DECEMBER 1994/$3

# AIR FORCE

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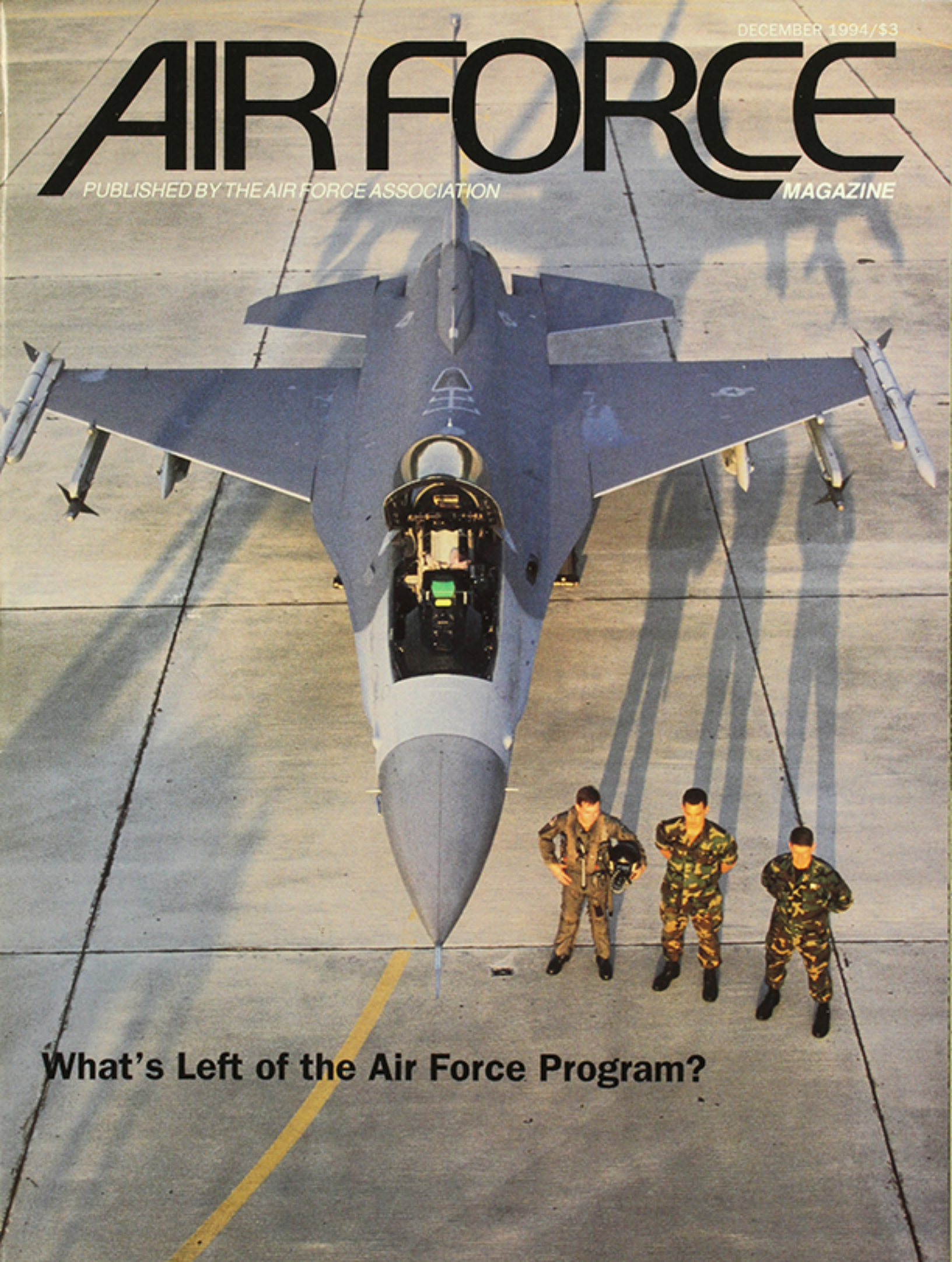

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December 1994, Vol. 77, No. 12

# AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



**About the Cover:** An aircrew and F-16 from the 347th Wing stand tall at Moody AFB, Ga. The pressure on force levels and aircraft continues in the FY 1995 budget. See "What's Left of the Air Force Program?" p. 24. Photo by Randy Jolly.



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*Doing more with less is all in a day's work for the 2d Logistics Group.*

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# Editorial

**By John T. Correll,** Editor in Chief

# Airplanes in the Mist

For the past fourteen months, the Air Force Association and Air Force Magazine have been at odds with the National Air and Space Museum about plans for exhibition of the *Enola Gay*, the B-29 that dropped the atomic bomb on Hiroshima. Counting the latest revision, published October 26, we have seen this situation through eight evolutions—three concept plans and five versions of the full script.

In the beginning, the museum was all set to use the *Enola Gay* as a prop in a politically rigged program that made the Japanese in World War II look like victims instead of aggressors. The exhibition, timed to coincide in 1995 with the fiftieth anniversary of the *Enola Gay*'s famous mission, picked up the story in 1945 as the end approached. It portrayed the Japanese as desperate defenders of homeland and culture, the Americans as ruthless invaders, driven by racism and revenge. Use of the atomic bomb was depicted as a questionable act, if not an immoral one.

After publication of "War Stories at Air and Space" in Air Force Magazine last April, the curators were swamped by negative public opinion, protests from veterans' groups, news media coverage, and attention from Congress. The pressure eventually led top officials of the Smithsonian Institution—of which the Air and Space Museum is a part—to take a direct hand and moderate the blatant ideological bias.

First, the good news. The latest revision corrects the worst offenses of the earlier plans. Much of the anti-American speculation has been removed. The balance of casualty photos (which originally emphasized Japanese suffering by a ratio of more than sixteen to one) now approaches parity. More than half of the emotionally loaded graphic images have been deleted from the "Ground Zero: Hiroshima and Nagasaki" section. The curators seem to be adjusting—albeit with gritted teeth—to the position that dropping the atomic bomb was a legitimate military action taken to end the war and save lives.

It does not, however, add up to an acceptable salvage job, largely because the curators, retreating word by word and line by line, have managed to preserve the gist of their biases. US actions and policies inspire them to doubt, probe, and hint. Did we use the bomb to justify the cost of developing it? Wasn't the war almost over anyway? Did our insistence on unconditional surrender prolong the war? Was the alternative to the bomb truly an invasion of Japan, and would casualties really have been that high?

**People come to the Air and Space Museum to see restored airplanes, not for counterculture pageants or spiels about the ozone layer.**

The speculation is one-sided, of course. There is no compulsion to dig deeper into such issues as Japan's dramatized quest for peace in 1945, the Emperor's actual role in wartime policy and planning, or why Japan did not move to end the war sooner when it was evident that the cause was lost.

Imbalances persist as well. Words, pictures, and video "testimony" describe in detail the tragedy of *hibakusha* ("explosion affected persons") from Hiroshima and Nagasaki, but the curators have no time for another group—disabled American veterans—for whom the suffering also continued after the war.

I. Michael Heyman, the new secretary of the Smithsonian Institution (and a former Marine), says the revisions will continue until the exhibition opens next May. We hope he is steadfast in his promise because the job is far from done. More than a single exhibit is at issue here. If the *Enola Gay* program is fixed—and that is a big if—what about the next exhibition, and the one after that? What about the people who created such a biased exhibit in the first place? What else do they have in mind for the National Air and Space Museum?

We suspect they share the reported view of an official at another Smithsonian museum who looks down on visitors as clods who "don't want to be engaged, empowered, or even educated." It is difficult, apparently, for these fellows to accept that people come to the Air and Space Museum to see historic aircraft, professionally restored and cleanly presented. They are not interested in counterculture morality pageants put on by academic activists.

In remarks to the National Aviation Club September 21, Dr. Martin O. Harwit, director of the Air and Space Museum, talked about the annex to be built at Dulles Airport in suburban Virginia to display aircraft from the Smithsonian's collection that are too large to show at the main museum downtown. He spoke about airplanes for four sentences. The rest of his preview was about global awareness and using space platforms "to keep tabs on the ozone hole" and for "monitoring the size of the forested areas in the Amazon." Another Dulles exhibit will spin off Hubble space telescope data to ask, "How do stars form?" and "Where did life begin?"

That is a radical departure from the purpose of the Dulles extension and an indication of how interests and attitudes have shifted at the National Air and Space Museum. The old mission—collecting, preserving, and displaying aircraft and aerospace artifacts—has limited appeal for curators drawn by different causes. That, fundamentally, is why the *Enola Gay* exhibit went wrong and why the problems persist into the eighth revision. Unless the keepers and overseers take a strong hand and stop this slide, more and deeper troubles lie ahead for the nation's most popular museum. ■

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# Letters

**On the Cannibals' Menu**

Regarding your editorial, "The Cannibal Dynamic" *[October 1994, p. 2],* I join you in strongly supporting the F-22 program and decrying inter-service feeding frenzies. But I wish to make a couple of points.

The Army is not just in danger of being in the cannibals' pot. It *is* in the pot and has been there virtually ever since I've been a soldier, which is a lot of years.

In particular, the Army has already lost those programs that, like the F-22, will not be "operational for another ten years." When the services are forced to eat their seed corn, perhaps it's not in the national interest that it all come out of Army granaries.

Army concerns about the F-22's suitability for ground support may be misplaced, but they are not irrational. The F-22 is designed to be an air-superiority fighter. Recent ground-support enhancements give every appearance of "E-Ring Engineering" just to keep the program politically viable. If I were on the Army Staff, I'd be a little nervous too.

Your personal attack on the Army Staff's senior requirements officer, simply for voicing his professional opinion, was wholly inappropriate and is certainly no way to foster jointness. AIR FORCE Magazine would be better advised to build understanding and empathy among its readers for the other services' perspectives.

Col. David A. Appling,
USA (Ret.)
Morgan Hill, Calif.

The October editorial has, perhaps, cleared up a question that has been bothering me for some time: Why would the Air Force propose, or even consider, changes in joint doctrine that would assign sole air responsibility to the Army for fifty miles behind the forward edge of the battle area (FEBA)? It looks to me as if the Air Force is willing to give up responsibility for providing close air support, interdiction, and related missions, as a trade-off if the Army will, in return, support the F-22.

History shows that lack of service support for a major weapon system has never caused the cancellation of that system. The well-known "Admirals' Revolt" of 1949–50 *[see "The Revolt of the Admirals," May 1988, p. 62]* not only did not cancel the B-36; it caused the Senate to hold up the Navy flag officer promotion list while it sorted things out. Systems are canceled on the basis of need. Skybolt and DIVAD come to mind.

Setting aside the wholly specious arguments Maj. Gen. Jay M. Garner makes that "airpower contributes on the margins," it is extremely unlikely that any funds would become available for Army use if the F-22 were canceled unless the Army also acquired the forces required to do the mission behind the FEBA. Does the Air Force foresee the transfer of A-10 and F-16 wings now dedicated to close air support to the Army?

One would hope that Air Force leadership ignores General Garner and sticks to its guns, literally.

Maj. Gen. James B. Currie,
USAF (Ret.)
San Antonio, Tex.

"The Cannibal Dynamic" contained lots of emotion and mud-slinging and few or distorted facts, but a solid conclusion: "What goes around, comes around. One day you're picking the menu. The next day you're in the pot." The proud and professional service members of our Air Force deserve better editorial food for thought than the thin gruel you've offered.

Your personalization of the discussion, directed against General Garner (now a lieutenant general) was inappropriate and unwarranted. Those who have served with General Garner, regardless of service, rate him one of the finest leaders our nation has. As Gen. Merrill A. McPeak said in the inaugural issue of *Joint Force Quarterly,* "Ideas count. . . . Ideas must be iterated, argued, discussed, debated, experimented with, and finally put into practice." General McPeak and other Air Force leaders have repeatedly offered their unvarnished professional opinions and ideas, some contrary to the perspectives of the combatant commands or other services, without a similar AIR FORCE Magazine editorial.

In his address to a gathering of industry representatives in August 1994, General Garner shared some findings and recommendations of several recent studies by the Congressional Budget Office, the General Accounting Office, and the Joint Staff. Each of these studies directly or indirectly questions the cost, need, capability, or acquisition objective (quantity) of the F-22.

If AIR FORCE Magazine doesn't like the contents of these studies, it shouldn't take cheap shots at the messenger but rather present analysis that refutes their findings and recommendations. You elected to personalize your attack instead of arguing for the F-22 on its merits. The F-22 will likely be the premier and most expensive air-superiority fighter in the world. If it's as good as its publicity, it should bask in such attention.

You stated that the Army's presentation was also "tantamount to pounding a stake through the heart of jointness." Get real! You may not like the fact that the outcome of the land battle is typically employed by national leaders to measure success, but it remains a fact.

Additionally, while every nation's military might not contain an air force or navy, they all contain an army, and army leaders typically fill key positions within their military establishments. Once again, it is a fact, not a cheap shot or an assault on jointness.

The Gulf War Air Power Survey,

**Do you have a comment about a current issue? Write to "Letters," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Letters should be concise, timely, and preferably typed. We cannot acknowledge receipt of letters. We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS**


# SOMETIMES IT TAKES A COMPETITION TO PROVE YOU HAVE NO COMPETITION.

Once again, the multirole F-16 did what it does best - dominate the competition. This time, it was William Tell, the definitive USAF air superiority competition. The F-16 teams captured every major event - Overall, Operations, GCI, Maintenance, and Loading.

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|---|---|---|---|---|---|
| PLACE | OVERALL | GCI | MAINTENANCE | LOADING | OPERATIONS |
| 1st | **F-16** | **F-16** | **F-16** | **F-16** | **F-16** |
| 2nd | CF-18 | **F-16** | **F-16** | **F-16** | CF-18 |
| 3rd | **F-16** | CF-18 | F-15 | F-15 | F-15 |
| 4th | F-15 | F-15 | F-15 | F-15 | **F-16** |
| 5th | F-15 | F-15 | F-15 | CF-18 | F-15 |
| 6th | F-15 | F-15 | CF-18 | F-15 | F-15 |
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| 8th | F-15 | F-15 | F-15 | F-15 | F-15 |

Demonstrating its multirole talent, the F-16 also consistently dominates Gunsmoke, the premier worldwide air-to-ground competition, sweeping all events. The F-16 is the only aircraft ever to win both weapons competitions.

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Lockheed

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## Letters

commissioned by the Secretary of the Air Force and released in May 1993, concluded (as reported by the Washington *Post*) that "there was little evidence for two of the most cherished beliefs of airpower enthusiasts: that the key contribution to victory was a 'strategic campaign' against targets far from the central battlefield and that a 'military-technological revolution' has brought a new era of warfare that airpower will dominate." While some of the conclusions of the $5.8 million, eighteen-month Department of the Air Force assessment may not support the AIR FORCE Magazine agenda, the report is a fact.

Your restatement of the often used phrase that "no American soldier has been killed by enemy air attack since April 1953" is true but is a distortion. You could just as easily assert that our nation's presence at Pearl Harbor since 1887 protected Hawaii from external threats—at least until 1941 when the Japanese made a concerted effort. No enemy force that the US military has confronted since the Korean War has made a concerted effort to attack US ground forces with airpower. Don't be so quick to accept credit for preventing something no adversary has attempted.

The readers of AIR FORCE Magazine were ill-served by your shallow, albeit entertaining, editorial. I encourage you to thicken your skin and stick to facts, or at least ideas, instead of launching an attack on someone with whom you disagree. I believe that the current Air Force Chief of Staff would probably give you the same advice.

Lt. Col. Timothy S. Muchmore, USA
Washington, D. C.

The October 1994 editorial criticized the comments of Maj. Gen. Jay M. Garner, assistant deputy chief of staff for Operations and Plans (Force Development). In that editorial, the General was quoted as questioning the need for the F-22 and as asserting that "Armies are the foundation of nearly all national forces. . . . Air forces and navies are 'add ons.' " The General further questioned the value of "strategic [air] attacks to degrade the enemy's ability and will to fight."

Your editorial attacked his statements and characterized his comments as an Army (by default for not denouncing his statements) "budget attack across service lines" and a "poor tactic," in which "the services will not solve [the budget problem] by turning on each other in a feeding frenzy." The General's opinions represented the equivalent of "pounding a stake through the heart of jointness."

If General Garner's comments are unworthy because they represent interservice budget battles and denigrate the value of sister services, then similar comments made by Air Force leaders concerning other services should receive equal treatment.

In the September 26, 1994, issue of *Aviation Week and Space Technology,* General McPeak said, "In my judgment, the nation should look outside of the Air Force for further reductions in end strength." He referred to tanks and ships, when grouped together, as "dense target arrays. . . . When you get a target density of that type, it is a vulnerability, not a capability." General McPeak also expounded on the value of air superiority as a capability that "leverages every other capability this nation fields." Taken together, these comments could be construed as implying that other services' budgets should bear any further defense cuts and that airpower is more important to US military power than the Army or the Navy is.

To an Army or Navy audience, General McPeak's statements probably sound just as cannibalistic and anti-joint as do General Garner's. General McPeak's comments, whether correct or not, could be easily interpreted as a skirmish in the budget battle, just as General Garner's comments have been interpreted.

Both men are proposing to answer the same questions: What kind of force structure should this nation be building today, and where do you put the focus of your limited funds? Today the F-22 is at center stage; three years ago it was the B-2, and before that the Peacekeeper. Is there room for discussing the relative merits of both of these men's viewpoints, and should AIR FORCE Magazine examine both sides of the issue?

General Garner is wrong in his views about the importance of airpower, but I don't think the magazine has sufficiently explored the larger question of proper force balance in light of the actual threat. AIR FORCE Magazine should seriously address this type of topic in a manner that allows the readership, including those who do not automatically support airpower, to come to a fully informed, independent judgment.

Maj. Gregory T. Noble, USAF
Wright-Patterson AFB, Ohio

My recollection of history is apparently much different from that of Gen-

eral Garner, who contends that "air forces and navies are 'add-ons' " and that "airpower contributes at the margins." Most historians would agree that in different wars, different services provided the most significant contribution. . . .

For example, the invasion of Japan was made unnecessary mainly through the combined use of air and naval power in World War II. This is not in any way meant to demean the contribution of the Army. But the bombing of the home islands, the naval blockade—mainly by our submarine forces—and finally Hiroshima and Nagasaki stopped the bloodshed. There could have been no D-Day without the contributions of the Navy, the reduced resources of the Germans due to strategic bombing, and the inability of the German forces to move and resupply during the day. Operation Linebacker II brought the Vietnamese to the peace conference. And even those who can't read but who watch CNN could tell that it was airpower that broke the back of Iraq in the recent unpleasantness.

I suppose that if you were brought up in an environment that has existed since the early days of US participation in World War II, in which our Army has never experienced a serious threat from the sky, you might believe that such a threat can't exist. I suggest that General Garner give thought to what would have happened had the Warsaw Pact attacked and NATO had no Blue Air to keep Red Air off the backs of our ground forces.

If combined arms is to be more than a buzzword, then our military leaders will not only have to believe in the concept but put that belief into practice. With budgets tight and the demand for the utmost efficiency paramount, there is no room for parochial naysayers. General Garner should get with the program or get out!

Col. Morton T. Eldridge,
AFRES (Ret.)
Madison, Ala.

## Space Awareness

The Space Almanac *[August 1994, p. 44]* was full of superb information and should help increase "space awareness." Since Operation Desert Storm, the warfighters have become hungry for any and all space-related information they can get their hands on. As they become more educated, space will be included in decisions that will make the difference in our nation's ability to triumph in any military operation—be it humanitarian, rescue, or major regional conflict.

Your almanac serves as an excellent overview and starting point for

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further in-depth study of issues. Space is an extension of the modern battlefield, and as military members, it's our responsibility to understand and use all resources available to us. Your almanac gives many their first look at space. Thanks again!

Brig. Gen. James R. Beale, USAF
Director of Intelligence, NORAD
and US Space Command
Peterson AFB, Colo.

I enjoyed the Space Almanac but have to give it an A-minus for failing to mention the contributions made to the US space program by the X-15 project. Spanning a decade of R&D and 199 flights from the late 1950s to 1968, the X-15 produced eight astronauts who flew the three rocket planes a total of thirteen times into space (above the established fifty-mile mark). The knowledge gained from this program directly contributed to the development of the next "space glider"—our current space shuttle.

Unfortunately, our first space fatality also was with this program, when Maj. Mike Adams, USAF, reentered Earth's atmosphere sideways (apparently because of instrument malfunction) on November 15, 1967, and disintegrated over California.

The X-15 astronauts were Maj. Bob White, Joe Walker, Maj. Bob Rushworth, Capt. Joe Engle, John McKay, Bill Dana, Capt. Bill Knight, and Maj. Mike Adams.

All of these pilots were awarded the astronaut rating with badge. . . . We shouldn't forget these brave men.

Lt. Col. Joseph F. Reich, USAF
Ramstein AB, Germany

**Problems with NSA**

I read with interest the entry on the National Security Agency (NSA) in the Space Almanac *["Major US Agencies in Space," August 1994, p. 50].* As you may know, the Combined Cryptologic Program (CCP) has taken significant budget cuts since 1990, particularly in the "conventional" elements due to the shutdown of numerous sites formerly tasked against Cold War targets. Contrary to your article, NSA's distribution of signals intelligence (sigint) is based on out-of-date and untimely means and modes (paper-generated textual reports vs. graphically generated pictures in near-real time).

Although NSA would love to monopolize all sigint equipment, there *was* a very dedicated group of Air Force personnel at Wright Laboratory, Rome Laboratory, Aeronautical Systems Center, Electronic Systems Center (ESC), and Air Force Materiel Command Special Projects that made significant contributions to both the CCP and the Tactical Cryptologic Program (TCP) over the years. I use past tense because under the former Air Intelligence Agency commander, all Air Force program management of TCP sigint research and development efforts was handed back to NSA. Although the office was externally under an Air Force liaison office, its collocation with NSA at Fort Meade, Md., is all too transparent.

Given NSA's past performance in supporting warfighters in the field with timely sigint, I wonder if Lt. Gen. Lawrence E. Boese, Gen. John M. Loh, or others were consulted on this change, particularly given ACC's large stake in TCP reconnaissance platforms (*e.g.,* RC-135, U-2R, and RC-130). . . .

This is just the tip of the iceberg of what's wrong with Air Force intelligence. When you take into account the fraud, waste, and abuse in sensor programs and NSA's unconscionable withholding of vital intelligence from service intelligence organizations during the buildup before Operation Desert Storm (only rectified by the resourcefulness of a select group of officers, NCOs, and civilians from the Office of the Secretary of the Air Force, AFLC, and ESC working around the NSA bureaucracy), the picture of Air Force intelligence is much bleaker.

Terrence C. Goodwin
Marquette, Mich.

**Facing High Risks**

Regarding John T. Correll's "High-Risk Military Strategy" *[September 1994, p. 34],* in which he explicates very well the reasons for having strategy and resources for a two-MRC (major regional conflict) stance in the world: The reasons seem to boil down to deterring opportunistic conduct by a regional power while the US is engaged in a conflict elsewhere and providing the US a margin of safety in a single major regional conflict. These are good reasons for having such resources in a world without fiscal limits. However, I am sure Mr. Correll would agree that we cannot face our future without considering resources.

It used to be fashionable to conceptualize willingness to commit to a major fight in terms of "vital national interests." In other words, thinkers and politicians decided what the country should not or could not live with as an outcome without its best efforts to undo or prevent the damage.

The strategy reflective of a "vital national interest" formulation is the military measures a nation takes to ensure its survival in the event of the failure of "other means." All other moral and military commitments a nation undertakes scale down from that "line in the sand" and, I contend, somewhere stop being "vital."

I suggest that however much we would like to define the secondary national interests (*i.e.,* those not necessary for survival) in a vacuum, separate and apart from consideration of means, we cannot. Somewhere, a realistic consideration of means must emerge from deliberations and affect commitments. Thus a nation may be forced to adjust its sights to concentrate on what is realistically achievable with its available resources.

Since AIR FORCE Magazine has undertaken the political evaluation, by commentary on resource allocation, of our nation's strategy, I would like to see some further political explication. I would like to see an article justifying explicitly how our vital national interests are bound up with a full-up two-MRC strategy, especially in view of competing requirements elsewhere. Such an article would shed light on what heretofore may have been taken as articles of faith without adequate examination. The academically honest among us could even have our minds changed.

Lt. Col. Rolland Truitt, USAF (Ret.)
Summit, N. J.

I have read and reread "The High-Risk Military Strategy."

To me, this is the most comprehensive article on the subject that has ever been written, and I congratulate you on its excellence.

The one thing missing was mention of personnel—personnel to operate and maintain the aircraft that are in the inventory now as well as those in R&D.

Given the Air Force's current personnel policies, I wonder what manpower resources will be available both in the near term and ten to twelve years from now, how well they will be trained, and who will train them.

Not only are personnel numbers declining, but also trained personnel are leaving at an alarming rate. Your statement that young replacements for these people are not inclined to join the armed forces is all too true—for good reasons.

As an example, I read that the GAO has stated that the Air Force budget can and will be cut an addi-

tional $5.3 billion without "adversely affecting the Air Force mission." Hogwash! That money will likely come out of operations and maintenance and personnel budgets.

Lt. Col. Jess O. Yaryan,
USAF (Ret.)
Austin, Tex.

**Not a Bat Boy**

I would like to respond to SMSgt. Christopher Jones's letter *["Life-Support Training," September 1994 "Letters," p. 10].* True, survival equipment shops do not get all the attention they deserve. They are a vital link in the life-support equipment process and do their jobs with little or no recognition. But life support does more than just transport equipment.

I have been in the career field for fifteen years and have seen the scope of work flow both ways. From 1980 to 1987, I was assigned to USAFE, where life support issued, inspected, and repacked life preservers and also inspected, cleaned, and fitted anti-G suits. If any of these items needed to be repaired, they were taken to the survival equipment shop. Without the shop's expertise, we would have had to condemn that equipment.

At my current assignment in AMC, life support inspects and packs the life raft accessory kits, survival kits, survival vests, and a vast array of equipment that survival equipment shops never work on, including oxygen masks, helmets, chemical warfare ensembles, night vision goggles, and flash blindness goggles.

I take offense at Sergeant Jones's comparison of instruction we give to aircrews to the work of a "bat boy." Using life-support equipment improperly can be as lethal as having none at all. To quote Gen. Ronald R. Fogleman, "Equipment without training is hollow."

If you feel your people don't get the recognition they deserve, then you need to pursue that recognition . . . but don't attack your colleagues. All sides to crew member protection—egress, survival equipment, survival training, and life support—are essential to protect the aircrews, our most valuable resource. To act otherwise would jeopardize their lives.

MSgt. Arthur E. Sevigny,
USAF
Andrews AFB, Md.

**The Drone and the Mother Ship**

The caption pertaining to the photograph on p. 28 of your September 1994 issue *["Aerospace World"]* contained several errors.

The "mother ship" noted as being an A-12 is actually one of two A-12 variants officially designated (by Lockheed) M-21. When the M-21 and D-21 drone were mated, the two in combination were sometimes referred to as the MD-21.

The M-21s were purpose-built D-21 transports. They differed from the standard A-12 in having a second crew station in what was—in the A-12—a "Q-bay" designed to accommodate the optical sensor system. The M-21's environmentally controlled second crew station was equipped with D-21 system monitors and launch-related devices and panels.

The performance figure of 3,000 mph you noted for the D-21 is incorrect. It had a maximum cruising speed of Mach 3.35 (about 2,250 mph) at 90,000 feet. Range was almost exactly 3,000 miles. The D-21 was the first, and to date only, conventional ramjet-powered aircraft able to cruise at Mach 3 for more than an hour.

Jay Miller
Arlington, Tex.

**More Than 19,000 Gallons**

I was surprised to see the nose compartment of a B-36 in the September 1994 issue *["A Hot Seat in the Cold War," p. 144].*

I was even more surprised to see the caption. Your figure for fuel capacity was incorrect. The correct figure, according to the "Dash-1," is 30,630 gallons in the main and auxiliary tanks and another 2,996 gallons in the bomb bay tank if installed. . . .

MSgt. Rod Smith,
USAF (Ret.)
Niceville, Fla.

**A Superior Picture**

The comparisons between the U-2R's Advanced Synthetic Aperture Radar System II (ASARS II) and the E-8C Joint Surveillance and Target Attack Radar System (Joint STARS) could cause some to conclude erroneously that the U-2R/ASARS II is the superior surveillance system *["The U-2 Comes In From the Cold," September 1994, p. 44].*

Joint STARS possesses unique and important capabilities that were *not* mentioned in the article. For example, *only* Joint STARS can interleave the collection of synthetic aperture radar (SAR) "still" images with the collection of wide-area and small-area (high-resolution) moving target indicator (MTI) "moving" imagery. Joint STARS can also display both types of imagery at each of its eighteen operator workstations and on the monitors at an *unlimited* number of Ground Station Modules (GSMs). . . .

Perhaps the best way to understand Joint STARS's unprecedented theater surveillance capabilities is to compare the theater to a football stadium. Joint STARS's surveillance is similar to having a network that uses thirty-three different TV cameras (the number of workstations and GSMs with radar tasking capability) to televise the game to an unlimited number of TV sets (GSMs). One of these cameras is high overhead in a blimp providing a continuous, live, wide-area view of all movement within the entire stadium. At the same time, some of the other thirty-two cameras may be showing in near real time close-up freeze-frame (SAR) images, while the remaining cameras are providing live views (which are being recorded and can be replayed at any speed) of the movement of players in different parts of the field.

In contrast to Joint STARS, the U-2 network can only provide a single camera capable of taking just high-resolution *still* photos of the game. Besides requiring precious time to develop his photographs, the other network's cameraman has a vision problem: He can't see movement. Forced to guess where to aim his camera and when to take a photograph, he has no chance of providing timely images of the important events in a fast-paced game.

I hope this analogy shows Joint STARS's revolutionary (and unique) capability. In peacetime, Joint STARS can cover the other team's practice (training). Besides helping our CINCs to detect developing threats and opportunities in time to take effective action, this coverage can also make an immense contribution to a CINC's preparation of a winning game plan.

Thomas S. Swalm
Grumman Aerospace
& Electronics
Melbourne, Fla.

**In Search of Valor**

Since May 1983, 137 "Valor" stories recounting exceptional heroism of Air Force individuals or crews have been published in AIR FORCE Magazine. Hundreds of incidents have not been recognized.

Many books on Air Force history include accounts of heroism, but often the information cannot be verified or is lacking in detail. Official sources can be of little help.

Nominations of "Valor" subjects by readers are welcome. All nominations will be acknowledged. If a subject is accepted for publication, the source will be cited in the story. Send your nominations to me at P. O. Box 1137, Lynchburg, VA 24505-1137.

John L. Frisbee
Lynchburg, Va.

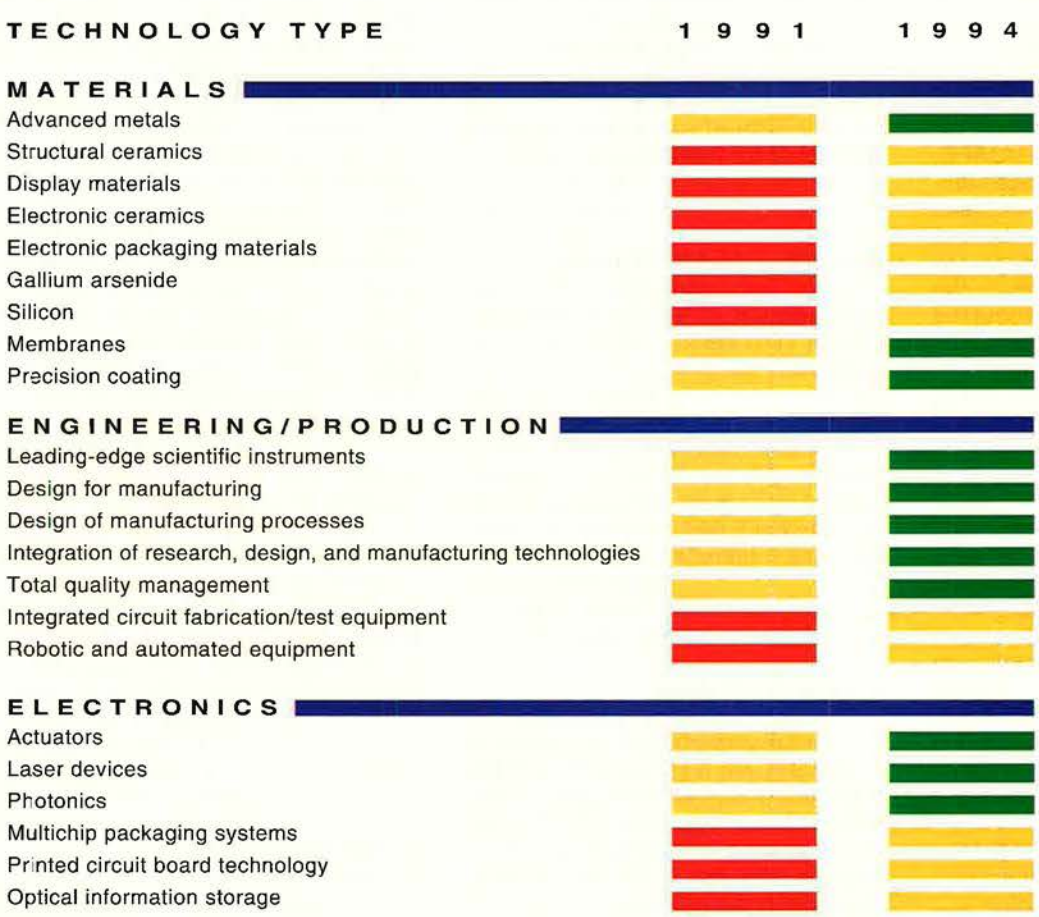
# The Chart Page

**By Tamar A. Mehuron,** Associate Editor

# Gaining Ground in Critical Technologies

***In 1991, the Council on Competitiveness issued a report that sounded an alarm about the weakening US position in critical technologies. This year, the private-sector, nonprofit organization issued a progress report that gives cause for optimism. One finding is that the US has retained its leading edge in information technology. Another is that the nation has remained competitive in design and engineering tools.***

***The table shows that over the past three years, the US became competitive in eleven critical technologies where it once lagged.***




**KEY**

| | |
|---|---|
| **Competitive** | US roughly even with or superior to world's best |
| **Weak** | US lagging or likely to lag within five years |
| **Losing/lost** | US no longer competitive and will not be for five years |

Source: Council on Competitiveness, *Critical Technologies Update 1994*, Washington, D. C., September 1994

# When it comes to delivery, we pull out all the stops.

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*Performance Above and Beyond.*

# Capitol Hill

**By Brian Green,** Congressional Editor

# Battling Gulf War Syndrome

Help for those suffering from this mysterious malady is the centerpiece of recent veterans' legislation.

CONGRESS has authorized the Department of Veterans Affairs to provide compensation to veterans of Operation Desert Storm suffering from undiagnosed illnesses contracted during or shortly after service in the 1991 Persian Gulf War. The maladies collectively are known as "Gulf War syndrome," but their causes have thus far defied identification. The new benefit is the centerpiece of a wide-ranging veterans' bill approved at the end of the 103d Congress.

Lawmakers also approved VA funding in Fiscal 1995 totaling $37.6 billion, a slight real decrease from the Fiscal 1994 level.

The new measure allows the VA to provide benefits to Gulf War veterans suffering from chronic disabilities of at least ten percent, even without determination of cause. It establishes a two-year test and examination program for veterans' spouses and children suffering from illnesses "that cannot be dissociated from the veteran's service in the Southwest Asia theater of operations."

The VA will use program results to recommend further legislation, if needed.

VA Secretary Jesse Brown supported the bill, having expressed the desire for legislative authority to compensate Gulf War veterans. He argued that the measure was necessary because previous law prohibited the VA from assisting veterans without proof that their medical conditions were service-related or service-aggravated.

"This legislation was badly needed," said Mr. Brown. "We can't wait for research results to give these brave men and women the help they need and deserve."

The Senate version of the measure would have authorized a similar presumption for all veterans—not just those who served in the Persian Gulf War—if a health problem began during military service or within a year of separation. Opponents of the broader measure, including Mr. Brown, argued that the wider application would be too costly.

"The new authority . . . would be permanent and so broadly applicable and open-ended . . . that it could undermine the integrity of the [VA compensation] system," he said.

The law authorizes the VA to establish regulations that will determine the period covered by the presumption of "service-connectedness" and the duration of the benefits, as well as case assessment protocols, definitions, and diagnoses. (The original House measure, which Mr. Brown supported, provided three years of compensation for veterans whose symptoms appeared during or within two years of service in the Gulf War.)

The final bill mandates a comprehensive outreach program to let veterans know about the services and benefits now available to them and an extensive research program. The research will include studies on the types and incidence of illnesses and symptoms and risk factors associated with them, a study of the medical consequences of chemical warfare "pretreatments," and clinical research on causes, transmission, and treatment of Gulf War syndrome.

The bill also provided relief from cuts planned as part of the White House's "Reinventing Government" initiative. The VA had been slated to lose 25,000 workers over five years.

The original House veterans' bill would have prohibited cuts from the Veterans Health Administration (VHA), the branch of the VA that provides medical care to veterans, and would have eliminated nearly ninety percent of all personnel cuts. The Administration opposed this special protection. According to Leon Panetta, then director of the Office of Management and Budget, the House provision "would make it impossible for the Administration to carry out the downsizing of the executive branch."

In the end, Congress did not exempt the VHA from cuts but limited overall VA personnel reductions to a maximum of about 5,000 full-time employees. Congress was concerned that any deeper reductions would have seriously impaired the VA's ability to care for veterans.

In other key provisions, the bill:

- Establishes a commission to study the VA's system for handling claims.
- Extends to veterans who participated in nuclear arms testing in a foreign country the same treatment and compensation the VA gives to those exposed to nuclear tests in the US.
- Establishes centers for women and minority veterans to help meet the needs of these veterans.
- Codifies the VA's addition of several cancers to the list of diseases now presumed to be related to exposure to Agent Orange.

Congress also rejected a proposed $41 million cut in VA medical research and increased such funding to last year's level of $252 million. Proponents of these programs note that the VA tracks the health of a large population over many years, a research tool unavailable in any other institution.

### The Fight Over ARTs

President Clinton has challenged Congress' creation of certain exemptions to his effort to reduce the size of the federal bureaucracy. This portends continued controversy over the status of the Air Reserve technicians (ARTs) in ANG and AFRES.

The Fiscal 1995 defense appropriations act contained provisions that safeguarded ARTs from cuts projected in the Administration's "Reinventing Government" initiative.

Recently, however, the President told the lawmakers, "Get rid of these restrictions on our ability to cut back big government. This is a matter of principle. No agency anywhere should be exempt from doing its job as efficiently as possible."

The technicians, as full-time Reservists on active duty, have always been treated as part of the military community and are considered crucial to the readiness of the reserve components. DoD has now begun to claim that the technicians are in fact civilian employees and therefore subject to the personnel reductions. ■

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# THIS IS HOW AN F-15E LOOKS TO ENEMY RADAR.

**THE ACTION.**
ENEMY RADAR SPOTS AN AIRCRAFT EQUIPPED WITH ONE OF OUR ECM SYSTEMS AND ATTEMPTS TO LOCK ONTO IT.

**THE REACTION.**
NORTHROP GRUMMAN'S ELECTRONIC COUNTERMEASURES PICK UP THE THREAT, DETERMINE THE BEST WAY TO REACT AND TAKE THE STEPS TO NEUTRALIZE IT.

**THE RESULTS.**
AN AIRCRAFT YOU CAN PUT A PRICE TAG ON IS SPARED ALONG WITH AN AIRCREW YOU CAN'T.

IT'S HARD TO TRACK DOWN AIRCREWS USING OUR ELECTRONIC COUNTERMEASURES SYSTEM. THAT'S WHY THE AN/ALQ-135 IS ON BOARD EVERY COMBAT F-15E IN THE USAF FLEET. IN FACT, AN F-15E ISN'T CONSIDERED TO BE COMBAT-READY UNTIL OUR SYSTEM IS INSTALLED AND OPERATIONAL.

OUR LEADERSHIP IN AIRCRAFT DESIGN, STEALTH TECHNOLOGY, COMPOSITES, COUNTERMEASURES AND SENSORS PUTS US IN AN ELITE GROUP OF DEFENSE COMPANIES ATTUNED TO HOW THE WORLD IS TODAY. AND WILL HELP US STAY THAT WAY FOR YEARS TO COME. **NORTHROP GRUMMAN**

# Aerospace World

**By Frank Oliveri**

### US Stages Gulf Buildup

The Air Force staged another major show of force in the Persian Gulf area, deploying or preparing to deploy hundreds of combat and support aircraft and thousands of troops in a short-notice, mid-October buildup on the Arabian Peninsula.

The Pentagon said that by late October, USAF's presence in the Gulf region had increased from seventy-seven to 270 aircraft, including squadrons of F-15E, F-16, and A-10 ground-attack aircraft.

The Air Force and other services had responded to provocative Iraqi troop movements. Iraqi leader Saddam Hussein suddenly massed 90,000 troops and sent them southward to the border with Kuwait, the tiny monarchy Baghdad had seized in August 1990 only to be badly mauled and ejected in early 1991 by a US-led coalition.

The sudden deployment of US airpower seemed to catch Saddam Hussein by surprise. His troops soon withdrew northward.

Until the Iraqi leader backed down, the Air Force had been pursuing a plan that would have produced a much larger in-theater force. Deploying fighters would have included twenty-four F-4Gs, nine F-15s, thirty-six F-15Es, sixty-six F-16s, forty-two A-10s, twelve F-117s, and thirty F-111s.

Planned deployments also included six B-52 bombers, four E-3A Airborne Warning and Control System aircraft, two RC-135 Rivet Joint reconnaissance aircraft, four U-2 spyplanes, one E-8 Joint STARS aircraft, and fifty-seven C-130 transports.

When the crisis eased, many of the Air Force units were told to stand down.

### USAF A-10s Bed Down in Kuwait

Even as the latest Persian Gulf crisis subsided, the Pentagon announced plans to station an Air Force squadron of A-10 attack fighters permanently in Kuwait. The twenty-four-plane unit would be only one part of a larger permanent US presence in the region.

Photo by Randy Jolly

***Twenty-four A-10s from the 75th Fighter Squadron, 23d Wing, Pope AFB, N. C., will bed down in Kuwait as part of a force of up to 130 aircraft that will be permanently based in the Persian Gulf region. The aircraft are to help deter Iraqi forces from provocative moves that threaten US allies in the area, as they did in October.***

Never before have US forces been stationed permanently in the conservative Islamic country.

In an October 27 press briefing, Pentagon spokesman Kenneth Bacon disclosed the A-10 deployment, adding that it was part of a near doubling of the permanent US aircraft presence in the Gulf region. The expansion of on-call airpower—and the presence of tank-killing A-10s, in particular—is aimed at enforcing the US demand that Iraqi forces stay well away from Kuwait.

Before the latest flare-up in the Gulf, the US maintained seventy-seven aircraft in the region. Plans call for increasing the permanent force to about 130 aircraft. Mr. Bacon did not say what types of aircraft other than A-10s would be added to the force list in the region.

The exact timing of the A-10 deployment was not immediately announced. Mr. Bacon said the fighters were to be stationed at Al Jaber AB in southern Kuwait.

### C-17 Flies Operational Mission

In the Mideast operation, the Air Force's newest long-range airlifter, the C-17, flew its first operational mission, joining C-5 and C-141 transports in ferrying troops and equipment to the Arabian Peninsula, Air Mobility Command said in October.

The C-17 embarked for the Mideast with equipment from the Army's 7th Transportation Group, Fort Eustis, Va. The Air Force said it was using the C-17 because it is reliable, able to carry outsize cargo, and able to deliver time-sensitive equipment quickly to almost any area. A second

USAF photo by MSgt. William R. Dowers

***The first operational B-2,* Spirit of Missouri, *undergoes its first phase inspection, a maintenance check performed after every 200 flying hours. After the check, members of the 509th Maintenance Squadron may spend as much time restoring the plane's stealth characteristics as they did on maintenance.***

C-17 later deployed for action in the Gulf region.

### F-22 Radar Passes Milestone

The AN/APG-77 radar, developed for the Air Force's F-22 Advanced Tactical Fighter, successfully passed its Critical Design Review, the service said in October.

The accomplishment is a major milestone in acquiring the new air-superiority fighter. The F-22 is in its engineering and manufacturing development phase, during which its overall design is reviewed in detail to ensure it will meet requirements.

The F-22 team plans to complete 231 Critical Design Reviews of subsystems and software before the start of air vehicle design review in February 1995. To date, eighty-nine reviews have been completed, the Air Force said.

The new radar features a low-observable, electronically scanned array; long-range, multimode, multitarget, all-weather capability; AIM-120 missile multiple-launch capability; advanced low-probability-of-intercept and antijam capabilities; and high reliability.

The F-22 is expected to reach operational status in 2004. Production will continue until 2010.

### Fourth B-2 Named

*Spirit of Washington* is the official name of the fourth operational B-2 bomber, the Air Force said in October.

The bomber was delivered to the 509th Bomb Wing at Whiteman AFB, Mo. The name was selected to honor the state of Washington's aerospace industry, which played a major role in the development and manufacture of the B-2.

### TALCE Shines in Haiti

When the US decided in September to move forces into Haiti, Air Mobility Command personnel transformed the airport at Port-au-Prince into a major staging area within twenty-four hours.

Personnel from the 436th Airlift Wing, Dover AFB, Del., ran the show, receiving more than 250 support people from various USAF organizations, and was designated the 436th Tanker Airlift Control Element.

The foundation of a TALCE is built on a cadre that acts as the command element, the Air Force said. The organization is set up at fixed, en route, and deployment locations where AMC operational support is nonexistent.

A deployed TALCE resembles a wing, with the cadre providing command and operations functions and deployed maintenance and aerial port people providing cargo and passenger handling duties. The top priority is to establish airlift operations.

### Air Force Names New CMSAF

In September, the Air Force named CMSgt. David J. Campanale the eleventh Chief Master Sergeant of the Air Force.

Chief Campanale had been Air Mobility Command's Senior Enlisted Advisor. He replaced CMSAF Gary R. Pfingston, who retired at Bolling AFB, D. C., in October.

Chief Campanale, who will serve a two-year term, is an aircraft maintenance professional with more than twenty-four years of service. He began his career maintaining B-52s at Barksdale AFB, La.

***CMSgt. David J. Campanale has been named the eleventh Chief Master Sergeant of the Air Force.***

### DoD Completes Nuclear Review

The Pentagon has completed its Nuclear Posture Review, the first comprehensive review of US nuclear weapons policy since 1978.

The NPR wrapped up by the Department of Defense in September was the first single study to analyze nuclear weapons policy, doctrine, force structure, operations, command and control, supporting infrastructure, safety and security, and arms control, the Pentagon said.

The NPR calls for:

- Reducing from eighteen to fourteen the planned number of *Ohio*-class Trident submarines carrying D5 submarine-launched ballistic missiles.
- Maintaining an inventory of sixty-six B-52 bombers, down from the ninety-four planned a year ago.
- Reorienting all B-1B bombers from nuclear missions to the conventional combat role.
- Keeping operational a full three wings of Minuteman III ICBMs—about 450 to 500 weapons, each with a single warhead.

