History Office; Joseph J. Burger, Space Analysis and Research, Inc.; and US Strategic Command and Air Force Space Command Public Affairs Offices.

Figures that appear in this section will not always agree because of different cutoff dates, rounding, or different methods of reporting. The information is intended to illustrate trends in space activity.

2006-07 AFA Nominees



Largent

Sutter

Church

Dierlam

Lundgren

The Air Force Association Nominating Committee, which consists of the five most recent past National Presidents (not serving as National Chairman of the Board) and one representative from each of the 14 US regions, met in Dallas on April 22 and selected a slate of candidates for the four national officer positions and six elective positions on the Board of Directors. This slate will be presented to the delegates at the National Convention in Washington, D.C., in September.

Robert E. "Bob" Largent of Harrison, Ark., was nominated for his first one-year term as Chairman of the Board. He is presently serving as AFA National President. He is a Life Member and has been active in AFA since 1974. He has served as the Carl Vinson Memorial Chapter Vice President and Vice President for Leadership Development; Georgia State President and Vice President for Awards and Leadership Development; Southeast Region President; and as a member of AFA's Membership Committee, the Long-Range Planning Committee, and the AFA Organizational Review Group. In addition to chapter and state awards, he has received the national Medal of Merit, Exceptional Service Award, and Presidential Citation.

Largent was commissioned through AFROTC in 1968 and served for more than 24 years in various strategic missile operations assignments, including Minuteman Combat Crew, Squadron Operations Officer, Chief of Wing Training, Chief of Wing Plans, Squadron Commander, and Assistant Deputy Commander for Wing and Group Operations. He has also served in a variety of staff assignments, including Special Assistant to the Chief of Staff, USAF; in the Office of the Director, Joint Staff, Joint Chiefs of Staff; Military Assistant to the Commander in Chief Pacific; and Chief, Strategy Division, Headquarters US Pacific Command. Largent retired in 1992 as a colonel and has received, among other awards, the Legion of Merit, Defense Meritorious Service Medal (two times), and the Air Force Meritorious Service Medal (two times).

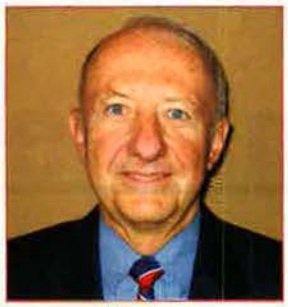
He currently is the owner and principal of an organizational and leadership development consulting firm with a practice that includes an array of national and international clients. Largent is involved in a variety of local civic and community activities, including Rotary and his local Chamber of Commerce, as well as those of AFA.

Largent graduated from the University of Arkansas with a degree in business administration and has a master's of public administration from the University of Oklahoma. He is also a resident graduate of the Air War College.

He currently resides in Harrison, Ark., with his wife, Becky.

Joseph E. Sutter of Knoxville, Tenn., was nominated for his first one-year term as National President. He is a Life Member and has been active in AFA since 1987. He has served as a member of the Aerospace Education Foundation Board of Trustees and in AFA at the chapter, state, and national levels. He has served as President of the Gen. Bruce K. Holloway Chapter, as both Chapter and State Vice President for Aerospace Education, and as Tennessee State President. At the national level, he has served as both a member and the Chairman of the AFA Strategic Planning Committee and currently serves as a National Director and Chairman of the afa21 Governance Team. He has received the AFA Presidential Citation, Exceptional Service Award, and Medal of Merit and was named AFA Tennessee

2006-07 AFA Nominees



Hannam

Davoren

Nelson

Volunteer Member of the Year in 1996 and 2004.

Sutter has been active in the civilian community. He is a past President of the Rotary Club of Knoxville and the East Tennessee Military Affairs Council, past Chair of his parish council, and served on the Board of Directors of the United Way of Knoxville. While maintaining active involvement in those organizations, he also currently serves as member of the Board of Directors of Covenant Health.

He served on active duty for 28 years at various USAF locations: Minot AFB, N.D.; Vandenberg AFB, Calif.; the Pentagon; Offutt AFB, Neb.; Whiteman AFB, Mo.; and the University of Tennessee, Knoxville. His primary military duties were in ICBM operations; he commanded an ICBM squadron, operations group, and missile wing. Other military duties included Staff Officer assignments at the Pentagon, including two years in Air Force Legislative Liaison; Hq. Strategic Air Command, Chief of the Advanced ICBM Requirements Division; and Senior Controller, SAC Command Center. He graduated from the Naval War College, College of Command and Staff, with Highest Distinction, and from the Industrial College of the Armed Forces as a Distinguished Graduate.

His decorations include the Legion of Merit with two Oak Leaf Clusters; Meritorious Service Medal with four OLCs; Air Force Commendation Medal with one OLC; and the Air Force Achievement Medal.

Sutter graduated from the University of Florida with a bachelor's degree in civil engineering and from the University of Southern California with a master of science degree in systems management. He works as a consultant on national security matters, serving USAF and other clients in the Washington, D.C., area.

He and his wife, Geri (who is currently serving as the Tennessee State Secretary), have three grown children and three grandchildren.