The Pentagon said that no new strategic systems were under development or planned. In the nonstrategic nuclear forces arena, the NPR recommended retaining the existing commitment to NATO of dual-capable aircraft based in Europe and the deployment of nuclear weapons in Europe; retaining continental US–based dual-capable aircraft, ending the practice of deploying nuclear weapons on carrier-based dual-capable aircraft; eliminating the option to carry nuclear cruise missiles on surface ships; and retaining the capability to deploy nuclear cruise missiles on submarines.

The NPR also reaffirmed support for threat reduction and proliferation by calling for cooperative engagement and support of the Cooperative Threat Reduction program to reduce the danger of unauthorized/accidental use or diversion of weapons or materials from or within the former Soviet Union.

USAF photo by Sgt. Paul Coupaud

***SSgt. Amy Bobrowitz points out a low hydraulic pressure reading to Amn. Michael Spataro, a 61st Fighter Squadron crew chief trainee. Well-cared-for but older F-16s may be sold overseas to generate funds to buy newer ones. Without such a buy, a shortage of the type will develop early in the next decade.***

### Congress Acts on Source Tax

In the closing days of the last congressional session, advocates of source-tax repeal got a significant boost when the House voted to approve such legislation. Elimination of such taxes has been a major goal of military retirees, whose frequent moves while on active duty put them at risk of being taxed in multiple jurisdictions.

Repeal did not actually occur; the Senate did not have sufficient time to consider and pass its own version of source-tax legislation.

Even so, the House vote was considered significant, as it was the first time that the House Judiciary Committee, led by Chairman Rep. Jack Brooks (D-Tex.), had approved such a measure and sent it to the full House. Proponents of repeal pledge to reintroduce the measure in the new Congress.

A source tax is the imposition of a tax on the pension or retirement income of an individual who no longer resides in the taxing state. California was the first state to adopt a source tax, and nine other states have followed suit: Connecticut, Idaho, Iowa, Kansas, Massachusetts, New Hampshire, New York, Oregon, and Tennessee.

The House measure would not eliminate all source taxation. Ken Goss, the Air Force Association's director of National Defense Issues, said it would have exempted all retirement income up to $30,000 per year, while income above that level would still be subject to taxation. Eighty percent of those currently affected would be relieved of all tax obligation.

### USAF Pushes F-16 Sale

A "Coalition Force Enhancement" program envisions the sale of 300 A and B model F-16s to US allies. The proceeds would be used to purchase about eighty new F-16C and D model fighters.

So said Robert Bauerlein, USAF deputy under secretary for International Affairs. Mr. Bauerlein provided no timetable for the prospective fighter sale.

Legislation already exists calling for the sale of F-16s, but Congress must approve use of the proceeds to buy the newer aircraft. "This would have no impact on the taxpayer since the initial investment for the older F-16s is reinvested in newer airframes," Mr. Bauerlein said.

The older fighters are available because the service is drawing down its force structure to twenty fighter wings. The Air Force needs replacement aircraft because it projects that by 2000 the aircraft inventory will, as a result of attrition, fall below the level needed to sustain twenty wings.

"The Air Force has a real need for additional airframes, either the F-16A or B or a new aircraft," Mr. Bauerlein said. "We have enough F-16s in good shape until the year 2000, when most of the A and B models will have been retired. However, if we still have the same mission . . . we won't have enough aircraft to do it."

F-16As and Bs on average have used up some 3,000 of their 4,000 flying hours, the Air Force said. They will need to be modified or retired in five to ten years. Even upgraded, the A and B models would have a limited capability. The Block 50 F-16, the newest variant, has more thrust and range, better avionics, and the ability to carry more weapons, the Air Force said.

Buyers would pay roughly $6 million for the airframes and $8.5 million for modifications. At that price, the buyer would get a modern aircraft with an airframe life of 8,000 hours, the service said.

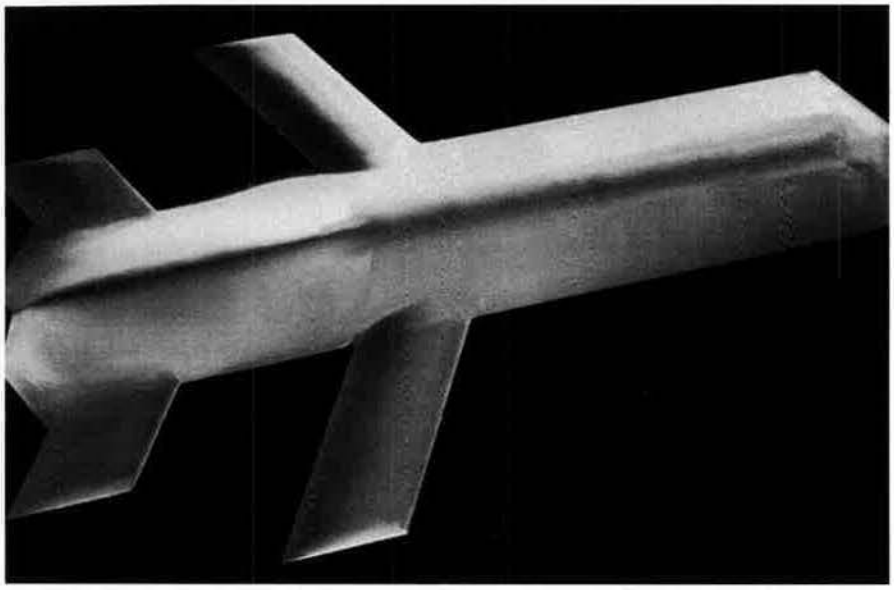
### McPeak Receives Award

Gen. Merrill A. McPeak, retiring Air Force Chief of Staff, received the Gen. Thomas D. White Award for contributions to the nation's progress in aerospace in 1993, the service said in October.

The actual trophy is on permanent display at the National Air and Space Museum in Washington, D. C. The National Geographic Society presented a replica of the trophy to General McPeak.

The citation credited General McPeak with redefining the Air Force's mission to include the control and exploitation of space, a change that directly affected how the service viewed itself.

The citation stated, "General McPeak's superior leadership and significant contributions will ensure that the Air Force has the proper organization, doctrine, policies, and research facilities to provide the world's most respected space forces and guarantee American leadership in space well into the twenty-first century."



***Many details of the Northrop Grumman AGM-137 Triservice Standoff Attack Missile (TSSAM) were declassified in September, along with this retouched photograph. The highly stealthy and accurate cruise missile, in development since the mid-1980s, won't see operational service until the end of the 1990s.***

**Military to Get Pay Raise**

The active-duty force will get a 2.6 percent pay increase next year. Money and mandates for the raise were included in the final Fiscal 1995 defense appropriations bill signed into law in September.

The Administration had sought a 1.6 percent pay raise for the military.

Congress approved a $243.6 billion defense spending plan three days after the House and Senate Appropriations conference committee reached a compromise. The conference committee agreed to fund two percent of the 2.6 percent pay raise and directed the Pentagon to fund the rest out of other accounts.

Provisions were also made to pay cost-of-living allowances to military retirees six months early and provice $299.3 million in emergency funds to support the Pentagon's operations in Rwanda and Cuba.

**RED HORSE Comes to Haiti**

USAF civil engineers set up tents to house 1,500 airmen and soldiers after US service members were forced to live for eleven days in a Haitian airport terminal and adjacent warehouses, the Air Force said in October.

The tent city was built by 820th Civil Engineering Squadron RED HORSE members. The 110-member unit from Nellis AFB, Nev., was assisted by a twenty-three-man team from the 49th Materiel Maintenance Group, Holloman AFB, N. M.

1st Lt. T. Paul Dean, RED HORSE chief of engineering, said, "We had to build a base from nothing, including all the infrastructure requirements any typical base would have."

Eight C-5 transports were needed to fly the tent city kits to Haiti. Cots were lined up less than two feet apart at the airport terminal, and more than 350 people lived less than forty yards from where transports were unloaded.

Only four toilets were available at the terminal, and members used one-gallon jugs to pour water over themselves in a makeshift shower. There were also no mess facilities, leaving service members with only MREs.

The tent city alleviated much of the discomfort of the early occupation. There are general-purpose and air-conditioned tents. Along with toilets and showers, the tent city has a dining facility, recreation facilities, a chapel, a barber shop, and an Army and Air Force Exchange Service store.

**US Bombers Land in Ukraine**

In September, US bombers touched down on Ukrainian soil for the first time since World War II. Air Force B-52 and B-1B bombers and a KC-10 visited Poltava AB, Ukraine.

The arrival came on the fiftieth anniversary of the last shuttle bombing mission in World War II. In shuttle missions, American B-17 bombers took off from air bases in southern Italy and England, hit Nazi targets in eastern Europe, and landed in Ukraine. The bombers hit further targets on the return flights.

The B-52 was from the 2d Bomb Wing at Barksdale AFB, La. The 2d Bomb Group was part of the first shuttle mission to run on June 2, 1944. It is the only unit that still exists from Operation Frantic, carried out that day.

The KC-10 also came from Barksdale. The B-1B was from Dyess AFB, Tex.

The bombers carried eight veterans of the first shuttle mision. The former B-17 crew members were specially invited by the Ukrainian veterans, who hosted them fifty years ago.

**A-10 Pilot Dies in CAS Accident**

An A-10 pilot from Davis-Monthan AFB, Ariz., was killed in September at Fort Irwin, Calif., when his plane crashed during close air support exercises.

Capt. Ronald B. Truesdale, of Texarkana, Tex., was assigned to the 355th Wing, based at Davis-Monthan. The thirty-one-year-old pilot was married and had three children.

The aircraft was operating temporarily from Nellis AFB, Nev., as part of the Air Warrior close air support exercises at the Army's National Training Center at Fort Irwin. The accident is under investigation.

**First Goshawk Class Graduates**

The first naval aviators to use the T-45 Training System received their wings in October at NAS Kingsville, Tex.

The class of ten aviators began undergraduate pilot training in January. The first student flight took place in February and the first solo flight in March.

The T45TS is the first totally integrated training system developed for and used by the Navy. The system includes the McDonnell Douglas–built T-45A Goshawk aircraft, advanced flight simulators, instructional programs using computer-assisted techniques, a computerized training integration system, and a contractor logistics support package.

The T45TS will replace the Navy's present fleet of intermediate and advanced jet trainers.

**Ukrainians Overfly US**

A delegation from the Ukrainian Arms Control Verification Center recently flew the first observation mission through US airspace as a preliminary exercise in the Open Skies Treaty. The accord goes into effect this month.

The late August mission was flown aboard an OC-135 operated by the 45th Reconnaissance Squadron under the US On-Site Inspection Agency. The nine-member Ukrainian team was led by Col. Valery Nikolaevich Bolinsky.

The first day's flight ran down the East Coast to look at naval facilities. At North Carolina, the aircraft headed inland to look at Pope AFB and Fort Bragg.

From there it went to the north Florida Atlantic coast and turned west, flying across the Florida panhandle. Sensors surveyed Eglin AFB and Hurlburt Field before turning north near NAS Pensacola.

The next day, the flight plan called for returning to the Eglin AFB area. From there the aircraft flew west, surveying Gulf Coast military facilities through to NAS New Orleans, La.

The crew then flew to Wright-Patterson AFB, Ohio, where it stayed overnight, developed its film, and returned to Dulles International Airport, Va., for the trip home.

USAF photo by MSgt. Robert Clinton

*Retired Brig. Gen. Robin Olds (center), one of the top F-4 Phantom II pilots of the Vietnam War, trades stories with present-day Phantom drivers Capt. Chip Mattingly, Capt. Mark Draper, Maj. Mike Nolan, and Capt. Eric Larson. General Olds and other 8th TFW "Wolf Pack" vets were convening in Florida.*

### The Air Force Takes Up Cycling

The Air Force has decided to sanction cycling as a sport.

Air Force Secretary Sheila E. Widnall, an avid cyclist, said the Air Force plans to host a joint-service cycling training camp in Colorado Springs, Colo., next summer. The best cyclists from the camp would represent the US at the September 1995 Conseil International du Sport Militaire Games in Italy, where 5,000 military athletes from 106 nations will compete in sixteen individual and team sports.

The Air Force will decide after the games if it will continue the cycling program.

"Between now and the games next year, we will continue to recognize competitive cyclists on a case-by-case basis, whereby the best athletes can request specialized sports training on an Air Force Form 303," Secretary Widnall said.


*The "Black Knights" of the 57th Fighter Squadron, Keflavik, Iceland, lay claim to being the most experienced F-15 Eagle drivers in the Air Force, with an average of 1,262 hours per pilot. Three of the fifteen pilots have more than 2,000 Eagle hours, and nine have more than 1,000 hours.*

### US Trains Russians in Nuclear Accident Response

Russian nuclear weapons experts have learned how to use US equipment for response to nuclear accidents, Los Alamos National Laboratory said.

Nine scientists and engineers from the nuclear weapons laboratories at Arzamas-16 and Chelyabinsk-70 and the Russian Ministry of Atomic Energy trained at Los Alamos, N. M., for nearly a month, culminating two years of discussions, education, and transfer of emergency response equipment.

The equipment included an X-ray system for examining damaged weapons or weapon components, video fiberscopes for visual inspections, portable radiation detectors, a special liquid rubber to stabilize high explosives, protective clothing, and operational training manuals translated into Russian.

The equipment was designed for use by the Department of Energy's nuclear weapons Accident Response Group at Los Alamos and other DoE facilities.

### New Technologies Should Reduce Costs

The new Defense Science and Technology Strategy, released in October, calls for technology to be developed to reduce costs as well as to meet warfighters' needs.

Anita K. Jones, director of Defense for Research and Engineering, said in October, "Technology can and must ensure that the military departments

can buy more for less. The department is for the first time proactively developing technology that has the potential to be the basis for both military and commercial products. This contributes to integration of commercial and defense industry."

The strategy addresses the different demands on the warfighter, and the program must develop technological options and rapidly integrate the most promising options into the operational force. The Pentagon said affordable technology permits materiel and systems to be developed at a lower cost, to last longer, and to be incrementally enhanced in capability through planned upgrades.

Dual-use technologies will continue to be emphasized because they allow the investment in national security to strengthen the US economy.

### USAF Phases Out Uniform Items

The Air Force phased out four uniform items in early October: the blue formal dress head gear, the woman's blue beret and maternity smock, and the olive drab T-shirt.

Women may wear their service cap or flight cap in lieu of the beret and the maternity blouse with or without the maternity jacket instead of the smock. October 1 was the last day Air Force members could wear the olive drab T-shirt. They may wear the brown T-shirt or, where authorized, the black T-shirt.

### AMC Realigns Operations

Air Mobility Command has realigned its major operations around two bases on the East and West coasts. The East Coast site is McGuire AFB, N. J.; the West Coast site is Travis AFB, Calif.

KC-10 aircraft are stationed at both bases, the Air Force said. Key airlift and aerial refueling assets were established at the two bases as a result of the 1993 Base Realignment and Closure process.

The realignment called for the relocation of KC-10 aircraft from Seymour Johnson AFB, N. C., March AFB, Calif., and Barksdale AFB, La., to the two bases.

The KC-10s began arriving during ceremonies that marked the activation of the 9th Air Refueling Squadron and its associated Air Force Reserve squadron, the 70th ARS at Travis. The 32d ARS activated at McGuire. The active-duty 2d ARS and two Reserve squadrons, the 76th and the 78th ARS, will round out the force at McGuire.

Realignment will be completed in September 1995. Travis will house C-5s, C-141s, and KC-10s. McGuire will be home to C-141s and KC-10s.

### ARPA Targets Key Technology Areas

The Advanced Research Projects Agency highlighted four key areas during its seventeenth Systems and Technology Symposium, held in October.

The following technology areas will be funded over the next three to five years:

- "Information technology activities to develop and integrate fundamental communications and computing technologies and infrastructure and automate key functions, such as planning, decision-making, and execution," ARPA said. Information technology will eventually expand human senses, reach, intelligence, and ability to do productive work.
- Affordable defense programs, which "can be achieved if addressed early in the requirements and development phases when production and

## Senior Staff Changes

**RETIREMENTS:** Buster C. **Glosson,** at the rank of Lieutenant General; B/G Joseph C. **Wilson,** Jr.

**CHANGES: M/G Patrick K. Gamble,** from Comdt. of Cadets, USAF Academy, Colo., to Ass't C/S, Ops./Log. Div., SHAPE, NATO, Mons, Belgium, replacing M/G Nicholas B. Kehoe III . . . **B/G John D. Hopper, Jr.,** from Cmdr., 375th AW, Hq. AMC, Scott AFB, Ill., to Comdt. of Cadets, USAF Academy, Colo., replacing M/G Patrick K. Gamble . . . **M/G Nicholas B. Kehoe III,** from Ass't C/S, Ops./Log. Div., SHAPE, NATO, Mons, Belgium, to Cmdr., 19th AF, Hq. AETC, Randolph AFB, Tex., replacing M/G (L/G selectee) Everett H. Pratt, Jr. . . . **B/G David R. Love,** from Dep. Dir., Leg. Liaison, OSAF, Hq. Washington, D. C., to Cmdr., 375th AW, Hq. AMC, Scott AFB, Ill., replacing B/G John D. Hopper, Jr.

**SENIOR ENLISTED ADVISOR (SEA) RETIREMENTS:** CMSgt. James B. **Livesay,** CMSAF Gary R. **Pfingston.**

**SEA CHANGES: CMSgt. Eric W. Benken,** to SEA, Hq. USAFE, Ramstein AB, Germany, replacing retired CMSgt. Robert W. Bailey . . . **CMSgt. Edwin B. Brown,** to SEA, Hq. ANG, Washington, D. C., replacing retired CMSgt. Richard A. Moon . . . **CMSAF David J. Campanale,** to CMSAF, Hq. USAF, Washington, D. C., replacing retired CMSAF Gary R. Pfingston.

**SENIOR EXECUTIVE SERVICE (SES) RETIREMENTS:** Donald L. **Giadrosich,** Francis J. **O'Meara.**

**SES CHANGES: Eric E. Abell,** to Dir., Engineering, C-17, ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing Ted M. Lynch . . . **Donna J. Back,** to Dir., Financial Mgmt., ASC, Hq. AFMC, Wright-Patterson AFB, Ohio . . . **Thomas W. Batterman,** to Dep. Dir., Log., Hq. AFMC, Wright-Patterson AFB, Ohio, replacing Thomas Miner . . . **John P. Brailey,** to Dir., Engineering, B-2, ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing Frederic Schwartz.

**Karla W. Corcoran,** to Ass't Auditor Gen., Dir., Ops., AFAA, Washington, D. C. . . . **James B. Culpepper,** to Dir., Financial Mgmt., Warner Robins ALC, AFMC, Robins AFB, Ga., replacing retired Charles Wallace . . . **Stephen L. Davis,** to Exec. Dir., Warner Robins ALC, AFMC, Robins AFB, Ga. . . . **James B. Day,** to Dev. Sys. Mgr., Propulsion, ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing Frank O. Tuck . . . **Edward A. Feigenbaum,** to Chief Scientist of the Air Force, Hq. USAF, Washington, D. C., replacing retired George R. Abrahamson . . . **Brendan B. Godfrey,** to Dir., Armstrong Laboratory, AFMC, Brooks AFB, Tex., replacing retired Billy D. Welch.

**Morris D. Goodrich,** to Dep. Dir., Contracting, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing Stephen Davis . . . **Gary M. Grann,** to Exec. Dir., Human Systems Ctr., AFMC, Brooks AFB, Tex. . . . **Gene L. Hathenbruck,** to Dir., Financial Mgmt., Ogden ALC, AFMC, Hill AFB, Utah, replacing retired Gene Mortenson . . . **Maurice R. Himmelberg,** to Dir., Engineering and Technical Mgmt., ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing retired James Bair . . . **Tommy B. Jordan,** to Dir., Contracting, San Antonio ALC, AFMC, Kelly AFB, Tex., replacing Phillip Steely.

**Ted M. Lynch,** to Dir., Avionics Engineering, ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing retired Gary L. Ludwig . . . **Susan M. O'Neal,** to Dir., Commodities Mgmt., Oklahoma City ALC, AFMC, Tinker AFB, Okla., replacing Robert Conner . . . **Jesse C. Ryles,** to Dir., Avionics, Wright Laboratory, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing John P. Brailey. ■

operational cost drivers can be integrated into the design and development process," ARPA said. Some examples are rapid prototyping of application-specific signal processors, interferometric fiberoptic gyroscope, infrared focal plane array, multimissile manufacturing, Tier 2+, MARITECH, War Breaker, and precision strike, among others.

■ Expanding opportunities, which include "highly promising ARPA programs that have already demonstrated major technical advantages in the laboratory and are ripe for focusing toward unique developments and demonstrations for new military capabilities or dual-use markets," ARPA said. ARPA focused on human-computer interaction, electronics producibility, opto-electronics producibility, electronic packaging, microwave technology, high-definition display systems, composites, and high-temperature superconductivity.

■ New technology opportunities, which ARPA is initiating "to cause a fundamental change or to focus on critical areas that will have the greatest impact for defense and for the economic well-being of the US." Areas that were covered include health-care technologies, environmental technologies, operations other than war, uncooled novel infrared detectors, ultra-electronics and ultra-photonics, microelectromechanical systems, intelligent processing of materials, and the Technology Reinvestment Project.

### AWACS Flies 2,000th Mission

`On September 18, the Air Force's birthday, twenty members of the 963d Airborne Control Squadron flew the 2,000th AWACS mission of Operation Southern Watch, while deployed as the 4405th Airborne Air Control Squadron (Provisional), the service said.

The mission was like any other surveillance flight over the Persian Gulf region for most of the crew. Many crew members were veterans of multiple tours supporting Operation Southern Watch. Maj. Mark Lyle, commander of the mission crew for the 2,000th flight, said, "Every time an E-3 completes its watch on station, it marks the combined efforts of a whole team of professionals."

### Category Y Service Canceled

The Category Y commercial airline service changed its regular schedule in October, the Air Force said.

Instead of Category Y, the military traveler will be offered an expanded AMC Category B, full airplane charter service, or regularly scheduled airline service using the General Services Administration's enhanced international City Pair program.

Cancellation of Category Y will have little impact on the average military traveler. Lt. Col. Ted Brewer, chief of AMC's Passenger Reservation Management Branch at Scott AFB, Ill., said that about the only change the traveler needs to be aware of is the limited amount of assistance the Passenger Reservation Center can provide to certain types of travel requests.

**Red Cross Delivers for Troops**

American Red Cross Service to Armed Forces workers deployed to Haiti handled more than 300 emergency messages to family members since the operation began in September, the Red Cross said.

The Red Cross deploys with US forces to provide humanitarian support to troops. Six workers are stationed in Haiti, attached to the 1st Corps Support Command in Port-au-Prince and the 10th Mountain Division in Cap Haitien.

Unreliable mail service and telephone systems in Haiti make Red Cross emergency communications vital for deployed troops. Red Cross workers also provide troops with counseling and referral services.

**F-22 Parts Fabrication Begins**

Lockheed Aeronautical Systems Co. began fabrication of its first flight-ready parts for the first F-22 fighter, the firm said in October.

Using computer-aided design and manufacturing tools that require no tooling fixtures, Lockheed engineers created the design for an engine inlet duct frame segment.

Construction also began on the F-22's midfuselage, which will be machined out of a plate of aluminum and will be roughly eleven inches wide, eighteen inches long, and up to 2.5 inches thick. It will take ten to twenty days to finish processing the part, although processing time is expected to be cut to five days once the F-22 is in full production.

**News Notes**

■ The newest McDonnell Douglas C-17 Globemaster III transport was accepted by the Air Force one month earlier than scheduled, McDonnell said in September. The sixteenth C-17 delivered to the Air Force, it was the tenth to join the 437th Airlift Wing, Charleston AFB, S. C., where the first operational C-17 wing is being formed. The unit is conducting flight and maintenance training leading to initial operational capability in January 1995.

■ Former Defense Secretary Les Aspin joined the Center for Strategic and International Studies as a holder of the Arleigh A. Burke Chair in Strategy, CSIS said in September.

■ Paul Kaminski was sworn in as under secretary of defense for Acquisition and Technology in a ceremony at the Pentagon in October. Mr. Kaminski will be responsible for all matters relating to DoD acquisition, including research and development, procurement, acquisition reform, advanced technology, atomic energy, economic security, dual-use technology, logistics, the defense technology and industrial base, and military construction.

■ Air Education and Training Command Commander Gen. Henry Viccellio, Jr., became the first Order of the Sword inductee from AETC, the service said in October. The Order of the Sword is the highest honor enlisted members can bestow on an individual.

■ NASA Lewis Research Center in Cleveland, Ohio, signed a $266 million contract to the industry team of GE Aircraft Engines and Pratt & Whitney for work on the critical propulsion components technologies for the High-Speed Civil Transport. The goal of the program is to produce a supersonic airliner that will be environmentally friendly and will operate at fares close to those of subsonic airlines.

■ Operation Support Hope was completed in late September, ending US support of millions of Rwandan refugees, the Pentagon said. DoD withdrew about 478 personnel from the region. Air Mobility Command flew more than 1,220 airlift sorties, delivering almost 15,000 tons of humanitarian aid, in support of the operation.

■ As of mid-October, Air Mobility Command had flown 198 missions, transported 5,128 passengers and 2,309 tons of equipment, and completed 2,978 flight hours in support of Operation Southern Watch, which encompasses the massive deployment of troops and equipment to the Arabian Peninsula, AMC said in October.

**Purchases**

The Air Force awarded Pratt & Whitney a $7.8 million cost plus fixed-fee contract for the Flight Weight High-Temperature Magnetic Bearing Program, which will develop and test the system for turbine engine main shaft support. Expected completion: January 1998.

The Air Force awarded Westinghouse Electric Corp. a $106.5 million face-value increase to a firm fixed-price contract for 301 midlife update production kits for the AN/AP-66(V)2 fire-control radar applicable to the F-16 aircraft. Expected completion: January 2000. ■

# Index to Advertisers

The T-Bird II from Lockheed Aeronautical Systems Company/Aermacchi s.p.a./ Rolls-Royce plc/Textron Aerostructures.

# T-Bird II. The JPATS fail-safe solution.

Student pilots make mistakes. The next primary trainer for the Air Force and Navy not only has to effectively train pilots, but it must also do it safely. The aircraft must be student-proof with no inherent characteristics that could lead to pilot errors or worsen an abnormal situation.

The T-Bird II is just such an aircraft. It's a balanced design, combining ease of flight, capability to perform more advanced training events—and safety. During the initial 270,000 hours for flight training for both the T-37 and the T-Bird II, the T-Bird II proved to be four times safer.

Without a doubt, the T-Bird II is the best choice—and the safest.

**Lockheed leads.**

Lockheed

**The decisions on the 1995 program are in. Soon the Air Force will have lost half of its combat aircraft and more than a third of its people.**

# What's Left of the Air Force Program?

**By Peter Grier**

Photo by Randy Jolly / Arms Communications

***Though the number of F-15Es (above) has been frozen and F-16s (opposite) have been cut, spare parts shortages and cannibalization rates are on the rise. USAF people, such as (from left) Capt. Andrew Kennedy, SrA. William McClain, and A1C John Stirewait, have fared better, with modest increases in pay and support for quality-of-life programs.***

THE AIR FORCE'S program roadmap for the future is perhaps best summed up with a single statistic: The service's inventory of combat aircraft soon will be one-half what it was only five years ago.

Personnel cuts have occurred almost as quickly since it became clear that the boom of the 1980s had given way to a budget bust in the 1990s. In 1986, the Air Force hit a post–Vietnam War peak of some 608,000 people. By the end of 1995, Air Force end strength will fall to slightly more than 400,000, a reduction of around thirty-four percent.

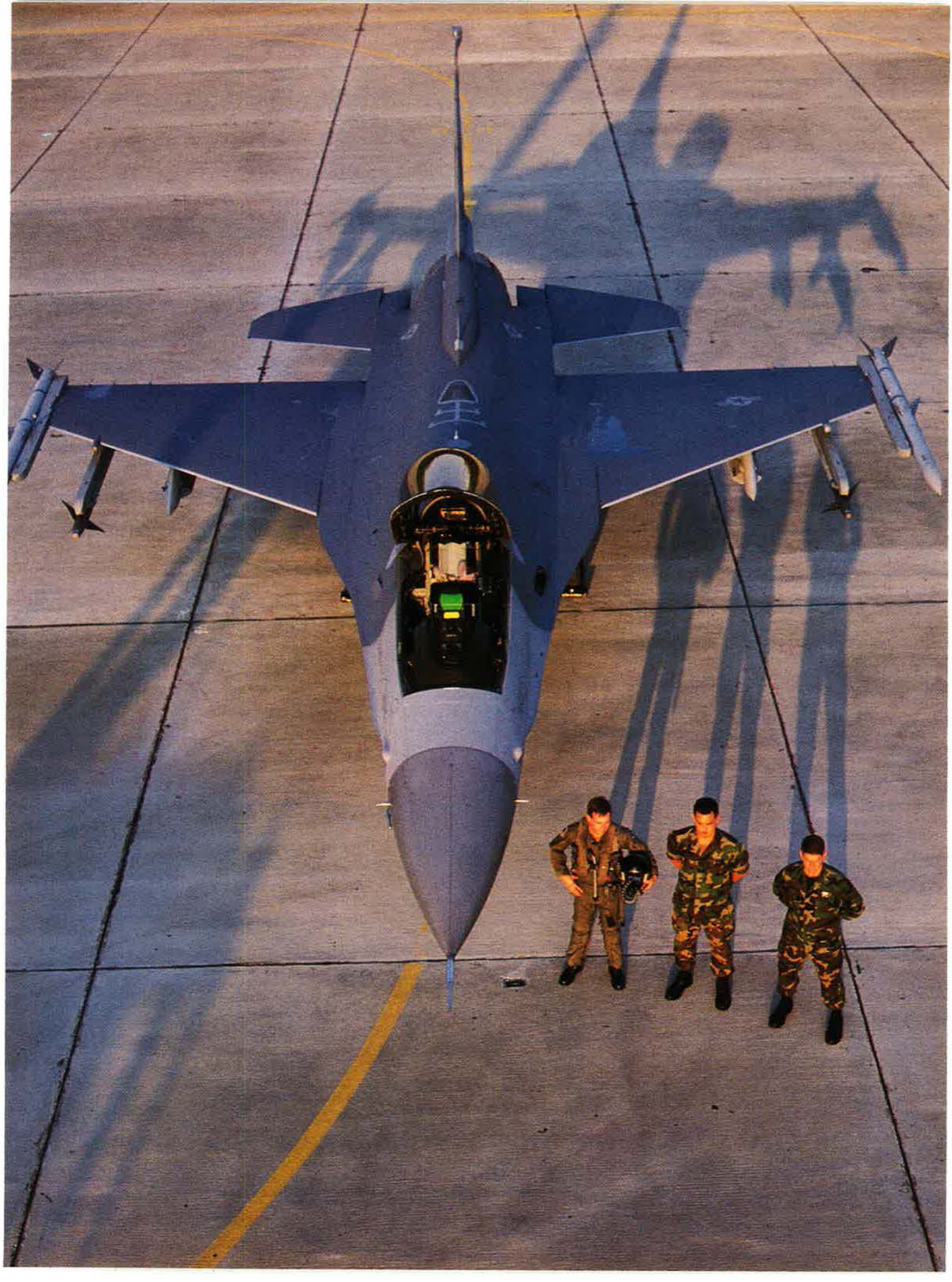
Bases are closing too: Twenty-two Air Force installations in the US have been marked for termination by the Base Realignment and Closure Commission. On its own, the Air Force has reduced the number of its overseas posts from fifty-two in 1989 to twenty-nine today.

Air Force officials hoped that by cutting force structure deeply and quickly, they could preserve the readiness of what was left of the force. Officials dubbed 1994 "The Year of Readiness" and vowed to prevent a return to the bad old days of hangar queens and parts shortages.

Hints of readiness trouble have appeared nevertheless, as the harsh downward pressure on budgets continues. In the effort to keep equipment operating, cannibalization rates have gone up at some bases this year; for example, F-15 engine parts have occasionally been in short supply.

Meanwhile, major modernization programs continue to undergo restructuring, with everything from the Joint Primary Aircraft Training System (JPATS) and C-17 airlifter to

Photo by Randy Jolly



Staff photo by Guy Aceto

*The Bottom-Up Review sees a force of 100 combat-ready bombers, including twenty B-2s, as sufficient for the two-conflict requirement. A congressional report disagrees, but the Administration says it cannot afford more B-2s.*

the F-22 fighter and Triservice Standoff Attack Missile (TSSAM) facing intense congressional and Defense Department scrutiny.

The 1995 Air Force program, proposed by Defense Secretary William J. Perry in February and rewritten somewhat by Congress, came in with an appropriation of $69.40 billion. The new plan devotes $12.2 billion to research and development, $17.3 billion to procurement, $18.8 billion to operations and maintenance (O&M), $19.2 billion to military personnel, $839 million to construction, and $1.1 billion to housing.

Continued cuts will not come without a price, according to Air Force leadership. "As we downsize our forces, we face a certain level of risk, most of which occurs in the near term," Secretary of the Air Force Sheila E. Widnall told Congress this year as legislators scoured the Air Force program for savings.

In particular, conventional bomber capability, precision weapons, spare parts and support equipment, and airlift capacity present potentially grave problems, said Secretary Widnall. She added, "We have cut our force structure as far as we can prudently go and still support the current strategy and operations tempo."

## Stable—For Now

The foundation for Air Force budget planning remains the Pentagon's 1993 Bottom-Up Review. Conducted with much fanfare during Les Aspin's tenure as Secretary of Defense, the review says national security requires having a capability to fight and win two nearly simultaneous major regional conflicts.

Those who fashioned the conclusions of the Bottom-Up Review maintained that the Air Force could discharge its part of the two-war requirement with only twenty fighter wings (thirteen active-duty and seven reserve) and 100 combat-ready bombers. The review called for maintaining in force about 500 single-warhead Minuteman missiles and a mix of nuclear-capable bombers and strategic submarines as part of the nation's continued nuclear deterrent.

This force structure seems relatively stable, at least for now. At the moment, Pentagon leadership appears more inclined to slash the service's modernization programs further in an effort to close an estimated minimum $20 billion gap between available revenue and the cost of the nation's five-year defense program. If eliminating or slowing down new weapon programs does not produce enough savings, however, the Defense Department may turn to force-structure cuts beyond those mandated in the Bottom-Up Review.

"We may have to [do that] if the money's not there," Deputy Defense Secretary John M. Deutch told Congress this fall.

The number of USAF active-duty aircraft of almost all types has shrunk steadily in recent years as the service has moved to meet continually falling budget targets. Plans call for the combat-ready fighter force to be nearly half the size at the end of Fiscal 1995 that it was in 1988. The long-range bomber force was set to be slashed to only one-third of its 1988 size, until congressional action froze some bomber retirements.

In 1993, the Air Force had 444 active-duty F-15s of all models; in 1995, there will be only 390. (The


Photo by Randy Jolly / Arms Communications

*The efforts to preserve readiness have forced many research and development projects into limbo, endangering the technological edge that in the past produced such high-performance aircraft as the stealthy F-117.*

number of F-15Es—138—stays the same.) The number of F-16s is similarly set to fall from 510 in 1993 to 396 in Fiscal 1995. Active-duty C-130s will decline from 148 to 136, while KC-135s will go from 267 to 217. All figures correspond to primary aircraft authorized, or those available for immediate operations. The PAA fleet is smaller than the total inventory.

On a smaller scale, the Air National Guard and Air Force Reserve have undergone their own downsizing. The Guard is set to lose sixty-eight of its primary aircraft next year. The Reserve is slated to lose fifty.

### Numbers Down, Missions Up

While numbers of aircraft have fallen, the number of missions the Air Force is asked to do has continued to rise. Humanitarian relief has strained airlift resources, with USAF crews delivering more than 52,000 tons of food and medicine in the Balkans alone. In the Persian Gulf region, Air Force aircraft enforcing the no-fly zone over northern Iraq have flown more than twice the sorties USAF units flew during the whole of Operation Desert Storm.

"Despite the drawdown in forces," Secretary Widnall said, "the Air Force is more engaged today than during any period of 'peace' in recent years."

The good news is that the budget, expressed in terms of total obligational authority, is not falling as fast as it has been in recent years. For example, the Fiscal 1993 Air Force TOA was 5.1 percent smaller, in real terms, than the Fiscal 1992 spending blueprint. In Fiscal 1994 TOA fell another 11.7 percent, but for 1995, the real budget shrinkage was set at a relatively modest 2.1 percent.

Within the Fiscal 1995 program and budget, some mission areas fared better than others. Spending on power projection fell modestly, reflecting smaller bomber and fighter forces. Nuclear deterrence and space missions also were hit with cuts reflecting the lessened importance of the strategic nuclear balance in the post–Cold War era.

On the other hand, the global mobility budget was projected to increase. The US military still suffers from a shortage of the airlift needed to rush troops overseas in the first weeks of a major regional conflict.

Photo by Randy Jolly / Arms Communications

***Forces and budgets are down, but activity is up. Missions to the Balkans, the Persian Gulf, and Rwanda prompted Secretary Widnall to declare that USAF "is more engaged today than during any period of 'peace' in recent years."***

Personnel support was set to increase as Air Force officials look to improve quality-of-life programs.

Air Force people, in fact, will do better in 1995 than was originally called for in Administration plans, thanks to action by Congress. The Fiscal 1995 authorization and appropriations bills approved by lawmakers contained a 2.6 percent pay increase for those in uniform, as opposed to the 1.6 percent the Pentagon proposed in its budget submission at the start of the year.

That is not exactly a whopping pay raise, as it falls short of even keeping up with inflation, but it has political significance. The hike also complicates an already difficult budget situation and is one of the big reasons why DoD leadership is looking yet again at squeezing money from major new weapon programs.

### Modernization vs. Readiness

In late August, the Pentagon saw the financial crunch coming and decided to take another hard, skeptical look at nine big weapon systems. Mr. Deutch drafted a formal memo to the services, calling on them to suggest cut options. Pentagon officials had always expected to limit the damage to only one or two programs. For USAF, the big potential target was the F-22 fighter, which had been considered for a possible four-year delay. As the review continued into the fall, DoD took up the cases of the JPATS and the stealthy air-to-surface TSSAM weapon.

Mr. Deutch told Congress that his decisions would be made as part of the ongoing process aimed at producing a proposed 1996 budget, to be unveiled in January 1995. The Pentagon's budget problems, said Mr. Deutch, have been exacerbated by peacekeeping and humanitarian activities, which now cost around $1.5 billion a year. Modernization programs and readiness are competing for full funding, according to Mr. Deutch. Readiness is likely to win.

"The top priority is to increase readiness, to maintain the emphasis on readiness," Mr. Deutch said.

"Protect readiness" has been a mantra throughout the US military ever since the Reagan buildup ended and the Bush-Clinton drawdown began. The current Pentagon leadership believes it deserves some credit for stopping a slow decline in funding of O&M accounts: Per person, Air Force readiness spending will be about seventeen percent higher in 1995 than it was in 1993, according to Mr. Deutch.

However, for all the attention it has received, force readiness is still deteriorating in certain spots, say Air Force officials. A lack of spare parts at depots has slowed repair of F-15 engines, for instance, giving Air Combat Command occasional problems with F-15 availability.

Overall Air Force O&M funding,

Photo by Randy Jolly

*One of the few areas of the budget that is set to increase is global mobility. Even if the C-17 is fully funded, the Air Force would be hard-pressed to move troops and materiel quickly enough during the first weeks of a conflict.*

as approved and funded in the 1995 defense appropriations bill, will total $18.8 billion. That represents a relatively slight but—in the current circumstances—still painful congressional cut in the $19 billion O&M request contained in the President's 1995 budget proposal and a decline from the $19.1 billion appropriated in Fiscal 1994. Of this total, about $2.9 billion will pay for the operations and maintenance of primary combat forces. Some $1.2 billion will fund airlift operations.

In 1995 the Air Force will continue an operations tempo that generates roughly the same number of flying hours per month for each aircrew as in 1994. Flying time for active-duty tactical aircrews will be about twenty hours per month.

Some tasks are being shoved aside. Paint jobs for headquarters buildings and other general base management activities are the big O&M losers. Most of the congressional trimming occurred in accounts that fund noncombat base operations and real-property management activities.

## Budget Winners

Depot-level reparable parts were budget winners. Appropriators added $129 million to the depot reparable account, which the President's original proposal had funded at only ninety percent of requirement. Legislators also voted to freeze the public/private share of depot maintenance work load at its current split of sixty percent for in-house government facilities and forty percent for private contractors. Competition between public depots and private firms will be reinstituted, if Congress has its way. DoD had ended such competition, over Air Force objections.

Congress also added $16 million to O&M for extra training of the Air Force's E-3 Airborne Warning and Control System aircraft crews. One factor cited in last April's fratricidal shootdown of US helicopters in northern Iraq was overworked AWACS crew members.

In a show of intense congressional management of O&M accounts, appropriators ordered the Air Force to keep them up to date on efforts to provide the Louisiana ANG with a display-condition B-26 bomber. The USAF Museum at Wright-Patterson AFB, Ohio, will have to give the Louisianans one of its B-26 models unless the Air Force can finagle one from the Chilean National Aviation Museum by January 15, 1995, according to the defense appropriations bill conference report.

## Budget Afterthoughts

If readiness and O&M are today's Pentagon budget linchpins, then procurement and modernization are its funding afterthoughts. Not long ago, when M1 tanks and F-16s were rolling off production lines, DoD's procurement budget was three times the size of research, development, test, and evaluation (RDT&E) spending. In 1995 that ratio will be more nearly one to one.

Air Force procurement spending for Fiscal 1995 will total $17.3 billion, under appropriations legislation. That is about $1 billion less than the President's budget proposed and some $900 million lower than the comparable Fiscal 1994 figure.

Congress appropriated about $6.4 billion for Air Force aircraft procurement. Of that, $2.2 billion will

Staff photo by Guy Aceto

*Missiles received a $3.6 billion appropriation in the most recent budget. Substantial sums will be spent on the new AIM-120 and AGM-130 missiles, but older systems, such as this AIM-7 Sparrow, must be maintained and upgraded.*

be spent on the procurement of six additional C-17 airlifters, the number that the Air Force had requested. The next biggest line item for new aircraft procurement is $440 million for two E-8B Joint Surveillance and Target Attack Radar System aircraft.

Missile purchases received a $3.6 billion appropriation. Some $290 million of this total is earmarked for 413 AIM-120 Advanced Medium-Range Air-to-Air Missiles and $70 million for 102 AGM-130 powered land-attack missiles.

The 1995 budget contains no money for procurement of additional bombers, but Congress and the Air Force remain concerned about the future of the US conventional bomber arsenal and the industrial plant needed to build it. Lawmakers therefore earmarked $125 million to keep alive the possibility of purchasing additional stealthy B-2 bombers by preserving key parts of the nation's bomber industrial base for at least one year. In 1992 Congress capped the total B-2 buy at twenty aircraft costing a total of about $44 billion.

"Independent studies have concluded that the twenty B-2 aircraft now on order are simply not enough to provide a militarily significant and cost-effective long-range conventional bomber force," says the FY 1995 appropriations bill conference report.

Sen. Sam Nunn (D-Ga.), who chairs the Senate Armed Services Committee, is a strong proponent of renewed B-2 purchases. However, the aircraft remains controversial in Washington, and the Clinton Administration would have to fight hard to reopen the production line. Administration officials show no inclination to conduct such a fight on behalf of the B-2, saying that in their five-year plan there is just no money to pay for any more bombers.

In any case, some old standby B-52s will be staying in service longer than planned. Appropriators added $60 million to the budget to keep ten B-52s the Air Force had planned to retire. The Air Force is barred by Congress from mothballing any currently operational long-range bombers in 1995.


Photo by Randy Jolly / Arms Communications

***The F-15 is still the world's premier air-superiority fighter, but its successor, the F-22, will not be operational until the Eagle is more than thirty years old. Some have called for further F-22 delays.***

Air Force RDT&E appropriations for Fiscal 1995 will total about $12.2 billion. The Administration had requested $12.35 billion; Fiscal 1994 funding was $12.31 billion.

## R&D in Limbo

Meanwhile, planning and development of the Air Force's next-generation weapons remain in budget limbo. Support for the biggest aircraft program currently in R&D, the stealthy F-22 Advanced Tactical Fighter, still appears solid, but some worry that even it could become a casualty if cutbacks continue for a few more years. Other big programs that have driven R&D funding for years, including the C-17, B-2, and Joint STARS aircraft, have all but left the development arena.

The F-22 has long been the service's top modernization priority, and USAF leaders reacted with dismay to the prospect of further delay raised by Mr. Deutch's memo to service leaders. Already, they note, the first F-22 squadron will not be operational until 2004. That is thirty-two years after the F-15 first took to the air.

For now, the F-22 is the biggest R&D line item, at $2.35 billion for 1995. Some $388 million is earmarked for the B-2, down from $1.2 billion in 1993. Joint STARS gets $175 million, down from $313 million in 1993.

The TSSAM might seem a congressional favorite. After all, it is a new cruise missile that should enhance the conventional bomber capability that lawmakers worry about. The program has had more than its share of technical glitches, however, and it made Mr. Deutch's hit list. Congressional appropriators voted only $222 million for the new missile, instead of the $604 million originally requested.

If TSSAM program officials can work out its bugs and get costs under control—and if the TSSAM somehow survives the 1996 budget review—Congress might quickly increase its funding in years to come. The appropriations report backed "the unique potential warfighting capabilities of TSSAM" even as it reduced the weapon's 1995 funding.

Congress also wants to make sure the US can defend itself against nations that may be developing TSSAM-style weapons. A classified program named "Have Yak" addresses what the defense appropriations report calls "a serious deficiency in countering the proliferating cruise missile threat." Legislators voted to urge the Air Force to complete Have Yak design and testing under the auspices of the USAF Theater Air Defense program. ■

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**Stealthy bombers are too thin in the baseline force to fight one major regional conflict, much less the two prescribed by strategy.**

# Bomber Forces for "Cold

By Maj. Gen. Jasper Welch, USAF (Ret.)


DURING the Cold War, the US bomber force concentrated on nuclear deterrence. The inventory was large enough to permit diversion of several hundred bombers to the Korean and Vietnam wars. Even as recently as the 1991 Persian Gulf War, sixty-six heavy bombers were available to the theater commander.

The result was that since the end of World War II, Air Force planners have not had to evaluate seriously the adequacy of the bomber force for conventional, nonnuclear operations.

That situation has changed dramatically. With the abrupt end of the Cold War, the rapid decline in the political intensity of the strategic threat, pressure to reduce US military spending and forces, and formal adoption of a new, two-conflict planning scenario, officials are required to judge bomber forces primarily in terms of conventional, nonnuclear adequacy.

Against this backdrop, President Clinton early this year unveiled a Fiscal 1995 defense budget funding a total inventory of 125 bombers, of which only sixty-nine (seven B-2s, thirty-eight B-1Bs, and twenty-four B-52Hs) would be in the active-duty

# Start" Conflict

Air Force. This lends new urgency to the question of whether the bomber force is adequate.