The Nominating Committee is submitting two names—Judy K. Church and Mark Dierlam—for consideration for a one-year term as National Secretary:

Judy K. Church of Lenexa, Kan., is a Life Member and has been active in AFA since 1987. Her involvement with the association began through her late husband, National Treasurer Charles H. Church Jr. She was active at the chapter level and also gained national experience as she traveled with him to national meetings and events throughout the country.

She has served AFA in appointed and elected positions at all levels. She held the position of Chapter Treasurer of the Harry S. Truman Chapter and has served as Missouri State President, Vice President, and Vice President for Communications. She is currently serving as the Midwest Region President. At the national level, she serves as a member of the Constitution Committee and has served as both a member and Chairman of the Credentials Committee.

She has also maintained a full commitment to other volunteer work through service on many civic boards. She is a current member of the NE Johnson County Kansas Republican Women's Board, past member of the Kansas City Symphony Board, and past member of the University of Missouri Kansas City Women's Council Board.

She was named the 2003 Midwest Member of the Year and was made a Charles H. Church Jr. Fellow by the state of Missouri. At the national level, she has received the Medal of Merit and Exceptional Service Medal.

Church graduated from Southland Girl's High School, Invercargill, New Zealand. She attended Otago University in Dunedin, New Zealand, and has a diploma in early childhood education. She has two children.

Mark Dierlam of Montgomery, Ala., is a Life Member and the current Alabama State President. He has concurrently served for the past five years at the national level on the AFA Finance Committee. He has served the Montgomery Chapter as Chapter President, Vice President, and Secretary. He has received the AFA Medal of Merit and the Exceptional Service Medal.

Dierlam was a leader of and continues to participate in the Wright Flyers, a Maxwell Air Force Base support organization that provides assistance to the base leadership, service members, and their families. He has served in many civilian leadership roles including being the Rotary International District Governor for 49 Alabama clubs, President of the Montgomery Rotary Club, and board member of the Montgomery Chamber of Commerce, Frazer Memorial Methodist Church, Montgomery Education Building Authority, YMCA, and Baptist Hospital.

Dierlam served 26 years in the Air Force in numerous military leadership roles. He served as a Wing Commander, Vice Wing Commander, Group Commander, Hq. SAC Chairman of the M-X Missile Ad Hoc Planning Group, Deputy Wing Commander for Resources, B-52H Instructor Pilot, Base Civil Engineering Chief of Programs, Maintenance Control Officer for 150 B-52 aircraft at Andersen AFB, Guam, Officer in Charge of a 565-man Jet Engine Repair Facility, B-52D Instructor Pilot, and Wing Staff Officer.

Since retirement from the Air Force, Dierlam has led an award-winning financial advisor business currently serving more than 400 clients.

He graduated from Texas A&M University with a bachelor of science degree in electrical engineering and has a master of science degree in operational research from the Air Force Institute of Technology.

He and his wife, Kay, have three children who are Air Force Academy graduates and are currently serving the Air Force as lieutenant colonels—two as squadron commanders.

Zimkas

Horlen

Schowalter

White

Steven R. Lundgren of Fairbanks, Alaska, was nominated for his second one-year term as National Treasurer. He is a 20-year member having begun as a Community Partner. He has served AFA in many leadership positions, including Chapter, State, and Region President. He currently chairs the AFA Finance Committee. Lundgren is the AFA Alaska Leadership Development Director and the Fairbanks Chapter Community Partner Vice President. He has received an Exceptional Service Award and the national Presidential Citation.

Lundgren is a member of the Alaskan Command Civilian Advisory Board, Vice Chairman of the Alaska State Committee for Employer Support of the Guard and Reserve (ESGR), and member of the Greater Fairbanks Chamber of Commerce Military Affairs Committee. He is also active as a leader in other civic organizations, serving as Vice Chairman of the Fairbanks Economic Development Corp. and on the Board of Directors of the Greater Fairbanks Chamber of Commerce. Lundgren has also served as a Director of the Interior Alaska Builders Association and the United Way of the Tanana Valley as well as President of the Fairbanks Sunrisers Rotary Club. He has received numerous awards, including the 2004 ESGR Spirit of Volunteerism Award, and he was recently honored with the 2006 Annual Honorary Iceman Award from Eielson AFB, Alaska.

Lundgren's entire professional career of more than 25 years has been in the financial services industry. He is currently Senior Vice President and member of the Senior Management Committee for Mt. McKinley Bank, the largest community bank in the Fairbanks area. His primary day-to-day job as a commercial lender requires budget analysis, financial statement analysis, trend analysis, risk analysis, and general oversight of a $75 million-plus securities portfolio and $75 million-plus commercial loan portfolio.

He graduated from Oregon State University with a bachelor's degree in business administration and has completed graduate studies at Portland State University and the University of Alaska. He attended the American Bankers Association National Commercial Lending School in 1991 and the ABA National Commercial Lending Graduate School in 1992 at the University of Oklahoma.

He and his wife, Susan, have three children.

The AFA Constitution directs that one-third of the 18 elected Directors be elected at the National Convention each year. For the 2006 election, the Central East, Far West, North Central, Rocky Mountain, and Texoma Regions have Director positions open, and there is one Director position open to be elected at large.

The nominees for Director to be chosen by their regions are:

Central East: **James Hannam,** Virginia. Former Region President, State Secretary and Vice President, and Chapter President and Vice President. Current member of the Strategic Planning Committee.

Far West: **Dennis R. Davoren,** California. Former Leadership Development Director, State President, Vice President, and Area Vice President, and Chapter President and Vice President for Membership. Current Region President.

North Central: **Charles A. Nelson,** South Dakota. Former National Treasurer, Region President, State President and Vice President, AEF Board of Trustees member, and Chapter President, Vice President, and Treasurer.

Rocky Mountain: **Charles P. Zimkas Jr.,** Colorado. Former Region President, State President, Vice President, and Vice President for Aerospace Education, AEF Vice President, AEF Board of Trustees member, and Chapter President, Vice President, and Vice President for Aerospace Education. Current Chairman, AFA Membership Committee.

Texoma: **Buster Horlen,** Texas. Former State President, Vice President, and Vice President for Leadership Development and Chapter President, Treasurer, Secretary, Vice President for Membership, and Vice President for Communications. Current Region President.

The Nominating Committee is submitting two names—Paul W. Schowalter and Jerry E. White—for consideration for the office of National Director to be chosen at large:

Paul W. Schowalter, North Carolina. Former member of the Board of Trustees, AEF, Co-Chairman of the AEF Development Committee, member of the AEF Audit Committee, and member of the afa21 Governance Team as part of the afa21 Task Force. He retired as a colonel after 30 years of active and reserve service in the Air Force that included combat duty in Vietnam. He has extensive experience in marketing and sales with a variety of companies and also started and ran his own business which sold and operated companies in a three-state area. He has also served on the board of several churches and as manager and director of youth sports programs.

Jerry E. White, Colorado. Former member of the Board of Trustees, AEF, Co-Chairman of the AEF Development Committee, and member of the afa21 Tax Status Team as part of the afa21 Task Force. He retired as a major general after serving in the Air Force for 37 years in both active and reserve assignments and was a member of the Reserve Forces Policy Board. He holds a Ph.D. in astronautics, has served as CEO, President, and Chairman of the Board of a large nonprofit 501(c)(3) organization, Chairman of a management association of several hundred 501(c)(3) organizations, and Co-founder of CEO Dialogues facilitating interactions among their leaders. ■

This Is AFA

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AFA National Report

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By Frances McKenney, Assistant Managing Editor

Symposium at Langley

The **Langley Chapter** sponsored its annual airpower symposium at Langley AFB, Va., in May.

Salute to ACC, as the event is called, is "one of the primary forums to exchange information between Air Combat Command staff and its industry partners," explained Chapter VP Jerry L. Levesque.

Nearly 300 attended the symposium. Air Force Association Chairman of the Board Stephen P. "Pat" Condon and Vice Chairman of the Board L. Boyd Anderson represented AFA.

Keynote speaker was the ACC commander, Gen. Ronald E. Keys. Following his remarks were three panel discussions on the symposium theme, "Targeting Investment to Ensure Combat Air Forces Core Capabilities."

The first of three ACC-defense industry panels discussed recapitalizing the ACC force structure. A second panel covered the challenge of sustaining a legacy force. The third panel focused on warfighting in the new dimension, including command and control and intelligence in a network-centric environment; support for the ground forces; and computer modeling and simulation.

Informal gatherings during the symposium included a reception at the Langley Officers' Club and a chapter-hosted golf tournament with 140 players. More than 500 guests turned out for the culminating black-tie gala, held at the new Hampton Roads Convention Center. Lt. Gen. Victor E. Renuart Jr., Joint Staff director for strategic plans and policy, addressed the gala audience.

Chief's Scholarship

AFA National President Robert E. "Bob" Largent attended an annual reception in May, hosted by the **Paul Revere Chapter** in Bolton, Mass.

He joined Gen. Duncan J. McNabb, who heads Air Mobility Command, and Lt. Gen. Charles L. Johnson II, commander of Electronic Systems Center, in presenting the chapter's prestigious Chief of Staff Scholarship.

The college scholarship, given in the name of the Air Force Chief of Staff, is awarded to a military family member from the Hanscom AFB, Mass., community where ESC is located.

AFA Board Chairman Pat Condon (right) and Vice Chairman Boyd Anderson (left) received a $1,500 donation for AFA's educational programs from Langley Chapter Vice President Jerry Levesque (center). See "Symposium at Langley."

This year's recipient, Burlington High School student Kayla Hammond, is the daughter of Lt. Col. John Hammond and Colleen Hammond. Colonel Hammond is assigned to Joint Force Headquarters, Massachusetts National Guard.

Two "very special scholarships"—in the words of Chapter President Steven J. Negron—were also awarded at this reception and dinner. Russell Rennie received the Col. Charles E. Jones Scholarship, while the Brian D. Sweeney Scholarship was awarded to Allison Dennis. These scholarships are named for two Revere Chapter members who died on airliners that were hijacked on 9/11 and flown into the World Trade Center.