This study concerns US preparations to deal with major aggression whenever time, circumstances, and hostile actions have thwarted our ability to bring sufficient general-purpose forces into place before aggression occurs. It is concerned with using bombers as the immediate reponse to halt aggression and stabilize the military situation until US general-purpose forces have time and opportunity to get to the theater, recapture territory, and enforce a favorable settlement.

In assessing the bomber force, one must recognize the key role played by the *intensity* of conventional aerial bombardment in the political and military outcomes of post–Cold War armed conflicts. The notional post–Cold War conflict was taken to be similar in character and magnitude to the Gulf War, with one key exception: The US was not afforded five-plus months to forge a multinational coalition and build up forces in theater. Analysis of this "cold start," Desert Storm–like conflict led to detailed estimates of required intensity of aerial bombardment during the first thirty days.

Table 1. **Five Bomber Forces**

***Here are the five notional forces examined in this analysis. Numbers denote primary aircraft authorized (PAA), or aircraft available for combat. Force A is the baseline, roughly corresponding to the Pentagon's Fiscal 1995 plan. The prime variable is the number of B-2s.***

| Force | B-2 PAA | B-1 PAA | B-52 PAA | Tactical Air | Overseas Bases |
|---|---|---|---|---|---|
| A | 16 | 40 | 40 | Yes | 2 |
| B | 16 | 80 | 80 | No | 2 |
| C | 24 | 40 | 40 | Yes | 4 |
| D | 32 | 40 | 40 | No | 4 |
| E | 40 | 0 | 0 | Yes | 4 |

In this situation, long-range bombers were paramount. However, this study is *not* about using bombers to replace fighters. It analyzes the quantity of munitions needed and the rate at which they must be delivered to halt aggression. It makes a case that relatively expensive standoff weapons are unaffordable for the bulk of the mission and that the cost of stealthy aircraft is offset by their ability to use relatively inexpensive precision munitions.

All evidence was that investing in new B-2 bombers would prove more cost-effective than holding on to older B-1s and B-52s. The older bombers would require expensive new avionics and standoff precision guided weapons, and the cost of those improvements would more than offset the purchase price of new B-2s. The number of B-2s plays a key role in providing effectiveness, survivability, and relatively low weapon costs in the early days of a war, when bombers are most critical to success.

The Pentagon's 1993 Bottom-Up Review (BUR) rested on a new planning scenario, postulating an international crisis in which US military forces had to cope with two major regional conflicts (MRCs), each of which was similar in scope and magnitude to the Gulf War and both of which could break out more or less simultaneously. This analysis superimposes that military requirement on five notional bomber forces, shown in Table 1.

In this chart, the entries for sixteen B-2 primary aircraft authorized (PAA) correspond to a total inventory of twenty; eighty B-1 and eighty B-52 PAA are the most that could be kept with the necessary major outlays for modifications, spares, and logistic support. Forty B-1 and B-52 PAA corresponds to the level actually planned by the Pentagon. The term "yes" under tacair means it was included in the analysis. The number of overseas bases is two—Diego Garcia and Guam (both about 3,000 nautical miles from the conflict)—or four, with two additional unspecified bases much closer (about 1,000 nm).

Here it is important to note a fundamental conclusion of the quantitative analysis: *None of these notional bomber forces—even when aug-*

Table 2. **B-2 Sortie Requirements**

**(Invasion scenario, with active missile defense)**

| | Time Period in Days After Start of Air Campaign | | | | |
|---|---|---|---|---|---|
| **Combat Task** | **1–5** | **6–10** | **11–15** | **16–20** | **21–30** |
| Halt invasion | 100 | 70 | 45 | 20 | 40 |
| Suppress enemy air defense | 35 | 35 | 10 | 10 | 20 |
| Offensive counter-$C^3I$ | 80 | 25 | 15 | 10 | 15 |
| Offensive counterair | 150 | 150 | 50 | 50 | 50 |
| Offensive countermissile | 75 | 75 | 10 | 10 | 20 |
| Interdict invasion route | 30 | 15 | 15 | 15 | 30 |
| Attack military support and reserve ground forces | 60 | 60 | 60 | 60 | 120 |
| **Total all tasks** | **530** | **430** | **205** | **175** | **295** |
| **Equivalent B-2 sorties per day** | **106** | **86** | **41** | **35** | **30** |

***The first MRC would be a "cold start" war featuring an intense bombing campaign. Ideally, this campaign would last thirty days. MRC 1's seven major combat tasks are ranked according to urgency, with the number of B-2 sorties required in specific periods.***

*mented by tactical aircraft—was sufficient to meet the full range of demands imposed by the Bottom-Up Review's planning scenario.* In essence, therefore, we are engaged in a quantitative analysis of the nature and degree of risk inherent in these shortfalls.

The data and analysis show that all the forces in Table 1 could temporarily halt an initial enemy invasion in the first conflict. However, all five fail to prevent timely reinforcement, reconstitution, and resumption of the invasion; to stop ballistic missile attacks from stifling the US in-theater buildup; or to finish the combat tasks of the first MRC in time for the bomber force to swing to the second MRC.

Forces with fewer B-2s would have to be equipped with several tens of billions of dollars worth of highly advanced standoff missiles so that enough of the force could survive attrition and carry out two successive campaigns.

The analysis of alternative bomber forces was undertaken against the BUR planning scenario of two unforeseen MRCs. The BUR envisioned starting dates about thirty days apart, barely sufficient time for sealift closure on the first MRC, when tactical aviation would have enough logistic support to take over.

In the first MRC, the bomber force was evaluated for its ability to halt aggression, achieve air superiority, and suppress an aggressor's power to interfere with the US in-theater buildup. The most worrisome threat was the use of ballistic missiles with chemical warheads or worse.

In the analysis, employment of bomber forces was guided by relative task urgency, a need to hold losses to twenty-five old bombers, and a requirement to minimize the cost of weapons.

All of the bombers used advanced, precision weapons throughout. This novel approach was taken because the target systems were vulnerable to precision weapons (and much less vulnerable to unguided ones), and the analysis sought to establish the minimum size of the bomber force the BUR scenario required.

The analysis left out many combat tasks, assumed good intelligence, and made scant allowance for the fog of war. Even so, the bomber forces in each MRC expended some 42,000 precision weapons—three and a half times the 17,000 PGMs used in Operation Desert Storm. Some might question that number, but use of fewer PGMs would require more bombers and time, exactly the opposite of the BUR goals. About 40,000 targets were attacked during Desert Storm.

The point of departure was the set of combat task sortie demands, ordered by relative urgency (Table 2). The target sets are consistent with the BUR planning scenario. Invading forces start on Day 1, as does the bomber force. The notation "with active missile defense" means there is a ninety-percent-effective missile defense in place on Day 1; the bomber force would not be required to find and attack mobile missile launchers. That task could consume another twenty B-2 sorties per day, if required.

The Department of Defense, in its Fiscal 1995 budget submission, announced it would *not* try to keep active the maximum number of older bombers. It proposed to retire some, put some in reserve units, and maintain some in training status. These actions would leave available only about half the number of bombers operating in Fiscal 1993.

### Force A: The Baseline

In this analysis, the baseline force is a stylized version of the Pentagon proposal; call it Force A. Its composition (in aircraft, basing, and sortie rates) is presented in Table 4 (next page). Force A would result from the Pentagon's plan to purchase twenty B-2s, retain fifty B-52s equipped with modern PGMs, and keep fifty B-1s with enough spare engines and parts to permit full use in war.

The B-52s are generally unsuitable for attacking armor and surface-to-air missiles (SAMs), and the B-1 also is not well suited to the job of attacking these targets. Most target systems are best attacked by a combination of B-2s and older bombers. Early use of older bombers has high weapon costs, and the US can afford to attack only critical targets. Using a balance of losses, weapon costs, and relative urgency, a series of allocations to each task by bomber type, weapon type, and time period results in the equivalent B-2 sorties (Table 3).

We now have equivalent B-2 sorties needed (Table 2) and equivalent B-2 sorties generated by Force A (Table 3). A close comparison of the two reveals several interesting conclusions:

Table 3. **Force A's Equivalent B-2 Sorties**

| | Time Period in Days After Start of Air Campaign | | | | |
|---|---|---|---|---|---|
| **Combat Task** | **1–5** | **6–10** | **11–15** | **16–20** | **21–30** |
| Halt invasion | 100 | 70 | 45 | 25 | 50 |
| Suppress enemy air defense | 10 | 30 | 48 | 10 | 20 |
| Offensive counter-$C^3I$ | 13 | 41 | 72 | 22 | 17 |
| Offensive counterair | 0 | 0 | 0 | 140 | 262 |
| Offensive countermissile | 0 | 0 | 0 | 72 | 184 |
| Interdict invasion route | 0 | 0 | 0 | 0 | 0 |
| Attack military support and reserve ground forces | 0 | 0 | 0 | 0 | 0 |
| **Total all tasks** | **123** | **141** | **165** | **269** | **533** |
| **Equivalent B-2 sorties per day** | **25** | **28** | **33** | **54** | **53** |

***Force A does well in the most urgent task, "Halt invasion," but it falls short—sometimes dangerously so—in every other combat task. Force A cannot generate sufficient intensity for even one MRC, let alone two, and the first war drags out.***

Table 4. **Force A**

| | | |
|---|---|---|
| ***Force A is a stylized version of the Pentagon plan, fielding relatively few B-2s and retaining a limited number of older bombers.*** | **Aircraft** | B-2 = 16<br>B-1 = 40<br>B-52 = 40 |
| | **Overseas bases** | Two at 3,000 nautical miles (nm)<br>60 aircraft (16 B-2, 40 B-1, 4 B-52) |
| | **US bases** | Many at 7,000 nm<br>36 aircraft (36 B-52) |
| | **Sortie rates** | Overseas = 0.8 per bomber per day<br>US = 0.4 per bomber per day |
| | **Total sorties per day** | B-2 = 12.8<br>B-1 = 32<br>B-52 = 17.6 |

■ The most urgent task, "Halt invasion," is fully subscribed. The foe is halted by the end of Day 7, and the halted forces are subject to continuing attack sufficient to pin them in place throughout the first thirty days.

■ "Suppress enemy air defense" receives partial coverage until Day 6. Major SAM sites are stronger in Days 1–5 than desired but are suppressed by Day 13. Reconstitution is subject to sufficient attack to limit SAM effectiveness to ten percent of initial value or less for the rest of the campaign.

■ "Offensive counter-$C^3I$" gets only partial coverage until Day 9. Only targets judged most important would be struck.

■ "Offensive counterair" (OCA) comprises only harassment attacks until an intense attack sequence at Day 16. The airborne interceptor threat remains potent more than three weeks into the campaign—a bad circumstance very different from Desert Storm. Delayed completion of the OCA task was the single worst effect of bomber force inadequacy. Until intense OCA operations are almost complete, it is not feasible to start the remaining tasks without large weapon costs and heavy losses of older bombers.

■ "Offensive countermissile" is delayed in initiation of its intense attack sequence until Day 25. Protection of friendly airfields and seaports would rely on defenses until Day 25. The delayed OCM effort could mean a significant delay in the airlift buildup and sealift closure. This in turn could prevent the bomber force from moving to the second MRC in time.

■ "Interdict invasion route" is delayed until Day 31 for initiation of its intense attack sequence. Halted invaders could be resupplied and reinforced throughout the thirty days. The halted invasion forces could well mount a renewed drive forward in the Day 20 time frame.

■ "Attack military support and reserve ground forces" is delayed until Day 34. It would be Day 44 before most of the target system could be subscribed, and then only if the reserve ground forces have not dispersed. If they have, closure would be about Day 60. Reserve forces would be available to mount a new invasion down the same route (no interdiction until Day 31 or so) or another route at any time up to six weeks into the campaign.

The fact that Force A performed so poorly and carried such high risks is disappointing, particularly because it did, after all, have some B-2s, used an array of advanced precision weapons, had good intelligence and use of off-board sensors, and retained and adequately supported eighty older bombers. However, Force A is inadequate to deal with even one MRC, let alone two nearly simultaneous MRCs.

Worse, the estimates presented here are optimistic. In any real campaign, there would be major inefficiencies and political pressures to attack targets out of sequence. Bomber losses were estimated but not fed back into projections of sortie rates. No reduction in sorties was attributed to lack of maintenance or spares. In short, the bomber force was cred-

Table 5. **Combat Results: Forces A, A-Plus, and B**

| Combat Task | | Goals | Force A | Force A+ | Force B |
|---|---|---|---|---|---|
| Halt invasion | **Start** | 1 | 1 | 1 | 1 |
| | **Close** | 7 | 7 | 7 | 7 |
| Suppress enemy air defense | **Start** | 1 | 6 | 4 | 4 |
| | **Close** | 10 | 13 | 10 | 10 |
| Offensive counter-$C^3I$ | **Start** | 1 | 9 | 8 | 11 |
| | **Close** | 5 | 17 | 15 | 20 |
| Offensive counterair | **Start** | 1 | 16 | 13 | 11 |
| | **Close** | 10 | 28 | 22 | 20 |
| Offensive countermissile | **Start** | 1 | 25 | 23 | 21 |
| | **Close** | 10 | 34 | 30 | 30 |
| Interdict invasion route | **Start** | 1 | 31 | 21 | 24 |
| | **Close** | 5 | 40 | 30 | 31 |
| Attack military support and reserve ground forces | **Start** | 1 | 34 | 23 | 26 |
| | **Close** | 30 | 45 | 32 | 31 |

***Numbers listed under "Goals" denote days on which each combat task should begin and end. Force A falls well short of the ideal. Adding tactical airpower (Force A-plus) or older bombers (Force B) shortens the war, but these options carry certain risks and costs.***

ited with its maximum reasonable capability.

This analysis examines ways to improve the capability of the future bomber force to meet BUR requirements. The large number of weapons required, the short time available to deliver them, and the need to pursue lowest-cost solutions are driving factors in the analysis of four paths for improving the bomber force:

- Add in nonbomber airpower—naval aviation, seabased cruise missiles, and landbased fighter-bombers.
- Build up the force with more B-1 and B-52 bombers.
- Pursue a more aggressive overseas basing posture.
- Increase the inventory of newer bombers.

### Force A-Plus: Add Tactical Airpower

The Air Force has made much of the synergy among fighters, cruise missiles, tactical naval air components, and bombers. If all goes well, tactical forces would begin to arrive in the theater during the first week and in substantial numbers by Day 30. These components can deliver most of the same precision guided munitions and standoff missiles that the bombers can, and they can rely on the same reconnaissance and intelligence. They also bring technical and operational attributes helpful in coping with and permanently suppressing enemy air defenses.

For a quantitative analysis of the ability of a combined bomber force and tactical airpower force to accomplish the airpower tasks at hand, it is useful to separate the tactical forces into three components:

- Stealthy F-117 fighter-bombers are able to penetrate unsuppressed enemy air defenses and deliver precision munitions. Currently, the F-117 delivers laser-guided bombs, two per sortie, that cost less than $100,000 each. These weapons require the absence of clouds between the aircraft and the target. The F-117 could be adapted to carry the all-weather Joint Direct Attack Munition (JDAM) at $100,000 per weapon. F-117s would directly add to the B-2 sorties.
- The F-15E and F-111F landbased fighter-bombers and the programmed F/A-18E/F carrier-based fighter-bombers have operational flight profiles similar in many respects to those of B-1 bombers. They are credited with the ability to deliver most of the same weapons as the B-1, in particular JDAM, Tactical Munition Dispensers (TMDs), the Joint Standoff Weapon (JSOW), and the Triservice Standoff Attack Missile (TSSAM), but not the Long-Range Cruise Missile (LRCM), for which there is no need in fighter-bomber force structure. They could deliver laser-guided bombs (weather permitting), High-Speed Antiradiation Missiles for defense suppression, and of course air-to-air weapons.
- Ship-launched long-range, precision Tomahawk Land-Attack Missiles (TLAM-Cs) are functionally equivalent to the air-launched LRCMs used extensively by the B-52 and to a lesser extent by the B-1 in Force A. They cost about as much as LRCMs, perhaps less, because the TLAM-C production line is mature and ongoing.

The time-phased quantitative value of these three force components, taking into account estimated time to deploy to the theater prior to combat employment, was analyzed and the quantitative contributions summarized.

The major value of F-117s lay in augmenting a small B-2 force with many more opportunities than it could handle to strike deep, well defended, urgent targets. Even the small F-117 force made a big contribution to suppressing SAMs and airborne interceptors.

The major value of the F-15E, F-111F, and F/A-18E/F fighter-bombers was providing reinforcements and mass late in a campaign, after Day 20.

The TLAM-C's major value was its ability to strike time-urgent individual targets. TLAM-Cs' launch platforms are generally closer than the bomber bases to target areas. Inclusion of the TLAM-C did not produce substantial improvement in the time performance of Force A because there were plenty of B-52 and B-1 sorties to carry LRCMs and the number of LRCMs (and TLAM-Cs) used was limited by cost considerations.

Table 5 displays the quantitative results of including the nonbomber forces (Force A-plus). Their inclusion significantly shortens the time needed to complete the seven combat tasks.

Table 6. **Force B**

***Force B beefs up the baseline force by retaining additional older bombers, though at a high cost in weapons and maintenance.***

| | |
|---|---|
| **Aircraft** | B-2 = 16<br>B-1 = 80<br>B-52 = 80 |
| **Overseas bases** | Two at 3,000 nautical miles (nm)<br>60 aircraft (16 B-2, 44 B-1) |
| **US bases** | Many at 7,000 nm<br>116 aircraft (36 B-1, 80 B-52) |
| **Sortie rates** | Overseas = 0.8 per bomber per day<br>US = 0.4 per bomber per day |
| **Total sorties per day** | B-2 = 12.8<br>B-1 = 49.6<br>B-52 = 32.0 |

Unfortunately, several serious concerns arise about Force A-plus. Estimated arrival rates of nonbomber components make no allowance for interference with or impediments to the theater buildup. In reality, such difficulties could arise from a number of causes: political opposition in the host country, sabotage, and air or missile attacks on ports and airfields, particularly with nuclear, biological, or chemical weapons.

Supporting these in-theater forces with adequate fuel, munitions, and maintenance can severely strain airlift capacity. The force would require prepositioning and/or sealift closure (about Day 30) to sustain a heavy sortie/payload rate.

These deployment surges are without any hedge toward a second MRC and involve all of the F-117s and F-15Es and the majority of the US Navy's available major combatant ships. That is, these forces would

also have to be divided, with part going to the second MRC. For example, if arrival times were delayed by only fifteen days, then the total contribution by Day 30 would be only about twenty-five percent of what it would be with a Day 1 start.

Put another way, Force A-plus is internally inconsistent. The purpose of OCA and countermissile tasks is to facilitate the unhindered entry of forces into the theater, but for the nonbomber components to make a difference, they must enter *before* these tasks are complete.

Force A is too meager and its action too much centered on early periods of the campaign for arrival of the nonbomber forces to provide an adequate remedy.

to wind up the campaign in time (about Day 31) for the bomber force to be available to swing to the second MRC at the nominal planning time of Day 30.

The big problem is exorbitant cost. The weapon costs for Force B for one MRC are about $42 billion—even higher than for Force A and Force A-plus. This arises because the older bombers need the more expensive standoff missiles to gain sufficient intensity of attack and maintain an acceptable loss rate. The trade-off boils down to this: Avoiding the loss of a single older bomber costs about $1 billion in weapons.

In fact, weapon costs for all three forces—A, A-plus, and B—are extremely high by historical standards.

Table 7. **Force C**

***Force C features a twofold improvement: increasing the number of B-2s and expanding the forward basing of bombers.***

| | |
|---|---|
| **Aircraft** | B-2 = 24<br>B-1 = 40<br>B-52 = 40 |
| **Overseas bases** | Two at 1,000 nautical miles (nm)<br>44 aircraft (24 B-2, 20 B-1)<br>Two at 3,000 nm<br>60 aircraft (20 B-1, 40 B-52) |
| **US bases** | Many at 7,000 nm<br>None during MRC |
| **Sortie rates** | Overseas,<br>1,000 nm = 1.2 per bomber per day<br>Overseas,<br>3,000 nm = 0.8 per bomber per day |
| **Total sorties per day** | B-2 = 28.8<br>B-1 = 40.0<br>B-52 = 32.0 |

## Force B: Add Older Bombers

Much of Force A's inadequacy has to do with not getting the tasks done on time. More bombers—whether old or new—can generate more sorties and increase the rate of task accomplishment.

The maximum reasonable number of older bombers (B-1s and B-52s) that could be retained in PAA status is about eighty of each, given logistic support demands. These, combined with the currently authorized production of B-2 aircraft, would result in Force B, as shown in Table 6.

The results of Force B's time performance are given in Table 5 and compared with the results for Forces A and A-plus. As can be seen from the data, doubling the number of older bombers significantly helps

For example, total cost for air-delivered and sea-launched munitions, precision and otherwise, for Desert Storm was less than $3 billion. This much lower value stemmed from extensive use of lower-cost gravity weapons, both unguided and precision guided, and the parsimonious use of standoff precision weapons. This munitions mix was permitted when Iraq's interceptor threat collapsed early.

In Desert Storm, these lower-cost gravity precision weapons could be used in two distinct operational settings: by stealthy F-117 aircraft in areas where air defenses were strong (*e.g.*, Baghdad) and by other fighter-bombers in areas where defenses were weak or temporarily suppressed.

Fortunately, the mismanagement and inadequacies of the Iraqi Air Force, impelled in part by the Coalition's defense-suppression campaign, provided ample opportunity for the second case. Had the Iraqi Air Force fought harder and better (*e.g.*, as well as the North Vietnamese Air Force), then the nonstealthy fighter-bombers would have had a much more difficult and more dangerous time of it.

Thus the exploration of the second path, using more older bombers, reveals improved performance, but only at the risk of counting on the aggressor's air defense force to fail to fight or at the expense of unrealistically high weapon costs.

The analysis found that the overall effectiveness of the older bombers, on a per-sortie basis, was about sixty percent to eighty percent of the effectiveness of the B-2, depending on the particular force mix. Managing losses to fewer than twenty-five bombers would further reduce this effectiveness because the standoff weapons that would make such reductions possible are the least efficient on a per-sortie basis and the most costly.

The principal effect of enemy air defense was twofold: to limit the utility of older bombers until defenses could be suppressed and to force the use of relatively expensive standoff weapons so the older bombers could survive. Thus, in order to achieve their full potential, older bombers need an adequate B-2 force to suppress enemy air defenses.

## More Modern Forces

The analysis assessed several more modern bomber forces that would provide reasonable performance in terms of winning the first MRC in time for the force to handle a second MRC (starting about Day 30), enforceable performance against a determined enemy, and performance at an affordable cost for new bombers and precision weapons.

This path entails substantial production costs, but they are more than offset by reduced production of expensive standoff precision munitions needed by the older bombers. The newer bombers, being stealthy, can use mostly precision gravity weapons rather than precision standoff missiles that cost many times more per weapon.

This path also calls for aggres-

Table 8. **Combat Results: Forces C, D, and E**

| Combat Task | | Goals | Force C | Force D | Force E |
|---|---|---|---|---|---|
| Halt invasion | **Start** | 1 | 1 | 1 | 1 |
| | **Close** | 7 | 7 | 7 | 7 |
| Suppress enemy air defense | **Start** | 1 | 1 | 1 | 1 |
| | **Close** | 10 | 10 | 10 | 10 |
| Offensive counter-$C^3I$ | **Start** | 1 | 1 | 1 | 1 |
| | **Close** | 5 | 5 | 5 | 5 |
| Offensive counterair | **Start** | 1 | 6 | 4 | 6 |
| | **Close** | 10 | 15 | 15 | 20 |
| Offensive countermissile | **Start** | 1 | 16 | 14 | 21 |
| | **Close** | 10 | 22 | 22 | 30 |
| Interdict invasion route | **Start** | 1 | 16 | 11 | 16 |
| | **Close** | 5 | 22 | 21 | 36 |
| Attack military support and reserve ground forces | **Start** | 1 | 16 | 13 | 21 |
| | **Close** | 30 | 27 | 23 | 37 |

***Numbers listed under "Goals" denote days on which each combat task should begin and end. Forces C and D are able to wrap up the MRC 1 bombardment campaign within the thirty-day limit. Force E cannot, though it still outperforms Force A.***

sive forward basing. Even from overseas bases 3,000 nm from the target area, the sortie rate is limited primarily by flight time to and from the target area. Overseas basing (temporary, only during the MRC) at 1,000 nm from the target area, for example, would provide a fifty percent sortie rate increase over basing at 3,000 nm.

In both Vietnam and Desert Storm, some bombers were relocated as far forward as was practical. Some went to Thailand and some to western Saudi Arabia, respectively. The value is increased sortie rate; the difficulty is finding available, secure base facilities.

There are costs associated with such basing structures, of course—and not only in monetary terms—but the monetary costs are modest compared to the costs of buying new weapons and aircraft.

Increased overseas basing is a powerful, cost-effective strategy for increasing the effectiveness of any bomber force. Long-range bombers do not need to be based overseas in peacetime.

### Force C: More B-2s

The improvements incorporated in Force C are twofold: a modest increase in the number of B-2 bombers (rising from sixteen PAA to twenty-four PAA) and more aggressive forward basing for all bombers.

The number of older bombers is the same as for Force A. The characteristics of Force C are listed in Table 7.

The analysis shows that compared to Force A, Force C could generate about 2.2 times as many B-2 sorties per day, twenty percent fewer B-1 sorties per day, and about the same number of B-52 sorties a day.

The impact of the additional B-2 sorties is quite strong. The duration of the campaign falls from about forty-five days for Force A to about twenty-seven days for Force C (Table 8). Weapon costs for Force C are about $15 billion less for just one MRC (Table 9). Savings for weapons for two MRCs would be correspondingly greater.

There are two reasons for the strong showing. More B-2 sorties, especially early in an MRC, allow defense suppression to occur more quickly and to be performed primarily by the B-2, thus avoiding aircraft losses and costs for the more expensive stand-off weapons needed by the older bombers.

The bad news: Weapon costs for Force C are still high by historical standards—about $19 billion.

It is instructive to examine trade-offs between weapon costs and aircraft losses. Precision weapon types differ in their ability to stand off from the threat of SAMs and airborne interceptors. They differ in their effectiveness against target types within the target systems characteristic of each combat task. Finally, they differ radically in cost, ranging from about $100,000 per

Table 9. **Costs of Forces**

**(Estimates in billions of FY 1995 dollars)**

| | Force A (20 B-2s) | Force B (20 B-2s) | Force C (30 B-2s) | Force D (40 B-2s) | Force E (50 B-2s) |
|---|---|---|---|---|---|
| New B-2, additional cost | $ 0 | $ 0 | $ 6 | $12 | $18 |
| B-1, B-52, modification costs | 4 | 7 | 4 | 4 | 0 |
| Weapon costs, one MRC | 34 | 42 | 19 | 13 | 7 |
| Weapon costs, two MRCs | 51 | 63 | 28 | 20 | 11 |
| **Total, two MRCs** | **55** | **70** | **38** | **36** | **29** |

***Forces with more B-2s—C, D, and E—are less expensive to field and employ than are Forces A and B, if one counts not only the cost of new B-2s but also modifications and weapons. Marginal cost imputed to new B-2s is $600 million per inventory aircraft.***

Table 10. **Combat Results: Forces A-Plus, C-Plus, and E-Plus**

| Combat Task | | Goals | Force A+ | Force C+ | Force E+ |
|---|---|---|---|---|---|
| Halt invasion | **Start** | 1 | 1 | 1 | 1 |
| | **Close** | 7 | 7 | 7 | 7 |
| Suppress enemy air defense | **Start** | 1 | 4 | 1 | 1 |
| | **Close** | 10 | 10 | 10 | 10 |
| Offensive counter-$C^3I$ | **Start** | 1 | 8 | 1 | 1 |
| | **Close** | 5 | 15 | 5 | 5 |
| Offensive counterair | **Start** | 1 | 13 | 6 | 6 |
| | **Close** | 10 | 22 | 15 | 15 |
| Offensive countermissile | **Start** | 1 | 23 | 11 | 11 |
| | **Close** | 10 | 30 | 20 | 20 |
| Interdict invasion route | **Start** | 1 | 21 | 11 | 11 |
| | **Close** | 5 | 30 | 15 | 20 |
| Attack military support and reserve ground forces | **Start** | 1 | 23 | 16 | 16 |
| | **Close** | 30 | 32 | 22 | 25 |

***Numbers listed under "Goals" denote days on which each combat task should begin and end. The data reveal the impact of early arriving tactical airpower on the three bomber forces. Tactical airpower corrects the major drawbacks of Force C and Force E.***

JDAM to at least $3 million for each LRCM.

Analysis to date indicates that the trade-off is between the loss of one older bomber and an additional weapon expenditure of $1 billion. Weapon costs were established on the assumption that bomber losses would be held to about twenty-five aircraft, split roughly equally between B-1s and B-52s.

This trade-off ratio—$1 billion in standoff weapon costs per aircraft loss averted—hinges on several considerations. One is the desire to get the first-MRC combat tasks completed before the bulk of the bomber force swings to the second MRC. This time pressure encourages the US to initiate the offensive countermissile task before completing the offensive counterair task and to use older bombers to wrap up the OCA task.

Unless the older bombers were equipped with standoff weapons, this move would conflict with the need to operate at a loss rate per sortie that leaves enough bombers to fight and win the second MRC.

If further stealthy B-2s are added to the bomber force, weapon costs become markedly lower, for two reasons. First, the extra B-2s can fly sorties in heavily defended regions with less expensive weapons. Second, the addition of B-2 sorties allows the US to complete the air defense suppression tasks sooner, and older bombers could get by with fewer standoff weapons.

## Forces D and E: B-2s and Bases

Two more notional bomber forces, each having more B-2 aircraft and closer bases, were evaluated for their contribution to reducing weapon cost and for shortening the duration of the air campaign.

The first, Force D, differs from Force C in two respects. It possesses thirty-two PAA B-2s—eight more than in Force C—and it positions all of them on bases within about 1,000 nm of the first MRC.

The second, Force E, differs from Force C and Force D in fairly important ways. First, it has forty PAA B-2s—sixteen more than Force C and eight more than Force D. Second, it is a pure B-2 force, with no older bombers, all of which would be retired. Like Force D, all of Force E's B-2s would be based within 1,000 nm of its targets (Table 1).

Table 8 compares the time performance of Forces C, D, and E. The data make clear that adding stealthy B-2 aircraft has a substantial impact on shortening the duration of the campaign. Even Force E, with no old bombers or tactical air forces, does a fair job, better than Force A.

Improved time performance, however, is not the whole story. Forces with more B-2s (Forces C, D, and E) actually cost less to field and employ than Forces A and B. Table 9 shows costs for three steps:

- Purchase of B-2s above the currently authorized twenty.
- Modifications to B-1s and B-52s to carry advanced PGMs.
- Purchase of munitions sufficient to win two MRCs.

When the analysis was run, one item of great interest emerged: The number of B-2 sorties produced by Force D enabled the older bombers to carry out their missions without expensive, standoff LRCMs. Thus, USAF could avoid the LRCM's steep development, production, and integration costs. It is possible that some of those costs are already sunk, and so no claim of savings is made in Table 9. Force E, with no older bombers, would not need LRCMs either. Force C, with more B-2 sorties than Force A, did not need to use LRCMs on B-1s.

The marginal cost of additional B-2s is about $600 million per inventory aircraft. Costs for modifying older bombers is $7 billion for the 160 aircraft in Force B and $4 billion for eighty bombers in the other five notional forces.

Costs for weapons are based on detailed allocations for one MRC. This cost is not doubled for the two-MRC scenario but only multiplied by 1.5. Total weapon usage for MRC 2 could well be about the same as for MRC 1, but the urgency would be less, and the force surviving MRC 1 would be somewhat richer in B-2s than the initial force, so the weapon inventory would be leaner in the more expensive types. Moreover, a larger buy would entail some economies of scale. Even so, the correct multiplier probably is higher than 1.5, and the estimate is on the low side.

The high costs of the precision weapons are driven not by the need for precision so much as the need for standoff capability to preserve the older bombers as they face modern air defenses. The bulk of the weapon costs comes from the weapons delivered by the older bombers—except of course, for Force E, which has no older bombers.

The low cost of the all-B-2 Force E is offset by an overlong campaign duration (thirty-seven days), compared to Forces C and D, as shown in Table 8.

For pure B-2 forces as large as Force E, the campaign duration has a straightforward scaling in inverse proportion to force size. A pure B-2 force of forty-eight PAA bombers (sixty in inventory) would have a campaign duration of about thirty-one days. Fifty-six PAA would finish up in about twenty-six days. The weapon costs would be somewhat lower for the larger forces because there would be fewer penalties caused by late completion of tasks.

One can also project the impact of early arriving, in-theater tactical airpower on the pure B-2 Force E. This force is called Force E-plus. Time performance of Force E-plus is given in Table 10, along with the result for Force A-plus and for a new Force C-plus, which is Force C with tactical airpower.

Table 10 shows that tactical aviation corrects the major drawback of Force E, reducing the duration of the campaign from thirty-seven to twenty-five days.

The weapon costs for Force E-plus are only about $1 billion higher than for Force E, but they are about $20 billion *less* than for Force C-plus for two MRCs. Table 11 summarizes cost considerations for the three forces with tactical aviation included.

It is not really possible to know the extent to which tactical airpower would contribute during the early phases of a cold-start conflict. Estimates based on logistics and lift can be made, but the aggressor has many opportunities to interfere with and impede aircraft arrival and sortie generation.

One could plan for Force E to operate with tactical airpower, but if the latter were impeded, then only the completion of the less urgent tasks would be significantly affected.

Force E-plus's eighty older bombers would be able to complete the high-intensity part of almost all tasks quite early and shift appreciable bomber sorties to a second MRC by Day 10. None of the other forces examined in this analysis can deal with a second MRC before Day 22.

Increased B-2 sorties from more B-2 aircraft and more aggressive overseas basing make a very big improvement, even for modest increases in B-2 inventory (adding ten to twenty aircraft). The addition of thirty B-2 aircraft would allow the phaseout of all older bombers and provide a bomber force that would, in combination with tactical aviation, go a long way to meeting the BUR's planning guidance. The addition of any number of B-2s results in a sharply lower total cost, the reduced cost of weapons more than offsetting the cost of new aircraft.

This analysis spotlights several bomber force structures that would yield adequate performance in a two-MRC scenario at an affordable cost in bombers and weapons. Unfortunately, the bomber force proposed by the Pentagon is not among them. It is too thin in modern bombers, and efforts to augment this shortfall with older bombers and tactical aviation produce only marginal performance increases at great cost.

Forty to fifty stealthy bombers in inventory, based far forward during combat, would go far toward meeting the demands of the Bottom-Up Review for successful, cold start, high-intensity, enforceable campaigns in two nearly simultaneous major regional contingencies. The US could field and deploy such a force at a reasonable total cost. ■

Table 11. **Comparative Costs**

**(Estimates in billions of FY 1995 dollars)**

| | Force A (20 B-2s) | Force A+ (w/tacair) | Force C (30 B-2s) | Force C+ (w/tacair) | Force E (w/tacair) | Force E+ (w/tacair) |
|---|---|---|---|---|---|---|
| New B-2, additional cost | $ 0 | $ 0 | $ 6 | $ 6 | $18 | $18 |
| B-1, B-52, modification costs | 4 | 4 | 4 | 4 | 0 | 0 |
| Weapon costs, one MRC | 34 | 36 | 19 | 22 | 7 | 8 |
| Weapon costs, two MRCs | 51 | 54 | 28 | 33 | 11 | 12 |
| **Total, two MRCs** | **55** | **58** | **38** | **43** | **29** | **30** |

***Weapon costs for Force E-plus are only about $1 billion higher than for Force E, but they are about $20 billion less than for Force C-plus on a two-MRC basis.***

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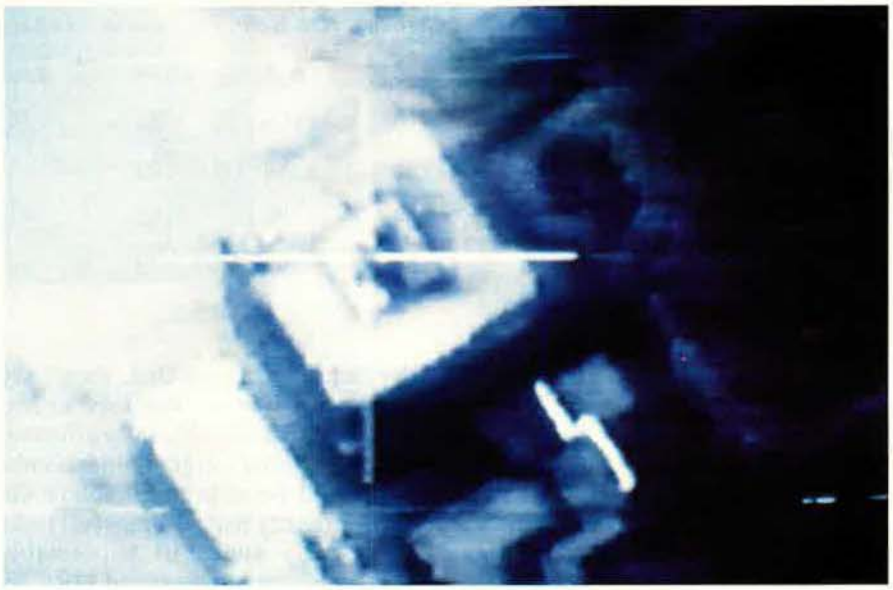
*Maj. Gen. Jasper Welch, USAF (Ret.), holds a Ph.D. in nuclear physics. He now consults for aerospace firms, including Northrop Grumman, prime contractor for the B-2 bomber. Before retiring in 1983, he served as assistant chief of staff for Studies and Analysis and assistant deputy chief of staff for Research, Development, and Acquisition. General Welch served as the defense policy coordinator on the National Security Council staff under Zbigniew Brzezinski. His 1992 paper "Conventional Long-Range Bombers" was prepared for House Armed Services Committee Chairman Les Aspin, who became the first Defense Secretary of the Clinton Administration. General Welch updated the paper in 1994 at the request of Sen. Sam Nunn, chairman of the Senate Armed Services Committee. This article is based on those two studies.*

**The Air Force transfers more dual-use technologies—some of them with life-saving implications—to the private sector.**

# The Medical Profession Meets Materiel Command

**By James Kitfield**



***Different battlefields, similar weapons: Air Force technology that pinpoints targets can be used to pinpoint tumors and blood clots. Technology transfer is a key consideration when Air Force Materiel Command funds research.***

IN THE rarefied world of basic research, long before technology is harnessed to a specific military system or mission, scientists are encouraged to dream. Might not an advanced neural network system designed to find hidden enemy tanks or command centers, for instance, prove just as adept at detecting malignant tumors? Why couldn't a helmet-mounted display and three-dimensional imaging system created to strengthen the situational awareness of a combat pilot do the same for surgeons in high-tech, high-pressure operating rooms? Perhaps tiny lasers designed for remote sensing could be used to clear blood clots from coronary arteries.

The paradox of exploiting advanced defense technologies for the art of healing is not lost on Gen. Ronald W. Yates, commander of Air Force Materiel Command, Wright-Patterson AFB, Ohio. "It's ironic," he says, "that technologies that make our weapons so smart may help us outsmart cancer with early detection and that tools that wreak destruction can also be lifesaving."

General Yates made that statement in September at AFMC's advanced-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technology symposium held at AFA's National Convention in Washington, D. C. The occasion was the unveiling of several new technology transfer initiatives by which the Air Force is sharing its technical wealth with an eager private sector.

Exploiting dual-use research that yields commercial as well as military benefits is in keeping with a Defense Department strategy to integrate the defense and commercial industrial bases more closely and maximize the "economic security" benefits of military research.

To accomplish that goal, AFMC has established a transfer focal point, or Office for Research and Technology Application, at each of its operating locations. The command also operates a technology information hotline called Tech Connect to help industry and academia identify military technologies with promising commercial spin-offs.

The number of cooperative research and development agreements that AFMC has signed with private firms, universities, and government agencies interested in Air Force technology has grown from thirty in 1992 to more than 150 in 1994.

"In the Air Force, technology transfer is an integral part of our job," says General Yates. "It's not secondary; it's not follow-on; it's a core part of what we do and a major criterion in determining where we devote our dollars and people because, in a time of budget cutbacks, it's absolutely vital that we very selectively nurture the most promising technologies."

AFMC officials stress that the research they fund has clear military applications, first and foremost, and thus meets a specific warfighting need. Indeed, the core military technologies they explore have changed little in the past decade.

"We've learned, however, that by its very nature, most basic research has dual-use applications," says Brig. Gen. Richard R. Paul, AFMC's director of Science and Technology.

He points out that even the technological building blocks of conventional weapons—advanced guidance systems, miniaturized components, and sensors—have commercial applications.

"The difference at AFMC today is that with this Administration's and Congress's interest in exploiting dual-use technologies for the sake of economic competitiveness—which is a part of national security—we've gone from a largely reactive mode concerning technology transfer to a more proactive mode," says General Paul. "We're spending more energy considering possible dual-use applications."

One area apparently ripe for such technology crossover is medicine, an industry that equals the military in its devotion to high-tech solutions.

### Laser Treatment for Heart Disease

In the late 1980s, for instance, two medical companies became interested in research on tiny holmium lasers conducted at Phillips Laboratory, Kirtland AFB, N. M. The Air Force wants to mount the lasers on aircraft and satellites for remote sensing of wind patterns and movements.

Medical researchers with Schwartz Electro-Optics, Orlando, Fla., and Eclipse Surgical Technologies, Sunnyvale, Calif., discerned a different potential in the lasers. Mounted on a catheter and fed energy through a thin array of quartz fibers similar to

*The E-8 Joint Surveillance and Target Attack Radar System's sophisticated technology can detect enemy command centers and distinguish a mobile missile launcher from a decoy. Detailed, color-coded images appear on-screen . . .*

erful transputers for massive computational capability, neural networks function much like the human brain.

"The neural network processes a lot of different information, assigning weights to each information bit in terms of importance, and then, much like the brain, it will say 'Yes' when it has enough information to make a positive identification," says Capt. Nelson Ludlow of Rome Laboratory, adding that the system was modified to hunt for Scud missiles during Operation Desert Storm.

Cooperating with partners Booz-Allen & Hamilton and Cornell Medical Center, New York, N. Y., Air Force researchers are helping to build a database that will allow ATR technology to distinguish between malignant and benign lung tumors, which could reduce the number of biopsies by fifty percent.

those used in fiber optic communications, the holmium lasers can vaporize blood clots or plaque blockage in arteries.

Clinical trials of the new technique began at Stanford University in 1989. To date, the lasers have been used to clear blocked or obstructed arteries in more than 1,500 patients worldwide.

"This year, this technique was used in forty-five cases where the patient was actually in cardiac arrest," says Stephen Alejandro, a researcher at Phillips Laboratory. "Many of the patients reported feeling the gripping pain in their chests subside even as the laser was cutting through the blockage in their arteries."

Because the laser technique is minimally invasive and less expensive than open-heart bypass surgery, officials at Schwartz Electro-Optics and Eclipse believe it will become a standard medical tool for treating arterial blockages. They are awaiting final Federal Drug Administration approval of holmium laser treatment.

AFMC officials believe they too have benefited from this partnership with the commercial world. Supported by sales of the holmium laser device, commercial researchers have produced advances in laser component design and optical coatings that the Air Force is using as it continues to develop the technology for remote sensing.

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*. . . like those enabling private-sector medical technicians to differentiate malignant tumors from benign ones without the need for a biopsy. Air Force researchers say this tool could cut the number of biopsies in half.*

## Neural Networks for Tumor Detection

An Automatic Target Recognition (ATR) system that uses advanced "neural networks" to help pilots identify enemy tanks and command bunkers is being altered to perform double duty in hospitals. Originally developed for AFMC's Rome Laboratory, Griffiss AFB, N. Y., the technology will be used to detect and classify benign and malignant lung tumors.

Using advanced parallel processing techniques with thirty-six pow-

"We only tested the system against the toughest cases, where the radiologists said they couldn't tell whether the tumor was malignant or benign and they would have had to conduct a biopsy," says Captain Ludlow, noting that the neural network assembles a tumor image of a much higher grain than that available with other types of diagnostic equipment.

## Computer-Assisted Surgery

In much the same way that Air Force pilots will one day have an unprecedented amount of informa-

tion at their fingertips in cockpits, surgeons in future operating rooms may benefit from three-dimensional "virtual" imaging, helmet-mounted displays, and voice-recognition systems.

That vision drives a project called computer-assisted, minimally invasive surgery at Wright Laboratory, Wright-Patterson AFB, Ohio.

Just as next-generation aircraft will fuse information from a variety of sensors—radar, thermal imaging, and forward-looking infrared—to create a three-dimensional image for a pilot's situational awareness, so can similar systems provide a surgeon with a virtual-image backup during operations.

"While the sensors will be different in the medical environment, the fusion of that information is the critical link," says James Leonard, an electrical engineer at Wright Laboratory. "We've found that magnetic resonance imagery gives you a real good 3-D image of the body, but it doesn't register well the changes during surgery. Ultrasound imaging, on the other hand, gives you very good information in terms of monitoring tissue change."

Project managers, including researchers at the Cleveland Clinic Foundation in Ohio, envision a surgeon's receiving the resulting three-dimensional image of the affected area on a helmet-mounted display. Air Force voice-recognition technology could also help end communication breakdowns between the surgeon and his information sources.

"The doctor will be able to look at
images of the area he is per-
ing on with only a small move-
eyes, which is very im-
s Mr. Leonard, noting
urgeries, the slightest
can result in paraly-
will be able to talk
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xt on his display,
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***In much the same way they can enhance a pilot's situational awareness, three-dimensional imaging technology and various sensor systems can allow a surgeon to monitor changes in a patient's body during surgery.***

lasers have on the human eye and specifically on how flashes of laser light travel from the front of the eye (cornea) through the lens to the back of the eye (retina).

Because so many weapon systems on the modern battlefield depend on lasers, the Air Force had already determined the need to protect against laser damage and establish safety standards for laser use. That research into how lasers affect the eye has led to two medical applications.

In collaboration with Duke University Eye Center, Durham, N. C., researchers at Armstrong Laboratory have developed the Intraocular Laser Surgical Probe (ILSP), a direct result of research involving the generation of very fast flashes of laser light. The ILSP operates by sending laser light through a transparent fiber. The resulting "fireball flash," roughly the size of a pinhead, can cut tissue into slices whose thickness measures close to the diameter of a human hair. Such a precise tool is expected to aid doctors in delicate eye surgery, especially in treating eye disease resulting from diabetes and premature birth.

"The ILSP offers major advantages over the mechanical tools that represent current technology, which can add to eye damage as they cut." says Capt. Pat Roach of Armstrong Laboratory. "Because we use such a small fiber, and the laser cuts are so precise, this could represent a revolution in eye surgery." The device has a patent pending and still faces a lengthy FDA approval process.