For Jim Crawford

The Airmen Leadership School at Minot AFB, N.D., was renamed in May to honor the late James M. Crawford, a former region president for AFA's North Central Region.

Crawford was a retired chief master sergeant and had held all offices in the **Gen. David C. Jones Chapter,** as well as the state-level offices of president, vice president, and secretary. He had just completed a term as region president when he died in a car accident in November 2003.

James W. Simons, the current North Central Region president, reported that more than 100 people attended the ceremony, including Crawford's close friends Victor Seavers, of the **Gen. E.W. Rawlings Chapter** in Wisconsin, and Richard P. Giesler, from the **Richard I. Bong Chapter,** also in Wisconsin.

Col. Eldon Woodie, commander of the 5th Bomb Wing at Minot and a Jones Chapter member, conducted the dedication and, in his remarks to the audience, mentioned Crawford's work with AFA.

Congressional Attention

US Rep. Emanuel Cleaver (D-Mo.) was the distinguished guest at the **Harry S. Truman Chapter** meeting in Kansas City, Mo., in June.

He presented AFA Certificates of Achievement to outgoing leaders of AFJROTC booster clubs in the area. The booster clubs—made up of volunteers who are parents of AFJROTC cadets—provide support and raise funds for uniform accessories, field trips, and other items not covered by school budgets.

AFA National President Bob Largent (far right) helps present a Paul Revere Chapter scholarship to Kayla Hammond (center). Assisting were (l-r) Gen. Duncan McNabb, Chapter President Steven Negron, and Gen. Charles Johnson. See "Chief's Scholarship," p. 91.

Chapter VP Jerry Hughes works with booster club leaders at the five AFROTC units in the Kansas City area supported by the Truman Chapter.

Also at this chapter meeting, Rodney G. Horton was named Missouri State Man of the Year and received an AFA Charles H. Church Jr. Memorial Fellowship. Horton serves as both chapter and state VP for communications and has edited the chapter newsletter for years. In four decades of AFA membership, he has held many state and chapter leadership posts. Midwest Region President Judy K. Church and State President Patricia J. Snyder presented Horton with the fellowship plaque. The award is named for Church's late husband, who had served as AFA's National Treasurer, 1995-2000.

In another presentation during the chapter meeting, Richard J. Keeney received the Member of the Year award, as recognition for organizing the chapter's Honors Element. A group of six chapter volunteers, the Honors Element marched in Kansas City's Memorial Day parade and manned an AFA table at Whiteman Air Force Base's open house in June. Keeney established the Honors Element in April so the chapter would be able to send a group of formal representatives to patriotic events and funerals.

More AFA News

■ Army, Air Force—it makes no difference to the **Frank Luke Chapter (Ariz.).** Medically retired US Army Specialist Erik Castillo, who was wounded in a mortar attack in Baghdad two years ago, recently received a gift from the chapter: a week's vacation for two at a resort vacation club in Puerto Vallarta, Mexico. It was just one of the many ways the chapter promotes AFA, with a particular emphasis on junior enlisted personnel. When Chapter President Harry Bailey provided Castillo with the details of the vacation, he stated the simple reason behind the gift: "Thanks for defending us."

■ It was 100 degrees that day and, for all of them, a trip of at least 100 miles one way, but several AFAers from the **Enid Chapter, Central Oklahoma (Gerrity) Chapter,** and the **Tulsa Chapter** traveled to Altus AFB, Okla., in May for the 2006 Altus America Air Show. David L. Blankenship, who is a former AFA board chairman Joan L. Blankenship, Terry Cox, Mary Feightner, Donald L. Jones, Sheila K. Jones, Dung Q. Nguyen, and George Pankonin watched demonstrations by the Air Force Thunderbirds and other groups and toured aircraft displays. Lt. Col. Richard Baldwin, the **Altus Chapter** president, said the group—most of them attired in matching AFA polo shirts and ball caps—made the trip to show AFA support for the 97th Air Mobility Wing at Altus.

■ Outer space came to Earth in a 53-foot trailer, when the **Leigh Wade Chapter (Va.)** sponsored a traveling exhibit from the Science Museum of Virginia. The exhibit trailer was filled with hands-on activities that teach visitors about payload weight, gravity, and planets—in short, the challenges of traveling, living, and exploring in space. The museum trucked the trailer—called the Space Traveler—down from Richmond to help celebrate Space Day, on May 4, at Lakeview Elementary School in Colonial Heights. More than 350 students went through the trailer.

■ How much does it cost to bring outer space to Earth? $1,000. **Roanoke Chapter** President Scott Van Cleef presented a check for that amount to officials at Ferrum (Va.) Elementary School. It funded a Space Traveler visit to the school in April. As with the Wade Chapter, the Roanoke Chapter contributed a basic amount, the state AFA matched it, and AFA matched that total. The local newspaper featured the Space Traveler visit to Ferrum on page one, with photo of Van Cleef, and even explained in detail how the chapter arranged the AFA matching grant.

■ It took months of paperwork, phone calls, and coordination, but **David J. Price/Beale Chapter (Calif.)** members were determined to help preserve the history of the SR-71 reconnaissance aircraft. Chapter President Lt. Col. Jeffrey W. Decker and chapter member Frederic Levien facilitated the transfer of 10 SR-71 electronic warfare suites from the Naval Post Graduate School to Beale Air Force Base and to various aviation museums. The EW suites on the high-speed, high-altitude Blackbird were crucial equipment in the Cold War, said Levien, a retired NPGS professor. He and MSgt. Claude L. Latham, chapter VP, recently presented a chapter award to Rear Adm. Richard H. Wells, the NPGS president, as thanks for preserving this part of US military history. The NPGS is located in Monterey, Calif. The SR-71 last flew in October 1999.

■ The **H.H. Arnold Memorial Chapter** hosted the Tennessee State Convention in Lynchburg in May. During the awards banquet, several members of the Air Force Total Force received honors for outstanding performance. A Teacher of the Year and Volunteer of the Year were also named. Bob Largent, AFA National President, attended the banquet, along with George M. Livers, state president. Brig. Gen. David L. Stringer, commander of the Arnold Engineering Development Center at Arnold AFB, Tenn., was the featured speaker.

■ The **Brig. Gen. Bill Spruance Chapter** co-hosted the annual Focus on Aviation awards dinner, held at Wilmington College in New Castle, Del., in May. Central East Region President William Williams headed the group of AFA attendees, including Richard B. Bundy, state president, and Ernest G. Talbert, chapter president. Several awards went to outstanding members of

the 166th Airlift Wing (ANG), New Castle County Arpt. Other awards highlighted achievements by local civilians in the categories of aviation maintenance, flight training, education, and community service. Chapter member Norman H. Runge, who established the Focus on Aviation 16 years ago, received an AFA plaque and a citation from Delaware Gov. Ruth Ann Minner. Guest speaker was Wolfgang W.E. Samuel, who spoke about his latest book, *American Raiders: The Race to Capture the Luftwaffe's Secrets.*

■ Chris G. Bailey, president of the **Cape Canaveral Chapter (Fla.),** presented the chapter's annual Eagle Award to Scitor Corp. for its outstanding Community Partner support. Bailey reported that the information technology and engineering firm has donated $12,000 over the past six years to the chapter's education fund. Bailey presented the Eagle Award to Scitor CEO Jim Hoskins.

■ Community Partners also were the focus of a luncheon hosted by the **Edward J. Monaghan Chapter** in Anchorage, Alaska. Gary A. Hoff, the Northwest Region president, counted more than 50 guests, who turned out to hear Brig. Gen. Herbert J. Carlisle, commander of 3rd Wing at Elmendorf Air Force Base. Hoff said the general spoke about the Elmendorf's realignment with the Army's Ft. Richardson and the upcoming beddowns of the C-17 and F-22.

■ The **Gen. Nathan F. Twining Chapter (Fla.)** named its Science Teacher of the Year and its Science Student of the Year. Chapter President Henry L. Marois Jr. attended the annual awards ceremony for Shorecrest Preparatory School in St. Petersburg to present the awards to Michele D'Ambrosio and Nick Voce. D'Ambrosio teaches oceanography. Voce won the honor for a science project that tested wing airfoil cross-sections.

■ Sponsorship of the 18th annual AFJROTC drill competition in Valrico, Fla., yielded local newspaper coverage for the **John C. Meyer Chapter.** The article described the contest and AFA's purpose and ran a photo of Chapter President Dennis E. Foley presenting the first-place trophy to cadet Rachel Campbell. Earlier, Campbell had received the Cadet of the Year award from Richard H. Trout II, chapter secretary. Making it a complete sweep for Campbell, her AFJROTC instructor at Hernando High School, retired Col. James Crigger, was named in May as chapter Teacher of the Year.

■ The **Jerry Waterman Chapter (Fla.)** joined the **Meyer Chapter** and the **Twining Chapter** in May for an orientation to the Coast Guard cutter *Hawk,* anchored in St. Petersburg, Fla. Capt. Joseph Servidio, commander of USCG Sector St. Petersburg, hosted the 31 AFAers. He provided a briefing on the mission of his command, whose assets include the 87-foot-long *Hawk.* The $4 million patrol boat was commissioned two years ago as part of the Coast Guard's fleet upgrade. *Hawk's* 10-person crew is armed with two .50-caliber machine guns and small arms to carry out its antiterrorism, search and rescue, environmental, and law enforcement missions.

Tucson Chapter's Carl Beck observes SSgt. Brandon Corwin working on a TF34 engine at the 355th Component Maintenance Squadron, Davis-Monthan AFB, Ariz. Beck challenged chapter members to donate $100 so the chapter could offer AFA memberships to junior airmen. Corwin was the first to receive free membership.

■ **Southern Indiana Chapter** President Marcus R. Oliphant didn't have to search hard to line up entertainment for the chapter's May dinner meeting. He simply asked three of his granddaughters—Lauren, Jenna, and Lilly—to perform. The Brown Sisters opened a 40-minute program by singing the National Anthem and the Air Force Song. Special guests at the meeting were William A. Howard Jr., the Great Lakes Region president, and a group from the **Fort Wayne Chapter,** led by State President Thomas Eisenhuth. The group included Theodore Huff Jr., Everitt Padgitt, Jeanne L. Hissem, and Marjorie A. Feeback.