Another project directed by the Air Force, in collaboration with scientists from the Massachusetts Institute of Technology, Duke University, the US Army, and the Laser Medical Center in Lübeck, Germany, uses a laser to conduct noninvasive eye exams. The diagnostic technology, called Optical Coherence Tomography (OCT), illuminates the back of the eye with a laser and collects reflected light for imaging. Such in-depth, detailed views of the retina structure were previously possible only through radical eye-removal procedures.

"This past June, we used OCT to take detailed images of a live patient's retina and document damage due to cataracts," says Captain Roach.

"Those are the first such images of their kind, and we're in the process of getting them published in a medical journal. . . . That's hot stuff." ■

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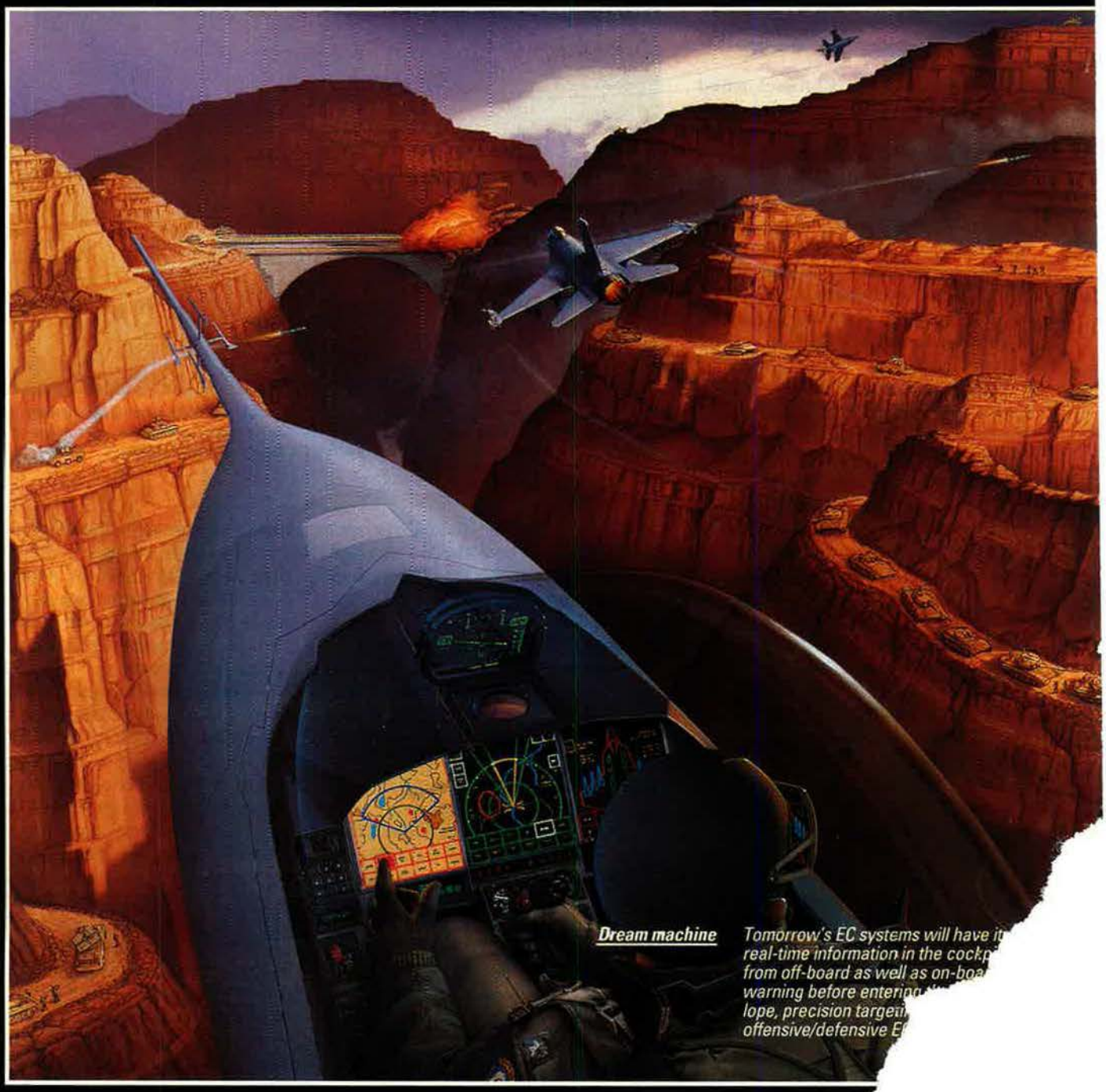
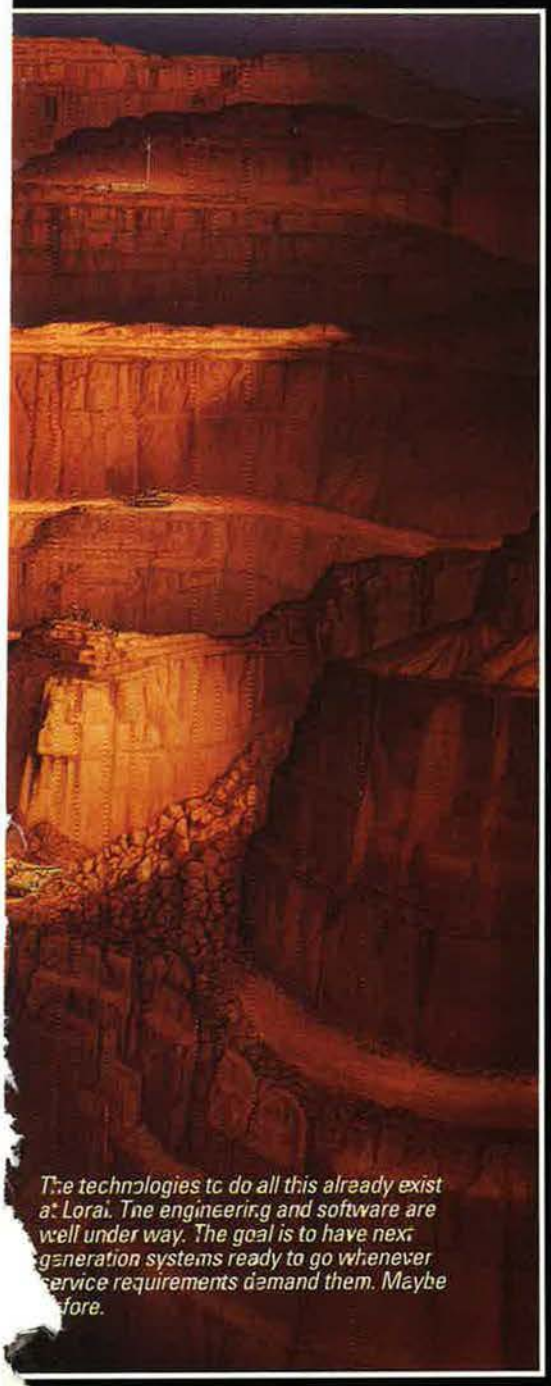
*James Kitfield is the defense correspondent for* Government Executive *Magazine in Washington, D. C., and a regular contributor to* Air Force *Magazine. His most recent article, "The End of the Line for Milspec?" appeared in the October 1994 issue.*



**Dream machine** *Tomorrow's EC systems will have it real-time information in the cockp from off-board as well as on-boa warning before entering lope, precision targeti offensive/defensive E*

## Electronic Combat Systems

# Performanc

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**A new RAND Corp. study considers options for the structure of the smallest Air Force since 1947.**

# New Concepts for the Force Mix

**By Bruce D. Callander**

EVEN AS Air Force end strength plummets toward an all-time low, the service has started considering what could prove to be important shifts in the force mix itself.

The current drawdown plan calls for the number of active-duty Air Force personnel—608,199 in 1986—to bottom out at about 390,000 around the turn of the century and remain at that level, the lowest since USAF became independent in 1947. Air National Guard, Reserve, and civilian components also will undergo reductions.

This drastic downsizing has raised basic questions about other aspects of the force. Recent Air Force and Defense Department studies have been looking at how a scaled-down service could best use its officers. By extension, the studies have also examined prospects for the enlisted force and civilian workers.

The basic question posed by both studies is whether some positions now filled by active-duty commissioned officers could be turned over to others with little or no decline in performance.

Could the jobs be done as well by enlisted personnel, civilian employees, Guardsmen, or Reservists? Could certain positions be farmed out to civilian contractors?

DoD's study was performed by the RAND Corp.'s National Defense Research Institute at the behest of Congress. Its focus was on future officer management systems, but it also looked at the present force mix and possible alternatives.

While RAND was conducting the study, the Air Force was making one of its periodic job-by-job reviews of future officer requirements to determine if all its commissioned positions are justified.

About nineteen percent of Air Force active-duty troops are officers, and projections call for about the same percentage through 2001. That picture could change as the service faces continuing pressure to save money and streamline still more. Officers, particularly those who stay for full careers, are the service's most expensive members. Any move to reduce their number or change their career patterns offers tempting savings.

The Pentagon is still studying the Air Force review, but the RAND study, referring to the service's conclusions,

***Opposite: MSgt. Ron Sadora and his civilian colleague Jerry Bragg work on an A-10 at Sacramento Air Logistics Center, McClellan AFB, Calif. RAND Corp. believes there could be an expanded role for enlisted personnel and civilians if the Air Force were to shift toward a "streamlined and reengineered" force.***

Staff photo by Guy Aceto

says, "The Air Staff expects that the review will result in the conversion of several officer positions to enlisted or civilian positions."

### Is the Pyramid Best?

RAND looked not only at raw strength figures but also at the basic structure of the officer corps. It questioned whether the traditional rank pyramid is the best approach and whether all officers necessarily have to enter at the lowest ranks and stay for full careers. It even raised the prospect of restoring the warrant officer program that the Air Force scrapped more than thirty years ago.

RAND analysts first looked at all the services' planned active-duty strengths for 1999, when they are expected to drop to 1.4 million members. Slightly more than 12.5 percent of them would be officers; forty-seven percent of those would be in the field grades. The Air Force's figures call for a force of about 390,000 members, about nineteen percent in the officer grades.

RAND then considered other totals and how they would affect officer requirements. Neither enlarging nor reducing the 1.4 million figure by 400,000 would have much impact, RAND concluded. Nor would any major changes in the mix, whether the force became more specialized or more generalized.

A specialized force would require more training and concentrate more officers in the technical skills. A generalized force would increase the population in the line skills and thin the specialized forces. The overall officer requirement would continue to hover around 12.5 percent.

A shift toward what RAND called a "streamlined and reengineered force," however, would definitely have a major effect on the mix. Such a force still would have about 1.4 million members but would substantially lower officer requirements. Some 21,000 officer positions would be "civilianized."

Not only the mix but also the nature of officer requirements would change under the streamlined scenario. More officers would have specialized military skills, and fewer would specialize in skills common in the civilian world. Fewer officers would be needed in the field grades.

Particularly affected would be officer positions located in the centralized logistics and management headquarters, where the services now show requirements for some 16,000 field grade officers. The RAND study suggests that as many as 4,000 of these positions could be downgraded to captain billets.

The effect of such a change would be to increase the percentage of officers in line skills and reduce the percentage in other areas.

### Fewer Officers

In RAND's "streamlined and reengineered" Air Force, total officer strength would drop by another 8,560. The number in line specialties would stay at about 27,000, but fewer officers would fill specialist, support, or professional slots.

In total numbers, such changes would be fairly modest compared with the cut the Air Force has taken in its officer ranks in recent years. But in a smaller overall force, even small changes become significant.

The impact of any change on the careers of the remaining members would be important too. The RAND study showed that, in recent years, officer requirements have dropped

Photo by Randy Jolly / Arms Communications

***Among other questions, the RAND study considered whether USAF helicopters could be flown by warrant officers, as they are in the Army, with little or no decline in performance and at a substantial saving.***

in such areas as strategic and tactical forces, communications, training, and support. They have increased in joint activities where the need is for specifically tailored "packaged forces."

## Changing Needs, Changing Force Mix

Budget constraints have caused the military to "de-layer" forces, reduce duplication, and rely more on Guardsmen and Reservists for short-term requirements, and they have forced all services to exploit technology that allows cuts in total strength and alters the force mix.

RAND says such changes may require the military to look at new approaches to "careering" officers and enlisted members. Traditionally, members counted on staying for a full career. That prospect has been changed by "up or out" management systems and, in recent years, by forced attrition. Even so, a full career still is the goal of many.

The RAND study suggests other possibilities. It notes, for example, that the trend in industry is toward the "in and out" approach. Companies hire people with needed skills, often at advanced levels, and let them go, voluntarily or otherwise, as needs change. Even at higher levels, workers no longer count on spending a lifetime with the same firm. Upward mobility often means changing jobs.

RAND suggests that the same approach might work in some military positions. The study cites as an example the requirement for an airlift pilot with ten years of experience. Does that necessarily mean ten years of service with at least three years' experience beyond flight training? Or could the job be filled by a pilot with ten years of flying with a civilian airline and only six weeks in the military?

The RAND report finds that the services dislike this approach; it tends to devalue military experience and professionalism. The study points out, however, that the services already follow a similar principle when they bring in medical professionals, call up Guardsmen and Reservists, and train enlisted members to become officers. In World War II, RAND says, the services took in hordes of civilians from businesses, trades, and professions, often giving them advanced ranks because of their experience.

## A Turbulent Personnel History

Even if they are theoretically possible and at times necessary, such approaches can disrupt traditional career patterns, the RAND study acknowledges.

Career officers need to develop their skills, move up promotion ladders at acceptable rates, make career selections at reasonable points, and serve long enough to build up a stake in eventual retirement.

However, RAND says, the services rarely have been able to guarantee such prospects. In the first 120 years of US military history, the professional officer corps was small, the pay was modest, and—except in wartime—promotions came slowly. The most attractive feature of service life was its security. At times even that was threatened by tight budgets.

After World War I, a large number of officers stayed on in peacetime. Even more stayed on after World War II.

Service strengths have fluctuated wildly in recent years. Since the end of the Cold War, they have been in a sustained dive. Force structures have also changed. The Air Force's moves toward composite wings and combined tactical and strategic forces, for example, have changed the demand for officer grades and skills.

In fact, the Air Force's entire personnel history has been turbulent, especially in the commissioned ranks.

Early on, when aviation was a minor activity of the Army, officers joined specifically to become pilots. When the Air Corps was created in 1926, Congress formalized this rule with laws requiring that generals and commanders of flying units be pilots, rated officers constitute at least ninety percent of the officer corps, and West Point graduates be assigned to other branches unless they qualified as pilots.

These seemed reasonable requirements at the time. As the parent service, the Army could furnish support officers so those in the Air Corps could concentrate on flying and fighting.

With time, however, the flying arm needed nonflying officers specifically trained in skills related to aviation. In World War II, the Army Air Forces trained some 159,000 nonrated line officers. At war's end, more than forty percent of all officers were nonflyers, a considerably larger percentage than in the present force.

With the end of the war, the active-duty force shrank dramatically and the percentage of officers even more so. Air leaders proposed a separate postwar Air Force with a million members, 150,000 of them officers. The Air Force had to settle for less than half those totals, and budget

cuts in the late 1940s forced it to release some of those.

The Korean War surge brought the force close to its original million-member goal, and USAF had to ask Congress for increased pay and benefits to recruit and retain enough officers. Then, in the post-Korea drawdown, it had to order another reduction.

This pattern of buildups and cutbacks continued with the Cuban missile crisis, the Vietnam War, and the Reagan Administration buildup of the 1980s. Throughout much of the past forty years, the Air Force was still contending with the large numbers of career-force personnel from World War II and the Korean War.

Staff photo by Guy Aceto

***At more than 80,000, civilians outnumber their military counterparts by better than two to one in Air Force Materiel Command. While the other major commands will not approach that ratio, they may see the roles of their civilians increase.***

### Flyers in Leadership Positions

While the Air Force had established the need for a substantial force of support officers, it continued to argue for a seventy-to-thirty ratio of rated to nonrated officers. In the tradition of the Air Corps days, the RAND study observes, the Air Force continued to fill most leadership positions with flyers and to fight off criticism that it was steering an unfair share of its regular commissions and promotions their way as well.

To get enough pilots and other crew members for World War II, says RAND, the Air Corps had lowered age and educational requirements. It had trained teenagers without high school diplomas to fly, commissioned them, and moved some into the field grades. It had used enlisted pilots and given some flyers warrants as "flight officers" instead of commissions. At war's end, the initial cadre of the newly independent Air Force included many officers who fell far short of meeting prewar officer qualifications. The Korean War buildup added more.

While it remained protective of flyers, the Air Force became concerned about the leadership and professionalism of its officer corps, RAND noted. Almost one-fourth of the regular officers in the postwar Air Force had no college education, and barely one-third had degrees. By comparison, almost ninety percent of all Army regulars had some college credits, and two-thirds held degrees.

The Air Force tried to raise education levels by requiring active-duty officers to take college courses and by drawing in new officers from service academies and through ROTC. It offered officer training to well-educated enlisted members and tried to lure civilian college graduates to Officer Training School and the aviation cadet program. Unfortunately, many civilians sought nonrated jobs, and relatively small numbers opted for flight training.

As attrition spurred by "up or out" policies reduced the wartime personnel "humps," education levels rose. The Air Force was again able to make a college degree a requirement for commissioning in both rated and nonrated specialties.

Nonetheless, flying remained the Air Force's reason for being and its justification for favoring rated officers. Its rationale traditionally had been that rated officers make up the bulk of its combat force and that flying units should be commanded by officers whose flying experience would inspire confidence in their subordinates.

Photo by Paul Kennedy

***A skilled cadre of enlisted maintenance personnel, such as this C-5 crew chief, keep USAF aircraft in top condition. Contractor personnel could assume many duties now assigned to military and full-time civilian personnel, the study says.***


Photo by Chris A. Neill / Arms Communications

***The Air Force has developed a rigorous set of standards to determine which positions should be filled by active-duty officers. If those standards cannot be met, the position should be converted to enlisted, Guard, Reserve (as the cockpits of these B-52s have been), or civilian—or be eliminated.***

## A New Dimension

The rated-vs.-nonrated debate took on a new dimension in the 1970s, when female officers claimed that their career prospects were limited because they were not allowed to become pilots. Nonrated males agreed.

The services finally admitted a few women to flight training, but it would be another twenty years before any were allowed to fly combat aircraft and aspire to the types of positions considered stepping stones to top leadership.

To meet such objections, the Air Force developed a set of standards for measuring its officer requirements and refined them over the years. The latest Air Force Officer Requirements Review uses criteria based on a 1993 Air Command and Staff College study. They call for a position to be filled by an officer if it:

- Involves command, including responsibilities under the Uniform Code of Military Justice,
- Requires warfighting policymaking at the executive level in a noncommand position, or
- Is necessary to provide military leadership, oversight, and decision making and to sustain the career-development pipeline to supply command and warfighting policymaking.

The Air Force review recommends that a position that does not pass muster under one of these tests should be converted to an enlisted, Guard, Reserve, civilian, or contractor billet—or be eliminated. This recommendation applies to line officer positions only.

These criteria do not specifically mention flying, but some secondary factors suggest it. They measure the levels of risk and accountability a position requires. The risk level could be a factor in deciding whether a slot has to be military or could be civilianized. The accountability level suggests whether a position requires an officer or could be handled by an enlisted member.

Presumably, a cockpit position in a multimillion-dollar fighter would qualify as an officer billet under the risk and accountability tests and would qualify also because it helps feed the career-development pipeline.

Other officer positions may be harder to justify. Even if a job entails some risk and requires a military member, it might well be handled by a noncommissioned officer. Positions that are risk-free but involve accountability could be appropriate for a civilian under both the Air Force's criteria and RAND's suggestions for streamlining the forces.

## Restore Warrant Officers?

One idea floated by RAND is unlikely to get much Air Force support. RAND looked at the services' warrant officer programs and concluded that WOs could be used more widely to replace commissioned officers in all services. The Army, Navy, and Marines now use WOs in many fields, including intelligence, communications, and supply, and the Army uses them as helicopter pilots. If all services used the same criteria to shape their requirements, the study said, the Air Force might use as many as 1,500 WOs, including 175 as helicopter pilots.

The Air Force decided in 1959 that it did not need a third layer of supervision and scrapped its WO program. Many of the former warrant jobs now are filled by supergrade NCOs. The Air Force has resisted pressure to restore the WO program or adopt some form of limited-duty-officer approach. It is not apt to support any new WO proposal.

In some other respects, however, USAF may be more willing to change the mix. It already uses its Guard and Reserve forces more than the other services to handle jobs traditionally filled by active-duty members. This has elements of the "in and out" alternative suggested in the RAND study but operates within the traditional military framework.

The Air Force also is bringing more women into the full spectrum of military positions. They still make up only about fifteen percent of the force, but that is a significant increase from the 11.4 percent in 1986. After decades of quotas, USAF now has gender-neutral recruiting and assigns women to all but ground-combat positions, which make up less than one percent of the service's total positions.

This fall, fourteen women were flying in Air Force combat aircraft—half of them as pilots. Another fourteen were in or were waiting for flight training. Women serve as commanders of flying and missile squadrons and in jobs from chaplain to astronaut. ■

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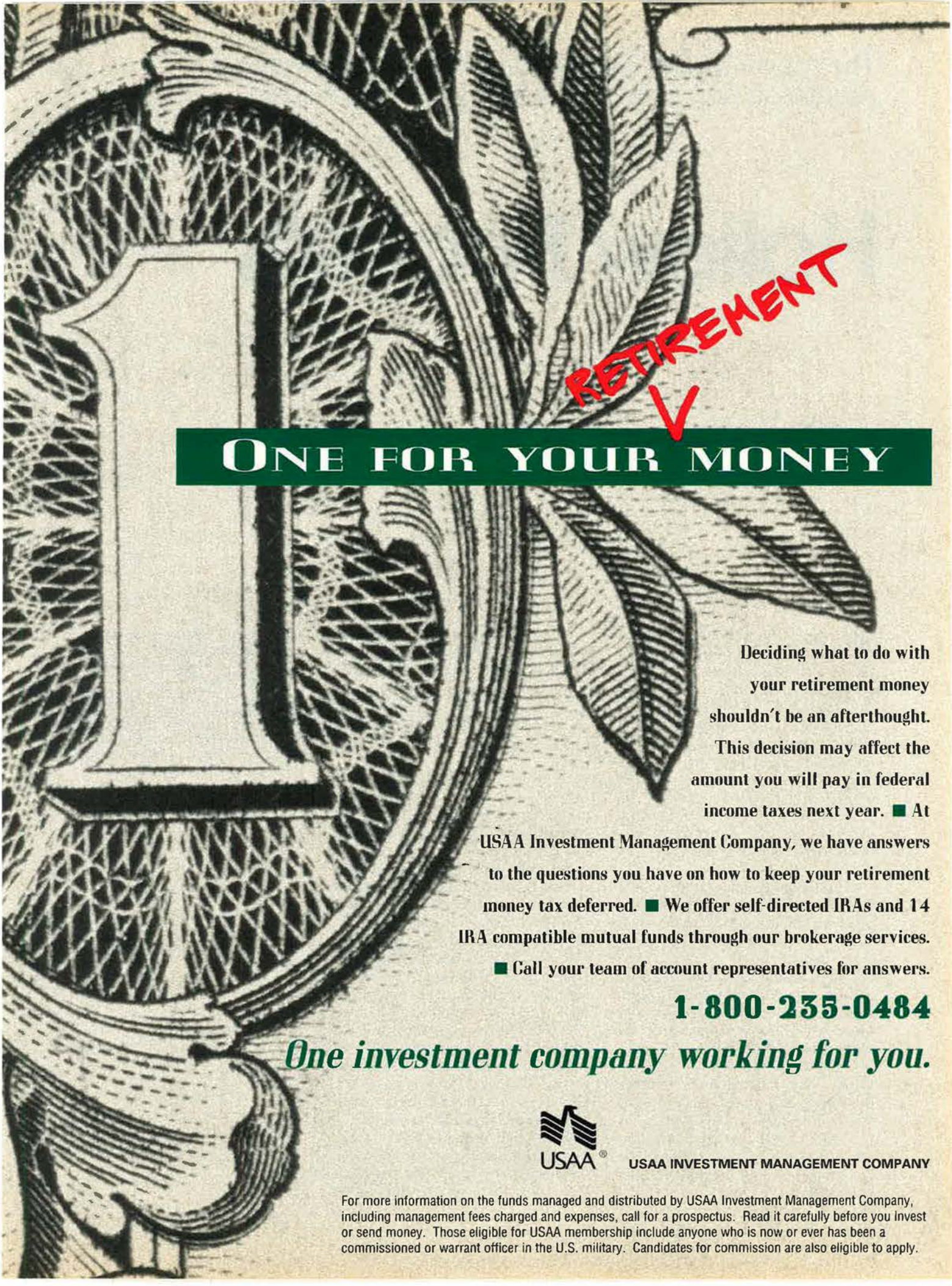
*Bruce D. Callander, a regular contributor to* AIR FORCE *Magazine, served tours of active duty during World War II and the Korean War. In 1952, he joined* Air Force Times, *becoming editor in 1972. His most recent article for* AIR FORCE *Magazine, "The Tricare Era in Military Medicine," appeared in the October 1994 issue.*

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**The Meyer panel advises the Pentagon to head off readiness problems before they get out of hand.**

# Hollow Pockets

By John Tirpak

ANYONE who served in the US military during the late 1970s knows it was a grim time to be in uniform. The nation was still reeling from the turmoil of the Vietnam War, and many seemed to care little or nothing about the state of the armed forces. Defense budgets were slashed. Spares were in short supply; fighters sat idle on runways, cannibalized for parts. Units were chronically undermanned, recruiting quotas were routinely missed, and recruit quality had slipped.

Military pay had been undermined by severe inflation. Deployment times stretched out, and families were strained to the limit. Skilled mid-level noncommissioned officers were becoming scarce. Thousands of troops had been "RIFed," thousands more were leaving out of frustration, and those left behind were asked to do too much with too little.

Up and down the chain of command, doubt existed about whether the United States was ready to fight the Soviet Union or anyone else. At the top, Army Chief of Staff Gen. Edward C. "Shy" Meyer gave the situation a now-infamous name: "the hollow Army."

"We were sort of a laughingstock over in NATO," General Meyer recalls. US military forces often could not go on maneuvers in Europe because "we didn't have adequate training supplies. . . . Our equipment was in bad shape. We didn't have spare parts."

The Navy was "short 20,000 petty officers. You'd see a Navy ship preparing to sail . . . and having to fly a critical [specialty] petty officer from one coast to the other so they could make up the complement of the ship."

The Air Force, he said, though "probably a little better off" because of fighter, weapon, and electronic upgrades during the Vietnam War—and because of fewer recruiting problems—was still hindered by a severe lack of flying hours, major parts problems, and low troop morale.

General Meyer explained that "the combination of people, materiel, and sustainability aspects . . . caused me to say we had a 'hollow Army' at that time. . . . It turns out we had 'hollowness' in all the services."

It took eight years of remedial funding and a concentration on quality, in both troops and equipment, to fill out the hollow force. By the time of the

***World events call for ever-faster response from US military forces. Opposite, Maj. Mary Hart, stationed in Hawaii, helps load a C-130 for medical evacuation. The Defense Science Board's Task Force on Readiness made "putting people first" its top recommendation because defense rests on recruiting, training, and keeping top-quality personnel.***

USAF photo by SrA. Mark Borosch

Persian Gulf War in 1991, readiness indicators—education and skill levels of troops, the availability of their machines, and the flow of parts and supplies—were at record high levels.

### Readiness Endangered

A series of political earthquakes since the Gulf War has again shifted the security landscape. With the Soviet Union and Warsaw Pact out of business—and now, incredibly, signing up to join NATO—defense budgets are plummeting. The force has been cut by a third, overseas bases are being abandoned, and thousands have been and are being asked to leave the service. In such times, can readiness be maintained?

As the first new Administration since the end of the Cold War, the Clinton Administration promised that despite massive reductions, the US would not revert to a hollow force. To keep itself honest in honoring that pledge, it created the Defense Science Board's Task Force on Readiness, an independent group charged with studying readiness and being a tripwire warning system, should trouble appear.

Defense Secretary Les Aspin appointed General Meyer to head the eight-member group. It included retired Air Force Chief of Staff Gen. Larry D. Welch; Gen. Maxwell R. Thurman, Lt. Gen. Julius W. Becton, Jr., and Lt. Gen. Herbert R. Temple, all retired Army generals; retired Navy Adms. Huntington Hardisty and Robert L. Long; and retired Marine Corps Gen. Joseph J. Went.

Besides looking at today's preparedness, the group was to consider trends for the future. It traveled the world, visiting front-line units, inspecting facilities, poring over data, and above all listening to the troops.

In August the task force issued a formal report, stating that "the readiness of today's conventional and unconventional forces . . . is acceptable in most areas." However, said General Meyer, "we found some of the beginnings of things that started us down the slope before."

Reflecting on the "pockets" of unreadiness that had appeared, he acknowledged that "it's still a little bit early to determine whether this is just a result of the turbulence created by downsizing or whether it's a long-term indicator." General Meyer's panel made clear to the Pentagon brass that unreadiness indicators are "sufficiently identifiable that you better pay attention to [them], because if you don't, you're going to be slipping back into those same real hollow forces that we had before."

Because high-tech weapons will not work effectively unless they are operated by highly skilled, motivated troops, the task force made "putting people first" its top recommendation, along with providing enough resources to attract, train, and keep top-quality personnel. This is critical because "the thing that's taken us the longest time to build up since the days of the hollow force is a strong cadre of noncommissioned officers," said General Meyer. "We can build equipment, we can get ammunition," but it takes time to "grow" top-quality NCOs who make it possible to train and retrain for new missions.

### Signs of Trouble

Recruiting is one cause for worry. While quotas are being met, studies indicate that young people are increasingly disinclined to serve in the armed forces, and such influences as parents and teachers are less inclined

USAF photo by SrA. Steve Thurow

***A greatly increased operating tempo overextends deployments. Here, an A-10 from Spangdahlem AB, Germany, prepares for a mission in Operation Deny Flight, the patrolling of the no-fly zone over Bosnia that began in 1993.***

to steer them toward a military career. The supply of teenagers and persons in their early twenties—the "enlistment-eligible cohort"—is at its lowest point in decades. In order to keep high-quality people, especially in some critical skill areas, additional "bonuses and incentives" may soon be needed, the task force concluded.

Another troubling sign is that increased operating tempo is keeping some troops away on temporary duty too long. The Navy has cracked down on overextended deployments, recognizing the havoc they play with retention, but the Air Force and Army have not. Soldiers and airmen with skills in short supply—such as Airborne Warning and Control System and F-15E crews—often face exhausting "temporary" assignments overseas.

Deployments to Bosnia-Hercegovina, Somalia, and Rwanda have become so frequent and lengthy that a new need has surfaced: establishing a routine way to get Congress to fund them. Until now, contingencies have been funded from operations and maintenance accounts. O&M is supposed to cover the cost of some of these contingencies. When they stretch out, however, they cut into money for other types of training.

As the task force noted, "While air-dropping supplies in Bosnia would seem to provide excellent training opportunities, if . . . it precludes performance of other required mission training," such humanitarian efforts will have a negative impact on readiness.

The task force also found that too great an operating tempo "means excessive time away from both home and family." The group decided that "fully funding OPTEMPO at some expense to force modernization and force structure accounts is appropriate at least as a temporary measure."

General Meyer is "not optimistic" that readiness will remain adequate; he regards Congress as the biggest challenge to readiness. "If Congress doesn't figure out a system that provides resources for these contingencies, they're going to contribute to unreadiness," he warned. If Congress "doesn't give up on defending unneeded bases, and forcing unneeded expenditures . . . for their pet projects . . . they are going to do more serious harm . . . by causing resources that are already very, very tight to be spent imprudently."

He added that it is "questionable . . . whether you can get Congress to be part of the solution rather than part of the problem."

## Shortages and Backlogs

The force is short of certain munitions. There probably are not enough precision guided munitions (PGMs) on hand to satisfy the demands of a two-MRC (major regional conflict) scenario, the task force warned.

The panel "really didn't get an answer" as to whether there are enough PGMs available for even one regional war, General Meyer said. "I honestly do not believe anybody knows the absolute answer to that question, . . . which is why we said it really needs to be 'gamed' as quickly as possible," to figure out what a reasonable inventory would be.

Another big sustainment worry is the growing backlog in deferred maintenance. Said the task force, "All services indicated the presence of a maintenance backlog, and only the Navy thought it was manageable." The panel noted "particular concern" about "the projected growth of the backlog" over the next six years.

As a side effect of the task force's inquiries, "maintenance and logistics are getting more attention from the leadership than I think they got before," General Meyer observed. The services are "working together to come up with a lot of different solutions," such as sharing bases or training functions, as they "never would have done" in the past.

He added that more emphasis is needed on joint training, but the responsibility for requiring, measuring, and assuring "joint readiness" is something that "slips through the cracks."

"There's a major schism between the services, the Joint Staff, and OSD [the Office of the Secretary of Defense] as to who's charged with joint readiness," General Meyer said, "that really needs to be sorted out. . . . How much of the requirements should be set by CINCs, providing input not just to their services but [to] all the services on their future requirements?"

The commission found that intelligence and surveillance systems and organizations are "particularly fragmented."

"The services and the national intelligence agencies have always been 'stovepiped,' " General Meyer noted. Information is collected by the CIA, NSA, and service intelligence departments individually and does not get coordinated until "it's back here in Washington."

This capability needs to be "decentralized," said the General, so intelligence is of more immediate and relevant use to field commanders. Theater CINCs, particularly, need to be able to "directly task space assets."

"The world is far more fractionalized," he said. "It's going to get more so, and we still have a centralized approach to intelligence."

The preparedness of all the services—and the ability to predict how ready they really are—will be greatly helped by putting resources into modeling and simulation, the task force said. Simulation should be aimed not only at improving the abilities of the individual or unit but also at linking those simulations all the way up the chain of command for better realism and more effective planning.

Reserve forces have not been given adequate attention, in spite of senior defense leadership's suggesting there will be "increased reliance" on them in the future. "Specific plans have not yet been developed to clarify the exact role intended," the panel said.

USAF photo by TSgt. David McLeod

*Tanzanian children observe flight line operations that were part of US relief efforts for Rwandan refugees. Such humanitarian deployments have become so frequent and lengthy that funding has become a problem.*

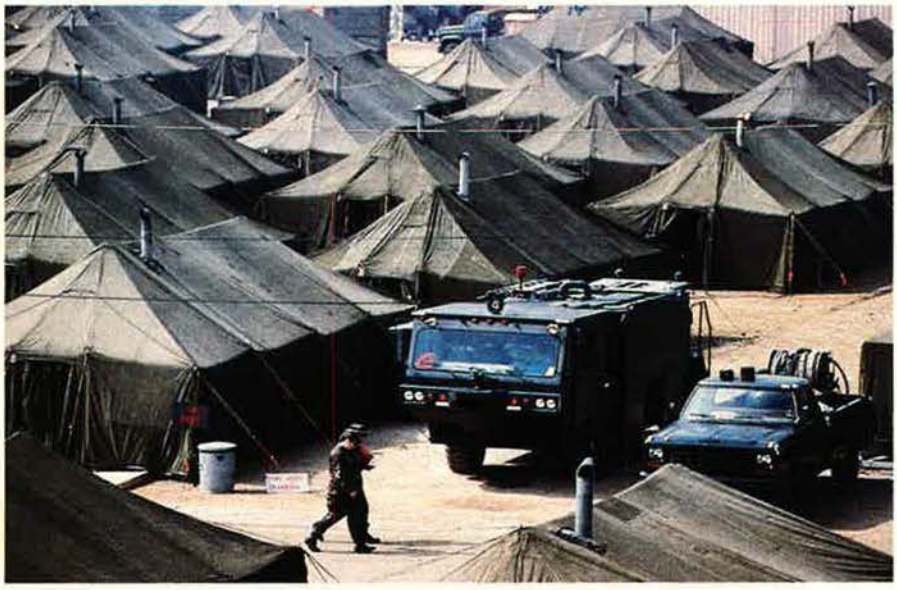
## Recommendations for Readiness

The reserves are "fully focused on readiness" and seemingly in good shape by virtue of receiving frontline equipment freed up by smaller active-duty units. However, the General said, "Behind these displayed readiness levels are . . . signs of declining readiness and sustainability."

Hands-on training opportunities are declining, and the Guard and Reserve face possible "skill erosion" without an investment in large numbers of inexpensive simulators, the task force asserted.

Based on Gulf War experience, it recommended that the Presidential Selective Reserve Call-Up authority be extended from ninety days with a ninety-day extension to 180 days with a 180-day extension. It also recommended that better mobilization plans be drawn up and that Guard and Reserve functions be a bigger part of the decisions on closing bases.

The reserve component will still need "extensive post-mobilization training, equipment maintenance, modernization, and reorganization" before it can be usefully applied in combat, the panel found.



USAF photo by TSgt. Scott Stewart

*Maintenance and logistics are getting more attention as a result of the task force's inquiries. They are critical in deployments to unprepared areas. Here, a tent city compound's fire department sets up during exercise Team Spirit '93.*

"The Guard and Reserve issue has to be rationalized, particularly in the Army," General Meyer said. "It's a big thing for the Army, and there the Guard and Reserve don't feel comfortable with the current situation. The country has to decide: Are we or aren't we going to rely on them for two MRCs? And they argue that they're not even considered."

However, the General said, "the Air Force has done a good job of rationalizing the Guard and Reserve. They have it integrated, it's rationalized, they spend on it, they count on it, and it's integral."

Shortfalls in strategic mobility pose the greatest threats in the two-MRC scenario, the task force found. "Without additional wide-body, outsize cargo–capable aircraft augmentation" beyond the currently planned forty C-17s, "not more than half of the air-delivered combat forces required in the first thirty days [would be able] to close on time."

General Meyer called strategic lift the Achilles' heel of the two-MRC strategy.

"Right now, every time you raise that issue over in the Pentagon with the senior civilian leadership, they say, 'Well, the time between the two MRCs can stretch out.' But the longer you stretch it out, then it isn't really near-simultaneous anymore. And it's stretched out because of the requirements for lift."

The "strategic mobility conundrum

USAF photo by TSgt. Jerry Baker

***The military is not prepared for ballistic missile attack and biological weapons, the task force determined. In Team Spirit '93, however, F-15 Capts. Larry Bruce and Michael Czapiewski paid attention to decontamination procedures.***

remains the number one challenge of the two-MRC scenario . . . followed by sustainment," he added.

The task force warned that airlines and cargo companies must be kept interested and participating in the Civil Reserve Air Fleet, without which lift would be mortally impaired. The absence of a West Coast seaport capable of handling containerized ammunition "could be a showstopper in a nearly simultaneous two-MRC scenario."

Ballistic missile attack and biological weapons are two threats for which the military is not at all prepared, the group determined. "The number one question of any commander entering a theater of operations is, 'What weapons of mass destruction do they have, and what long-range missiles do they have?' " General Meyer said.

The answers dictate "the nature of his forces, the way he introduces his forces, and the way in which he manages the battle." Defense against ballistic missiles and weapons of mass destruction, he said, "needs to be kept a very high priority."

While the US has "good tactics, good doctrine, and relatively good capability against chemical weapons, we need some upgrade. Against biological weapons . . . we really haven't done much, and that's a cheap capability" for an enemy.

Though the task force's recommendations were not binding, Pentagon leadership quickly moved to adopt them. In late August, Deputy Defense Secretary John M. Deutch stunned the defense industry by announcing that in order to afford an adequate level of O&M and personnel pay and benefits, nine major weapon programs—possibly more—might be canceled or postponed.

## People Over Systems

"Money is tight, and we are choosing people over systems," Mr. Deutch said. "For example, if we must delay chemical lasers in space in favor of housing for our enlisted people, then [Defense Secretary] Bill Perry and I will do so. . . . We are choosing quality of life of the troops in contrast to provisions for the future."

General Meyer thinks such an approach is safe—for the moment.

"The force we have today, if maintained in an adequately ready state, is adequate to the challenges that we're likely to face technologically" through 2000, he said. "Nobody is going to come up with a new weapon, a new capability that's going to negate what we have for the rest of this decade. . . . I feel quite confident that, for the next six years, we're in pretty good shape."

Beyond that, the General warned, "I feel very uncomfortable" about further delaying modernization. He added, "I'm told the senior defense leadership is, as well. . . . There are some areas where we just have to stay ahead."

Down the road, without "a major adjustment in the number and size of the forces we have . . . along with a greater willingness to rely on the Guard and Reserve," the funding available for research and development will not be sufficient, he said.

It is unclear how the Pentagon's shift of resources to "people first" will affect the defense industrial base—an important aspect of readiness. The task force's charter did not call for such an assessment.

If the identified problems are not brought under control in two years, "by '96, we will find that we are beginning to have an endemic unreadiness problem and not just a snapshot problem," General Meyer asserted.

In that year, the overseas drawdown will be complete, the Base Realignment and Closure process for 1995 will have been concluded, and the Administration "should have decided" what it wants the role of the Guard and Reserve to be, he said. "By then, you should have a pretty good idea of what you want the force to do for the rest of the century."

However, said the General, "we still don't know exactly what we want to do, despite what it says in the President's National Security Strategy, because there hasn't been a concomitant defense strategy yet or a military strategy, and we have to go through that process."

The National Defense Strategy, "Engagement and Enlargement," was released the same day as the task force report. Thus the group had no national strategy against which to measure readiness.

Readiness, General Meyer said, is difficult to measure "unless you can answer the questions, 'Ready to do what?' and 'How?' "

"The very core of every readiness question depends on how we interpret [national] strategy." ■

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*John Tirpak is the senior military editor of* Aerospace Daily, *a Washington, D. C., defense and commercial aviation periodical. His most recent articles for* Air Force *Magazine, "Now, the Good News," and "The Word Is 'Joint,' " appeared in the November 1994 issue.*

# Verbatim

**The North Korean Nuke Deal**

"This agreement is good for the United States, good for our allies, and good for the safety of the entire world."

***President Clinton, in October 18, 1994, remarks to the White House press, referring to the agreement between Washington and Pyongyang that limits North Korea's nuclear program at a cost of US economic and political concessions and inadequate inspections for five years.***

**Don't Start Packing Just Yet**

"This agreement provides an environment which allows for improvement of the political relationships [between the United States and North Korea]. It does not *guarantee* that [emphasis added]. If that environment works and if the political agreements do improve, then we can start looking more seriously at our deployments and our equipment. In the meantime, I don't see any reason for changing them."

***William J. Perry, Secretary of Defense, in October 21, 1994, remarks in South Korea about the need to maintain a large US military force on the peninsula to deal with the huge North Korean conventional force. He was referring to the just-completed US–North Korean nuclear accord.***

**Progress, Popularity, and McPeak**

I suspect that somewhere in the tenure of any leader of a large organization, you confront the choice between popularity and progress. Progress on roles and missions will be very unpopular. My standing with my brother service chiefs [on the Joint Chiefs of Staff] and so on is not all that good. The Air Force is activist on this question of roles and missions change. We see it as essential, as really having been necessary for a long time. . . . This is an opportunity to change the way we're doing business, and that kind of change is not going to be very popular."

***Gen. Merrill A. McPeak, USAF Chief of Staff, in October 11, 1994, remarks to the Defense Writers Group in Washington, D. C. General McPeak, who retired on October 25, was referring to his blunt, public calls for all of the armed services to embrace major changes in their roles and missions.***

**Hollow Force II?**

"I believe we are now seeing the beginning of a new hollow force. . . . The armed services have been working to preserve current, or near-term, readiness. They are maintaining current readiness at the expense of future, or long-term, readiness. In other words, the services are spending their dollars to keep equipment operating in the high-tempo environment of expanding, nontraditional missions, rather than developing and buying modern equipment. The services are doing this not because it is sound policy but because the Administration has stated that readiness is its number one priority. . . . The services do not have the funds to maintain either current or future readiness, and certainly not both. . . . As a result of the unrealistic objective to maintain the appearance of readiness with current budget levels, both current and future readiness are evaporating."

***Sen. John McCain (R-Ariz.), Senate Armed Services Committee, in a September 1994 report, "Going Hollow: The Warnings of the Chiefs of Staff."***

**Supreme National Interests**

"I want to make a distinction between *national interest* and *supreme national interest*. . . . By supreme national interest, I mean an action that can threaten the survival of the United States or one of our allies. The attack by Japan on Pearl Harbor was a clear example. . . . The Soviet Union during the Cold War threatened the survival of the United States. . . . We still have a situation in Russia that potentially affects the supreme national interest of the United States. . . . The threat from North Korea to South Korea affects the supreme national interest of the United States. . . .

"There are many situations where our national interests are involved, but not our *supreme* national interest. The two most obvious examples today are in Bosnia and in Haiti. I draw a sharp distinction between these and the previous cases, because the latter do not involve survival of the United States and therefore we don't contemplate a full-scale war, or even the threat of full-scale war, to deal with these problems."

***Secretary of Defense Perry, in September 21, 1994, remarks to the American Business Conference.***

**Department of Faint Praise**

"I am not sure what [the Smithsonian Institution's critics] expect in great museums. I believe that our role is not simply to offer a romantic portrait of the nation's past; Hollywood and Disney do that quite well. Rather, the Smithsonian is dedicated to accuracy and overall balance. . . . We could hardly fill our role as an educational institution if we limited ourselves to uncritical adulation [of the US]. On balance, however, America comes out quite well in the Smithsonian's exhibits because America, on balance, is a great nation."

***I. Michael Heyman, new head of the Smithsonian Institution, in a letter published October 31, 1994, in* US News & World Report. *Mr. Heyman was responding to criticisms of the National Air and Space Museum's proposed exhibit of the* Enola Gay, *the B-29 that dropped the first atomic weapon on Hiroshima in August 1945, and other Smithsonian exhibits.***

**The Delicate Art of Chinese Diplomacy**

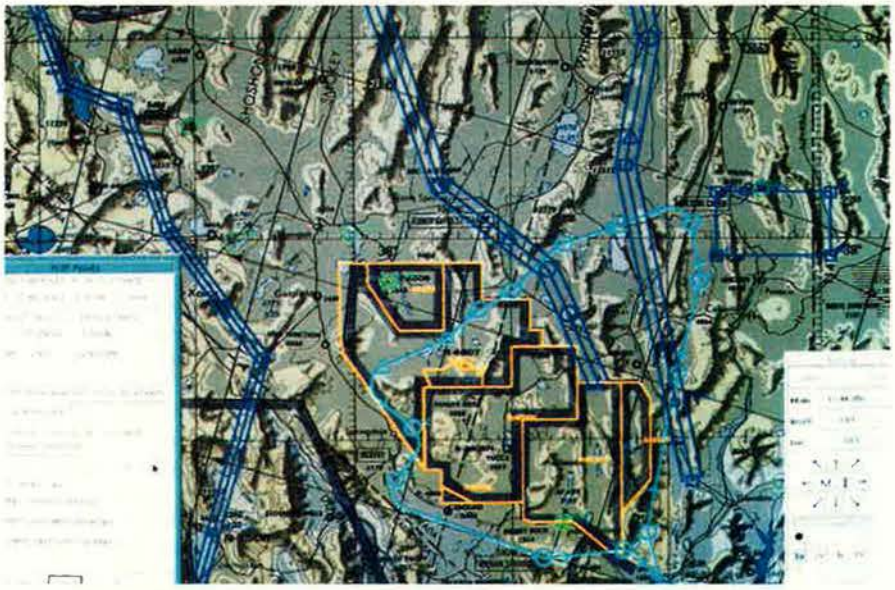
"We can work together to commonly deal with a bastard."