■ Twenty airmen who had just returned from deployments to Iraq or Afghanistan played golf as guests of the **Hurlburt Chapter** at its annual golf tournament at Fort Walton Beach, Fla. Frederick Gross, who organized the tournament's 34 foursomes, said the funds raised by the golf outing go to chapter projects that support Hurlburt's airmen. Col. Paul R. Harmon, 16th Special Operations Wing vice commander at Hurlburt Field, thanked the chapter for its generosity.

■ An AFA commemorative coin was created specifically for a Salute to the Virginia Air National Guard gathering, held in March at the Virginia Aviation Museum in Richmond. The state AFA organization sponsored the event. Members of the Virginia ANG's 192nd Fighter Wing, the 203rd RED HORSE Squadron, and the 200th Weather Flight at the dinner each received a coin. All unit members who had deployed recently were given an AFA Citation, and their employers received AFA Certificates of Appreciation. At the Salute banquet, Virginia State President James R. Lauducci presented a commemorative coin to Col. Jay M. Pearsall, 192nd commander. A bronze statuette went to CMSgt. Susanne L. Dates, the wing senior enlisted advisor.

■ In Front Royal, Va., in May, **Northern Shenandoah Valley Chapter** President Arthur Andraitis, VP Norman M. Haller, and Chapter Secretary Norman G. Brander were special guests at the Warren County (Va.) High School awards ceremony. On behalf of AFA's educational programs, they donated $500 to the school to assist its physics and astronomy classes.

■ The **C. Farinha Gold Rush Chapter** in Sacramento, Calif., selected a sixth-grade math-science-physical education instructor as its 2006 Teacher of the Year. Liz Staton-Arter from Newcastle (Calif.) Elementary School received the award at the chapter's Spring Awards gala. Held in April in a hotel and conference center at the former Castle Air Force Base, the evening's

awards banquet also honored several military personnel and 10 students. The students received scholarships totaling nearly $22,000, donated by the chapter and corporations. Amit Jain, a UC Berkeley student, received the top $5,000 scholarship from the Dwelle Family Trust.

■ **Spirit of St. Louis Chapter** President Gary M. Young presented a Civil Air Patrol Cadet of the Year award to Samuel Riehn during a May meeting of the CAP's Trail of Tears Composite Squadron in Cape Girardeau, Mo. Young noted that the group is the top CAP unit in Missouri, having won the CAP Squadron of Merit award in 2005 and 2006.

■ A World War II Army sniper who landed on Omaha Beach for the June 6, 1944 D-Day invasion was guest speaker for a D-Day observance, conducted by the Civil Air Patrol's Patrick Composite Squadron at Patrick AFB, Fla. **Central Florida Chapter's** Richard A. Ortega described capturing a German gun battery and his other D-Day experiences. He then challenged the CAP cadets to answer this question: What is the AFA mission? He awarded an AFA membership to Jessica Femia, who came up with the correct answer.

■ A veteran of three tours in Iraq addressed the May meeting of the **Pasadena Area Chapter** in California. Marine Reserve Chief Warrant Officer Thomas G. Tomka emphasized the infrastructure being rebuilt in Iraq, said chapter government affairs VP Martin W. Ledwitz. Tomka described the building of roads and schools, oil pumping operations, and generating electricity. The chapter members also listened to presentations by Bill Farmer, who was a B-17 ball turret gunner in World War II, and by Steve Johnson, who represented a local government official and spoke about supporting the National Guard.

■ The **Capt. Eddie Rickenbacker Memorial Chapter (Ohio)** has begun holding its meetings in a replica of its namesake's boyhood home. Rickenbacker, who was born in Columbus in 1890, was America's top World War I ace, credited with 26 aerial victories. The chapter named after the Medal of Honor recipient is one of AFA's original charter chapters. ■

Have AFA News?

Contributions to "AFA National Report" should be sent to *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Phone: (703) 247-5828. Fax: (703) 247-5855. E-mail: natrep@afa.org. Digital images submitted for consideration should have a minimum pixel count of 900 by 1,500 pixels.

Reunions

reunions@afa.org

21st/6461st TCS (Korean War). Oct. 18-22 in San Antonio. **Contact:** Dana Mansur (908-782-1657) (kgypsy@patmedia.net).

38th BG (WWII), Mesa, AZ. Sept. 28-30. **Contact:** Jack DeTour, 98-1108 Malualua St., Aiea, HI 96701 (phone/fax: 808-487-2842) (jackdet@hawaii.rr.com).

47th BG (WWII). Aug. 25-28 at the Doubletree Hotel in Arlington, VA. **Contact:** Costa Chalace (508-224-4982).

303rd BG Assn (WWII), Eighth AF. Sept. 12-16 at the Menger Hotel in San Antonio. **Contact:** 303rd BGA Reunion Manager, 3552 Landmark Trail, Palm Harbor, FL 34684 (ed303fsra@aol.com).

315th BW Assn, Northwest Field, Guam. Nov. 1-5 in Tucson, AZ. **Contact:** Bev Green (217-893-3197).

363rd FG and **161st TRG** (WWII), Ninth AF. Oct. 24-26 at the Gold Coast Hotel & Casino in Las Vegas. **Contact:** Arthur Mimler (209-966-2713).

366th Fighter Assn. Sept. 7-10 in Philadelphia. **Contact:** Steven Pennington (425-774-7504) (gunfighter11@juno.com).

435th Aerial Port Sq. Nov. 9-12 in Branson, MO. **Contact:** Fred Norton (618-355-0632) (derfnorton@aol.com).

445th FIS. Aug. 15-18 in Colorado Springs, CO. **Contact:** Al Bruder (937-879-3800) (abruder652@aol.com).

450th BG (1943-45). Sept. 11-15 at the Circus Circus Hotel in Reno, NV. **Contact:** Al Goodman, 2 Portside Ct., Grayslake, IL 60030 (847-543-8381) (gobaral@aol.com).

486th BG Assn. Oct. 13-16 at the Holiday Inn in Irving, TX. **Contact:** Burton Paquin (802-868-7660) (bapaquin@worldnet.att.net).

3389th (formerly 3512th) **Pilot Training Sq.** Oct. 12-15 at the Holiday Inn Select in San Antonio. **Contact:** Chuck Davies, 4435 Monaco Dr., San Antonio, TX 78218 (210-653-1475) (cpmfd@sbcglobal.net).

7505th USAF Hospital, Burderop Park, England. Oct. 4-8 at the Radisson Hotel in Branson, MO. **Contact:** R. Blasing (404-291-5019) (rb7505th@aol.com).

Chanute AFB Alumni. Sept. 29-30 at the Chanute Air Museum in Rantoul, IL. **Contacts:** Don Weckhorst (217-379-3253) or Dale Lyons (217-892-4861).

KC-135, all units. Sept. 8-10 at Tinker AFB, OK. **Contact:** Steve Auchter (405-741-0048, ext. 202) (steve.auchter@kc135.org).

Ninth Air Force Assn. Aug. 23-26 at the Crowne Plaza Hotel in Dayton, Ohio. **Contact:** Lloyd Johnson (402-423-2304).

Pilot Training Class 57-E. Dec. 2-4 in Tucson, AZ. **Contact:** Dewey Fitch (309-693-8378) (deweyair@aol.com).

Pilot Training Class 63-A, Craig AFB, AL (1961-62). Oct 5-8 at the Doubletree Hotel Seattle Airport in Seattle. **Contact:** John Taylor (360-893-8022).

Pleiku Air Base Assn. Aug. 10-13 at the Ramada Inn in Bowling Green, KY. **Contact:** Harry Beam (724-745-9129).

Seeking members of **pilot training classes 1941-44** at Bush Field in Augusta, GA, for a possible reunion in October. **Contact:** Willis Boshears, Augusta Regional Airport, 1501 Aviation Way, Augusta, GA 30906 (706-798-3236) (wboshears@augustaga.gov).

The Distinguished Flying Cross Society. Oct. 22-26 at the Riviera Hotel in Las Vegas. **Contact:** Michael O'Neil (1-866-332-6332) (dfcs@dfcsociety.org).

USAF Pilot Class 56-V. Oct. 13-15 in Eureka Springs, AR. **Contact:** George Partridge (334-365-8368) (gpartridge56v@knology.net). ■

E-mail unit reunion notices four months ahead of the event to reunions@afa.org, or mail notices to "Unit Reunions," *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information. We reserve the right to condense notices.

AFA Conventions

Aug. 5	**Georgia State Convention,** Warner Robins, Ga.
Aug. 9	**Michigan State Convention,** Mt. Pleasant, Mich.
Aug. 11-12	**Colorado State Convention,** Pueblo, Colo.
Aug. 19	**Indiana State Convention,** Indianapolis
Aug. 26	**California State Convention,** Ontario, Calif.
Aug. 26	**Midwest Region Convention,** Galesburg, Ill.
Aug. 26	**North Carolina State Convention,** Raleigh, N.C.
Sept. 22-24	**AFA National Convention,** Washington, D.C.
Sept. 24-27	**Air and Space Conference,** Washington, D.C.

AFA In Action

The Air Force Association works closely with lawmakers on Capitol Hill, bringing to their attention issues of importance to the Air Force and its people.

Air Force Depot Caucus

AFA and the Program Division of the Air Force's Legislative Liaison Directorate sponsored a breakfast meeting to discuss issues and programs affecting Air Force depots. Lt. Gen. Donald J. Wetekam, deputy chief of staff for logistics, installations, and mission support, briefed those attending about programs under way to ensure depots retain organic capability while instituting reforms to make them competitive with civilian industry. Also making remarks were Gen. Bruce Carlson, commander of Air Force Materiel Command, and William C. Anderson, assistant secretary of the Air Force for installations, environment, and logistics.