***Chinese Communist Party Chairman Mao Zedong, in a February 23, 1973, statement to National Security Advisor Henry Kissinger, referring to the Soviet Union; quoted in a June 13, 1994, Los Angeles* Times *report on the contents of a secret diplomatic history of Sino-American relations.*** ■

**By 1999, every operational Air Force squadron will be able to plot amazing things with this new automated system.**

# Basic Change in Mission Planning

**By Tony Capaccio**



*Scissors, rulers, paste, and pencils will no longer be part of an aircrew's mission-planning toolbox when use of the Air Force Mission Support System becomes widespread. Creating new routes and identifying known hot spots are just two of the benefits that save time in mission planning, allowing more thorough mission analysis.*

THE AIR FORCE is poised for what could well prove to be major advances in the speed, accuracy, and sophistication with which its aircrews plan dangerous combat missions.

The basic goal is to disseminate throughout the force an effective, highly automated mission-planning system. In the past, some doubted the Air Force's commitment to this cause. Service programs moved relatively slowly, and officers often had to improvise in their planning for Persian Gulf War operations.

Now, all evidence is that Air Force bomber, fighter, transport, and special operations crews will soon profit from major advances in software, computer processing, and dissemination of digital maps and imagery all the way down to squadron-level planners. The upshot, officials report, is the production of systems with the capability to:

- Display, with the stroke of a computer key, a three-dimensional composite map with imagery of five-meter resolution, showing mountaintops or surface-to-air missile sites along the route, plus side, forward, and rearward views.

■ Produce a split-screen picture of the battle area, one side showing a "god's-eye" view of the run-in route and the other a detailed picture of a weapon's planned impact point.

■ Forecast the weather—winds, temperature, humidity, clouds—on each leg of the planned attack route and at specific times.

■ Calculate the height and density of an exploding bomb's "frag cloud"—swirling debris that could endanger aircraft in a multiship formation.

Such power will be mind-boggling for A-10 pilots and B-52 crew members, who had nothing like it in the Gulf War. Maj. Robert Rankin, formerly a B-52G commander with the 4300th Bomb Wing (Provisional), observed, "In the Persian Gulf, I used paper charts and pencils. I never heard of any of this stuff."

Major Rankin, whose specialty was low-level, nighttime penetration of Iraqi airspace, added, "We mission-planned basically the same way Napoleon did."

At the heart of the effort is the Air Force Mission Support System. AFMSS has many companion systems and different forms of software. The Air Force aims to have this new mission-planning equipment installed by 1999 at every operational Air Force squadron—whether it has bombers, fighters, transports, tankers, or special operations forces aircraft.

### No More Cutting and Pasting

"I spent eleven years flying the A-10," said Maj. Gregg Montijo, the Air Force's Pentagon-based program element monitor for the new system. "I can't tell you the number of maps, the amount of cutting and pasting, the hand-drawing of stuff that I did. You will be able to do things in minutes, not hours. You'll have the ability with AFMSS to call things up on the screen, plot your routes. Intel[ligence] will automatically show up on screen.

"You'll be able to . . . take your little mouse, find your arrow, and say, 'I want to go here,' . . . to create a new route."

The basic hardware component will use core software to support a broad range of capabilities. These include route planning, penetration analysis, airlift delivery, conventional weapon delivery computations, target-area tactics, route deconfliction, combat-mission-folder production, strip charts, maps, line-up charts, and standard radar and synthetic aperture radar predictions.

Next year the system will pick up another feature: "autorouting," designed to help perform penetration analysis for such stealth platforms as the F-117, B-2, and F-22 aircraft.

AFMSS terminals will contain modules with data on the specific characteristics of a squadron's systems and weapons. These modules will allow the software to craft a route that optimizes each system's performance parameters and to warn when plans will exceed capabilities.

The Air Force plans called for the fielding of the first operational software—Block C1—this fall for use by some crews flying A-10 attack aircraft, C-130 tactical transports, and B-52 heavy bombers. The schedule also calls for F-15E crews to get their new equipment next summer.

The system is already paying dividends for Air Force Special Operations Command (AFSOC). Its AC-130 gunship crews, flying patrols over Bosnia-Hercegovina, plan mis-

Staff photo by Guy Aceto

*The value of the AFMSS is not limited to pilots and navigators. Guncrews, such as this one on an AC-130, will be able to determine the mix of munitions best suited to take out their assigned targets.*

sions with versions of AFMSS software. AFSOC crews from the 7th, 16th, and 21st Special Operations Squadrons use Special Operations Forces Planning and Rehearsal System hardware.

At their Brindisi, Italy, base, gunship crews walk out to their airplanes with strip charts, flight logs, and a digital transfer module that initializes the avionics with all their waypoints, which they once had to enter into the computer by hand. One officer pointed out that on a seven-hour mission the crew would have had to make almost 18,000 keystrokes to enter all the data.

### Whole Crew System

"They are using the system for area familiarization," said Lt. Col. Julio Ferreira, AFSOC mission planning chief. "It's a whole crew concept. It's not just like in the fighter world where one or two guys are doing it all."

During a planning sequence, the map of Bosnia comes up. A planner will "ID the aircraft, and the computer will get everything ready for the aircraft," Colonel Ferreira explained. "He goes on the screen and plans his route to avoid any hot spots. He'll get an electronic order of battle fed into the machine. All the threats are georeferenced so he knows there is an AAA site at this location."

The planning system indicates a threat's maximum range, allowing the gunship crews to plan their altitude accordingly.

"It's been super valuable," said Colonel Ferreira, "because it's given the operator much more time to do mission analysis.

"During [Operation] Desert Storm, we had to cut all maps, put threats on, draw the routes. Now [one] can spend about two to three hours doing mission planning and four hours of what-iffing: 'What happens if I lose an engine? What happens if the weather is bad or I lose my jamming capability?' "

Each crew member looks for specific information from the planning system. "The nav[igator], pilot, and electronic warfare officer will primarily be coming up with the route info," Colonel Ferreira said.

"The gunners will be looking at what . . . mix of munitions they need to support the United Nations troops. So they will be looking at what type of armored vehicles the other guy has that they might have to take out, what is the correct mix of 105-mm bullets they need."

The radar operators may be looking at the escape and evasion plan in case the airplane is shot down and the crew members need to bail out.

The system could have major implications for the success of joint combat operations. The Army has just announced it will adopt AFMSS as its standard software in its own mission-planning devices. This is good news for Air Force units, such as the 23d Wing, Pope AFB, N. C., a composite outfit that works closely with the Army's 82d Airborne Division.

Via modem, Army and Air Force AFMSS planners could swap data. "I know the platoon or brigade that I am going to help," explained Maj. Tom Novak, an Air Force mission support systems program manager at Electronic Systems Center, Hanscom AFB, Mass. "It will be a ques-

*The AFMSS will permit side, forward, and rearward views, as well as split-screen displays. The right screen here shows a three-dimensional view of a flight path while the left adds threat information and navigation charts.*

tion of sending over to them [the message], 'This is where I'll be at this time with this kind of ordnance.' Coming back, the Army would say, 'This is where my troops are going to be doing this and that.' Now you have a graphic picture."

The capability will be particularly useful for pilots of the A-10 close air support aircraft, said Capt. Neal Culiner, standards and evaluation chief for the 357th Fighter Squadron, Davis-Monthan AFB, Ariz. His squadron received early-model AFMSS units last summer.

### CAS Potential

Thus far, Captain Culiner is the only airman in his unit trained on the system, but he and his fellow officers see its potential for both close air support and other standard A-10 missions.

"It will be able to tie in weather information to tell me what approximate [AGM-65] Maverick ranges I'll be able to shoot and how well I'll be able to see with Maverick," he said. "It gives us dust and humidity predictions and how much [they] will degrade Maverick."

For close air support, Captain Culiner added, "when you tie into intel, you can determine your best attack axis, your best entry and exit avenues. The biggest thing is just looking at the battlefield, seeing friendly and enemy locations, and being able to print up the latest maps."

The real-world experiences of the AFSOC and 357th FS crews are being closely watched by officers at Air Combat Command, said Col. Art Michel, chief of ACC's mission-planning special management organization.

He said that the mission-planning systems ACC had previously looked at possessed limited capability and were specific to a particular weapon system. Desert Storm took matters to a higher level. Air Force officers used Mission Support System II, the predecessor of AFMSS, for route planning, penetration analysis, target study, networking, passing data, and updating databases.

Among the major Desert Storm mission-planning accomplishments was digitizing fine-resolution national imagery and broader-resolution commercial SPOT imagery and georeferencing it with 170-foot accuracy.

Photo by Randy Jolly / Arms Communications

***USAF mission planners will be aided by the Army's decision to purchase AFMSS for its mission planners. The respective planners will be able to talk to each other while seeing the same image, improving coordination and avoiding fratricide.***

Maps and imagery were then layered in three-dimensional views. These precision data were used in planning strikes featuring Low-Altitude Navigation and Targeting Infrared for Night equipment and Pave Tack targeting and designation equipment. Another accomplishment was the creation of a network by which computers could exchange threat data and imagery.

The next evolution in mission planning involves producing wide-area, seamless, georeferenced, digital map scenes and layered images with man-made features, said Colonel Michel.

"The idea is to take advantage of the better and faster processing capability to get beyond route planning and penetrations analysis, and . . . get it down to a fifteen- to twenty-minute planning time," he said.

An October 1991 Air Force report on Gulf War mission planning indicates that the times set aside for planning varied greatly by unit—from one to three hours for the F-15E crews of the 336th Tactical Fighter Squadron, Seymour Johnson AFB, N. C., to twenty-four hours for the F-117 crews of the 37th Tactical Fighter Wing. F-111E crews from the 20th TFW, RAF Upper Heyford, UK, allotted twelve to sixteen hours for mission planning.

With new equipment coming along, the Air Force appears to have strengthened its commitment to improving mission planning all the way down to squadron level.

ACC, for example, has centralized its management of mission-planning requirements and coordination with the Defense Mapping Agency and Central Imagery Office, the better to ensure timely production of maps and imagery.

DMA has established a liaison office at ACC headquarters. ACC headquarters gets regular visits from officials of DMA, CIO, and the National Security Agency, who receive tutorials in mission planning and how their products are used.

"CIO has helped a lot regarding declassifying imagery," Colonel Michel said. "The more we show them how we use it for mission planning, the more they understand and welcome how their product is being used," and the greater the cooperation.

Some difficulties remain. AFMSS is intended to run with "secret" imagery, and squadrons may run into trouble getting the higher-resolution imagery produced by "national technical means" assigned a higher classification.

DMA has adopted the Air Force's method of digitizing maps, called the Common Mapping System (CMS). This means the Air Force, Army, Navy, and special operations forces will be working with the same map formats and mission-planning hardware. DMA has taken digital maps

Photo by Randy Jolly / Arms Communications

***Through use of add-on modules, AFMSS will be compatible with many types of aircraft. Composite wings, such as the 23d Wing and the 366th Wing, will be able to share the system for all their different aircraft types.***

of the entire surface of the Earth and packaged them in 120 CD-ROMs. The CMS would allow for the production of layered Digital Terrain Elevation Data, with maps of varying scale. On top would be imagery from open or classified satellite sources.

### Diverse But Compatible

Not wishing to be totally dependent on the DMA for map digitization, the Air Force has developed its own in-house conversion capability within the 480th Intelligence Group, Langley AFB, Va.

To ensure compatibility, Air Force acquisition officials have directed the system program offices of the top forty USAF platforms and weapon systems to develop software modules for integration into AFMSS's core software.

"We need to get the look and feel tailored to the specific weapon system," Colonel Michel said. "If you're flying an F-15E and you look in a mission planner, you want to look at your run-in as it is going to look on a synthetic aperture radar."

The specific modules will contain flight-performance information, such as drag, thrust, takeoff, and landing data, translated into digital form. AFMSS will match these with basic time, distance, heading, and altitude route-planning information.

Modules also will be developed for precision guided weapons like the Joint Direct Attack Munition and the Triservice Standoff Attack Missile. Their respective software will allow planners to match routes and aimpoints against anticipated obstacles, defenses, and man-made objects.

A-10 software will contain fuel-flow data, parameters on clearing terrain, and radar cross section information. "Now you can put in the route, and the system will tell if you will clear the terrain," Captain Culiner said.

These types of aircraft modules will be particularly useful to the composite wing at Mountain Home AFB, Idaho, said Major Montijo. The 366th Wing deploys F-15C, F-15E, and F-16C fighters, B-1 bombers, and KC-135R tankers.

Under the old scenarios, said the Major, "you'd have to have a different mission-planning system for each aircraft in that wing. Now you can have a mission-planning system that runs on the same basic software and different software modules for each plane."

Mindful of the intelligence distribution problems from Desert Storm, the Air Force has in place an "intelligence counterpart officer" and an "intelligence support plan" for each weapon system in development. AFMSS was one of the first programs assigned an intelligence counterpart officer. The idea is to ensure that the system in development can be adequately supported by the intelligence community.

"To best perform its high-tech function, the AFMSS requires an 'in-time' intelligence feed," said Maj. Jerry Sanders, a system acquisition manager for the Air Force assistant chief of staff for Intelligence. "Specifically, the [system] will automate the functions of collection management, target intelligence, threat warning, current intelligence, and military-capabilities intelligence and feed [those] data to AFMSS," Major Sanders said.

Planning for humanitarian missions is benefiting from this early sharing, said Colonel Ferreira. "Having access to the imagery and being able to describe it to the crew members and print it in a legible format that they can [carry] to the cockpit has been a tremendous asset for [operations over] Bosnia," he said.

For Captain Culiner, the most significant advantage is the variety of intelligence products that his unit will be able to receive. "Having the map database is the most significant key," he said.

"Secondly, having the intel information. . . . I can see I've got a mechanized infantry company here. I can see I've got an artillery battery here. I can see I've got an SA-3 missile system here. To be able to sit there and put a visual picture on this scene and print that and take it with me [is] an optimal situational awareness system."

During the Gulf War, Captain Culiner's squadron had no planning aids, so the new systems "will be gravy."

Major Rankin pointed to another benefit. "If you can give the crews an extra percentage of mission planning," he said, "just let them know what's going on and be a little bit smarter and have their minds right when they go in, that's going to get the 'pucker factor' down so they can concentrate on flying and fighting instead of being scared." ■

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*Tony Capaccio is deputy editor of* Defense Week *in Washington, D. C. His most recent article for* Air Force *Magazine, "The Fully Deployable Air Campaign," appeared in the January 1994 issue.*

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# Valor

**By John L. Frisbee,** Contributing Editor

# The Ordeal of *Sad Sack II*

The heroism of *Sad Sack II*'s crew typified that of the more than 160 crews that bombed refineries at Ploesti in the low-level attack of August 1, 1943.

Most readers of Air Force Magazine are familiar with the August 1, 1943, low-level attack on refineries near Ploesti, Romania. A carefully prepared plan for simultaneous strikes on assigned targets by a force of almost 170 B-24s was disrupted en route by bad weather and navigation error. It was, nevertheless, a day of unsurpassed heroism. Leaders of the five B-24 groups saved a broken plan from disaster—but at a terrible cost. Nearly one-third of the B-24 force was lost in combat or forced by battle damage to land in neutral Turkey.

Many stories and several books have been written about that mission, but less has been said about the heroism of individual crews. The story of *Sad Sack II,* a B-24 from the 66th Bomb Squadron, 44th Bomb Group, epitomizes the valor and self-sacrifice of so many on that mission.

The 44th, an Eighth Air Force group, had been sent to North Africa to participate in the Ploesti mission. Col. Leon W. Johnson, commander of the 44th and later a four-star general, led thirty-seven of his bombers on that mission.

Unlike the two groups that preceded him, Colonel Johnson turned at the correct initial point and led sixteen of his planes to their target—the Columbia Aquila refinery—while twenty-one of his bombers broke off to attack another target. The sixteen descended to their bombing altitude of 250 feet. They could see that their target had already been hit by another group in the confusion of the disrupted plan, but Colonel Johnson, who would later be awarded the Medal of Honor, elected to continue his strike as planned.

As the sixteen B-24s approached their target, which was obscured by heavy black smoke, they came under concentrated small-arms and antiaircraft fire from all sides. Before "bombs away," *Sad Sack II*, piloted by 1st Lt. Henry Lasco, took many hits. Left waist gunner SSgt. Charles DeCrevel was shot through the thigh. Tail gunner Sgt. Thomas Wood was killed. The number two engine was knocked out, and its propeller would not feather. It seemed to the crew impossible for any plane to survive a bomb run through the maelstrom of smoke, fire, and exploding delayed-action bombs that engulfed the target. This was it.

At bombs away, navigator 2d Lt. Harry Stenborn's chest was torn open by an 88-mm shell. He managed to crawl along the bomb bay catwalk to the rear of the aircraft, where he collapsed and died. Top turret gunner TSgt. Leonard Raspotnik and radio operator SSgt. Joseph Spivey were hit. Neither survived. Lieutenant Lasco knew then that they could not make it back to North Africa. He decided to head for Turkey.

By this time, *Sad Sack II* was at treetop level, vibrating badly, and barely able to remain airborne. Several Bf-109s attacked the critically damaged bomber. The wounded Sergeant DeCrevel continued to fire at the enemy fighters, downing one, while ammunition boxes exploded around him. He was wounded by more shell fragments. SSgt. Albert Shaffer, the right waist gunner, kept shooting at the fighters, though one of his legs had been almost severed by enemy fire.


The bomber was down to about fifty feet with one wing low when a Bf-109, coming in level at ten o'clock, shot the pilot through the face, stunning and temporarily blinding him. Copilot 2d Lt. Joseph Kill leveled the wings just before *Sad Sack II* bellied into a corn field. Bombardier 2d Lt. Dale Scriven was killed in the crash; both of Lieutenant Kill's legs were broken, and one of his ankles was dislocated.

Lieutenant Lasco was pinned in his seat by a harness that would not release. He finally managed to free himself, remove the tangle of wires around Lieutenant Kill's legs, and drag him out of the burning wreckage through a hole in the fuselage. Still dazed, Lasco staggered off to look for help. While he was gone, Romanian peasants stole Lieutenant Kill's watch and ring, beat him, and left him for dead.

Sergeant DeCrevel fought his way out of a plane he later described as "a pile of burning junk." Then he remembered that Sergeant Shaffer was still inside, immobilized with only one functioning leg. DeCrevel went back and dragged Shaffer out of the wreckage. After stripping off his own smoldering clothing, DeCrevel also went for help.

Of *Sad Sack II*'s nine crew members, all had been wounded and five killed. The four survivors—Lieutenants Lasco and Kill and Sergeants DeCrevel and Shaffer—became POWs in Romania until they were rescued by Fifteenth Air Force B-17s in late August 1944, after the Germans had retreated before advancing Soviet troops. (The story of that repatriation will appear in a future issue of Air Force Magazine.)

August 1, 1943, will always be special in USAF history. It was a day of supreme heroism on a unique scale, when hundreds of men laid their lives on the line—and many lost—to complete their mission. ■

*Thanks to Will Lundy, the 44th Bomb Group's historian, and to retired Col. William R. Cameron, who participated in the mission.*

# World Gallery of Trainers

**By John W. R. Taylor and Kenneth Munson**

## Jet Trainers

### Alpha Jet

Dassault and Dornier built 504 production Alpha Jets, including 176 trainers for the French Air Force and 175 as close-support aircraft for the German Air Force. The German aircraft were later fitted with 3,175 lb thrust Larzac 04-C20 engines, improved instrumentation, provision for two Sidewinder self-defense AAMs, a podded 27-mm Mauser gun, and other refinements, but only 30 now remain in Luftwaffe service. These are used to refamiliarize pilots with the European climatic environment after training in the US, before they convert to the Tornado. Fifty have been donated to Portugal to equip one training (No. 103) and one combat (No. 301) squadron, the latter unit including six Alpha Jets configured for electronic warfare, and 40 have been acquired by Greece. The rest (approximately 48) of Germany's surviving aircraft are up for sale. Other Alpha Jet customers were Belgium (33), Egypt (30, designated **MS1**), Ivory Coast (seven), Morocco (24), Nigeria (24), Qatar (six), and Togo (six). Dassault offered an alternative close-support version, with inertial platform, head-up display (HUD), laser rangefinder, and radar altimeter; Egypt ordered 15 (as **MS2**s) and Cameroon seven.

**Contractors:** Dassault Aviation, France, and Dornier Luftfahrt GmbH, Germany.

**Power Plant:** two SNECMA/Turbomeca Larzac 04-C6 turbofans standard; each 2,976 lb thrust. Two 3,175 lb thrust Larzac 04-C20s retrofitted in German close-support aircraft.

**Dimensions** (trainer): span 29 ft 10¾ in, length 38 ft 6½ in, height 13 ft 9 in.

**Weights:** empty 7,374 lb, gross 11,023–17,637 lb.

**Performance** (at 11,023 lb weight, 04-C6 engines): max speed at 32,800 ft Mach 0.85, max speed at S/L 621 mph, stalling speed (gear and flaps down) 104 mph, ceiling 48,000 ft, T-O run 1,215 ft, landing run 1,640 ft, radius of action at high altitude 764 miles on internal fuel, 901 miles with external tanks, *g* limits (ultimate) +12/–6.4.

**Accommodation:** crew of two, on tandem zero height/104 mph or zero/zero ejection seats.

**Armament:** centerline stores pylon or pod for 30-mm DEFA or 27-mm Mauser gun. Provision for two hardpoints under each wing for 18-tube rocket packs, bombs of up to 882 lb, cluster bombs, 30-mm gun pods, Sidewinder or Magic AAMs, Maverick ASMs, a reconnaissance pod, drop tanks, and other stores. Max load on five pylons 5,510 lb.

### AT-3 Tzu-Chung

Following its first flight, September 16, 1980, the **AT-3** entered service as Taiwan's standard basic and advanced military trainer in March 1984. Of 60 built, 20 were later converted to use the 6,000 lb external stores-carrying capability in a ground-attack role. Smiths Industries was contracted in 1989 to upgrade the avionics of the first two aircraft with Westinghouse APG-66 radar and fire-control system; these 20 aircraft now equip a single Republic of China Air Force night attack squadron.

A single-seat ground and maritime attack version is known as the **AT-3A Lui-Meng.** Although offering increased payload/range, its production is considered unlikely, but its nav/attack avionics have been used to upgrade the AT-3s to **AT-3B** standard. *(Data for AT-3.)*

**Contractor:** Aero Industry Development Center, Taiwan.

**Power Plant:** two Garrett TFE731-2-2L turbofans, each 3,500 lb thrust.

**Dimensions:** span 34 ft 3¾ in, length (incl probe) 42 ft 4 in, height 14 ft 3¾ in.

**Weights:** empty 8,500 lb, gross 11,500–17,500 lb.

**Performance** (at max gross weight): max speed at S/L 558 mph, max cruising speed at 36,000 ft 548 mph, stalling speed (gear and flaps down) 104 mph, ceiling 48,000 ft, T-O run 1,500 ft, landing run 2,200 ft, max range on internal fuel 1,415 miles.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament:** two hardpoints under each wing and one under fuselage for up to 6,000 lb of single, cluster, or fire bombs, flare dispensers, or rocket launchers. Centerline hardpoint can be occupied instead by a semirecessed machine-gun pack or (in conjunction with outboard underwing pylons) an aerial target system. Provision for infrared AAM at each wingtip.

*Alpha Jet, French Air Force*

*C-101CC-04 Aviojet, Royal Jordanian Air Force*

### C-101 Aviojet

Developed with assistance from MBB of Germany and Northrop of the US, the first of four Aviojet prototypes flew on June 27, 1977. Ninety-two **C-101EB** basic and advanced trainers were built for the Spanish Air Force, by which they are known as the **E.25 Mirlo.** These have 3,500 lb thrust Garrett TFE731-2-2J engines. An armed version, with a 3,700 lb thrust TFE731-3-1J turbofan, was ordered by Chile (14 **C-101BB-02**s, Chilean Air Force designation **T-36 Halcón**: "hawk") and Honduras (four **C-101BB-03**s). All but the first four BB-02s were assembled under license by Empresa Nacional de Aeronáutica de Chile (ENAER), with partial local manufacture. A dedicated light attack version, designated **C-101CC-02** in Spain and **A-36 Halcón** by the Chilean Air Force, was developed jointly by CASA and ENAER. The first of two prototypes flew November 16, 1983, and 23 production A-36s, with more powerful TFE731-5-1J engines, were ordered for the Chilean Air Force. Four were supplied from Spain; ENAER is due to complete co-production of the other 19 in 1995. Sixteen basically similar **C-101CC-04**s serve with the Royal Jordanian Air Force.

An enhanced training version, with a TFE731-5-1J engine, a GEC-Marconi HUD, Alenia mission computer, Litton inertial platform, and HOTAS (hands on throttle and stick) controls, flew for the first time on May 20, 1985, as the **C-101DD**, but has not entered production. *(Data for C-101CC.)*

**Contractor:** Construcciones Aeronauticas SA, Spain.

**Power Plant:** one Garrett TFE731-5-1J turbofan; 4,300 lb thrust, with military power reserve (MPR) rating of 4,700 lb thrust.

**Dimensions:** span 34 ft 9½ in, length 41 ft 0 in, height 13 ft 11¼ in.

**Weights:** empty 7,650 lb, gross 11,023–13,890 lb.

**Performance** (at 9,590 lb weight, except where indicated): max speed at 15,000 ft with MPR 518 mph, stalling speed (gear and flaps down) 102 mph IAS, ceiling 44,000 ft, T-O run 1,835 ft, landing run 1,575 ft, mission radius (armed) 287–374 miles, *g* limits at 10,802 lb weight +7.5/–3.9.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament:** ventral bay for quick-change packages, including a 30-mm DEFA gun with 130 rds, twin 12.7-mm Browning machine guns, reconnaissance camera, ECM package, or laser designator. Six underwing hardpoints for up to 4,960 lb of stores, including four pods of 2.75-in or 5-in rockets, six 550-lb bombs, two Maverick ASMs, or Sidewinder or Magic AAMs.

### Cessna 526 JPATS CitationJet

There was no all-American entry for the JPATS competition until late 1992, when Cessna began work on the Model 526, embodying as many features as possible of its six/seven-seat CitationJet business aircraft. The wings are shortened and strengthened to withstand 7*g* but retain the latter's supercritical laminar-flow airfoil. The fuselage is new and is designed to meet the original JPATS requirement of accommodating 80 percent of pupil pilots, from 5 ft, 100-lb females to 6 ft 6 in, 240-lb males; but the landing gear and systems are adapted from off-the-shelf CitationJet components. The engines are military versions of the CitationJet's FJ44s. Construction remains basically all aluminum alloy, with composites only in nonstructural areas. The first of two prototypes flew December 20, 1993, the second March 2, 1994. After logging more than 500 flying hours, with 350 spins, they received FAR Pt 23 aerobatic certification in June, 18 months after program launch.

**Contractor:** Cessna Aircraft Company, USA.

**Power Plant:** two Williams-Rolls F129 turbofans; each 1,500 lb thrust.

**Dimensions:** span 37 ft 0 in, length 40 ft 8 in, height 12 ft 6 in.
**Weights:** empty 4,920 lb, gross 7,400 lb.
**Performance** (estimated): max speed 311 mph, stalling speed (50 percent fuel) 88 mph, ceiling 35,000 ft, range 1,209 miles.
**Accommodation:** crew of two, in tandem, with UPC zero/zero ejection system.
**Armament:** none specified.

### CM 170 Magister

In May 1993, at Salon-de-Provence, Groupement d'Instruction 312 celebrated the two-millionth flying hour of Magisters in French Air Force service since this elegant first-generation trainer was first delivered in 1956. Of more than 400 once owned, France still operates nearly 90, including 16 navalized **CM 175 Zéphyrs.** Israel's 80 Magisters, which have the local name **Tzukit,** were rebuilt and upgraded between 1981 and 1986 by IAI's Bedek Aviation Division under a program known as AMIT (Advanced Multimission Improved Trainer). Other Magisters still serve with the air forces of Algeria (20+), Bangladesh (15), Cameroon (10), El Salvador (five), Ireland (six), Lebanon (five), Libya (12), Morocco (22), Senegambia (five), and Togo (four), often in both training and counterinsurgency roles. Belgium's 15 are on the verge of retirement.

The basic **CM 170** has 880 lb thrust Marboré IIA turbojets, but the last 137 production aircraft were fitted with uprated Marboré VIs and are known as **Super Magisters.** *(Data for Super Magister.)*
**Contractor:** Aerospatiale (originally Fouga), France.
**Power Plant:** two Turbomeca Marboré VI turbojets; each 1,058 lb thrust.
**Dimensions:** span over tiptanks 39 ft 10 in, length 33 ft 0 in, height 9 ft 2 in.
**Weights:** empty 5,093 lb, gross 6,280–7,187 lb.
**Performance:** max speed at S/L 435 mph, at 30,000 ft 451 mph, ceiling 13,125 ft, T-O run 1,970 ft, range 870 miles.
**Accommodation:** crew of two, on tandem ejection seats.
**Armament:** two 7.62-mm machine guns, with 200 rds/gun, in nose; hardpoint under each wing for rocket launcher, wire-guided missile, or bomb.

### CT-114 Tutor

Despite an initial lack of government interest, Canadair Ltd launched its CL-41A design as a private venture in the late 1950s, the first of two prototypes making its initial flight January 13, 1960. Official indifference was reversed in September 1961 by an order for 190 Tutors for the then Royal Canadian Air Force, given the RCAF designation CT-114. These were powered by J85 engines of greater power than the 2,400 lb thrust Pratt & Whitney JT12A-5s that had been fitted in the prototypes. Production deliveries began in October 1963 and were completed in 1966; during the earlier part of their career, the Tutors were also used to train pilots of the Royal Netherlands Air Force in Canada. Almost 120 Tutors remain in service with the Canadian Forces, including more than 80 with No. 2 CF Flying Training School, about 10 with the Flight Instructors' School, and 14 others with No. 431 Squadron, which provides the service's "Snowbirds" aerobatic display team. All of these units are based at Moose Jaw, Saskatchewan; about seven other Tutors equip the Central Flying School at Winnipeg, Manitoba. A late-1970s upgrade of 113 aircraft introduced an improved canopy jettison system, updated avionics, and provision for external fuel tanks, and work has begun recently on a first batch of 22 aircraft to rewire and otherwise refurbish them to extend their service life to 2010.
**Contractor:** Canadair Ltd, Canada.
**Power Plant:** one Orenda-built General Electric J85-CAN-40 turbojet; 2,663 lb thrust.
**Dimensions:** span 36 ft 6 in, length 32 ft 0 in, height 9 ft 3¾ in.
**Weights:** empty 4,895 lb, gross 7,397 lb.
**Performance:** max speed at 28,500 ft 498 mph, stalling speed 81 mph, ceiling 43,000 ft, T-O to 50 ft 2,160 ft, landing from 50 ft 2,330 ft, max range 944 miles.
**Accommodation:** crew of two, on side-by-side zero-height ejection seats.
**Armament:** provision for single pylon under each wing for a machine-gun or rocket pod, napalm tank, or 500-lb bomb.

### G-2A Galeb and G-4 Super Galeb

A few straight-winged **G-2A Galebs** built for the Yugoslav Air Force during 1963–83 remain in service, but most have been replaced by sweptwing G-4 Super Galebs. About 30 of the G-2A-Es supplied to Libya in 1975 and 1983–84 are thought to survive, with both training and light attack roles.

The **G-4 Super Galeb** has a more formidable light attack capability and has been used in combat during the civil war in former Yugoslavia, together with J-1 Jastreb single-seat light attack counterparts of the G-2A. The first of two G-4 prototypes flew in July 1978, and six preseries aircraft followed. The Yugoslav Air Force ordered about 150 production G-4s, with anhedral tailplanes, to replace T-33s and to reequip G-2A units on a one-to-one basis. The Air Force of Myanmar has 12.

After the Soko ("falcon") factory in Mostar, Bosnia-Hercegovina, closed in May 1992, some G-4 plant and machinery were transferred to the Utva facility at Pančevo, Serbia, which is reported to have built two prototypes of a single-seat development, designated **G-5.** Optimized for ground attack, this is said to have the GSh-23L gun built in, freeing the centerline station for other weapons, and wingtip rails for R-60 ("Aphid") AAMs. *(Data for G-4 Super Galeb.)*
**Contractor:** Vazduhoplovna Industrija Soko, Yugoslavia.
**Power Plant:** one Rolls-Royce Viper Mk 632-46 turbojet; 4,000 lb thrust.
**Dimensions:** span 32 ft 5 in, length 40 ft 2¼ in, height 14 ft 1¼ in.
**Weights:** empty 6,993 lb, gross 10,379–13,889 lb.
**Performance** (at 10,379 lb gross weight): max speed at 13,120 ft 565 mph, max cruising speed at 19,700 ft 525 mph, stalling speed (gear and flaps down) 112 mph, ceiling 42,160 ft, T-O run 1,877 ft, landing run 2,674 ft, range with two drop tanks 1,553 miles.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

***CM 170 Magister, French Air Force (P. R. Foster)***

***CT-114 Tutor, Canadian Forces***

***Hawk T. Mk 1, Royal Air Force (P. R. Foster)***

***HJT-16 Kiran Mk II (Denis Hughes)***

**Armament:** removable centerline gun pod containing 23-mm GSh-23L twin-barrel gun with 200 rds. Two pylons under each wing for such weapons as napalm tanks, cluster bombs containing eight 35-lb fragmentation munitions, containers for 40 antipersonnel or 54 antitank bomblets, 16-tube rocket packs, triple carriers for 220-lb bombs, 12.7-mm gun pods, or drop fuel tanks. Max weapon load 2,822 lb.

### Hawk

Seven years after the Royal Air Force began taking delivery of 176 **Hawk T. Mk 1**s as Britain's standard basic/advanced flying and weapons trainers, 89 of the original T. Mk 1s, with 5,200 lb thrust Adour 151 turbofans, initiated the development of combat-capable Hawks when they were upgraded to **T. Mk 1A** standard. Fifty of these are NATO-declared for point defense, to accompany radar-equipped Tornados on air defense missions as part of the RAF's Mixed Fighter Force. A pylon was wired under each wing to carry a Sidewinder AAM, supplementing the standard underbelly 30-mm gun pack. Since 1991, 15 T. Mk 1s and T. Mk 1As have also succeeded Canberras of No. 100 Squadron for target-towing and as "silent targets" for electronic warfare training.

Even before its 1981 selection by the US Navy (as the T-45A Goshawk, which see), the Hawk had begun to attract export orders. The first of these were for the **Hawk 50** series, which, with a 5,200 lb thrust Adour 851, offered a 70 percent greater disposable load and 30 percent longer range. Customers were Finland (57 Mk 51/51A, with a 12.7-mm centerline gun), Kenya (12 Mk 52), and Indonesia (20 Mk 53). Best seller to date has been the further improved **Hawk 60** series, with four-position flaps, modified wing leading-edge devices, and other refinements. This has been bought by Zimbabwe (13 Mk 60/60A), Dubai (nine Mk 61), Abu Dhabi (16 Mk 63), Kuwait (12 Mk 64), Saudi Arabia (30 Mk 65), Switzerland (20 Mk 66), and South Korea (20 Mk 67). Fifteen of the Abu Dhabi aircraft have been upgraded to Mk 63A, with Adour 871 and new wings with wingtip Sidewinders.

The two-seat **Hawk 100** and single-seat **200** series are more specialized, high-performance strike versions. To date they have been ordered by Abu Dhabi (18 Mk 102), Indonesia (12 each of 100 and 200 series), Malaysia (10 Mk 108, 18 Mk 208), and Oman (four Mk 103, 12 Mk 203), most with wingtip rails for Sidewinders. The Omani aircraft have FLIR, a Sky Guardian radar warning receiver and laser rangefinder. A further large order is anticipated from Saudi Arabia under the Al Yamamah II program. *(Data for Hawk 60 series.)*
**Contractor:** British Aerospace Defence Ltd, UK.
**Power Plant:** one Rolls-Royce Turbomeca Adour 861 turbofan; 5,700 lb thrust.
**Dimensions:** span 30 ft 9¾ in, length (incl probe) 38 ft 10¼ in, height 13 ft 0¾ in.
**Weights:** empty 8,845 lb, gross 20,061 lb.
**Performance:** max Mach number in dive at and above 17,000 ft 1.2, max speed at S/L 627 mph, stalling speed (gear and flaps down) 110 mph, ceiling 46,000 ft, T-O run 2,330 ft, landing run 1,800 ft, ferry range with two drop tanks 1,812 miles, *g* limits +8/–4.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.
**Armament:** centerline 30-mm Aden gun with 120 rds, or 12.7-mm gun pack, or pylon, plus two pylons under each wing. Within overall max of 6,614 lb, typical loads can include centerline gun pack or reconnaissance pod and four underwing rocket packs; 1,000-lb bombs; 36 x 80-lb runway denial bombs; five 600-lb cluster bombs; four Sidewinder/Magic AAMs; two Maverick ASMs and two 156-gallon drop tanks.

### HJT-16 Kiran

The prototype Kiran first flew in September 1964, and delivery of 118 Viper-engined **Mk I**s for basic flying training with the Indian Air Force began in the spring of 1968. They were followed by 72 **Mk IA**s, for the IAF and Indian Navy, with a hardpoint under each wing to carry armament for weapons training. On July 30, 1976, Hindustan Aeronautics Ltd flew the first **Kiran Mk II,** with a more powerful turbojet, updated instruments and avionics, improved hydraulics, and two additional underwing stations. Sixty-one were built for the Indian Air Force and Navy between 1982 and 1989. IAF Kirans equip the Air Force Academy and the Flying Instructors' School; Indian Navy aircraft serve with No. 551 Squadron, which also provides the service's "Phantoms" aerobatic display team. A Kiran replacement is now being sought by the IAF, with the Hawk and Alpha Jet (which see) reportedly the front-runners. *(Data for Mk II.)*
**Contractor:** Hindustan Aeronautics Ltd (Bangalore Complex), India.
**Power Plant:** one Rolls-Royce Orpheus 701-05 turbojet; 4,200 lb thrust.
**Dimensions:** span 35 ft 1¼ in, length 34 ft 9½ in, height 11 ft 11 in.

**Weights:** empty 6,603 lb, gross 9,369–11,023 lb.
**Performance** (at max gross weight): max speed at S/L 418 mph, max cruising speed at 15,000 ft 386 mph IAS, stalling speed (gear and flaps down) 98 mph IAS, ceiling 39,375 ft, T-O run 1,772 ft, landing from 50 ft 4,725 ft, max range (internal fuel) 457 miles.
**Accommodation:** crew of two, on side-by-side zero-height ejection seats.
**Armament:** two 7.62-mm machine guns in nose; two hardpoints under each wing for 551-lb bombs, 18-tube rocket pods, or drop tanks.

### I-22/M-92 Iryda

The Polish Air Force has a requirement for 50 or more Irydas. In service, they will cover the spectrum of pilot, navigation, air combat, reconnaissance, and ground-attack training, with day/night and adverse weather capability. Now in preseries production to replace the TS-11 Iskra (which see) and LiM-6 (MiG-17) basic and advanced trainers of the Polish Air Force, the **I-22** Iryda ("iridium") was designed from the outset to have considerable potential for reconnaissance and close-support missions. It can operate from unprepared airfields and tolerate substantial battle damage. The first of five prototypes flew March 5, 1985. These are being followed by nine preseries I-22s, of which the first five have the original 2,425 lb thrust PZL-5 engine. The next four, for delivery by the end of this year, are of the **M-92** model with more powerful K-15 turbojets and Polish avionics.

PZL Mielec is meanwhile exploring a number of possible future variants. The **M-93** would be a combat trainer with strengthened airframe, increased weapons capability, and Western engines, avionics, and zero/zero seats. Modified prototypes flew earlier this year as the **M-93V** (Rolls-Royce Viper engines) and **M-93S** (French SAGEM avionics). A two-seat reconnaissance/close-support variant, the **M-95**, would be an M-93 derivative with larger, slightly swept wings and an internal 30-mm gun. Single-seat ground-attack or dual-role fighter/ground-attack derivatives of the M-95, designated **M-97S** and **M-97MS**, respectively, may now give way to the **M-99 Orkan**, with a larger wing, more powerful turbofans, and ability to carry 8,818 lb of stores on eight external stations. *(Data for M-92.)*
**Contractor:** PZL Mielec, Poland.
**Power Plant:** two Instytut Lotnictwa K-15 turbojets; each 3,307 lb thrust.
**Dimensions:** span 31 ft 6 in, length 43 ft 4½ in, height 14 ft 1¼ in.
**Weights:** empty 10,450 lb, gross 16,093 lb.
**Performance:** max speed at 16,400 ft at 13,668 lb weight 574 mph, stalling speed (gear and flaps down) at 12,786 lb weight 127 mph, ceiling 39,375 ft, T-O run at 12,345 lb weight 1,640 ft, landing run (with brake-chute) at 11,023 lb weight 2,460 ft, max range on internal fuel at 14,550 lb weight 683 miles, *g* limits +8/–4.
**Accommodation:** crew of two, on tandem zero-height/94 mph ejection seats. Rear seat raised.
**Armament:** one centerline 23-mm twin-barrel GSz-23L gun with 50–200 rds; two multiple stores carriers under each wing for up to 2,425 lb of bombs (up to 1,102-lb size), gun pods, AAMs, guided or unguided rockets, or (inboard stations only) 100-gallon drop tanks.

### IA 63 Pampa

After evaluation against six other designs, the Pampa was selected by the Argentine Air Force in 1979 as the replacement for its elderly Morane-Saulnier Paris IIIs for basic, advanced, and weapons training. The first of three prototypes flew October 6, 1984. Delivery of the initial batch of 18 production **IA 63 Pampas** began in April 1988, and 14 were in service by the beginning of 1994. They were unarmed; but the first six have been fitted with an AAF-developed HUD, which will eventually become standard, together with a podded 30-mm gun and underwing weapon stations. Present plans call for a further 46 Pampas for the AAF. A new Elbit weapon delivery and navigation system is available for these follow-on aircraft.

FMA teamed with Vought and Loral to offer the **Pampa 2000 International** as its entry for the USAF/USN JPATS competition. This has a TFE731-2-2B engine, Bendix/King digital avionics, an AiResearch environmental control system, and a modified fuel management system. The first of the two JPATS-configured aircraft flew May 25, 1993. *(Data for current IA 63.)*
**Contractor:** Fábrica Militar de Aviones, Argentina.
**Power Plant:** one Garrett TFE731-2-2N turbofan; 3,500 lb thrust.
**Dimensions:** span 31 ft 9¼ in, length 35 ft 9¼ in, height 14 ft 1 in.
**Weights:** empty 6,219 lb, gross 8,157–11,023 lb.
**Performance** (at 8,377 lb gross weight except where indicated): max speed at S/L 466 mph, stalling speed 106 mph, ceiling 42,325 ft, T-O run (at 8,157 lb weight) 1,390 ft, landing run (at 7,716 lb weight) 1,512 ft, range 932 miles (1,151 miles with external tanks), *g* limits +6/–3.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.
**Armament:** hardpoint under fuselage and two under each wing for up to 2,557 lb (with standard fuel) of gun pods, bombs, and rockets. With uprated engine, external load can be increased to 3,748 lb.

### IAR-99 Şoim and IAR-109 Swift

The first of two prototypes of the **IAR-99 Şoim** ("hawk") flew December 21, 1985. The Romanian Air Force placed initial orders totaling 50, for intermediate and advanced training, with light attack capability. Latest news (in 1993) was that about 20 of these had been delivered. Meanwhile, Avioane had contracted the Bedek Aviation Division of Israel Aircraft Industries to assist in upgrading the aircraft by installing state-of-the-art avionics. The upgraded demonstrator, known as the **IAR-109 Swift**, flew for the first time in Israel in November 1993. Two versions are now available: the **IAR-109T** "all-through" jet trainer and the **IAR-109TF** combat trainer/light attack version. Avionics in the TF, compatible with a MIL-STD-1553B multiplex data bus, include EFIS, a mission display processor, HUD, ring-laser gyro INS, HOTAS controls, radar altimeter, IFF transponder, and laser rangefinder. The underwing stations can accept east European or Western weapons, including infrared AAMs and precision guided munitions. *(Data for IAR-99.)*
**Contractor:** Avioane SA, Romania.
**Power Plant:** one Turbomecanica license-built Rolls-Royce Viper Mk 632-41M turbojet; 4,000 lb thrust.
**Dimensions:** span 32 ft 3¾ in, length 36 ft 1½ in, height 12 ft 9½ in.
**Weights:** empty 7,055 lb, gross 9,700–12,258 lb.
**Performance** (at 9,700 lb clean gross weight): max speed at S/L 537 mph, ceiling 42,325 ft, T-O run 1,477 ft, landing run 1,805 ft, max range 683 miles, *g* limits +7/–3.6.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.
**Armament:** centerline 23-mm GSh-23 gun pod with 200 rds; two hardpoints under each wing for up to 2,756 lb of 550-lb or smaller bombs, two twin 7.62-mm gun pods, four 16 x 57-mm or 32 x 42-mm rocket pods, drop tanks (inboard stations only), or other stores.


***IAR-99 Şoim, Romanian Air Force (Air Portraits)***


***K-8 Karakorum 8***

***L-29 Delfin, Czech Air Force (P. R. Foster)***

### K-8 Karakorum 8

Design of the K-8 (originally L-8) was initiated by NAMC in China in 1986, and Pakistan agreed to take a 25 percent share in mid-1987. The K-8 is now in initial production by NAMC as a jet basic trainer and light ground-attack aircraft. It made its public debut at the February 1992 Asian Aerospace show in Singapore. The first of three flying prototypes made its initial flight November 21, 1990. The second followed on October 18, 1991, and by the beginning of 1993 the three then flying had completed nearly 500 test flights. Production of an initial batch of 15 began in 1992; these have been delivered to the Chinese PLA Air Force. Six ordered by Pakistan in April 1994 were handed over in September. Pakistan's total K-8 requirement is believed to be for 75. Interest has been shown by other countries, including Bangladesh, Iran, Libya, and Sri Lanka.
**Contractors:** Nanchang Aircraft Manufacturing Company, People's Republic of China.
**Power Plant:** one Garrett TFE731-2A-2A turbofan; 3,600 lb thrust.
**Dimensions:** span 31 ft 7¼ in, length (incl nose pitot) 38 ft 0¾ in, height 13 ft 9¾ in.
**Weights:** empty 5,924 lb, gross 8,003–9,546 lb.
**Performance** (at 8,003 lb clean gross weight): max speed at S/L 497 mph, landing speed (gear and flaps down) 103 mph, ceiling 42,650 ft, T-O run 1,345 ft, landing run 1,680 ft, max range on internal fuel 870 miles, *g* limits +7.33/–3.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.
**Armament** (optional): one 23-mm gun pod under centerfuselage; two hardpoints under each wing. Twin-store inboard stations for small bombs; single-store outboard stations can each carry a PL-7 AAM, 12-rd pod of 57-mm rockets, or a 66-gallon drop tank.