Members of Congress at the breakfast included Sens. Saxby **Chambliss** (R-Ga.) and Orin **Hatch** (R-Utah), as well as Reps. Jim **Marshall** (D-Ga.) and Rob **Bishop** (R-Utah). Also attending the program were professional staff members, including Gregory T. **Kiley,** Derek J. **Maurer,** and Michael J. **McCord,** all from the Senate Armed Services Subcommittee on Readiness and Management Support. Counsel Jeffrey A. **Green** attended from the House Armed Services Committee.

Team of the Year on Capitol Hill

AFA hosted USAF's 2006 Team of the Year on Capitol Hill during the group's week-long stay in Washington. The team comprises five airmen from one of the service's career fields. This year's team members work in the food and recreation services areas. They are SSgt. Heather J. Schaffer, SrA. John J. Hitchens, A1C Nicolas A. Paulino, A1C Andrea Quintanilla, and A1C Ashley N. Sakurai.

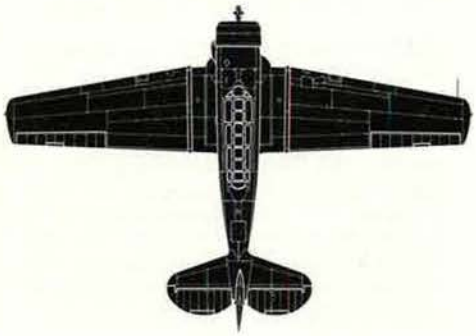
Team members met with their Congressman from either their home of record or where they are stationed. Each had an opportunity to explain their career field and to discuss their Air Force service. Paulino met Reps. Jim **Kolbe** (R-Ariz.) and Michael **Turner** (R-Ohio). Schaffer was introduced to Rep. Barbara **Cubin** (R-Wyo.). Quintanilla met with Reps. Jack **Kingston** (R-Ga.) and Randy **Neugebauer** (R-Tex.), while Sakurai met with Rep. Neil **Abercrombie** (D-Hawaii). Hitchens met with Rep. Jerry F. **Costello** (D-Ill.).

Before meeting with the Congressmen, the team was welcomed to a luncheon, sponsored by AFA, at which Rep. Sam **Johnson** (R-Tex.), a retired Air Force colonel, POW, and former member of the AFA Board of Directors, spoke.

Airpower Classics

Artwork by Zaur Eylanbekov

AT-6 Texan



One of the most widely used aircraft of all time, the World War II-era AT-6 Texan was the airplane in which all US Army Air Forces pilots and many Navy and Allied pilots got their advanced training. It was an ideal "classroom." A clean, cantilever monoplane, the Texan advanced trainer posed a significant challenge to a student pilot trying to make the transition from basic trainer to first-line aircraft. The AT-6 was complex, with flaps, controllable-pitch propeller, and retractable landing gear and difficult stall and spin characteristics. Its pilots could train in strafing, aerial combat, and bombardment.

Early in World War II, demand for the AT-6 soared, and some 60 models were built for specialized needs. The Navy called it the "SNJ," and the Royal Air Force called it the "Harvard." USAAF, though, flew two-thirds of the Texans. North American played many variations on the trainer theme. Derivatives served in many wars on many continents in the fighter, attack, bomber, reconnaissance, and forward air controller roles.

In 1949, USAF and the Navy gave the design a new lease on life by modifying 2,068 into T-6G models. The Texan also saw action in the Korean War as a FAC, flying 40,354 "Mosquito Missions" in which they spotted and marked enemy troops and guns. The Texan was acquired by the air forces of more than 30 nations, including postwar Germany and Japan. Australia, Canada, and Sweden all built it under license. While the Texan left USAF duty in the late 1950s, Brazil and Venezuela flew it into the 1970s. It is said that the AT-6 trained several hundred thousand pilots in 34 different countries over a period of 25 years.

—Walter J. Boyne

This aircraft: US Army Air Forces AT-6C-10-NT Texan #42-43925—*X-151*—as it looked while based at Luke Airfield, Ariz.

In Brief

Designed and built by North American ★ first flight 1935 (prototype) ★ crew of 2 (student, instructor) ★ single P&W radial engine ★ number built 15,495 ★ **Specific to AT-6A:** max speed 210 mph ★ cruise speed 145 mph ★ max range 629 miles (loaded) ★ armament, two .30 cal. machine guns ★ weight (max) 5,155 lb ★ span 42 ft ★ length 29 ft ★ height 11 ft 9 in.

Famous Fliers

Most of USAAF's World War II aces ★ Many Allied and Navy aces of World War II ★ Many Air Force aces of Korean War ★ U-2 pilot Francis Gary Powers.

Interesting Facts

Nicknamed "Pilot Maker" ★ repainted models used to depict Japanese Zeros in 1970 film "Tora! Tora! Tora!" ★ redesignated twice, from BC-1 to AT-6 (1940) and from AT-6 to T-6 (1948) ★ Last T-6 used by an air force (South African AF) retired in 1996 ★ France called its T-6s "Tomcats" ★ C model built partly of plywood (to conserve materials) ★ used as combat aircraft in conflicts in Latin America, Africa, Mideast, Southeast Asia.

AT-6 Texans in flight over Miami on Nov. 8, 1946.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