### L-29 Delfin

The **L-29 Delfin** ("dolphin") first flew April 5, 1959, powered by a Viper turbojet, but the Czech M 701 engine fitted in the second prototype became standard in the 3,568 Delfins built between 1961 and 1974. About 3,000 of these were delivered to the USSR, most of the remainder being supplied as the standard jet basic trainer for all other members of the former Warsaw Pact except Poland. Estimates of current strengths are Bulgaria 84, Czech (13) and Slovak (16) Republics 29, Hungary 24+, and Romania 30+. The purpose of Russia's current UTS program, for which the MiG-AT and Yak-130 (which see) are competing, is primarily to find a replacement for that country's L-29s. At least nine other nations received L-29s, of which Afghanistan (24), Ghana (eight), Mali (six), and Syria (60) still operate the Delfin. An **L-29R** version was produced for light attack duties, with underwing stores pylons and nose-mounted cameras. *(Data for standard L-29.)*
**Contractor:** Aero Vodochody National Corporation, Czechoslovakia.
**Power Plant:** one Motorlet Walter M 701c 500 turbojet; 1,960 lb thrust.
**Dimensions:** span 33 ft 9 in, length 35 ft 5½ in, height 10 ft 3 in.
**Weights:** empty 5,027 lb, gross 7,231–7,804 lb.
**Performance** (at 7,165 lb weight): max speed at S/L 382 mph, stalling speed (flaps down) 81 mph, ceiling 36,100 ft, T-O run 1,805 ft, landing run 1,444 ft, max range with underwing tanks 555 miles.
**Accommodation:** crew of two, on tandem ejection seats. Rear seat raised.
**Armament:** single attachment point under each wing for rocket pod, 7.62-mm machine-gun pod, 220-lb bomb, or drop fuel tank.

### L-39/59/139/159 Albatros

Since entering production in 1971, the L-39 delivery total has exceeded 2,800 (including 2,094 **L-39C** basic and advanced trainers for the former USSR). Apart from the Czech and Slovak Air Forces (36), other L-39C recipients include Afghanistan (12), Cuba (30), Ethiopia (20), and Vietnam (24). Ex-Soviet L-39Cs have been acquired by Lithuania and Latvia. Eight examples of the **L-39V**, a specialized target-towing version, were built for Czechoslovakia in 1976. The **L-39Z0**, with strengthened wings for additional stores carriage, was exported to the former German Democratic Republic (52, of which 20 or more recently transferred to Hungary), Iraq (81), Libya (181, of which 10 later transferred to Egypt), and Syria (55). The ground-attack/reconnaissance **L-39ZA**, which adds a centerline 23-mm gun pod to the capability of the Z0, was built for Algeria (32), Bulgaria (36), Czechoslovakia (31), Nigeria (24), Romania (32), and Syria (44). Thirty-six others (designated **L39ZA/ART** and having Elbit avionics) were delivered to Thailand in 1993–94, and 18 similar aircraft are required by the Philippine Air Force. All of

these models have a 3,792 lb thrust Progress (Ivchenko) AI-25TL turbofan.

The Albatros is now being offered in Westernized form for world markets. Principal differences in the **L-139,** first flown May 10, 1993, are a 4,080 lb thrust Garrett TFE731-4 turbofan, Flight Visions HUD, and Bendix/King avionics.

The principal change in the **L-59** is the use of a new and more powerful DV-2 turbofan, though the airframe and avionics have also been upgraded, and the ailerons and elevators have irreversible power controls. The first prototype flew September 30, 1986, and the first production L-59 October 1, 1989. The Czech Air Force received six in 1991–92, and deliveries of 48

***MiG-AT model (Mike Jerram)***

***Impala Mk 2, South African Air Force (Herman Potgieter)***

**L-59Es** to the Egyptian Air Force followed in 1993–94. Twelve L-59s are on order by the Tunisian Air Force. Under development, to fly in spring 1996, is the **L-159**, a single-seat derivative of the L-59 to be powered by a 6,300 lb thrust ITEC F124 turbofan. *(Data for L-59.)*

**Contractor:** Aero Vodochody, Czech Republic.

**Power Plant:** one ZMKB Progress DV-2 turbofan; 4,850 lb thrust.

**Dimensions:** span incl tiptanks 31 ft 3½ in, length 40 ft 0¼ in, height 15 ft 7¾ in.

**Weights:** empty 8,885 lb, gross 11,883–15,432 lb.

**Performance** (at 11,883 lb clean gross weight): max speed at 16,400 ft 537 mph, stalling speed (gear and flaps down) 115 mph, ceiling 38,725 ft, T-O run 1,936 ft, landing run 2,527 ft, range with external fuel 1,243 miles, *g* limits +8/–4.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament:** one 23-mm GSh-23 twin-barrel gun in underfuselage pod; four underwing pylons for a total of 2,425 lb of stores, including bombs of up to 1,102 lb, four 16 x 57-mm rocket pods, or two 39.5-gallon or 92.5-gallon drop tanks.

### MB-326, Impala, and AT-26 Xavante

The original tandem-seat trainer versions of the MB-326, with a 2,500 lb thrust Viper 11 turbojet, were bought for the air forces of Italy (**MB-326** and **326E**), Australia (**326H**), Ghana (**326F**), South Africa (**326M**), and Tunisia (**326B**). The strengthened wings of the E (each with three pylons) were combined with the more powerful Viper 540 to produce the trainer/light attack **MB-326GB** built by Aermacchi for Argentina, Zaïre, and Zambia, and by Embraer for the air forces of Brazil, Paraguay, and Togo. The Brazilian version is known as the **AT-26 Xavante.** Final Italian-built variants, bought by several earlier customers and Dubai, were the single-seat **MB-326K** for operational training/ground-attack and two-seat **MB-326L** advanced trainer; both have a 4,000 lb thrust Viper 632. Atlas Aircraft Corp. in South Africa built 151 MB-326Ms under license as **Impala Mk 1** trainers and a number of MB-326Ks as **Impala Mk 2s.** All versions continue in service, but the aging Australian aircraft, only 30 of which are still fully serviceable, encountered wing-fatigue problems and are scheduled for replacement, as are South Africa's Mk 1 Impalas. *(Data for MB-326GB.)*

**Contractor:** Aermacchi SpA, Italy.

**Power Plant:** one Rolls-Royce Viper 20 Mk 540 turbojet; 3,410 lb thrust.

**Dimensions:** span 35 ft 7¼ in, length 35 ft 0¼ in, height 12 ft 2 in.

**Weights:** empty 5,920 lb, gross 10,090–11,500 lb.

**Performance** (trainer at 8,680 lb gross weight, internal fuel only): max speed 539 mph, max cruising speed 495 mph, ceiling 47,000 ft, T-O run 1,350 ft, landing from 50 ft 2,070 ft, range 1,150 miles.

**Accommodation:** crew of two, on tandem ejection seats.

**Armament:** three attachment points under each wing for up to 4,000 lb of gun or rocket pods, bombs, wire-guided missiles, camera pack, or drop fuel tanks.

### MB-339 and T-Bird II

The first production **MB-339A** for the Italian Air Force flew July 20, 1978; the total of 101 delivered by 1987 included four **MB-339RM** (radiomisure) calibration aircraft and 19 **MB-339PANs** for the Frecce Tricolori aerobatic display team, with added smoke generator but with wingtip tanks deleted to aid formation keeping. Italian MB-339As are camouflaged for use as an emergency close-support force. One was converted into the prototype **MB-339AM,** with upgraded avionics and Marte antiship ASMs. Additional MB-339As were delivered to Argentina (Navy, 10), Dubai (seven), Ghana (four), Malaysia (13), Nigeria (12), anc Peru (16). The A model, four more of which were recently ordered, was succeeded by the **MB-339C** (first flight December 17, 1985), with new vertical tail surfaces, HOTAS controls, and advanced systems including GEC-Marconi radar and nav/attack computer, Kaiser HUDWAC, Litton INS, Honeywell radar altimeter, FIAR laser rangefinder, Tracor chaff/flare dispenser, and Elettronica active ECM pod. The Royal New Zealand Air Force received 18 of this version, which equip No. 14 Squadron and the Pilot Training School.

For the JPATS competition, Lockheed, Aermacchi, and Rolls-Royce entered a "missionized" version of the MB-339A known as the **T-Bird II.** This name recalls Lockheed's T-33, familiar as the "T-Bird" to pilots trained on it worldwide during four decades. A 4,000 lb thrust Viper 680-582 engine, small wing fences, and enlarged tiptanks characterize the JPATS aircraft. *(Data for MB-339C.)*

**Contractor:** Aermacchi SpA, Italy.

**Power Plant:** one Rolls-Royce Viper Mk 680-43 turbojet; 4,400 lb thrust.

**Dimensions:** span over integral tiptanks 36 ft 9¾ in, length 36 ft 10½ in, height 13 ft 1¼ in.

**Weights:** empty 7,562 lb, gross 10,983–14,000 lb.

**Performance** (at 10,983 lb weight): max speed at S/L 558 mph, at 30,000 ft 508 mph, stalling speed 98 mph, ceiling 46,700 ft, T-O run 1,608 ft, landing run 1,509 ft, ferry range with two drop tanks 1,266 miles, *g* limit +7.33.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament:** six underwing hardpoints for up to 4,000 lb of stores including 12.7-mm or 30-mm gun pods, rockets of 50-mm to 5-in caliber, 500-lb bombs, 100-mm runway demolition bombs, AIM-9L Sidewinder and Magic AAMs, AGM-65 Maverick ASMs, Marte Mk II sea-skimming antiship missiles, and other weapons.

### MiG-AT

Five Russian OKBs produced designs for a two-seat advanced jet trainer to replace the Czech-built L-29 Delfin and L-39 Albatros. The two finalists, still awaiting selection, are the MiG-AT and Yak-130. Of these, the MiG is the more conventional design, with unswept, low-mounted wings and twin turbofans in pods above the wingroots; the T-tail of the original design has now been moved to the base of the fin. Engines for the first two prototypes will be supplied by SNECMA of France, with the first flight scheduled for early 1995. Avionics will include two multifunctional CRT displays with buttons, a HUD with input from a color video and TV camera, laser rangefinder, HSI/ADI, automatic control system, INS, Tacan, ILS, RWR, and IFF. Armament will be optional. Design objectives include maneuverability comparable with front-line combat aircraft and a service life of 10,000 flying hours or 25 years, with 20,000–25,000 landings. The Russian requirement is for 700 trainers in this category.

**Contractor:** Mikoyan OKB, Russia.

**Power Plant:** two Turbomeca-SNECMA Larzac 04-R20 turbofans; each 3,175 lb thrust. Production engines to be license-built by Chernyshov.

**Dimensions:** span 32 ft 9¾ in, length 37 ft 1¼ in, height 14 ft 6 in.

**Weights:** normal T-O 10,163 lb, gross 12,037 lb.

**Performance** (estimated): max speed 528 mph, ceiling 49,200 ft, ferry range 1,865 miles, *g* limits +8/–3.

**Accommodation:** crew of two, on tandem zero/zero ejection seats.

**Armament:** up to 4,410 lb of guided and unguided missiles, guns, and bombs, on seven hardpoints.

### Ranger 2000

Known originally as the Fan Ranger, this JPATS contender was developed from the German turboshaft-powered Fantrainer (which see). Like the Fantrainer, the Ranger 2000 has a cabin section based on a single structural keel beam. The wings, center-fuselage, and engine housing are made of CFRP and GFRP (carbon-fiber- and glassfiber-reinforced plastics). DASA's US partner, the North American Aircraft division of Rockwell, redesigned the fuselage to raise the rear seat, embody new US military standard com/nav systems and Collins four-tube EFIS-85 displays based on those in the **T-1A** Jayhawk, and use a Universal Propulsion Co. lightweight ejection system. The aircraft's Pratt & Whitney JT15D engine, an uprated version of that which powers the T-1A, has the advantage of being already in the USAF inventory. The first Ranger 2000 prototype flew January 15, 1993; the second flew June 18 but was lost July 27, 1993, delaying further flight testing until December, but a third prototype flew June 20 this year in time for the JPATS flyoff. Upper-wing airbrakes are now relocated to a strengthened rear fuselage, and elevator hinges have been reinforced.

**Contractors:** Rockwell Corporation, USA, and Deutsche Aerospace, Germany.

**Power Plant:** one Pratt & Whitney Canada JT15D-5C turbofan; 3,190 lb thrust.

**Dimensions:** span 34 ft 4 in, length 25 ft 9¼ in, height 12 ft 10 in.

**Weight:** gross 5,291 lb.

**Performance:** max speed at S/L 379 mph, at 30,000 ft 451 mph, ceiling 35,000 ft, range on internal fuel 1,118 miles.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament:** none specified.

### S.211

The **S.211** prototype flew for the first time April 10, 1981; this version is in service with the air forces of Singapore (30) and the Philippines (24). The design is simple and inexpensive to manufacture, making it possible for the first six aircraft for Singapore to be delivered as kits and the remainder to be produced locally. They now fly from RAAF Pearce in Western Australia, where pilots of the Republic of Singapore Air Force receive their basic training. The first four Philippine S.211s were Italian-built; the remainder were assembled in Manila by PADC. They are used for advanced training by the 100th Training Wing and for weapons training by the 5th Fighter Wing.

In partnership with Northrop Grumman, Agusta has developed an uprated version, the **S.211A,** with a more powerful (3,190 lb thrust) JT15D-5C turbofan and supercritical wings, for the JPATS competition. Smallest of the JPATS candidates, it embodies a modified front fuselage, with the floor lowered to meet JPATS accommodation requirements, and with Rockwell Collins EFIS displays in the second of the two evaluation aircraft. The ejection seats are by Martin-Baker. Compared with the original S.211, the A has higher gross weights

(6,393–7,716 lb) and a max speed of 472 mph at 25,000 ft. New wing fittings raise the *g* limits to +7/–3.5. *(Data for basic S.211.)*

**Contractor:** Agusta SpA (SIAI-Marchetti), Italy.

**Power Plant:** one Pratt & Whitney Canada JT15D-4C turbofan; 2,500 lb thrust.

**Dimensions:** span 27 ft 8 in, length 31 ft 2 in, height 12 ft 5½ in.

**Weights:** empty 4,078 lb, gross 6,063–6,944 lb.

**Performance** (at 5,511 lb gross weight): max cruising speed at 25,000 ft 414 mph, stalling speed (gear and flaps down) 86 mph, ceiling 40,000 ft, T-O run 1,280 ft, landing run 1,185 ft, max range on internal fuel 1,036 miles, *g* limits (clean) +6/–3.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament:** two hardpoints under each wing for up to 1,455 lb of gun pods (single or twin guns), rocket launchers, bombs, napalm tanks, cartridge throwers, two camera/IR reconnaissance pods, or two drop tanks. Philippine Air Force aircraft can carry a 0.50-in gun pod under the front fuselage.

### Saab 105 (SK60)

Between 1966 and 1969, a total of 150 Saab 105s were delivered to the Swedish Air Force, with which they serve in five slightly different versions: **SK60A** two-seat primary/basic/advanced trainer; **SK60B** two-seat light attack/advanced trainer; **SK60C** two-seat light attack/reconnaissance/advanced training aircraft; **SK60D** four-seater for liaison duties; and **SK60E** four-seater for liaison, with civil avionics. Since 1987, the SK60 has been the only training aircraft in the Swedish Air Force, used for everything from primary to tactical training. Following a life extension program that included wing strengthening, it is intended to continue in use until at least 2010. Under a further program, new 1,900 lb thrust Williams-Rolls FJ44 turbofan engines are being installed in 115 SK60s during 1994–98, with options on reengining 20 more. Their instruments and avionics will also be upgraded.

Also in service is the Saab **105XT** special export version, with more powerful (2,850 lb thrust) General Electric J85-17 engines, strengthened structure, more internal fuel, more advanced avionics, and much greater weapon-carrying capability. The Austrian Air Force acquired 40 during 1970–72, under the designation **105OE.** About 30 remain operational with Nos. 1 and 2 Squadrons of a fighter-bomber wing, for conversion training, ground-attack, and tactical reconnaissance with an underwing Vinten camera pod. *(Data for SK60A; 105OE in parentheses.)*

**Contractor:** Saab Military Aircraft, Sweden.

**Power Plant:** two Turbomeca/SNECMA RM9B Aubisque turbofans; each 1,636 lb thrust.

**Dimensions:** span 31 ft 2¼ in, length 35 ft 5¼ in, height 8 ft 10½ in.

**Weights:** empty 6,404 lb (6,281 lb), gross 9,085 lb (10,218 lb).

**Performance** (trainer): max speed at S/L 453 mph (602 mph), at 20,000 ft 478 mph (578 mph), ceiling 39,370 ft (44,950 ft), T-O run 3,002 ft (1,247 ft), landing run 1,640 ft (1,969 ft), ferry range 1,180 miles (1,430 miles).

**Accommodation:** crew of two, side by side on ejection seats (four fixed seats in SK60D/E).

**Armament** (SK60B/C): up to 1,764 lb on six underwing hardpoints. Two 30-mm Aden gun pods or 12.7-mm practice gun pods; up to 12 x 135-mm rockets or six 60-mm practice rockets. (Up to 4,410 lb on 105OE.)

### T-2 and T-2A

First flown July 20, 1971, the XT-2 prototype was the first supersonic aircraft designed and built by the Japanese aerospace industry. Ninety production aircraft were built for the Japan Air Self-Defense Force, of which 28 were configured as **T-2** unarmed advanced trainers and the remaining 62 as **T-2A** armed combat proficiency trainers. Production ended in 1988.

**Contractor:** Mitsubishi Heavy Industries Ltd, Japan.

**Power Plant:** two Ishikawajima-Harima TF40-IHI-801A (license Rolls-Royce Turbomeca Adour Mk 801A) turbofans; each 7,305 lb thrust with afterburning.

**Dimensions:** span 25 ft 10¼ in, length 58 ft 7 in, height 14 ft 5 in.

**Weights:** empty 13,905 lb, gross 28,219 lb.

**Performance** (clean): max speed at height Mach 1.6, ceiling 50,000 ft, T-O run 2,000 ft, ferry range 1,610 miles.

**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.

**Armament** (T-2A): one JM61 Vulcan multibarrel 20-mm gun in lower fuselage, aft of cockpit on port side. Hardpoints on centerline and two under each wing for drop tanks or weapons. Wingtip attachments for AAMs.

### T-2 Buckeye

The first of 231 **T-2Cs** was delivered to the US Navy in April 1969, supplementing earlier single-engine T-2As and twin-engine T-2Bs. It is the only version still active in the USN inventory, providing not only pilot, navigator, NFO, and weapons training but also the all-important carrier qualification part of the strike training syllabus. A few T-2Cs are also flown by the "aggressor" training unit VF-43 at NAS Oceana, Va., and the Naval Test Pilots' School at Patuxent River, Md.

The Venezuelan Air Force acquired 24 **T-2Ds**, generally similar to the C except for their avionics and deletion of carrier landing capability. About 20 of these continue in service as advanced trainers, some with a secondary attack role. The attack kit had been developed originally for 40 **T-2Es** supplied to the Hellenic Air Force. Most of these are still used for advanced and tactical training, with provision for 3,500 lb of stores on six underwing hardpoints. *(Data for T-2C.)*

**Contractor:** Rockwell International Corporation, USA.

**Power Plant:** two General Electric J85-GE-4 turbojets; each 2,950 lb thrust.

**Dimensions:** span over tiptanks 38 ft 1½ in, length 38 ft 3½ in, height 14 ft 9½ in.

**Weights:** empty 8,115 lb, gross 13,191 lb.

**Performance:** max speed at 25,000 ft 530 mph, stalling speed 100 mph, ceiling 45,500 ft, max range 1,070 miles.

**Accommodation:** crew of two, on tandem ejection seats. Rear seat raised.

**Armament:** two underwing hardpoints for up to 640 lb of practice bombs, gun pods, or rocket launchers.

***Ranger 2000***

***Saab 105OE, Austrian Air Force***

***T-33A Shooting Star, Pakistan Air Force (P. R. Foster)***

### T-4

Under major budget cuts, the number of T-4 intermediate trainers to be built for the Japan Air Self-Defense Force in the current three-year program was reduced by 22 aircraft. Whether this will affect the originally planned production total of 200 is not known. Up to April 1994, 149 (excluding prototypes) had been ordered and about 112 delivered since production began in FY 1986 to replace Lockheed T-33As and Fuji T-1A/Bs. In readiness for the 1996 display season, eight T-4s have been delivered to the JASDF's "Blue Impulse" aerobatic team in place of its previous T-2s. These will have more birdproof windscreens and one fuel tank replaced by an oil tank for creating smoke trails.

The first of four prototypes flew July 29, 1985; a batch of 12 entered service with the 31st Flying Training Squadron of the 1st Air Wing at Hamamatsu, near Tokyo, in September 1988. Eight other wings now fly T-4s. The basic requirements of the specification to which they were designed called for high subsonic maneuverability and provisions to carry external stores under the fuselage and wings. Four underwing hardpoints can carry drop tanks or other stores; an underfuselage pylon can be used for target towing equipment, an ECM/chaff dispenser pod, or air sampling pack. Some T-4s may be deployed for liaison and other support duties under present plans. Fuji and Mitsubishi each have a 30 percent share in manufacture of the T-4, under Kawasaki's leadership. An enhanced-capability version has been proposed as a replacement for the Mitsubishi T-2 and T-2A for service entry early next century.

**Contractor:** Kawasaki Heavy Industries Ltd, Japan.

**Power Plant:** two Ishikawajima-Harima F3-IHI-30 turbofans; each 3,660 lb thrust.

**Dimensions:** span 32 ft 7½ in, length 42 ft 8 in, height 15 ft 1¼ in.

**Weights:** empty 8,356 lb, gross 12,544–16,535 lb.

**Performance** (at 12,544 lb clean gross weight): cruising speed Mach 0.75, ceiling 50,000 ft, T-O run 2,000 ft, landing run 2,100 ft, max range with two drop tanks 1,036 miles, *g* limits +7.33/–3.

**Accommodation:** crew of two, on tandem ejection seats. Rear seat raised.

**Armament:** no built-in armament.

### T-33A Shooting Star

Nearly 50 years have elapsed since this 4 ft 2½ in, tandem-seat stretch of America's first operational jet fighter first flew (as the TP-80C) on March 22, 1948, yet it is still active with 13 air forces. In addition to **T-33A** pilot trainers, **AT-33A** counterinsurgency versions are still flown by Bolivia (32), Ecuador (23), and Mexico (42), while Pakistan (four), Philippines (three), and Thailand (four) continue to operate the **RT-33A** tactical reconnaissance version. Largest T-33A fleets are those of Canada, whose more than 50 **CT-133A Silver Stars** have 5,100 lb thrust Rolls-Royce Nene engines; Greece (nearly 50); Japan (100+); and Turkey (75+). Other T-33A operators are the air forces of Guatemala (two), Iran (10), Pakistan (10), the Philippines (13), South Korea (30+), and Thailand (30+). Japan's T-33As are no longer used for training but are being retained for liaison and other duties following their replacement by T-4s. Canada's CT-133As serve with combat support squadrons. Ten are modified as **ET-133** "electronic aggressors"; others are used for maritime support. *(Data for T-33A.)*

**Contractor:** Lockheed Aircraft Corporation, USA.

**Power Plant:** one Allison J33-A-35 turbojet; 5,400 lb thrust.

**Dimensions:** span 38 ft 10½ in, length 37 ft 9 in, height 11 ft 8 in.

**Weights:** empty 8,084 lb, gross 11,965–14,442 lb.

**Performance:** max speed at S/L 590 mph, at 25,000 ft 543 mph, ceiling 48,000 ft, max range 1,275 miles.

**Accommodation:** crew of two, in tandem.

**Armament:** none in T-33A; provision for 0.50-in twin-gun pod under each wing in AT-33A.

### T-37 Tweet

Forty years after the first flight of Cessna's Model 318 side-by-side trainer prototype, October 12, 1954, the **T-37B** major production version continues as USAF's standard primary trainer and will not begin to retire until JPATS produces a replacement. The May 1994 Air Force Magazine showed 496 active, with an average age of 30.7 years. All are being upgraded by SLEP kits manufactured by Sabreliner Corp. The majority are operated by AETC, but four-plane units serve at ACC B-52H bases and AMC tanker bases, to perform accelerated copilot enrichment (ACE) duty.

The **T-37C,** delivered to fill MAP orders only, is generally similar to the B in its primary and intermediate training roles but also has provision for underwing armament and tiptanks. T-37Bs and/or Cs are operated today by the air forces of Chile (20+), Colombia (eight), Germany (34, US-based), Greece (31), Pakistan (50+), South Korea (40+), Thailand (15+), and Turkey (65+). *(Data for T-37B.)*

**Contractor:** Cessna Aircraft Company, USA.

**Power Plant:** two Continental J69-T-25 (license Turbomeca Marboré) turbojets; each 1,025 lb thrust.

**Dimensions:** span 33 ft 9¼ in, length 29 ft 3 in, height 9 ft 2¼ in.

**Weights:** empty 3,870 lb, gross 6,575 lb.

**Performance:** max speed at 25,000 ft 426 mph, cruising speed at 35,000 ft 360 mph, ceiling 35,100 ft, T-O to 50 ft 2,000 ft, landing from 50 ft 2,545 ft, range at 360 mph with standard fuel 870 miles.

**Accommodation:** crew of two, side by side on ejection seats.

**Armament** (T-37C): provision for two 250-lb bombs under wings, or four Sidewinder AAMs, and for fuselage-mounted camera.

### T-38 Talon

As the prototype for USAF's first supersonic trainer, the YT-38 first flew in April 1959. In all, 1,187 production **T-38As** were delivered over the next decade. More than 1,100 of these were for USAF, which still had 559 at the start of this year, including those for ACE duty with ACC and AMC. The original total included 46 allocated for US-based training of West German pilots. NASA received 24, the US Navy 18 (of which about six remain). Other current T-38A operators are Taiwan (40 leased) and Turkey (30).

More than 130 of the USAF aircraft were modified to **T-38B** (unofficially AT-38B) configuration for specialized weapons training, with an underfuselage gun pod or practice bomb dispensers. A SLEP named Pacer Classic, to extend the service life of USAF's T-38As until at least 2010, is under way. *(Data for T-38A.)*

**Contractor:** Northrop Corporation, USA.
**Power Plant:** two General Electric J85-GE-5A turbojets; each 3,850 lb thrust with afterburning.
**Dimensions:** span 25 ft 3 in, length 46 ft 4½ in, height 12 ft 10½ in.
**Weights:** empty 7,164 lb, gross 12,093 lb.
**Performance:** max speed at 36,000 ft more than 812 mph, typical cruising speed at 43,400 ft 578 mph, stalling speed (gear and flaps down) 156 mph IAS, ceiling above 55,000 ft, T-O run 2,500 ft, landing run 3,000 ft, range 1,093 miles.
**Accommodation:** crew of two, on tandem ejection seats. Rear seat raised.
**Armament:** none in T-38A; SUU-11 0.30-in gun pod or SUU-20/A rocket/practice bomb carrier in T-38B.

### T-45A Goshawk

A first group of US Navy student pilots began flying T-45A Goshawks of Squadron VT-21, at Kingsville, Tex., in early 1994. More than 12 years had passed since a development of the British Aerospace Hawk had been selected in preference to five other entries in a competition for an undergraduate jet pilot trainer to replace the T-2C Buckeye and TA-4J Skyhawk. Initial changes introduced by the US prime contractor, McDonnell Douglas, included a new main and nose landing gear, an arrester hook, and airframe strengthening to make the aircraft carrier-compatible. The Hawk airbrake and ventral strakes were replaced, avionics and cockpit displays changed for compatibility with USN front-line fighters, and a derated version of the Adour installed to prolong engine life. The handling characteristics suffered from these modifications, leading to the addition of full-span slats, airbrakes, and use of a more powerful model of the engine. The first flight was made April 16, 1988. Production was initiated by an FY 1988 Lot 1 contract for 12 production T-45As. At present, 268 T-45As are planned to enter USN service, to train around 300 pilots each year. A prototype with a digital/"glass" cockpit, HUD, and GPS/INS navigation flew March 19, 1994, and this upgrade is intended to be standard from the 73d production aircraft, in 1996, with retrofit on early Goshawks.

Initial results suggest that the T-45A will make possible intermediate/advanced training in 176 flight hours, saving 15 hours on the T-2C/TA-4J program. Fuel and maintenance costs are reduced from $870–$1,200 per flight hour to little more than $500.

**Contractors:** McDonnell Douglas Corporation, USA, and British Aerospace plc, UK.
**Power Plant:** one Rolls-Royce Turbomeca F405-RR-401 (Adour Mk 871) turbofan; 5,845 lb thrust.
**Dimensions:** span 30 ft 9¾ in, length (incl probe) 39 ft 4 in, height 13 ft 4¾ in.
**Weights:** empty 9,834 lb, gross 14,081 lb.
**Performance:** max speed at 8,000 ft 625 mph, max Mach number in dive 1.04, ceiling 40,000 ft, T-O to 50 ft 3,610 ft, landing from 50 ft 3,310 ft, ferry range, internal fuel 952 miles, *g* limits +7.33/–3.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.
**Armament:** one pylon under each wing for practice multiple bomb rack, rocket pod, or drop fuel tank. Provision for centerline stores pod.

### TS-11 Iskra-Bis

Poland's first indigenous jet trainer, the Iskra was developed for use by the Polish Air Force in preference to the Czechoslovak L-29 Delfin. The first prototype flew in February 1960, and the first of an eventual 423 production Iskras entered service in 1964. The initial **Iskra 100** (31 built) had a 1,720 lb thrust HO-10 turbojet, replaced from 1967 by the 2,205 lb thrust SO-1, from 1969 by the identically rated SO-3, and finally by the SO-3W. In addition to engine variations, the Iskra was built in four basic models. The Iskra **100-Bis A** (45 built) and **B** (134 built) were two-seat primary trainers, with two and four underwing hardpoints, respectively; the Iskra **200 ART-Bis C** (five built) was a single-seat reconnaissance version; the **200 SB-Bis DF** (208 built) was similar to the B but with a wider range of weapons and had three Soviet AFA-39 cameras in the nose. Six DFs were recently converted to **TS-11R** configuration for the Polish Naval Air Force's 7th Regiment, to replace coastal reconnaissance MiG-15UTIs. They have a Bendix/King RDS-81 weather radar in the nose, and the rear cockpit dual controls are replaced by a radar display screen and artificial horizon.

Fifty Iskras, of which 40+ remain, were acquired in 1975–76 for the Indian Air Force Academy at Hakimpet, to offset development delays with the Kiran II. Initial Iskra production ceased in 1979 but was resumed from 1982 to 1987 to meet additional requirements. *(Data for Iskra 200 SB-Bis DF.)*

***T-37B, Pakistan Air Force (Denis Hughes)***

***T-38 Talon, US Navy (Erik Simonsen)***


***First "digital cockpit" T-45A Goshawk, US Navy***

***Air Beetle, Nigerian Air Force***

**Contractor:** WSK-PZL Mielec, Poland.
**Power Plant:** one Instytut Lotnictwa SO-3W turbojet; 2,425 lb thrust.
**Dimensions:** span 33 ft 0 in, length 36 ft 7 in, height 11 ft 5½ in.
**Weights:** empty 5,655 lb, gross 8,232–8,465 lb.
**Performance** (at 8,232 lb gross weight): max speed at 16,400 ft 478 mph, normal cruising speed 373 mph, stalling speed (gear and flaps down) 114 mph, ceiling 37,725 ft, T-O run 2,150 ft, landing run 2,330 ft, range 783 miles, *g* limits (ultimate) +8/–4.
**Accommodation:** crew of two, on tandem lightweight ejection seats.
**Armament:** 23-mm gun in starboard side of nose; two hardpoints under each wing for gun or rocket pods or small bombs of up to 220 lb.

### Yak-130

Designed by Yakovlev in partnership with Aermacchi of Italy, the Yak-130 is competing with the MiG-AT to replace L-29 and L-39 jet trainers of the Russian Air Force. The prototype, soon to fly, is equipped with a quadruplex digital fly-by-wire control system but will be inherently stable. Production Yak-130s are intended to have five percent longitudinal instability, to reproduce the handling characteristics of the MiG-29/Su-27 families of combat aircraft.

The advanced configuration of the Yak-130 is designed to permit flight at angles of attack up to 35°. Basic power plant will comprise new RD-35 turbofans, with kidney-shaped underwingroot air intakes. The tandem cockpits will be equipped from the start with CRT displays, with a front cockpit HUD forming part of a collimated flight and sighting display linked with the pilot's helmet-mounted target designator. Roles will include everything from basic pilot training to weapons training and aircraft carrier deck training with folding wings.

**Contractor:** Yakovlev OKB, Russia.
**Power Plant:** two RD-35 (Klimov-modified ZMKB Progress DV-2) turbofans; each 4,852 lb thrust.
**Dimensions:** span 34 ft 11 in, length 39 ft 0½ in, height 15 ft 5 in.
**Weight:** gross 13,225–18,740 lb.
**Performance** (estimated): max speed at height 620 mph, ceiling 39,375 ft, T-O run 1,250 ft, landing run 2,200 ft, max ferry range 1,365 miles, *g* limits +8/–3.
**Accommodation:** crew of two, on tandem zero/zero ejection seats. Rear seat raised.
**Armament:** provision for seven pylons for weapons training and attack stores.

# Piston-Engine Trainers

### Air Beetle

Nigeria's first production aircraft, the Air Beetle is a fully aerobatic military and civil primary trainer developed from the US Van's RV-6A homebuilt lightplane with the assistance of Dornier of Germany. It is of all-metal construction, with a flat-four engine that can run on either avgas or mogas. Conventional three-axis flying controls are all equipped with electric trim, and the Air Beetle is IFR-equipped. First flight was made in 1989, and by the beginning of 1994 the three prototypes had accumulated more than 1,750 hours of flying. Following evaluation of No. 3 prototype, the Nigerian Air Force ordered 60 basic **T 18** Air Beetles to replace its BAe Bulldogs. Versions will include the 160 hp **T 16** and the 200 hp **T 20.** *(Data for T 18.)*

**Contractor:** Aeronautical Industrial Engineering and Project Management Company Ltd, Nigeria.
**Power Plant:** one Textron Lycoming O-360-A1A piston engine; 180 hp.
**Dimensions:** span 23 ft 0 in, length 20 ft 2¼ in, height 7 ft 6½ in.
**Weights:** empty 1,100 lb, gross 1,850 lb.
**Performance:** max speed at S/L 173 mph, max cruising speed at 10,000 ft 178 mph, stalling speed (flaps down) 58 mph, ceiling 20,000 ft, T-O run 476 ft, landing run 722 ft, range 605 miles, *g* limits +6/–3.
**Accommodation:** crew of two, side by side; baggage space aft of seats.
**Armament:** none.

### Airtrainer CT4

Following the completion of five **CT4Bs** for the Royal Thai Air Force, production of the Airtrainer has again ended, although development continues. The five aircraft were to supplement the remaining 18 of 24 **CT4As** delivered in the 1970s and recently modified by the RTAF to extend their wing-fatigue life. Australia retired its 51 CT4As (known as "Plastic Parrots") in 1993, leaving the Royal New Zealand Air Force, with 18 of its original 19 CT4Bs, as the only other military operator of this small primary trainer. These serve with the CFS and Pilot Training School at Ohakea. Twelve CT4Bs built for the BAe/Ansett Flying College in 1991–92 now provide pilot training for the RAAF.

Current development centers on the **CT4E,** certificated to FAR Pt 23 in May 1992 with a 300 hp Textron Lycoming AEIO-540 aerobatic engine, and the **CT4C,** which has a 300 shp (throttle-limited) Allison 250-B17D turboprop. *(Data for CT4B.)*

**Contractor:** Pacific Aerospace Corporation Ltd, New Zealand.
**Power Plant:** one Teledyne Continental IO-360-HB9 piston engine; 210 hp.
**Dimensions:** span 26 ft 0 in, length 23 ft 2 in, height 8 ft 6 in.

**Weights:** empty approx 1,600 lb, gross 2,650 lb.
**Performance:** max speed at S/L 166 mph, max cruising speed at S/L 161 mph, stalling speed (flaps down) 51 mph, ceiling 14,500 ft, T-O run 733 ft, landing run 510 ft, max range 691 miles, *g* limits +6/–3.
**Accommodation:** two seats, side by side. Space to rear for third seat or 115 lb of baggage.
**Armament:** none.

### AS 202 Bravo

A total of 180 AS 202 Bravo piston-engine two/three-seat primary trainers have been delivered. Subtypes are the **AS 202/18A2,** with higher max T-O and landing weights than the basic **18A,** an extended canopy, and electric instead of mechanical trim; the **A3,** which differs from the A2 in having mechanical trim, and 24V instead of 12V electrics; and the **A4,** with British CAA-approved special instrumentation. All versions are fully aerobatic. Customers include the air forces of Indonesia (40), Iraq (48, of which some were transferred to Jordan), and Morocco (10), plus four for the Royal Flight of Oman and eight for the Uganda Central Flying School.

Available since 1993, the **AS 202/32TP Turbine Bravo** has a 420 shp Allison 250-B17C turboprop, flat rated at 332 shp. Wingtip fuel tanks increase span to 32 ft 7¾ in; length is 25 ft 6¼ in. Max T-O weight is unchanged. No military order has yet been announced. *(Data for AS 202/18A4.)*
**Contractor:** FFA Flugzeugwerke Altenrhein, Switzerland.
**Power Plant:** one Textron Lycoming AEIO-360-B1F piston engine; 180 hp.
**Dimensions:** span 32 ft 1 in, length 24 ft 7¼ in, height 9 ft 2¾ in.
**Weights:** empty 1,565 lb, gross 2,226 lb (aerobatic), 2,380 lb (max).
**Performance** (at max gross weight): max speed at S/L 150 mph, max cruising speed at 8,000 ft 141 mph, stalling speed (flaps down) 56 mph, ceiling 17,000 ft, T-O run 705 ft, landing run 690 ft, max range 707 miles, *g* limits (aerobatic) +6/–3.
**Accommodation:** crew of two side by side in aerobatic version; space behind these in utility version for third seat or 220 lb of baggage.
**Armament:** none.

### Bulldog

This military primary trainer first flew in May 1969 and was produced in two series. The first 98 production **Series 100**s were followed by the **Series 120,** with a strengthened wing center-section and higher aerobatic takeoff weight. The RAF acquired 130 Model 121s as Bulldog **T. Mk 1**s. Ten of these remain with the Central Flying School and four with No. 6 Flying Training School; most of the others are with University Air Squadrons. Other current Bulldog operators are Ghana (10 Model 122), Jordan (10+ Model 125), Kenya (12 Model 103/127), Lebanon (five Model 126), Malaysia (10 Model 102), Nigeria (25+ Model 123), and Sweden (60+ Model 101/**SK61**s). The Swedish aircraft are used for liaison and other nontraining duties. *(Data for Series 120.)*
**Contractor:** British Aerospace plc, UK.
**Power Plant:** one Textron Lycoming IO-360-A1B6 piston engine; 200 hp.
**Dimensions:** span 33 ft 0 in, length 23 ft 3 in, height 7 ft 5¾ in.
**Weights:** empty 1,430 lb, gross 2,238–2,350 lb.
**Performance:** max speed at S/L 150 mph, max cruising speed at 4,000 ft 138 mph, stalling speed (flaps down) 61 mph EAS, ceiling 16,000 ft, T-O run 900 ft, landing run 500 ft, max range 621 miles, *g* limits +6/–3.
**Accommodation:** crew of two, side by side; optional third seat or 220 lb of baggage at rear.
**Armament:** normally none, but provision for four underwing points for up to 640 lb of air-to-surface weapons, machine-gun pods, bombs, grenade launchers, or other stores.

### CAP 10

The **CAP 10** was developed from the Piel Emeraude sport aircraft, which explains its wooden airframe and fabric-covered rear fuselage. The prototype of the basic version flew in August 1968 and received French certification in September 1970. The later **CAP 10B,** with an enlarged rudder and a ventral fin, was FAA certificated for day and night VFR operation in 1974. Both models are fully aerobatic. The major military operator is the French Air Force, which acquired 30 CAP 10s and 26 CAP 10Bs. Eight CAP 10Bs were supplied to the French Navy. The Air Force's CAP 10s are used to pregrade cadet pilots before proceeding to full flying training on the Epsilon or Tucano. Twenty CAP 10Bs were delivered in the early 1980s to the Mexican Air Force's flying school, equipped almost to IFR standard. The Republic of Korea Air Force recently received two. *(Data for CAP 10B.)*
**Contractor:** Avions Mudry et Cie, France.
**Power Plant:** one Textron Lycoming AEIO-360-B2F piston engine; 180 hp.

***AS 202 Bravo, Royal Flight of Oman (Denis Hughes)***

***PT-6A (CJ-6A), Bangladesh Air Force (Peter Steinemann)***

***HPT-32 Deepak, Indian Air Force (Denis Hughes)***

**Dimensions:** span 26 ft 5¼ in, length 23 ft 6 in, height 8 ft 4½ in.
**Weights:** empty 1,213 lb, gross 1,675 lb (aerobatic), 1,829 lb (max).
**Performance:** max speed at S/L 168 mph, max cruising speed 155 mph, stalling speed (flaps down) 50 mph IAS, ceiling 16,400 ft, T-O run 1,149 ft, landing run 1,182 ft, max range 621 miles, *g* limits +6/–4.5.
**Accommodation:** crew of two, side by side; space behind seats for 44 lb of baggage.
**Armament:** none.

### Cessna 150/152/172 and T-41 Mescalero

The smallest of this family of high-wing lightplanes is the side-by-side two-seat **Model 150,** first flown in 1957. Versions up to the 150E had an unswept fin and 100 hp Continental O-200-A engine. A swept fin was introduced on the Model 150F in 1966. From 1977, the 150s were superseded by the **Model 152** range, with a 110 hp Textron Lycoming O-235 engine. The four-seat **Model 172,** first flown in 1955, has a 145 hp Continental O-300-A in its basic form. It, too, acquired a swept fin, in 1960, when the deluxe Skyhawk version also appeared. A more powerful **R172E** (210 hp Continental IO-360) was introduced in 1964. The basic 172 was uprated with a 150 hp Lycoming O-320 in 1968; the standard Skyhawk engine from 1977 was the 160 hp O-320.

The **T-41A Mescalero** represented off-the-shelf procurement of 204 Cessna 172s for USAF. It was followed by 255 **T-41B**s for the US Army, 52 **T-41C**s for USAF, and 238 **T-41D**s for MAP export to friendly nations, all based on the civil R172E. About 100 remain in the USAF inventory. Other nations train with about 140 T-41s (mostly Ds), some 60 Cessna 150/152s, and 25–30 Model 172s, including Angola, Argentina, Bangladesh, Bolivia, Botswana, Burundi, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Greece, Haiti, Honduras, Ivory Coast, Madagascar, Mexico, Peru, the Philippines, Saudi Arabia, the Seychelles, South Korea, Sri Lanka, Turkey, Uruguay, and Zaïre. *(Data for R172E/T-41D.)*
**Contractor:** Cessna Aircraft Company, USA.
**Power Plant:** one Teledyne Continental IO-360-D piston engine; 210 hp.
**Dimensions:** span 35 ft 10 in, length 26 ft 11 in, height 8 ft 9½ in.
**Weights:** empty 1,405 lb, gross 2,550 lb.
**Performance:** max speed at S/L 153 mph, max cruising speed at 5,500 ft 145 mph, ceiling 17,000 ft, T-O run 740 ft, landing run 620 ft, max range 1,010 miles.
**Accommodation:** four seats, in tandem pairs; up to 200 lb of baggage aft of rear seats.
**Armament:** none.

### CJ-6A

This tandem-seat primary trainer is a derivative of the veteran Soviet Yak-18, which was itself license-built at Nanchang, as the CJ-5, between 1954 and 1958. Work on the **CJ-6** started at Shenyang in 1956, a prototype with a 145 hp Mikulin M-11ER engine flying August 27, 1958. Disappointing performance led to its replacement by a 260 hp Ivchenko AI-14R, with which a new prototype flew July 18, 1960. The project was then transferred to Nanchang, where further redesign was followed by flight of the first production-standard aircraft October 15, 1961. More than 2,200 CJ-6s had been built by 1994, of which some 1,500 are in Chinese service. Standard version since December 1965 has been the **CJ-6A,** with uprated engine, although 10 armed **CJ-6B**s were built in 1964–66. The CJ-6A retains the general configuration of the Yak-18A/CJ-5 but has an all-metal airframe with fully retractable landing gear, fitted with low-pressure tires for operation from grass strips. Export examples, with the Westernized designation **PT-6A,** are currently operated by Bangladesh (35), North Korea (100 or more, including some CJ/PT-5s), and Zambia (12). *(Data for PT-6A.)*
**Contractor:** Nanchang Aircraft Manufacturing Company, People's Republic of China.
**Power Plant:** one SMPMC (Zhuzhou) HS6A radial piston engine; 285 hp.
**Dimensions:** span 33 ft 6½ in, length 27 ft 9 in, height 10 ft 8 in.
**Weights:** empty 2,414 lb, gross 3,086 lb.
**Performance:** max speed 185 mph, landing speed 72 mph, ceiling 20,500 ft, T-O run 920 ft, landing run 1,150 ft, max range 429 miles.
**Accommodation:** crew of two, in tandem.
**Armament:** none.

### F33 Bonanza

Known as the Debonair when it first flew in September 1959, the Model 33 is essentially a conventional-tailed version of Beech's well-known V-tailed Model 35 Bonanza. It adopted the latter's name when the E33 version was introduced in the mid-1960s. Current models, adopted as pilot trainers by several air forces and major airlines, are the **F33C** and the nonaerobatic **F33A;** largest military fleets are those of Iran, Mexico, and Spain. The Islamic Republic of Iran Air Force has about 45, approximately 10 of which are F33As used mostly for communications duties; the rest are F33Cs. The Mexican Air Force's flying school has more than 30 F33Cs, and its Navy's counterpart about 10. The Air Academy of the Spanish Air Force operates some two dozen As and Cs, in approximately equal numbers, under the service designations **E.24B** and **E.24A,** respectively. Four other F33Cs serve with the Ivory Coast Air Force, but it is doubtful whether the single example owned by Haiti is still airworthy. *(Data for F33A.)*
**Contractor:** Beech Aircraft Corporation, USA.
**Power Plant:** one Teledyne Continental IO-520-BB piston engine; 285 hp.
**Dimensions:** span 33 ft 6 in, length 26 ft 8 in, height 8 ft 3 in.
**Weights:** empty 2,242 lb, gross 2,800 lb.
**Performance:** max speed at S/L 209 mph, max cruising speed at 6,000 ft 198 mph, stalling speed (flaps and gear down) 59 mph IAS, ceiling 17,858 ft, T-O run 1,000 ft, landing run 760 ft, max range 1,023 miles.
**Accommodation:** Four seats in tandem pairs; optional fifth seat in F33A; rear fuselage baggage door in F33C.
**Armament:** none.

### HPT-32 Deepak

This fully aerobatic basic trainer flew for the first time January 6, 1977. Production was delayed, and the first 22-week student grading course on HPT-32s did not begin at the Indian Air Force Academy until 11 years later. The key design requirement was to perform two consecutive training missions 50 km (31 miles) from base before needing to refuel. As well as fulfilling the roles of *ab initio,* aerobatic, night flying, instrument flying, and glider or target towing, the aircraft had to be suitable for such secondary duties as liaison, observation, and search and rescue. Initial orders were placed for 80 HPT-32s for the Indian Air Force Academy and eight for No. 550 Squadron of the Indian Navy. Delivery of a further 54 for the IAF/IN began in 1993.
**Contractor:** Hindustan Aeronautics Ltd (Kanpur Division), India.
**Power Plant:** one Textron Lycoming AEIO-540-D4B5 piston engine; 260 hp.

**Dimensions:** span 31 ft 2 in, length 25 ft 4 in, height 9 ft 5½ in.
**Weights:** empty 1,962 lb, gross 2,756 lb.
**Performance:** max speed at S/L 164 mph IAS, max cruising speed at 10,000 ft 132 mph, stalling speed (flaps down) 69 mph, ceiling 18,045 ft, T-O run 1,132 ft, landing run 720 ft, max range 462 miles, *g* limits +6/–3.
**Accommodation:** two seats, side by side.
**Armament:** none.

### Iak-52 (Yak-52)

First flown in early 1975, Yakovlev's **Yak-52** is a latter-day descendant of the Yak-18 primary trainer, which entered production immediately after World War II. It has been manufactured under license at Bacau since 1979, the Romanian prototype having first flown in May 1978. Of more than 1,700 so far built, most have been for the air forces of Romania and the former Soviet Union, although 12 were supplied to Hungary early this year. A few former East German civil examples have been acquired by Lithuania. Basic configuration and structure of the **Iak-52** (the Romanian designation) differ little from those of the Yak-18, but a metal semimonocoque rear fuselage replaces the original fabric-covered one, and a smooth cowling encloses the more powerful engine. All three wheels of the tricycle landing gear remain exposed when retracted, to offer greater safety in a wheels-up emergency landing.
**Contractor:** Aerostar SA, Romania.
**Power Plant:** one VOKBM (Bakanov) M-14P radial piston engine; 355 hp.
**Dimensions:** span 30 ft 6¼ in, length 25 ft 5 in, height 8 ft 10¼ in.
**Weights:** empty 2,238 lb, gross 2,877 lb.
**Performance:** max speed at S/L 177 mph, at 3,280 ft 167 mph, stalling speed (flaps down) 56 mph, ceiling 13,125 ft, T-O run 558 ft, landing run 985 ft, max range 341 miles, *g* limits +7/–5.
**Accommodation:** two seats, in tandem.
**Armament:** none.

### L-70 Vinka

The Leko-70 prototype of the Vinka flew March 23, 1973, and was followed by 30 production aircraft for use at the Finnish Air Force's Air Academy at Kauhava. Their major roles are primary, aerobatic, night, instrument, and tactical training before pupils progress to jet-powered Hawks, but they can be used also for casevac, search and rescue, supply dropping, weapons training, target towing, and reconnaissance. Fatigue life is better than 8,000 hours, and they are adaptable for ski takeoffs and landings.
**Contractor:** Valmet Aviation Industries Inc, Finland.
**Power Plant:** one Textron Lycoming AEIO-360-A1B6 piston engine; 200 hp.
**Dimensions:** span 31 ft 7¼ in, length 24 ft 7¼ in, height 10 ft 10¼ in.
**Weights:** empty 1,691 lb, gross 2,293–2,756 lb.
**Performance** (at 2,205 lb gross weight): max speed at S/L 146 mph, max cruising speed at 5,000 ft 138 mph, stalling speed (flaps down) 53 mph, ceiling 16,400 ft, T-O run 755 ft, landing run 575 ft, max range 590 miles, *g* limits +6/–3.
**Accommodation:** crew of two, side by side; space behind these for two more seats or up to 617 lb of baggage.
**Armament:** two hardpoints under each wing for (as two-seater) up to 661 lb of bombs, flare pods, rocket pods, machine-gun pods, antitank missiles, TV or still camera pods, or life raft/rescue packs and a searchlight.

### MD3-160 Aerokriss

First flown August 12, 1983, the **MD3-160** is the outcome of a design concept that originated in the late 1960s, its lengthy gestation reflecting the care taken by Swiss designer Max Dätwyler to achieve maximum component commonality in its mainly metal construction. Nine identical pieces make up the ailerons, inboard and outboard flaps, elevators, and rudder; five others the aileron, elevator, and rudder tabs; three more the tailplane halves and fin; and another three the tailplane/fin tips. Wing inner and outer spar sections can be used on either wing, as can wingtips and the four sections that make up the leading-edge. Primary controls are actuated mechanically, flaps electrically; the nonretractable landing gear has nosewheel steering. Further refinement deferred the second prototype's flight until 1990, but FAR Pt 23 certification was obtained in September 1992.

The MD3 was always intended for production outside Switzerland, and in 1993 the production rights were sold to SME Aerospace of Malaysia, which is to produce an initial batch comprising 20 for the Royal Malaysian Air Force, a similar batch reportedly for Indonesia, and others for Malaysian Airlines. The first production MD3-160 was due to be completed in mid-1994. Swiss activity has included refitting the first prototype to **MD3-116** standard, with a 116 hp Lycoming O-235-N2A engine, for 1991 trials. In 1993 an **MD3-160A** prototype was under construction by MDB with an aerobatic AEIO-320 engine and modified fuel system. *(Data for MD3-160.)*
**Contractors:** MDB Flugtechnik AG, Switzerland, and SME Aerospace, Malaysia.
**Power Plant:** one Textron Lycoming O-320-D2A piston engine; 160 hp.
**Dimensions:** span 32 ft 9¾ in, length 23 ft 3½ in, height 9 ft 7 in.
**Weights:** empty 1,455 lb, gross 1,940–2,337 lb.
**Performance** (at 1,940 lb aerobatic gross weight): max cruising speed at 5,000 ft 150 mph, stalling speed (flaps down) 53 mph, T-O run 453 ft, landing run 443 ft, max range 677 miles, *g* limits +6/–3.


***L-70 Vinka, Finnish Air Force (Denis Hughes)***

***Safari, Royal Norwegian Air Force***

***Su-32 model (Mike Jerram)***

**Accommodation:** crew of two, side by side; space to rear for up to 110 lb of baggage.
**Armament:** none.

### Mushshak, Safari, and Supporter

The prototype of this family of two/three-seat light aircraft flew in Sweden July 11, 1969, with a 160 hp engine. By 1971 it had progressed to a 200 hp engine and was retrofitted with a raised tailplane to prevent damage by snow or debris when operating in winter from unprepared airfields. Variants produced by Saab were the civil **Safari,** with underwing hardpoints for stores such as relief supplies, fooc, and medicines for disaster areas, and the military **Supporter** with weapon-carrying capability. Current operators of these aircraft, for training and other duties, include the air forces of Denmark, Norway, and Zambia.

Following Pakistan's import of 15 Safari/Supporters from Sweden, 92 more were assembled from kits at Risalpur for the Pakistan Army and Air Force in 1975–82. Meanwhile, in 1981 the Aircraft Manufacturing Factory (AMF) of the Pakistan Aeronautical Complex had been set up as a licensed production center for the aircraft, known locally by the Urdu name **Mushshak** ("proficient"). Subsequent manufacture has been from raw materials, and by November 1993 a further 138 had been delivered, with production continuing. Twenty-five were ordered by Iran, and others were delivered recently to Oman (3) and Syria (6); the remainder serve with the Pakistan Army (100+) and Air Force (80+). The wings' 5° of sweep forward enhances the view from the cockpit, and provision is made for full IFR instrumentation, radio, and armament. *(Data for Mushshak.)*
**Contractor:** Pakistan Aeronautical Complex, Pakistan.
**Power Plant:** one Textron Lycoming IO-360-A1B6 piston engine; 200 hp.
**Dimensions:** span 29 ft 0½ in, length 22 ft 11½ in, height 8 ft 6½ in.
**Weights:** empty 1,424 lb, gross 1,984–2,645 lb.
**Performance** (at 2,205 lb utility gross weight): max speed at S/L 148 mph, stalling speed (flaps down) 63 mph, ceiling 15,750 ft, T-O run 493 ft, landing run 460 ft, endurance 5 h 10 min, *g* limits (aerobatic) +6/–3.
**Accommodation:** two seats, side by side; provision for rearward-facing seat or 220 lb of baggage to rear.
**Armament:** provision for six underwing hardpoints for up to 660 lb of external stores; typical loads can include two 7.62-mm or 5.56-mm machine-gun pods, two pods of 7 x 75-mm or 2.75-in rockets, four pods of 7 x 68-mm rockets, 18 x 75-mm rockets, or six wire-guided antitank missiles.

### SF.260

More than 860 of these elegant piston-engine aircraft, in various forms, have been delivered to civilian customers and to 24 air forces worldwide, with production continuing. The basic military **SF.260M** is an improved and strengthened version of the civil SF.260A or C. It flew for the first time October 10, 1970, and subsequently became the Italian Air Force's standard primary trainer, capable of basic flying training, instrument flying, aerobatics including deliberate spinning, night flying, navigation instruction, and formation flying. From the SF.260M was developed the **SF.260W Warrior** dual-role trainer/tactical support version, with two underwing pylons for up to 661 lb of weapons or other stores when flown solo. Countries operating the M, the W, or a mix of both include Belgium, Bolivia, Brunei, Burkina Faso, Burundi, Chad, Ecuador, Ireland, Italy, Libya, Nicaragua, the Philippines, Singapore, Sri Lanka, Thailand, Tunisia, Uganda, Zaïre, Zambia, and Zimbabwe. Forty improved and updated civil **SF.260Ds**, 34 of them assembled locally by Tusas Aerospace Industries, were delivered to the Turkish Air Force in 1991–93. In a reorganization of its flying training system, the Belgian Air Force has ordered 15 SF.260Ds to supplement survivors of its original 36 SF.260Ms. *(Data for SF.260M.)*
**Contractor:** Agusta SpA (SIAI-Marchetti), Italy.
**Power Plant:** one Textron Lycoming O-540-E4A5 piston engine; 260 hp.
**Dimensions:** span over tiptanks 27 ft 4¾ in, length 23 ft 3½ in, height 7 ft 11 in.
**Weights:** empty 1,797 lb, gross 2,425–2,645 lb. (SF.260W, max gross 2,866 lb.)
**Performance:** max speed at S/L 207 mph, max cruising speed at 4,925 ft 186 mph, stalling speed (gear and flaps down) 79 mph, ceiling 15,300 ft, T-O run 1,260 ft, landing run 1,132 ft, max range 1,025 miles, *g* limits (aerobatic) +6/–3.
**Accommodation:** two seats, side by side, with third seat to rear.
**Armament:** none.

### Su-32

The prototype of this tandem two-seat trainer is scheduled to fly in December 1994. If all then goes according to plan, it will be followed by an initial series of 1,500 Su-32s, to succeed Romanian-built Iak-52s (Yak-52s) as the standard primary trainers at Russian flying schools. Superficial resemblance to the all-metal Yaks is misleading. The fuselage longerons and wing spars are made of CFRP; wing, fuselage, and tail unit skin panels are of Kevlar-type composites and GFRP. The cockpit is air-conditioned and pressurized, with a raised rear seat. The landing gear is fully retractable, but is pneumatically actuated like that of the Yak. Also similar is the Su-32's aging but reliable M-14P nine-cylinder radial engine. Sukhoi quotes the cost of an Su-32 as $500,000. Options include provision for an integral gun, bombs, antitank missiles and AAMs for combat use.
**Contractor:** Sukhoi OKB, Russia.
**Power Plant:** one VOKBM M-14P radial piston engine; 355 hp.
**Dimensions:** span 27 ft 10¾ in, length 23 ft 10⅞ in, height 8 ft 6½ in.
**Weights:** empty 1,874 lb, gross 3,307 lb.
**Performance** (estimated): max speed 230 mph, stalling speed (flaps down) 56 mph, ceiling 13,125 ft, T-O run 492 ft, landing run 656 ft, range with max payload 745 miles, with external tanks 1,242 miles.
**Accommodation:** two seats, in tandem, with KS-38 ejection system (through canopy, without seats).
**Armament:** none in primary trainer.

### T-25 Universal

Between 100 and 120 of the 140 all-metal side-by-side two-seat Universals built for the Brazilian Air Force remain in service in two forms. The **T-25** basic and advanced trainer serves with the Academia da Força Aérea, plus other training and utility units, while the **T-25A** is used in light attack and reconnaissance roles. Neiva also built 10 T-25s for Chile; five of these were passed on to the Paraguayan Air Force.

**Contractor:** Sociedade Construtora Aeronáutica Neiva Ltda, Brazil.

**Power Plant:** one Textron Lycoming IO-540-K1D5 piston engine; 300 hp.

**Dimensions:** span 36 ft 1 in, length 28 ft 2½ in, height 9 ft 9¾ in.

**Weights:** empty 2,535 lb, gross 3,306–3,747 lb.

**Performance** (at 3,306 lb aerobatic gross weight): max speed at S/L 186 mph, max cruising speed at S/L 177 mph, stalling speed (flaps down) 65 mph, ceiling 20,000 ft, T-O run 1,148 ft, landing from 50 ft 1,970 ft, range 621 miles.

**Accommodation:** crew of two, side by side; space for baggage or optional third seat at rear.

**Armament:** two underwing hardpoints for 7.62-mm machine-gun pods.

### T-35 Pillán

This fully aerobatic and instrument flying trainer was designed by Piper to embody components of the PA-28 Dakota and PA-32 Saratoga. The first of two Piper-built prototypes made its initial flight March 6, 1981. Production of the Pillán was then started in Chile by ENAER. Three were assembled from kits delivered from the US; after changes to the tail unit and deepening of the canopy, series manufacture began in September 1984. Sixty **T-35A** primary trainers and 20 **T-35B** instrument trainers were delivered to the Chilean Air Force. Kits for 41 **T-35C**s were supplied by ENAER to Spain, where they were assembled by CASA for the Spanish Air Force; equipped as primary trainers, they have the Spanish designation and name **E.26 Tamiz.** Ten **T-35D** instrument trainers were delivered to the Panamanian Air Force and 15 to the Paraguayan Air Force. A turboprop version, the **T-35DT,** is described separately. *(Data for T-35A.)*

**Contractor:** Empresa Nacional de Aeronáutica de Chile, Chile.

**Power Plant:** one Textron Lycoming IO-540-K1K5 piston engine; 300 hp.

**Dimensions:** span 29 ft 0 in, length 26 ft 3 in, height 8 ft 8 in.

**Weights:** empty 2,050 lb, gross 2,900–2,950 lb.

**Performance:** max speed at S/L 193 mph, max cruising speed at 8,800 ft 166 mph IAS, stalling speed (gear and flaps down) 72 mph, ceiling 19,160 ft, T-O run 940 ft, landing run 780 ft, max range 748 miles, *g* limits +6/–3.

**Accommodation:** two seats, in tandem. Rear seat raised.

**Armament:** none.

### T67M and T-3A Firefly

Winning USAF's Enhanced Flight Screener (EFS) program to replace T-41s, and the award of a British Design Council prize, set the seal on the already successful career of this elegant GFRP trainer, more than 120 of which had been delivered to military and commercial customers in 12 countries by mid-1994.

The basic **T67C3** version, with a carburetor version of Textron Lycoming's 160 hp engine and fixed-pitch propeller, is used for primary training of Canadian military and Dutch naval and airline pilots. The lowest-powered model of the military M versions is the **T67M Mk II,** with 160 hp fuel-injected Lycoming AEIO-320-D1B, two-blade constant-speed propeller, 42-gallon increased fuel capacity, and fuel and oil systems suitable for inverted flight. Seventeen have been delivered to RAF Topcliffe, North Yorkshire, where Hunting Aircraft Ltd operates a Joint Elementary Flying Training School for student pilots of the RAF and Royal Navy. The intermediate **T67M200,** serving the Royal Netherlands Air Force and government agencies in Hong Kong, Norway, and Turkey, has a 200 hp AEIO-360-A1E and three-blade propeller.

The top-of-the-range **T67M260,** designed specifically to meet the EFS requirement, first flew May 1991, and USAF will acquire up to 113 as the **T-3A,** all except the first few shipped as kits for assembly by Northrop Grumman at Hondo Airport, Tex. Half are for the 1st Flight Screening Squadron at Hondo, where student pilot training started in March 1994; the remainder will go to the USAF Academy, Colorado Springs, Colo., for training courses due to begin in January 1995. Extra features include electric elevator trim. *(Data for T67M260/T-3A.)*

**Contractor:** Slingsby Aviation Ltd, UK.

**Power Plant:** one Textron Lycoming AEIO-540-D4A5 piston engine; 260 hp.

**Dimensions:** span 34 ft 9 in, length 24 ft 10 in, height 7 ft 9 in.

***T-35A Pillán, Chilean Air Force (Denis Hughes)***


***T-3A Firefly, USAF***

***ACE prototype***

**Weights:** empty 1,780 lb, gross 2,525 lb (aerobatic and max).

**Performance:** max speed at S/L 175 mph, max cruising speed at 8,500 ft 173 mph, stalling speed (flaps down) 68 mph, ceiling approx 15,000 ft, T-O run 913 ft, landing run 1,226 ft, max range 469 miles, *g* limits +6/–3.

**Accommodation:** two seats, side by side.

**Armament:** none.

### TB 30 Epsilon

The prototype of this tandem-seat basic trainer flew for the first time December 22, 1979, followed by the first production Epsilon in June 1983. Delivery of 150 to the French Air Force began one year later. Direct entry pupils (as opposed to career officers) complete full *ab initio* and basic training on these aircraft with Groupement École 315 at Cognac/Chateaubernard, then progress directly to an operational type without needing intermediate transition training.

Esquadrão 104 of the Portuguese Air Force received 18 Epsilons, of which 17 were assembled locally by OGMA, and four armed examples were supplied to the Air Force of Togo. Performance of the armed version includes the ability to loiter for 30 min at low altitude over a combat area 195 miles from base.

**Contractor:** Socata (subsidiary of Aerospatiale), France.

**Power Plant:** one Textron Lycoming AEIO-540-L1B5D piston engine; 300 hp.

**Dimensions:** span 25 ft 11¾ in, length 24 ft 10¾ in, height 8 ft 8¾ in.

**Weights:** empty 2,055 lb, gross 2,789 lb.

**Performance:** max speed at S/L 236 mph, max cruising speed at 6,000 ft 222 mph, stalling speed (gear and flaps down) 73 mph, ceiling 23,000 ft, T-O run 1,345 ft, landing run 820 ft, range at 184 mph at 12,000 ft 783 miles, *g* limits +6.7/–3.35.

**Accommodation:** crew of two, in tandem. Rear seat raised.

**Armament** (optional: not on French or Portuguese Air Force aircraft): four underwing hardpoints for up to 661 lb of stores when flown as a single-seater. Typical loads can include two gun pods (each with two 7.62-mm machine guns), two 275-lb bombs or grenade launchers, four packs of 6 x 68-mm rockets, or four survival kit pods.

### Zlin 142 and 242

The Zlin 142 is the current production version of the Z 42/42 M/43 family of lightplanes that have been used over the past quarter-century for *ab initio* training and other duties. Construction is basically all-metal, with composites skin panels on the center-fuselage. Options include an auxiliary tank on each wingtip and equipment for night flying and IFR training. The prototype flew December 29, 1978, and 345 of all versions had been built by the beginning of 1994, including three Textron Lycoming–powered **Z 242 L**s for the Slovenian Air Force. The Czech Air Force's five military examples are designated **Z 142 CAF.** *(Data for Z 142 aerobatic category.)*

**Contractor:** Moravan Inc, Czech Republic.

**Power Plant:** one Avia M 337AK piston engine; 210 hp.

**Dimensions:** span 30 ft 0½ in, length 24 ft 0½ in, height 9 ft 0¼ in.

**Weights:** empty 1,609 lb, gross 2,138 lb (aerobatic), 2,403 lb (max).

**Performance:** max speed at 1,640 ft 143 mph, stalling speed (flaps down) 55 mph, ceiling 15,580 ft, T-O run 758 ft, landing run 624 ft, range 326 miles, *g* limits +6/–3.5.

**Accommodation:** two seats, side by side.

**Armament:** none.

# Turboprop Trainers

### ACE

Now that South Africa is back in the world export market, this turboprop trainer attracted considerable interest at the recent Farnborough Air Show in England. Its design was started in 1986 by the government research agency Aerotek (Aeronautical Systems Technology), to demonstrate the potential of composites. A prototype, built by Atlas Aviation, was flown April 29, 1991, and was given the name ACE (All-Composites Evaluator). Its airframe, of carbonfiber composites with honeycomb inserts, offers an unrivaled strength/weight ratio and a surface finish with a 30 percent lower drag coefficient than if it were made of metal. Both wing and fuselage are one-piece structures, with a 15,000-hour life.

**Contractor:** Atlas Aviation (Pty) Ltd, South Africa.

**Power Plant:** one Pratt & Whitney Canada PT6A-34A turboprop; 750 shp.

**Dimensions:** span 35 ft 5¼ in, length 35 ft 5¼ in, height 13 ft 5½ in.

**Weights:** empty 3,406 lb, gross 4,850 lb (aerobatic), 6,063 lb (max).

**Performance** (at 4,850 lb weight): max speed at 5,000 ft 311 mph, ceiling 33,000 ft, T-O to 50 ft 1,198 ft,

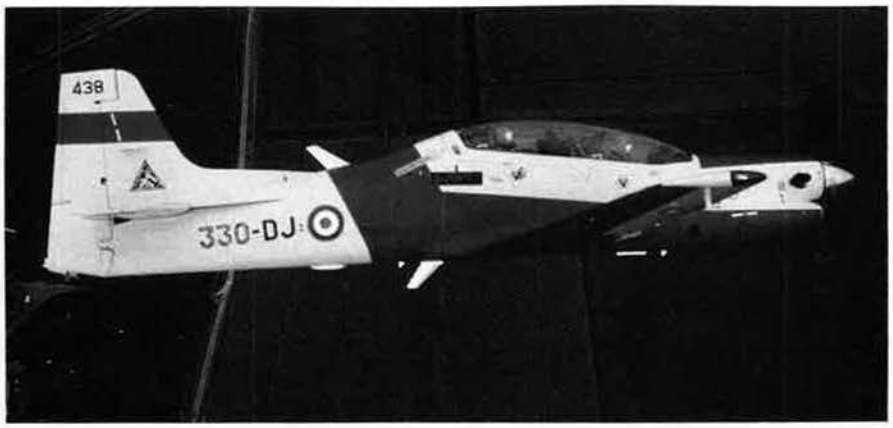
landing from 50 ft 1,231 ft, range 1,266 miles, *g* limits +7/–3.5.

**Accommodation:** crew of two on tandem zero/zero ejection seats; rear seat raised.

**Armament:** provision for 2,200 lb of stores on six underwing hardpoints.

### EMB-312/S312 Tucano and Super Tucano

The Embraer **EMB-312** Tucano prototype flew August 16, 1980, and deliveries to the Brazilian Air Force (designation **T-27**) began in September 1983. In the same month, Egypt ordered 120 for its own Air Force




***EMB-312F Tucano, French Air Force (Sirpa "Air")***

(40) and that of Iraq (80). Excluding British-built versions, orders totaled 435 by mid-1994, most of which have been delivered. Customers include the air forces of Argentina (30), Brazil (133), Colombia (14), Egypt (54), France (50), Honduras (12), Iran (25), Iraq (80), Paraguay (six), Peru (30), and Venezuela (31). The French **EMB-312F** version has a strengthened airframe and ventral airbrake like those of the S312, improved deicing and demisting, and French avionics.

The **S312** license-built by Shorts in the UK has a different engine, ventral airbrake, strengthened structure, new cockpit layout, and extensive British equipment. A total of 130 production **T. Mk 1**s for the Royal Air Force were delivered between June 1988 and January 1993. Principal units are the Central Flying School and Nos. 1, 3, and 6 Flying Training Schools. Strengthened flying controls, modified com/nav equipment, and structural improvements to extend fatigue life to 12,000 hours have been retrofitted. Twelve Shorts-built **T. Mk 51**s were delivered to the Kenyan Air Force in 1990–91, and 16 **T. Mk 52**s were built for No. 19 Squadron of the Kuwait Air Force.

On September 9, 1991, Embraer flew a proof-of-concept **EMB-312H Super Tucano** with a 1,600 shp PT6A-67R turboprop, stretched fuselage, modified wings and tail, pressurized cockpit with zero/zero seats, pressure refueling, and OBOGS (On-Board Oxygen Generating System). Able to cover the whole primary and half of the advanced training syllabus of a jet trainer, the Super Tucano is bidding in the USAF/USN JPATS competition, with Northrop Grumman as Embraer's US partner. Two production-standard aircraft, with a less powerful PT6A (see data), five-blade propeller, and "glass" cockpit, flew for the first time May 15 and October 14, 1993. A light attack **(ALX)** version of the Super Tucano is under development for a major Brazilian border surveillance program. *(Data for standard EMB-312, with Super Tucano in parentheses.)*

**Contractor:** Empresa Brasileira de Aeronáutica SA, Brazil.

**Power Plant:** one Pratt & Whitney Canada PT6A-25C (PT6A-68-5) turboprop; 750 shp (1,250 shp). Shorts S312 has a 1,100 shp Garrett TPE331-12B-701A.

**Dimensions:** span 36 ft 6½ in (both), length 32 ft 4¼ in (37 ft 5¾ in), height 11 ft 1¾ in (12 ft 9½ in).

**Weights:** empty 4,123 lb (5,335 lb), gross 5,622–7,000 lb (7,033 lb). S312 approx 750–800 lb heavier than EMB-312 empty, 850 lb heavier gross.

**Performance** (EMB-312 at 5,622 lb clean gross weight): max speed at 10,000 ft 278 mph, stalling speed (gear and flaps down) 77 mph EAS, ceiling 30,000 ft, T-O run 1,250 ft, landing run 1,214 ft, max range on internal fuel 1,145 miles, *g* limits +6/–3.

**Performance** (S312 at 6,393 lb clean gross weight): max speed at 10,000 ft 319 mph, at S/L 310 mph, stalling speed (gear and flaps down) 81 mph EAS, ceiling 34,000 ft, T-O run 1,190 ft, landing run 1,180 ft, range on max internal fuel 1,099 miles, *g* limits +6.5/–3.3.

**Performance** (Super Tucano at clean gross weight): max speed at 20,000 ft 350 mph, stalling speed (gear and flaps down) 87 mph EAS, ceiling 35,000 ft, T-O run 890 ft, landing run 1,414 ft, max range on internal fuel 943 miles, *g* limits +7/–3.5.

**Accommodation:** crew of two, on tandem zero height/81 mph (zero/zero) ejection seats. Rear seat raised.

**Armament** (both): four underwing hardpoints for up to 2,205 lb of stores, including (typically) two 0.30-in machine-gun pods, four 250-lb bombs, or four seven-

***L-90 TP RediGO, Finnish Air Force (Denis Hughes)***

***PC-7 Mk II, South African Air Force***

tube rocket launchers. Optional max stores load on S312 increased to 2,315 lb.

### Fantrainer 400, 600, and 800

The only customer to date for the Fantrainer which has a unique turboshaft/shrouded fan propulsion system, is Thailand, which in August 1982 ordered 47 in two versions: the **400** with a 420 shp 250-C20B and the higher-powered **600** (see data). First flight of a production Fantrainer (a 600) was made August 12, 1984. Two complete aircraft (one of each model), with GFRP wings and metal fuselages, were delivered from Germany, followed by 15 Fantrainer 600 kits without wings. The GFRP wings were bought under separate contract, and the aircraft were assembled on arrival by Royal Thai Air Force engineers. For the 30 Fantrainer 400s, the RTAF developed its own metal wings, the rest of each airframe being supplied in kit form by RFB. The 600s entered service as pilot trainers at Kampensaeng in January 1987; assembly of the 400s began in 1986 and was completed in 1991.

The Fantrainer **800** was announced in 1993 as a more powerful version of the 600, with its Allison 250-C30 uprated to 800 shp. The other major change for production would be a GFRP keel and forward fuselage, only the rear fuselage and tail remaining as metal structures, resulting in an empty-weight saving of 320 lb. At an aerobatic gross weight of 3,527 lb, max speed would increase to 298 mph at 15,000 ft, with no adverse effect on range or runway requirements. A prototype has been converted, but no order has yet been confirmed. *(Data for RTAF-built Fantrainer 600.)*

**Contractors:** Rhein-Flugzeugbau GmbH, Germany, and Royal Thai Air Force, Thailand.

**Power Plant:** one Allison 250-C30 turboshaft; 650 shp; driving five-blade wooden ducted fan.

**Dimensions:** span 31 ft 11½ in, length 31 ft 1¼ in, height 10 ft 4½ in.

**Weights:** empty 2,921 lb, gross 3,637–4,122 lb.

**Performance** (at 4,122 lb gross weight): max cruising speed at 3,000 ft 214 mph, stalling speed (flaps down) 95 mph, ceiling 25,000 ft, T-O and landing run 820 ft, range on internal fuel 645 miles, *g* limits (aerobatic) +6/–3.

**Accommodation:** crew of two, in tandem. Rear seat raised. Rocket-assisted escape system standard.

**Armament:** none, but provision for four underwing drop tanks.

### KTX-1 Yeo-Myoung

This tandem-seat turboprop primary trainer provides proof of the fast-growing capability of South Korea's youthful aerospace industry. Few details were available one year ago, although the first two prototypes had been under test since December 12, 1991, and the spring of 1992. They are powered by a 550 shp PT6A-25A and 950 shp PT6A-60 engine, respectively. Subsequent prototypes will have a Garrett TPE331 for comparative evaluation. Development is shared with Korean Air, with series production of 100 trainers required by the Republic of Korea Air Force scheduled to begin in 1998. They will have a more powerful engine, increased wing and fin areas, and provision for carrying guns and rockets for weapons training. The name Yeo-Myoung means "dawn." *(Data for second prototype.)*

**Contractor:** Daewoo Heavy Industries Company Ltd, South Korea.

**Power Plant:** one Pratt & Whitney Canada PT6A-60 turboprop; 950 shp.

**Dimensions:** span 33 ft 2½ in, length 33 ft 9½ in, height 12 ft 3¼ in.

**Weights:** empty 3,153 lb, gross 4,250 lb (aerobatic), 5,470 lb (max).

**Performance:** max speed at 10,000 ft 357 mph, ceiling 38,000 ft, T-O to 50 ft 1,300 ft, landing from 50 ft 1,680 ft, range 1,036 miles.

**Accommodation:** crew of two, in tandem. Rear seat raised.

**Armament:** provision for guns and rockets.

### L-90 TP RediGO

Two prototypes of the RediGO were flown, one with an Allison 250 engine (July 1, 1986) and the other with a 420 shp Turbomeca TP 319 turboprop (in December 1987). Production aircraft have the Allison engine and revised (unswept) vertical tail surfaces. Valmet optimized the design to cover primary and basic, aerobatic, night, instrument, navigation, formation, and tactical flying training. The Finnish Air Force, however, allocated its 11 RediGOs to replace Piper Arrows in the liaison and communications roles.

Initial exports of 18 RediGOs included four for the Mexican Naval Aviation School at Bajadas, Veracruz, and 10 for McDonnell Aircraft Co. In June 1993, production was increased to meet additional orders from current operators and new export customers. These may include the Finnish Air Force, which needs a replacement for its much-flown Vinkas.

**Contractor:** Valmet Aviation Industries Inc, Finland.

**Power Plant:** one Allison 250-B17F turboprop; 450 shp (flat rated).

**Dimensions:** span 34 ft 9¼ in, length 27 ft 11¾ in, height 10 ft 6 in.

**Weights:** empty 2,183 lb, gross 2,976–4,189 lb.

**Performance** (at 3,527 lb weight): max speed 258 mph CAS, max cruising speed at 10,000 ft 220 mph, stalling speed (flaps down) 65 mph, ceiling 20,800 ft, T-O run 700 ft, landing run 710 ft, max range 743 miles, *g* limits (aerobatic) +7/–3.5.

**Accommodation:** crew of two, side by side; space behind these for two more seats or 440 lb of baggage. Zero/zero rocket escape system optional.

**Armament:** none specified, but three hardpoints under each wing can (when aircraft is flown solo) carry up to 1,764 lb of photographic, TV, radar, or reconnaissance pods and two flares, or other stores.

### PC-7 Turbo-Trainer

The PC-7 is a fully aerobatic trainer suitable for primary, transition, and aerobatic training and, with

added equipment, for IFR and tactical training. More than 440 have been delivered, to nearly 20 countries, and further orders have been received in recent years. Most significant is a contract for 60 **PC-7 Mk IIs** to replace the South African Air Force's veteran T-6 Harvard primary trainers. To avoid conflict with UN sanctions then in force, Pilatus developed the Mk II version of the PC-7 with two (instead of six) underwing hardpoints, plumbed only for auxiliary fuel tanks. The airframe is based mainly on that of the aerodynamically cleaner PC-9, and a 700 shp PT6A-25C turboprop is fitted. Martin-Baker CH-11A ejection seats replace the usual fixed or optional CH-15A ejection seats. The Mk II prototype first flew September 28, 1992, and deliveries to the SAAF were due to begin in the third quarter of this year.

The original **PC-7** version first flew August 18, 1978. Customers have included the air forces of Abu Dhabi (24), Angola (18), Austria (16), Bolivia (36), Botswana (seven), Chile (Navy, 10), Guatemala (12), Iran (35), Iraq (52), Malaysia (44), Mexico (75), Myanmar (17), the Netherlands (10), Nigeria (seven), Suriname (one), and Switzerland (40). South Africa has inherited the three delivered earlier to Bophuthatswana.

**Contractor:** Pilatus Flugzeugwerke AG, Switzerland.
**Power Plant:** one Pratt & Whitney Canada PT6A-25A turboprop; 550 shp (flat rated).
**Dimensions:** span 34 ft 1 in, length 32 ft 1 in, height 10 ft 6 in.
**Weights:** empty 2,932 lb, gross 4,188–5,655 lb.
**Performance** (at 4,188 lb clean gross weight): max cruising speed at 20,000 ft 256 mph, stalling speed (gear and flaps down) 74 mph EAS, ceiling 33,000 ft, T-O run 787 ft, landing run 968 ft, max range 745 miles, *g* limits +6/–3.
**Accommodation:** two seats, in tandem; lightweight ejection seats optional. Space for 55 lb of baggage aft of seats.
**Armament:** Swiss law prohibits export of aircraft equipped for combat duties, but PC-7s operated by some air forces can be seen carrying a wide variety of stores on underwing weapon pylons installed under separate contract by armament manufacturers.

### PC-9

A more powerful turboprop, raised rear cockpit, ejection seats as standard, a ventral airbrake, modified wing airfoils and tips, new ailerons, a longer dorsal fin, larger wheels with high-pressure tires, and mainwheel doors are ample evidence of the differences between the **PC-9** and its PC-7 predecessor, despite their similar outward appearance. The first of two preseries PC-9s flew May 7, 1984, and customers have since included the air forces of Angola (four), Australia (67 PC-9/As), Iraq (20), Myanmar (six), Saudi Arabia (30), Switzerland (eight), and Thailand (20); the Cyprus National Guard has two. Total sales now exceed 180.

The RAAF **PC-9/A**s have Bendix/King EFIS cockpit displays, PC-7 low-pressure tires, and bulged mainwheel doors. Two were supplied in flyaway form, 17 as kits, and 48 were built in Australia. They equip the Central Flying School and "Roulettes" display team at East Sale, Victoria, and No. 2 FTS at Pearce, Western Australia; one is allocated to the RAAF Chief of Air Staff's office at Fairbairn, near Canberra. The German Air Force leases 10 **PC-9B**s from a private company to provide target-towing services.

For the USAF/USN JPATS competition, Pilatus teamed with Beech in offering the **PC-9 Mk II.** Beech built two "missionized" production prototypes with a 1,250 shp flat-rated PT6A-68 engine, modified tail unit, single-point fueling, new digital avionics, and a pressurized cockpit with birdstrike-proof canopy and Martin-Baker Mk 16 zero/zero ejection seats. These were first flown December 23, 1992, and July 29, 1993. *(Data for basic PC-9.)*

**Contractor:** Pilatus Flugzeugwerke AG, Switzerland.
**Power Plant:** one Pratt & Whitney Canada PT6A-62 turboprop; 950 shp (flat rated).
**Dimensions:** span 33 ft 2½ in, length 33 ft 4¾ in, height 10 ft 8¼ in.
**Weights:** empty 3,715 lb, gross 4,960–7,055 lb.
**Performance** (at 4,960 lb aerobatic gross weight): max speed at S/L 311 mph, at 20,000 ft 345 mph, stalling speed (gear and flaps down) 81 mph EAS, ceiling 38,000 ft, T-O run 745 ft, landing run 1,368 ft, max range 1,020 miles, *g* limits +7/–3.5.
**Accommodation:** crew of two, on tandem zero height/70 mph ejection seats. Rear seat raised. Space for 55 lb of baggage aft of seats.
**Armament:** see remarks under PC-7 entry.

### PZL-130 Turbo Orlik

The original prototype of the Turbo Orlik ("spotted eaglet"), with a PT6A-25A turboprop, flew July 13, 1986, but was subsequently lost. Two further prototypes, designated **PZL-130TM** and **PZL-130TP,** were completed with, respectively, a Czech 750 shp Motorlet M 601 E power plant and a 550 shp PT6A-25A. These made their first flights in January 1989 and early 1990. As a consequence of their testing, production Turbo Orliks have increased wingspan and incidence, two extra underwing hardpoints, stronger landing gear with nosewheel steering, double-slotted flaps, ejection seats under a modified canopy, and other airframe refinements. The **PZL-130TB,** first flown September 18, 1991, based on the TM, has an M 601 E (optionally fully aerobatic M 601 T) engine and is aimed at the Polish, east European, and other air forces accustomed to Russian/Soviet equipment. The **PZL-130TC,** with a more powerful (950 shp) PT6A-62, Bendix/King avionics, Martin-Baker seats, a Flight Vision HUD, and a Hamilton Standard environmental control system, first flew June 2, 1993. Two cheaper export versions are the **PZL-130TD** (as TC but with a 750 shp PT6A-25C) and the "economy" **PZL-130TE** with PT6A-25A, less comprehensive avionics, and no ejection seats.

Nine PZL-130TBs had been delivered to the Polish Air Force by February 1994. A further 15, delivered by mid-year, are reported to be TCs. Total requirement is believed to be 48. Hungary has ordered 12 TBs; next customer is expected to be the Czech Air Force. *(Data for PZL-130TB.)*

***PZL-130TB, Polish Air Force***

***SF.260TP***

***T-5, Japan Maritime Self-Defense Force***

**Contractor:** PZL Warszawa-Okecie, Poland.
**Power Plant:** one Motorlet M 601 E turboprop; 750 shp.
**Dimensions:** span 29 ft 6¼ in, length 29 ft 6¼ in, height 11 ft 7 in.
**Weights:** empty 3,527 lb, gross 4,409–5,952 lb.
**Performance** (at 4,409 lb aerobatic gross weight): max speed at 19,685 ft 311 mph, max speed at S/L 282 mph, ceiling 33,000 ft, T-O run 729 ft, landing run 604 ft, range on internal fuel 602 miles, *g* limits +6/–3.
**Accommodation:** crew of two, on tandem zero height/81–373 mph ejection seats. Rear seat raised.
**Armament:** six underwing hardpoints for up to 1,764 lb of 220-lb bombs, 7.62-mm twin-gun pods, launchers for 57-mm or 80-mm rockets, or infrared AAMs.

### SF.260TP

The SF.260TP is identical to the piston-engine SF.260 (which see) except for the power plant, automatic fuel feed system, and an inset rudder tab. It first flew July 1980. More than 60 have been sold to various air forces, several of which use them in a secondary light attack role. Customer nations include Burundi (four), Dubai (five), Ethiopia (12), Haiti (six), the Philippines (16), and Sri Lanka (14, several of which have been lost in combat). Some of Zimbabwe's 30 SF.260s may have been converted to SF.260TPs. *(Data as for SF.260, except as follows.)*

**Power Plant:** one Allison 250-B17D turboprop; 350 shp (flat rated).
**Dimensions:** length 24 ft 3¼ in.
**Weights:** empty 1,654 lb, gross 2,645–2,866 lb.
**Performance** (at 2,645 lb gross weight): max speed at 10,000 ft 265 mph, max cruising speed at 10,000 ft 248 mph, stalling speed (gear and flaps down) 70 mph, ceiling 24,600 ft, T-O run 978 ft, landing run 1,007 ft, max range 589 miles.

### T-5

This primary trainer is the latest of a series of training and utility aircraft developed by Fuji from the Beech T-34 Mentor. The prototype was produced by replacing the standard piston engine of a company-owned KM-2 primary trainer version with an Allison 250 turboprop. First flown June 28, 1984, as the KM-2D, this aircraft persuaded the Japan Maritime Self-Defense Force to replace its existing KM-2s with a KM-2Kai version of the KM-2D (JMSDF designation T-5), embodying additional changes to the cockpit structure and equipment. Deliveries began in August 1988. All of the required 32 T-5s had been funded by March of this year; 29 had been delivered.

**Contractor:** Fuji Heavy Industries Ltd, Japan.
**Power Plant:** one Allison 250-B17D turboprop; 350 shp (flat rated).
**Dimensions:** span 32 ft 11¼ in, length 27 ft 8¼ in, height 9 ft 8½ in.
**Weights:** empty 2,385 lb, gross 3,494–3,979 lb.
**Performance** (at 3,494 lb aerobatic gross weight except where indicated): max speed at 8,000 ft 222 mph, econ cruising speed at 8,000 ft 178 mph, stalling speed (gear and flaps down) 65 mph, ceiling 25,000 ft, T-O run 990 ft, landing run 570 ft, range (at 3,979 lb max gross weight) 587 miles.
**Accommodation:** crew of two side by side in aerobatic configuration. Second pair of seats behind these in utility version.
**Armament:** none.

### T-34C

The first YT-34C turboprop-powered prototype flew in September 1973. The US Navy subsequently received 353 production **T-34C**s, about 260 survivors of which will be replaced by the successful JPATS candidate. About 120 **T-34C-1** armament systems trainers, with FAC and light attack capability, continue in service with Argentina (Navy 10), Ecuador (20), Gabon (three), Indonesia (24), Morocco (12), Peru (Navy six), Taiwan (40+), and Uruguay (Navy two). About 75 of the original piston-engine T-34A/Bs remain in service with eight air forces in Central and South America and the Philippines. *(Data for T-34C, except where indicated.)*

**Contractor:** Beech Aircraft Corporation, USA.
**Power Plant:** one Pratt & Whitney Canada PT6A-25 turboprop; 400 shp (550 shp version optional).
**Dimensions:** span 33 ft 4 in, length 28 ft 8½ in, height 9 ft 7 in.
**Weights:** empty 2,960 lb, gross 4,300 lb.
**Performance:** max cruising speed at 17,000 ft 246 mph, stalling speed (gear and flaps down) 61 mph, ceiling 30,000 ft, T-O run 1,155 ft, landing run 740 ft, max range 814 miles, *g* limits +6/–3.
**Accommodation:** crew of two, in tandem.
**Armament** (T-34C-1): four underwing hardpoints for total of 1,200 lb of stores, including practice bomb/flare containers, LAU-32 or LAU-59 rocket launchers, Mk 81 bombs, SUU-11 Minigun pods, BLU-10/B incendiary bombs, AGM-22A wire-guided antitank missiles, and target-towing equipment.

### T-35DT Turbo Pillán

Soloy Corp. of Olympia, Wash., built a turboprop version of the piston-engine Pillán, known as the T-35TX Aucán, by installing a 420 shp Allison 250-B17D turboprop. It flew for the first time in February 1986, but trials were suspended in 1987 after about 500 flight hours. The T-35DT, which has the same engine, was converted, also by Soloy, under a 1990 contract to develop a production-ready conversion kit to be offered to existing Pillán operators. It first flew in March 1991; evaluation by the Chilean Air Force is continuing. *(Data as for T-35A except as follows.)*

**Power Plant:** one Allison 250-B17D turboprop; 420 shp.
**Dimensions:** length 28 ft 2½ in.
**Weight:** empty 2,080 lb.
**Performance:** max speed at S/L 264 mph, max cruising speed at 7,600 ft 209 mph, stalling speed (gear and flaps down) 71 mph, ceiling 25,000 ft, T-O run 640 ft, landing run 420 ft, max range 472 miles. ■

**The Barksdale loggies make a habit of doing a little more with a little less.**

# The Gerrity Award Team

**By Heather C. Martin,** Editorial Associate

Photo by Paul Kennedy

***The 2d Logistics Group's innovations won its commander, Col. William C. Buckley (center), AFA's 1994 Thomas P. Gerrity Award. AFA Chairman of the Board James M. McCoy (left) and Brig. Gen. Kenneth G. Miller presented Colonel Buckley with the award at AFA's annual Convention.***

"Do more with less" is routinely heard these days in the Air Force. Nobody likes to hear it, but it does not frighten the 2d Logistics Group, 2d Bomb Wing, Barksdale AFB, La.

For example, when Carswell AFB, Tex., became an Air Reserve Base in the fall of 1993, the 7th Bomb Wing's AGM-86 air-launched cruise missile racks needed to be transferred to Barksdale. This presented the 2d Logistics Group with a major equipment-handling challenge.

"It was going to cost several million dollars to hire a contractor to disassemble the racks at Carswell, lower them, transport these things to Barksdale, and reinstall them," reports Col. William C. Buckley, 2d Logistics Group commander. "We're talking about a rack that's about seventy feet long and weighs a whole bunch of pounds. We didn't have the money to do it."

His munitions people and civil engineers convinced Air Combat Command to let them tackle the project themselves. They went to Carswell, disassembled the racks, brought them back, reinstalled them, and made them operational. "We passed the Nuclear Surety Inspection the first time," Colonel Buckley said. "It was a self-help project, you might say, and we saved about $650,000 in shipping costs. The guys did it."

With a long string of accomplishments such as this, the 2d Logistics Group showed it could excel with limited means and won for Colonel Buckley the Air Force Association's 1994 Thomas P. Gerrity Award for Logistics Management, named for the former deputy chief of staff for Systems and Logistics.

"The Air Force is shrinking," Colonel Buckley said. "We *have* to perfect the art of being more productive with less."

## Blown Away

The Gerrity Award is not the only trophy in the 2d Logistics Group's case, however. Under Colonel Buckley's command in 1993, the group as a whole and several of its divisions won numerous awards, each of which motivated the group to strive for another, he said. "Success begets success."

Among the 2d Logistics Group's most notable accomplishments, which AFA in its award citation attributes to Colonel Buckley's "logistical prowess, astute management, productivity initiatives, and foresight":

- Earning the group's first-ever Air Force Outstanding Unit Award.
- Winning the 2d Bomb Wing's first "excellent" rating on a Nuclear Surety Inspection in twenty-two years of evaluations.
- Coming in runner-up for the American Petroleum Institute Award.
- Fuels flight winning top honors in 8th Air Force, best in Air Combat Command, and coming in runner-up USAF-wide, "which blew everybody away," Colonel Buckley said.
- Winning "Best Supply Squadron" in 8th Air Force, becoming a finalist for ACC's "Best Award for Transportation," and winning "Best Maintenance Complex" in 8th Air Force.
- Deploying to Roswell, N. M., in Mighty Force, the largest land deployment in the wing's history, moving twenty-three trucks with 110 tons of cargo.
- Saving the Air Force millions of dollars in personnel, equipment, contract, and transportation costs.

Colonel Buckley said he was honored to be singled out for the Gerrity Award, though he credits the entire group. As commander of 1,600 people whose specialties range from contract to supply to heavy aircraft to munitions, he said, "There's no way that I can have expertise in [all] those areas. I get the right people in the right job and then let them do their job. [I] stay the heck out of the way."

## Old BUFFs and Other Challenges

Colonel Buckley said he watched the group continually turn problems into solutions, always coming out on top. Outdated and worn-out equipment presented constant obstacles.

The newest B-52 bomber, Barksdale's primary aircraft, was built in 1961. "The sheet metal problems on the B-52 are getting worse and worse. . . . We were finding cracks, stress problems," Colonel Buckley said. "When an airplane lands and the tiptank is breaking off because of age, you have management challenges."

He said that maintainers were having to spend fifty percent more time on each bomber today than was the case a few years ago.

Because of cutbacks in funding, depots could not always produce parts quickly enough to repair the B-52G and H models as other BUFF models were retired, he continued. In response to this dilemma, the 2d Logistics Group took advantage of Gold Flag, an ACC program that allows operations and maintenance to scavenge for recyclable parts of systems that have been "condemned" as unusable, Colonel Buckley explained. The 2d Logistics Group's personnel saved more than $162,000 with this program.

Less-than-optimal facilities only compounded problems with equipment management and upkeep, he said. Until the completion of a $5.4 million vehicle-maintenance building this past September, crews maintained two-thirds of the wing's 1,100 vehicles in an inefficient, fifty-year-old building. The other third of the work was being done outdoors.

"Louisiana is not that cold in the winter," Colonel Buckley said. "It doesn't snow that much, but it rains a lot, and when you're trying to fix vehicles and equipment . . . and you have to lie in the mud to do that, that's tough."

While Colonel Buckley's vehicle-maintenance team had the increasingly rare good fortune to move into a newer and better shelter, weapon-storage space remained tight, and there was no money to build more space.

As the B-52s were drawing down, the logistics people had to figure out how to store large numbers of conventional and nuclear weapons safely and legally in limited space, while maintaining accessibility, Colonel Buckley explained.

"We gave the guys out in storage and handling the challenge," he said.

They came up with a method called "dense pack." It reduced the allowable space among weapons and support equipment and increased the amount of storable munitions in a particular site by twenty-five percent. Dense pack, said Colonel Buckley, "set the standard for being able to . . . increase handling and storage without impacting [the] ability to generate aircraft [or] the ability to prepare to go to war."

ACC's Aviation Petroleum, Oils, and Lubricants Test Program gave Colonel Buckley yet another chance to see his squadrons excel through their own initiative. The program, which seeks to cut fuel costs by giving wings a limited fund, calculates how much it should cost a wing to complete its flying hours. ACC figuratively provides a pot of money. The wing gets to keep fifty percent of whatever amount is not needed to carry out the prescribed tasks.

Colonel Buckley's group saved $2.2 million on fuels, netting a $1.1 million reward for Barksdale. The fuels crew achieved this with improved accounting methods. Operations figured out how to conserve fuel during missions. Once again, Colonel Buckley said, he gave his squadrons a challenge and the authority to make decisions, and they came through.

What did the logistics group do with its share of the savings? About $180,000 built a new fuels offloading support facility and equipped it with the most important technology lacking in the old building—indoor plumbing.

In the midst of all the internal innovation and adaptation, Colonel Buckley's crews supported Barksdale's humanitarian airlift deployments and refueling efforts.

"We were sending KC-10s constantly off to the desert, over to Rwanda," he said. "It was not uncommon for Col. [Bob] Glass [of Barksdale's 458th Operations Group] to call us up at noon on Friday and say, 'We just got tasked to send three KC-10s to Africa tomorrow night.' . . . We'd have to start with the load planning and set up the whole mobility line and everything else."

Overall, said Colonel Buckley, the key to maintaining readiness and executing deployments despite dwindling funds and increasing expectations comes down to putting the troops in a position to solve the problems.

"If you take care of the people, the people take care of the mission," he said. ■

# Open Cockpit

Photo courtesy C. V. Glines

*Count Ferdinand von Zeppelin's flight over Lake Constance in Germany in 1900 marked the true beginning of the airship era. The* Hindenburg *explosion in May 1937 signaled the end. In between, dirigibles saw service as transports and military weapons. The US Army bought its first dirigible, powered by a thirty-horsepower Curtiss engine, from Thomas S. Baldwin in August 1908. Lt. Frank P. Lahm (shown here in the rear seat of US Signal Corps Dirigible Balloon No. 1), Lt. Thomas E. Selfridge, and Lt. Benjamin D. Foulois were the first three pilots checked out on the eighty-foot-long airship.*

# Books

**Compiled by Frances McKenney,** Editorial Associate

**Bowman, Stephen.** *When the Eagle Screams: America's Vulnerability to Terrorism.* Carol Publishing Group, 120 Enterprise Ave., Seacaucus, NJ 07094. 1994. Including bibliography and index, 248 pages. $21.95.

**Brownstone, David, and Franck, Irene.** *Timelines of War: A Chronology of Warfare From 100,000 B. C. to the Present.* Little, Brown, and Co., 34 Beacon St., Boston, MA 02108. 1994. Including index, 562 pages. $29.95.

**Center of Military History, US Army.** *The War Against Germany: Europe and Adjacent Areas.* Brassey's Inc., 8000 Westpark Dr., First Fl., McLean, VA 22102. 1994. Including photos and index, 448 pages. $30.00.

**Christgau, John.** Sierra Sue II: *The Story of a P-51 Mustang.* Great Planes Press, 3182 Campus Dr., Suite 376, San Mateo, CA 94403. 1993. Including photos, 188 pages. $13.95.

**Conboy, Kenneth.** *War in Laos: 1954–1975.* Squadron/Signal Publications, Inc., 1115 Crowley Dr., Carrollton, TX 75011-5010. 1994. Including photos, 64 pages. $9.95.

**Davis, Paul K.,** ed. *New Challenges for Defense Planning: Rethinking How Much is Enough.* RAND, 1700 Main St., P. O. Box 2138, Santa Monica, CA 90407-2138. 1994. Including tables, figures, bibliography, and index, 769 pages. $35.00.

**Davis, Walter T.** *Shattered Dream: America's Search for Its Soul.* Trinity Press International, P. O. Box 851, Valley Forge, PA 19482-0851. 1994. Including notes and index, 193 pages. $16.00.

**Dawson, Joseph G. III,** ed. *Commanders in Chief: Presidential Leadership in Modern Wars.* University Press of Kansas, 2501 W. 15th St., Lawrence, KS 66049-3904. 1993. Including photos, notes, and index, 226 pages. $12.95.

**Finkelstein, Robert, and Shaker, Steven.** *Unmanned Vehicle Systems: Military and Civil Robots for the 21st Century and Beyond.* Pasha Publications, Inc., 1616 N. Fort Meyer Dr., Suite 1000, Arlington, VA 22209-3107. 1994. Including photos, illustrations, and references, 161 pages. $247.00.

**Frazer, Graham, and Lancelle, George.** *Absolute Zhirinovsky.* Penguin Books USA Inc., 375 Hudson St., New York, NY 10014. 1994. 157 pages. $7.95.

**Freedman, Lawrence.** *War.* Oxford University Press, 200 Madison Ave., New York, NY 10016. 1994. Including biographical notes and index, 385 pages. $13.95.

**Hamilton, Nigel.** *Monty: The Battles of Field Marshal Bernard Montgomery.* Random House, Inc., 201 E. 50th St., New York, NY 10022. 1994. Including photos and index, 653 pages. $30.00.

**Hayes, David.** *The Lost Squadron.* Hyperion, 114 5th Ave., New York, NY 10011. 1994. Including photos, selected bibliography, and index, 224 pages. $40.00.

**Jessup, John E., and Ketz, Louise B.,** eds. *Encyclopedia of the American Military: Studies of the History, Traditions, Policies, Institutions, and Roles of the Armed Forces in War and Peace.* Macmillan Publishing Co., 866 Third Ave., New York, NY 10022. 1994. Including maps, charts, tables, bibliographies, and index, 2,255 pages. $300.00.

**Launius, Roger D.,** ed. *History of Rocketry and Astronautics, Volume 11: Proceedings of the Fifteenth and Sixteenth History Symposia of the International Academy of Astronautics.* American Astronautical Society, AAS Publications Office, P. O. Box 28130, San Diego, CA 92198. 1994. Including photos, diagrams, bibliography, and index, 224 pages. $40.00.

**Levine, Alan J.** *The Missile and Space Race.* Greenwood Publishing Group, Inc., 88 Post Road W., P. O. Box 5007, Westport, CT 06881-5007. 1994. Including notes, selected bibliography, and index, 247 pages. $55.00

**Livingston, Harold.** *No Trophy, No Sword: An American Volunteer in the Israeli Air Force During the 1948 War of Independence.* Quintessence Publishing Co., Inc., 551 N. Kimberly Dr., Carol Stream, IL 60188. 1994. 262 pages. $21.95.

**Magyar, Karl P.,** ed. *Challenge and Response: Anticipating US Military Security Concerns.* Government Printing Office, Superintendent of Documents, P. O. Box 317954, Pittsburgh, PA 15250-7954. 1994. Including notes, 431 pages. $21.00.

**Middlebrook, Martin.** *Arnhem 1944: The Airborne Battle.* Westview Press, 5500 Central Ave., Boulder, CO 80301-2847. 1994. Including photos, appendices, and index, 501 pages. $34.95.

**Morelock, Col. J. D., USA.** *The Army Times Book of Great Land Battles: From the Civil War to the Gulf War.* The Berkley Publishing Group, 200 Madison Ave., New York, NY 10016. 1994. Including maps and photos, 331 pages. $29.95.

**Norris, Robert S., Burrows, Andrew S., and Fieldhouse, Richard W.** *Nuclear Weapons Databook, Volume V: British, French, and Chinese Nuclear Weapons.* Westview Press, 5500 Central Ave., Boulder, CO 80301-2847. 1994. Including tables, photos, maps, appendices, and index, 437 pages. $34.95.

**Osmont, Marie-Louise.** *The Normandy Diary of Marie-Louise Osmont: 1940–1944.* Random House, Inc., 201 E. 50th St., New York, NY 10022. 1994. Including glossary and footnotes, 118 pages. $17.00.

**Palmer, Lt. Gen. Dave R., USA (Ret.).** *1794: America, Its Army, and the Birth of the Nation.* Presidio Press, 505 B San Marin Dr., Suite 300, Novato, CA 94945-1340. 1994. Including suggested reading, 290 pages. $24.95.

**Reithmaier, Larry.** *Mach 1 and Beyond: The Illustrated Guide to High-Speed Flight.* TAB Books, Blue Ridge Summit, PA 17294-0850. 1994. Including diagrams, photos, glossary, bibliography, and index, 273 pages. $19.95.

**Rich, Ben R. and Janos, Leo.** *Skunk Works: A Personal Memoir of My Years at Lockheed.* Little, Brown, and Co., 34 Beacon St., Boston, MA 02108. 1994. Including photos and index, 370 pages. $24.95.

**Rowley, Elton H.** *Time Before Space: An Airman's Odyssey . . . From Biplanes to Rockets.* Sunflower University Press, 1531 Yuma (Box 1009), Manhattan, KS 66502-4228. 1994. Including photos and index, 238 pages. $25.95.

**Sasser, Charles W.** *Always a Warrior: The Memoir of a Six-War Soldier.* Simon & Schuster, Inc. 1230 Avenue of the Americas, New York, NY 10020. 1994. 306 pages. $5.50.

**Sefton, George William.** *It Was My War: I'll Remember It the Way I Want To!* Sunflower University Press, 1531 Yuma (Box 1009), Manhattan, KS 66502-4228. 1994. Including photos, maps, and index, 224 pages. $17.95.

**Segal, David R., and Segal, Mady Wechsler.** *Peacekeepers and Their Wives: American Participation in the Multinational Force and Observers.* Greenwood Publishing Group, Inc., 88 Post Road W., P. O. Box 5007, Westport, CT 06881-5007. 1993. Including references and index, 181 pages. $49.95.

**Sturgill, Claude C.** *Low-Intensity Conflict in American History.* Greenwood Publishing Group, Inc., 88 Post Road W., P. O. Box 5007, Westport, CT 06881-5007. 1993. Including tables, suggested reading list, bibliography, and index, 147 pages. $49.95.

**Tsouras, Peter G.** *Changing Orders: The Evolution of the World's Armies, 1945 to the Present.* Facts on File, Inc. 460 Park Ave. S., New York, NY 10016. 1994. Including tables, charts, notes, maps, photos, selected bibliography, and index, 352 pages. $40.00.

**Winnefeld, James A., Niblack, Preston, and Johnson, Dana J.** *A League of Airmen: US Air Power in the Gulf War.* RAND, 1700 Main St., P. O. Box 2138, Santa Monica, CA 90407-2138. 1994. Including figures, tables, photos, bibliography, and index, 335 pages. $15.00. ■

Air Force Association - Working for its National Membership.

National Report

# AFA's Year in Review on Capitol Hill

*AFA-Supported Legislation Enacted into Law During the 2nd Session of the 103rd Congress*

**Military Pay Raise** — The FY 95 Defense Authorization Act authorizes a 2.6 percent pay raise for military personnel effective 1 January 1995.

**Military Retirees Cost-of-Living Adjustment (COLA)** — Equity in the start date of military and federal civilian retirees' FY 95 COLA (2.8 percent).

**CONUS COLA** — In the FY 95 Defense Authorization Act, Congress authorized payment of a CONUS COLA to take effect on 1 July 1995, subject to receipt of a report on DoD implementation from the Secretary of Defense.

**Military Technician End Strength** — Public Law 103-337 effectively blocked a DoD initiative to reduce the military technician force in the Guard and Reserve.

**Persian Gulf Syndrome** — The Veterans' Benefits Improvements Act of 1994 authorizes the Department of Veterans Affairs to make disability payments to victims of Persian Gulf syndrome.

**Veterans' Reemployment Rights** — Requires employers to rehire any veteran with an honorable discharge who returns from military service within five years of the last date of employment without loss of seniority, status, or pay.

**VA Home Loan Guaranty** — Increases the maximum loan guaranty from $46,000 to $50,750.

**Senior ROTC Subsistence Allowance Increase** — Public Law 103-335 increases the subsistence allowance paid to members of the Senior Reserve Officers Training Program from $100 to $150 per month, effective 1 September 1995.

**Housing Allowances** — As outlined in the Defense Authorization Act, these allowances will increase commensurate with the basic pay raise.

**Veterans Affairs Budget Appropriations** — Restored a $41 million budget reduction by the Administration for VA medical research. Also includes funding to reduce the backlog of veterans' benefits claims.

**Medal of Honor Pension Increase (S.616)** — Increased from $200 to $400 the monthly pension for Medal of Honor recipients.

**Dental Care for Overseas Dependents** — Program to be enacted by 1 April 1995.

**Call-Up Authority Extended** — Public Law 103-337 modified the President's authority to call Reservists to active duty, extending it from 90 to 270 days.

**C-17 Globemaster III** — Full funding for six production aircraft for FY 95.

**B-2 Industrial Base** — $125 million approved to sustain B-2 industrial base for an additional year.

**F-22 Fighter** — $2.5 billion for engineering and manufacturing development of the Air Force's next-generation air-superiority fighter.

**Bomber Upgrades** — Funding for precision guided munitions upgrades.

## AFA Sends American Flags to Airmen in Haiti

After realizing time was too short to obtain American flags through regular channels, the Air Force mission commander in Haiti, Maj. Gen. James F. Record, contacted the Air Force Office of Legislative Liaison, which, in turn, asked AFA if it could arrange for delivery of 100 flags to Haiti within 24 hours.

AFA took up the challenge, receiving assistance from the office of Congressman Richard Pombo (R-CA), who arranged for AFA to purchase the flags from congressional supplies.

Federal Express also came through for our airmen. After learning of the request, FEDEX shipped the flags at no charge to Pope Air Force Base, where a transport was waiting to fly them to Haiti.

AFA's letter accompanying the flags said, in part, "With these flags go our thoughts and prayers for a successful mission and the safe return of every service member."

# AFA/AEF Report

**By Frances McKenney,** Editorial Associate

### World War II Remembered

Last summer, the **Quad Cities (Ill.) Chapter** helped create a successful museum exhibit commemorating the fiftieth anniversary of D-Day. Chapter members suggested the exhibit to the Putnam Museum in Davenport, Iowa, then combed their attics and basements for World War II memorabilia. Uniforms, photographs, letters, diaries, even a gun camera once mounted in a fighter, lent authenticity and poignancy to the six-week-long exhibit, which the museum called "American Airpower During World War II: The Flyers' Story."

Former Illinois State AFA President Richard Asbury, an ex–fighter pilot, and chapter member Jim Stopulos, a former B-17 pilot, spoke at the exhibit's opening ceremony, sharing D-Day memories.

Local newspapers credited the Quad Cities Chapter and AFA for creating this exhibit, and the museum gave both organizations prominent credit on its publicity fliers.

Inspired by this success, the chapter hopes to mount a V-E Day exhibit at the museum next year.

### Recognition for VA Staff

The **First Connecticut, Charles A. Lindbergh (Conn.), and Igor Sikorsky (Conn.) Chapters** and **Connecticut State AFA** pooled resources to sponsor Employee Recognition Day at the West Haven Veterans Administration Medical Center in West Haven, Conn., in September.

Miss Connecticut 1994, Mary Grace Santagata, and Mrs. Connecticut 1994, Lorraine Hudson Mauro, sang during the reception, and more than 650 doctors, nurses, and hospital staff enjoyed ice cream and a cake decorated with the AFA logo. Connecticut State AFA representatives thanked the medical center with an AFA sculpture.

The center's acting director, Gerard P. Husson, said it was the first Employee Recognition Day that he knew of to be sponsored by an organization representing the hospital's clients. "The day was all the more meaningful for it," he said.

***In June, Secretary of the Air Force Sheila E. Widnall and Air Force Chief of Staff Gen. Merrill A. McPeak presented the Mackay Trophy for 1993 to Capt. Jeff Swegel (second from left), Maj. Pete Mapes of AFA's Central Maryland Chapter, Capt. Bill Patnaude, Capt. Glen Caneel of the Ark-La-Tex Chapter, and Capt. Joe Rosmarin. The B-52H crew from the 668th Bomb Squadron, Griffiss AFB, N. Y., demonstrated superior airmanship on a training mission over Maine.***

### AFA's National Committees

The makeup of AFA's National Committees for 1994–95 has been determined. The following association members have been named to serve on the committees. (*Ex officio* members of all committees are nonvoting.)

**Executive Committee:** R. E. Smith (Chairman), William D. Croom, Jr., Michael J. Dugan, William A. Lafferty, Doyle E. Larson, James M. McCoy, Craig R. McKinley, Mary Anne Thompson, William N. Webb, Thomas J. McKee, *ex officio*, Walter E. Scott, *ex officio*, and Monroe W. Hatch, Jr., *ex officio.*

**Finance Committee:** William N. Webb (Chairman), Charles H. Church, Jr. (Vice Chairman), John R. Alison, William D. Croom, Jr., R. L. Devoucoux, Tommy G. Harrison, Jack G. Powell, Nuel E. Sanders, and R. E. Smith, *ex officio.*

**Membership Committee:** Craig R. McKinley (Chairman), Robert J. Cantu, James G. Clark, John E. Kittelson, Stephen M. Mallon, William W. Michael, Charles A. Nelson, John J. Politi, and R. E. Smith, *ex officio.*

**Constitution Committee:** William C. Rapp (Chairman), Gilbert E. Petrina, Jr., Mary Ann Seibel, Leonard R. Vernamonti, and R. E. Smith, *ex officio.*

**Resolutions Committee:** Mary Anne Thompson (Chairman), William D. Croom, Jr., Michael J. Dugan, William A. Lafferty, Doyle E. Larson, James M. McCoy, Craig R. McKinley, R. E. Smith, William N. Webb, Thomas J. McKee, *ex officio,* Walter E. Scott, *ex officio,* and Monroe W. Hatch, Jr., *ex officio.*

**Long-Range Planning Committee:** Martin H. Harris (Chairman), Charles G. Durazo (Vice Chairman), Harold F. Henneke, Doyle E. Larson, William V. McBride, Cheryl L. Waller, Paul A. Willard II, and R. E. Smith, *ex officio.*

**Science and Technology Committee:** Robert T. Marsh (Chairman), Thomas E. Cooper, Charles A. Gabriel, Thomas McMullen, William Schneider, Jr., Wayne A. Schroeder, Henry C. Smyth, Jr., Charles F. Stebbins, James

# AFA State Contacts

Following each state name are the names of the communities in which AFA chapters are located. Information regarding these chapters or any of AFA's activities within the state may be obtained from the appropriate contact.

**ALABAMA** (Birmingham, Gadsden, Huntsville, Mobile, Montgomery): **William B. Divin,** 6404 Pinehurst Run, Mobile, AL 36608 (phone 205-342-7092).

**ALASKA** (Anchorage, Fairbanks): **Herman Thompson,** 13031 Summer Cir., Anchorage, AK 99516-2630 (phone 907-345-2352).

**ARIZONA** (Green Valley, Phoenix, Prescott, Sedona, Sierra Vista, Sun City, Tucson): **Sally R. Reid,** 1148 W. Camino Urbano, Green Valley, AZ 85614 (phone 602-625-0974).

**ARKANSAS** (Blytheville, Fayetteville, Fort Smith, Hot Springs, Little Rock): **Marleen Eddlemon,** 2309 Linda Lane, Jacksonville, AR 72076 (phone 501-378-3582).

**CALIFORNIA** (Apple Valley, Bakersfield, Camarillo, Edwards, Fairfield, Fresno, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, Sunnyvale, Vandenberg AFB, Yuba City): **Francis Chapman,** 529 Archer St., Monterey, CA 93940 (phone 408-649-1966).

**COLORADO** (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Pueblo): **Don Dandurand,** 4450 E. Fountain Blvd., Suite 204, Colorado Springs, CO 80916 (phone 719-591-1011).

**CONNECTICUT** (Brookfield, East Hartford, Middletown, Storrs, Stratford, Torrington, Waterbury, Westport, Windsor Locks): **Donald R. Graves,** 208A Main St., Manchester, CT 06040-3534 (phone 203-548-3221).

**DELAWARE** (Dover, New Castle County, Rehoboth Beach): **Jack G. Anderson,** 28 Winged Foot Rd., Dover, DE 19901 (phone 302-335-3911).

**DISTRICT OF COLUMBIA** (Washington): **Rosemary Pacenta,** 1501 Lee Highway, Arlington, VA 22209-1198 (phone 703-247-5820).

**FLORIDA** (Avon Park, Broward County, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Hurlburt Field, Jacksonville, Leesburg, Miami, New Port Richey, Ocala, Orlando, Palm Harbor, Panama City, Patrick AFB, Port Charlotte, Saint Augustine, Sarasota, Spring Hill, Tallahassee, Tampa, Titusville, Vero Beach, West Palm Beach, Winter Haven): **William L. Sparks,** 175 Yorktown Dr., Unit 4, Daytona Beach, FL 32119-1459 (phone 904-226-6205).

**GEORGIA** (Athens, Atlanta, Columbus, Dobbins AFB, Rome, Saint Simons Island, Savannah, Valdosta, Warner Robins): **Jack Steed,** 309 Lake Front Dr., Warner Robins, GA 31088 (phone 912-922-4111).

**GUAM** (Agana): **William Dippel,** P. O. Box 12861, Tamuning, GU 96931 (phone 671-646-4445).

**HAWAII** (Honolulu, Maui): **Jeffrey H. Okazaki,** 2029 Lee Pl., Honolulu, HI 96817-2442 (phone 808-438-1132).

**IDAHO** (Boise, Mountain Home, Twin Falls): **Ralph D. Townsend,** P. O. Box 45, Boise, ID 83707-0045 (phone 208-389-5226).

**ILLINOIS** (Addison, Belleville, Champaign, Chicago, Moline, Peoria, Rockford, Springfield-Decatur): **Anton D. Brees,** P. O. Box 351, Palatine, IL 60078-0351 (phone 708-259-9600, ext. 5104).

**INDIANA** (Bloomington, Evansville, Fort Wayne, Grissom AFB, Indianapolis, Lafayette, Marion, Mentone, New Albany, South Bend, Terre Haute): **Don McKellar,** 2324 Pinehurst Lane, Kokomo, IN 46902 (phone 317-455-0933).

**IOWA** (Des Moines, Marion, Sioux City, Waterloo): **Gerald D. Loos,** 7708 Winston Ave., Urbandale, IA 50322-2571 (phone 515-224-9666).

**KANSAS** (Garden City, Topeka, Wichita): **E. D. Brown,** 4209 Westport St., Wichita, KS 67212-1748 (phone 316-942-8045).

**KENTUCKY** (Lexington, Louisville, Paducah): **Vaiden Q. Cox,** 800 S. 4th St., Apt. 2106, Louisville, KY 40203 (phone 502-583-8591).

**LOUISIANA** (Alexandria, Baton Rouge, New Orleans, Shreveport): **Ivan L. McKinney,** 331 Greenacres Blvd., Bossier City, LA 71111 (phone 318-861-8600).

**MAINE** (Bangor, Loring AFB, North Berwick): **Philip B. Turner,** P. O. Box 202, Caribou, ME 04736 (phone 207-496-6461).

**MARYLAND** (Andrews AFB, Baltimore, College Park, Rockville): **Robert B. Roit,** P. O. Box 263, Poolesville, MD 20837-0263 (phone 301-349-2262).

**MASSACHUSETTS** (Bedford, Boston, East Longmeadow, Falmouth, Hanscom AFB, Taunton, Westfield, Worcester): **Winston S. Gaskins,** 126 Valley Rd., Springfield MA 01119-2832 (phone 413-783-7860).

**MICHIGAN** (Alpena, Battle Creek, Detroit, East Lansing, Kalamazoo, Marquette, Mount Clemens, Oscoda, Traverse City, Southfield): **James W. Rau,** 466 Marywood Dr., Alpena, MI 49707 (phone 517-354-2175).

**MINNESOTA** (Duluth, Minneapolis–Saint Paul): **John C. Seely,** 11172 S. Brancel Rd., Solon Springs, WI 54873-9403 (phone 715-378-2525).

**MISSISSIPPI** (Biloxi, Columbus, Jackson): **Leonard R. Vernamonti,** 700 N. State St., Suite 500, Jackson, MS 39202 (phone 601-960-3600).

**MISSOURI** (Richards-Gebaur AFB, Saint Louis, Springfield, Whiteman AFB): **John J. Politi,** 2308 Jason Ct., Jefferson City, MO 65109-5825 (phone 314-634-2246).

**MONTANA** (Bozeman, Great Falls): **Sandra L. Henninger,** 4444-B Gummwood St., Great Falls, MT 59405-6623 (phone 406-453-8440).

**NEBRASKA** (Lincoln, Omaha): **C. Howard Vest,** 301 S. 70th St., Suite 140, Lincoln, NE 68510-2452 (phone 402-489-9255).

**NEVADA** (Las Vegas, Reno): **P. K. Robinson,** 3440 Moberly Ave., Las Vegas, NV 89118 (phone 702-385-8150).

**NEW HAMPSHIRE** (Manchester, Pease AFB): **Baldwin M. Domingo,** 5 Birch Dr., Dover, NH 03820 (phone 603-742-0422).

**NEW JERSEY** (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, Forked River, Fort Monmouth, Gladstone, Jersey City, McGuire AFB, Newark, Old Bridge, Trenton, Wallington, West Orange): **Joseph M. Capriglione,** 179 Newbrook Lane, Springfield, NJ 07081-3022 (phone 201-344-6753).

**NEW MEXICO** (Alamogordo, Albuquerque, Clovis): **Frank S. Gentile,** 1301 Desert Eve Dr., Alamogordo, NM 88310-5504 (phone 505-437-5140).

**NEW YORK** (Albany, Bethpage, Binghamton, Brooklyn, Buffalo, Chautauqua, Griffiss AFB, Nassau County, New York, Queens, Rochester, Staten Island, Suffolk County, Syracuse, Westhampton Beach, White Plains): **James E. Callahan,** 6131 Meadow Lakes Dr., East Amherst, NY 14051 (phone 716-631-7721).

**NORTH CAROLINA** (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Greenville, Havelock, Kitty Hawk, Littleton, Raleigh, Wilmington): **Alton V. Jones,** 223 Cutty Sark Lane, Nags Head, NC 27959-9532 (phone 919-441-2424).

**NORTH DAKOTA** (Fargo, Grand Forks, Minot): **John O. Syverson,** 6450 N. 13th St., Fargo, ND 58102-6011 (phone 701-232-2897).

**OHIO** (Cleveland, Columbus, Dayton, Mansfield, Newark, Youngstown): **Cecil H. Hopper,** 537 Granville St., Newark, OH 43055-4313 (phone 614-522-7258).

**OKLAHOMA** (Altus, Enid, Oklahoma City, Tulsa): **Larry M. Williams,** 11819 S. Douglas Ave., Oklahoma City, OK 73170-5635 (phone 405-736-5512 or 736-4317).

**OREGON** (Eugene, Klamath Falls, Portland): **Barbara M. Brooks,** 7315 N. Curtis Ave., Portland, OR 97217-1222 (phone 503-283-4541).

**PENNSYLVANIA** (Allentown, Altoona, Beaver Falls, Bensalem, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Johnstown, Lewistown, Philadelphia, Pittsburgh, Scranton, Shiremanstown, State College, Washington, Willow Grove, York): **Raymond Hamman,** 9439 Outlook Ave., Philadelphia, PA 19114-2617 (phone 215-677-0957).

**PUERTO RICO** (San Juan): **Vincent Aponte,** P. O. Box 8204, Santurce, PR 00910 (phone 809-764-8900).

**RHODE ISLAND** (Warwick): **John A. Powell,** 700 Saint Paul's St., North Smithfield, RI 02895 (phone 401-766-3797).

**SOUTH CAROLINA** (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **Rodgers K. Greenawalt,** 2420 Clematis Trail, Sumter, SC 29150 (phone 803-481-4481).

**SOUTH DAKOTA** (Rapid City, Sioux Falls): **Robert J. Johnson,** 1120 E. 57th St., Sioux Falls, SD 57106 (phone 605-338-4532).

**TENNESSEE** (Chattanooga, Knoxville, Memphis, Nashville, Tullahoma): **Dan F. Callahan III,** 130 Taggart Ave., Nashville, TN 37205 (phone 615-399-5658).

**TEXAS** (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **Larry L. Miller,** 8322 Van Pelt Dr., Dallas, TX 75228-5950 (phone 214-653-3537).

**UTAH** (Clearfield, Ogden, Salt Lake City): **Richard E. Schankel,** 370 S. 500 E., #120, Clearfield, UT 84015-4046 (phone 801-776-2101).

**VERMONT** (Burlington): **John W. Roach,** 46 Read Rd., Williston, VT 05495 (phone 802-879-3713).

**VIRGINIA** (Alexandria, Charlottesville, Danville, Harrisonburg, Langley AFB, Lynchburg, McLean, Norfolk, Petersburg, Richmond, Roanoke, Winchester): **John E. Craig,** 947 S. 26th St., Arlington, VA 22202 (phone 703-684-1315).

**WASHINGTON** (Seattle, Spokane, Tacoma): **Richard A. Seiber,** 5323 97th Ave. Court West, Tacoma, WA 98467-1105 (phone 206-627-0700).

**WEST VIRGINIA** (Charleston): **Samuel Rich,** P. O. Box 444, White Sulphur Springs, WV 24986 (phone 304-536-4131).

**WISCONSIN** (Madison, Milwaukee, Mitchell Field): **Gilbert M. Kwiatkowski,** 8260 W. Sheridan Ave., Milwaukee, WI 53218-3548 (phone 414-463-1849).

**WYOMING** (Cheyenne): **Robert S. Rowland,** 9001 Red Fox Rd., Cheyenne, WY 82009 (phone 307-632-8746).

*AFA's 1994 Member of the Year William A. Lafferty (right) of Arizona meets with newly elected Board Chairman James M. McCoy at the National Convention. Mr. Lafferty now serves on the Executive and Resolutions Committees.*

Tegnelia, Robert E. "Dick" Thomas, Dr. Billy E. Welch, John J. Welch, Jr., and R. E. Smith, *ex officio.*

**Audit Committee:** Lucius Theus (Chairman), Donald D. Adams, Henry W. Boardman, William V. McBride, John Russell, Claudius E. Watts III, and James M. McCoy, *ex officio.*

**Advisors:** Jerry Daltor (Communications), Dr. Ken Daly (Junior ROTC), Col. Walter Watson (Senior ROTC), Roger Blanchard (Civilian Personnel), Donna L. Tinsley (Medical), and Daniel McDowell (Civil Air Patrol).

### Dougherty Salutes ACC Unit

At the July meeting of the **Llano Estacado (N. M.) Chapter**, Gen. Russell E. Dougherty, USAF (Ret.), had to admit, "Here I am, with hat in hand, to eat crow, and to recognize the excellence of the 27th Fighter Wing."

As Strategic Air Command CINC twenty years ago, General Dougherty had invited Tactical Air Command's F-111 wings at Cannon AFB, N. M., and Mountain Home AFB, Idaho, to SAC's Bombing/Navigation Competition. "It will be a cold day in hell when TAC's fighter-bomber pilots can outbomb the professionals in Strategic Air Command," the General said back then.

Last April, Cannon AFB's 27th Fighter Wing, flying F-111Fs, won Air Combat Command's Proud Shield bombing competition, earning three awards, including the Russell E. Dougherty Trophy. "It's a cold day in hell, I guess," General Dougherty joked when he congratulated the 27th FW before addressing the chapter meeting.

### Chapter News

The **Central Florida Chapter** views cadets as USAF's future leaders and supports them with technical and managerial assistance and generous donations. Chapter President Richard A. Ortega recently presented cadets of Civil Air Patrol Group 6 with $1,000. In the past two years, the Chapter has contributed more than $18,000 to this group. Mr. Ortega, who has since stepped down, reports that these cadets have excelled in all rating areas assessed by CAP National Headquarters and have even assisted the local Air National Guard in an airlift of food to St. Petersburg, Russia.

No contest at the **John W. DeMilly, Jr. (Fla.), Chapter.** At their annual business meeting in September, chapter members unanimously reelected their current officers—President Mike Richardson, Vice President Ray Monti, Secretary Kathy Kaim, and Treasurer Bill Susser—for another term. Marshall Austin, executive director of TriCare Prime–Homestead, spoke on the healthcare program now in place in south Florida. President Richardson also announced four new Community Partners, qualifying the chapter for an Exceptional Achievement Award.

*At a state executive meeting, Alabama State President Bill Divin (left) presented several AFA awards. Robin Williamson, a volunteer for the Mobile Chapter, received an Appreciation Award. State Treasurer Bill Voigt, of the Birmingham Chapter, received an Exceptional Service Award, and Mobile President Steve Hester (far right) received the Alabama AFA Man of the Year Award.*

During World War II, Millville Army Airfield, N. J., was a gunnery training school for P-47 fighter pilots. Last August it was the site of a Confederate Air Force Air Show, at which **Brandywine (Pa.) Chapter's** Joe Dougherty, Joe Perlman, Steve Rudloff, and other chapter members got a chance to look over some vintage aircraft.

**For a Good Cause**

Last summer, Charles F. Curtis, who was then Montana AFA State President, and six active-duty Air Force personnel from Malmstrom AFB, Mont., volunteered as camp counselors for diabetic children. Mr. Curtis, a **Bozeman Chapter** member, said that without the Air Force volunteers, Camp Diamont would have been "hard-pressed" to cope with the record number of youngsters who attended it. The Montana affiliate of the American Diabetes Association sponsors the camp.

**Have AFA/AEF News?**

Contributions to "AFA/AEF Report" should be sent to Dave Noerr, AFA National Headquarters, 1501 Lee Highway, Arlington, VA 22209-1198. ■

# Unit Reunions

**Defense Communications Agency** (DCA), Europe. April 7–10, 1995, at the Hilton Inn–Gateway in Kissimmee, Fla. All military, civilian personnel, and contractors assigned or affiliated with DACCC-, DCA-, or DISA-Europe are invited. **Contact:** Charles R. Timms, P. O. Box 293, Fair Play, SC 29643. Phone: (803) 972-2020.

**Iwo Jima Veterans.** Fiftieth-anniversary reunion, February 16–19, 1995, at the Marriott-Airport Hotel in Atlanta, Ga. **Contact:** Jim Westbrook, 594 Old Hwy. 27, Vicksburg, MS 39180. Phone: (601) 636-1861.

**2d Air Division,** 8th Air Force, including Hq., 44th, 93d, 389th, 392d, 445th, 446th, 448th, 453d, 458th, 466th, 467th, 489th, 491st, and 492d Bomb Groups; 4th, 56th, 355th, 361st, and 479th Fighter Groups; and attached units, will hold its forty-eighth annual convention July 3–6, 1995, in Lexington, Ky. **Contact:** Evelyn Cohen, 06-410 Delaire Landing, Philadelphia, PA 19114.

**11th Bomb Group.** Thirty-fifth-anniversary reunion, May 24–27, 1995, in Louisville, Ky. **Contact:** Robert E. May, P. O. Box 637, Seffner, FL 33584-0637. Phone: (813) 681-3544.

**65th Aeromedical Evacuation Squadron.** Twenty-fifth-anniversary dinner, January 6, 1995. All former members are invited. **Contact:** Maj. Christine A. Frank, 65th Aeromedical Evacuation Squadron/SGA, 541 Travis Ave., Travis AFB, CA 94535-2169. Phone: (707) 424-3865.

**Mail unit reunion notices well in advance of the event 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.**

**351st Bomb Group.** May 3–7, 1995, at the Ramada Plaza Resort in Kissimmee, Fla. **Contact:** Frank Lubozynski, 5100 St. Marie Ave., Orlando, FL 32812. Phone: (407) 855-0011.

**444th Fighter-Interceptor Squadron.** April 14–16, 1995, at the Holiday Inn–Folly Beach in Charleston, S. C. **Contact:** Lt. Col. Wallace Mitchell, USAF (Ret.), 535 Mimosa Rd., Sumter, SC 29150. Phone: (803) 469-3297 (home) or (803) 775-1281 (work).

**665th Radar Squadron** (Calumet AFS, Mich.). July 14–16, 1995, at the Bicentennial Arena in Laurium, Mich., for all former civilian and military personnel. **Contact:** Clarence J. Wilson, 20 Union St., P. O. Box 94, Mohawk, MI 49950. Phone: (906) 337-1980.

**Pilot Training Class 71-06,** Laredo AFB, Tex. Seeking former members interested in a twenty-fifth-anniversary reunion in summer 1996 in Laredo or San Antonio, Tex. **Contact:** Kent McInnis, 5016 Echo Glen Cir., Oklahoma City, OK 73142-5403. Phone: (405) 752-0133.

**7370th Flight Service Squadron.** Seeking former members, including Berlin Air Safety Center, USAFE Notice to Airmen (NOTAM) Center, and flight service detachments in Europe and the Middle East, who would be interested in a reunion. **Contact:** Col. Barbara Darden, USAF (Ret.), P. O. Box 3683, Clarksville, TN 37043. ■

# Bulletin Board

Seeking information on **Blue Straw/Blue Shield** (September–December 1965) and a history of **7th Air Force. Contact:** MSgt. Thomas W. Young, Sr., USAF (Ret.), 830 W. Amsden St., Denison, TX 7520-7929.

Seeking contact with **Michael V. McGrath,** who flew with the 315th Fighter Squadron, 324th Fighter Group (World War II). **Contact:** Magnus P. Johnson, 5500 Sycamore Dr., Dickinson, TX 77539.

Collector seeks slides or photos of structural, crash, fire, rescue, and support apparatus used by USAF and base **fire stations.** Also will trade fire service patches and memorabilia with Air Force fire-fighting personnel. **Contact:** John E. Odum, 345 S. McNair Blvd., Lake City, SC 29560.

Seeking contact with those who flew or worked on the **C-27 Bellanca Aircruiser. Contact:** Leo Horishny, 4216 Turrill St., Cincinnati, OH 45223-2019.

Seeking contact with or information on **Jimmy (or James) Turner,** from Kentucky, stationed at RAF Chicksands, UK, in 1945. He knew Gladys Bozier. **Contact:** Juanita Dorese Norris, 33 Hallwicks Rd., Stopsley, Luton, Bedfordshire LU2 9BG, UK.

For a museum at Eagle Field, Calif., seeking a World War II **shirt pocket Bible** with armor-plated covers. **Contact:** Paul J. Meketa, 1645 Samedra St., Sunnyvale, CA 94087.

Seeking contact with **Burton L. Harris, Laurel Howell, George Liesenfelder, John McEntee, Robert McIntire,** and others stationed at Hq., 26th Air Division (Defense), Roslyn AS, N. Y., 1949–58. **Contact:** Virginia S. Taylor, 903 Sandwich Rd., East Falmouth, MA 02536.

Seeking information on **2d Lt. Mike (Miguel) Encinias,** assigned to the 2d Fighter Squadron, 52d Fighter Group, 15th Air Force. He was shot down and became a POW February 19, 1944. **Contact:** Santiago A. Flores, P. O. Box 430910, San Ysidro, CA 92143-0910.

Seeking information, particularly aircrew accounts, on combat operations of the **AH-1 Cobra** during the Vietnam and Persian Gulf Wars. **Contact:** Maj. Josef Suta, Kostelecká 9, 796 01 Prostejov, Czech Republic.

Seeking contact with **Lee Crawford,** an Air Force Security Policeman stationed at RAF Alconbury, UK, 1965–68. He returned to Minneapolis, Minn. **Contact:** Tarnall Lee Simpson, 124 Sharrow Lane, Sheffield S11 8AL, South Yorkshire, UK.

Seeking contact with **J. P. "Lando" Skelton** of Quinwood, W. Va., who was with the 60th Armored Infantry Battalion, in the UK during World War II. **Contact:** Andrea Vaughn-Smith, 74 Heel Bathafarn, Coedpoeth, Wrexham, Clwyd LL11 3LW, North Wales, UK.

Seeking NATO, OAS, SEATO and Far East **patches** and patches from mountain, Pacific, and other US states. **Contact:** Don Somers, 714 Rosedale Rd., Woodstock, GA 30188.

Seeking contact with **World War II bombardiers** who have not already contacted Bombardiers, Inc. **Contact:** E. C. Humphreys, Jr., Bombardiers, Inc., 500 Jackson St., #1407, Daphne, AL 36526-7029.

Seeking pictures of USAF squadron and wing **badges** and aircraft. Also seeking aircraft posters and flight patches. **Contact:** Capt. Francisco M. P. Dos Santos, Centro de Treino de Sobrevivencia da Força Aérea, Base Aérea #6, 2870 Montijo, Portugal.

Seeking contact with FB-111 pilots **Capt. Tom Kana** and **Lt. Col. Jack Pledger**, 393d Bomb Squadron; **Maj. Terry A. Ross, Steve Donahue,** and **Mark Lorence,** from Plattsburgh AFB, N. Y.; and **Captain Cardwell**, who was with the 4007th Combat Crew Training Squadron. Also seeking the whereabouts of **patch displays** from the 509th Supply Squadron's Individual Equipment Section and the Transient Alert Facility, Pease AFB, N. H. **Contact:** Curt Lenz, 32 June St., Nashua, NH 03060-5345.

Seeking copy of Keith Hill's print **"Attlebridge Winter."** Also seeking photos, documents, insignia, manuals, or artifacts from RAF Attlebridge, UK. **Contact:** Richard B. Dondes, 21 Firethorn Ct., East Brunswick, NJ 08816-2778.

Seeking witnesses to the flight of a **B-17 (381st Bomb Group),** Triangle L Tail, through a 3d Air Division formation on its way back from bombing Kassel, Germany, January 29, 1945. **Contact:** Wayne Layman, 14 Belle Crest Dr., Belleville, IL 62221-5513.

Researcher seeks personal stories and memorabilia from **World War II. Contact:** George E. Dively, Jr., P. O. Box 10743, Alexandria, VA 22310.

Seeking Libya Glass Works, Desert Shield/Desert Storm Partners in War, 1981 TAC Bomb Comp 48th TFW, 20th OSS, 20th TFW Red Flag, and F-111 "If Your Wings Don't Sweep" (55th TFS) **cloth patches. Contact:** TSgt. Robert E. Styger, 15 Genesee Lane, Willingboro, N. J. 08046-3319.

Seeking contact with flight personnel who served at **San Angelo AAF**, Tex., 1944–45. **Contact:** James F. Parker, 3616 Winifred Dr., Fort Worth, TX 76133.

Seeking contact with members and information on reunions of the **756th Bomb Squadron,** 461st Bomb Group. **Contact:** Larry Rosenberg, P. O. Box 1241, Rancho Sante Fe, CA 92067.

Seeking contact with members of the **645th Bomb Squadron,** 410th Bomb Group, who served in Europe on D-Day and who knew **SSgt. James E. Lindamood. Contact:** Mark Lindamood, 5256 Clifton St., Alexandria, VA 22312.

Seeking information on the origins of the **first sergeant** position and stories about first sergeants. **Contact:** MSgt. John W. Johnson, 5518 Greenwing Pl., Lithonia, GA 30058-8301.

Seeking a **pen pal** in the Air Force or correspondence with anyone interested in combat aircraft history. **Contact:** Aleksey Krasnov, ul. Krasnoflotska 5, 284005 Ivanofrankovsk, Ukraine.

Seeking contact with those assigned to Air Force **radar towers** deployed off the New England coast in the 1950s and 1960s. **Contact:** Joel M. Sears, 11822 Ottawa Ave., Orlando, FL 32837-7725.

Seeking anyone who saw the **B-24 #42-94881,** from the 714th Bomb Squadron, 448th Bomb Group, shot down over Brunswick, Germany, May 19, 1944. Also seeking information on **SSgt. Charlie L. Planton** and **Sgts. John R. Foss and**

## Bulletin Board

**Robert Spruill. Contact:** Robert G. Silver, Jr., P. O. Box 522, Alpena, MI 49707.

For a museum's restored F-4C (#63-555), seeking **squadron patches, scarves,** and **photos** from "Triple Nickel" pilots, weapon system officers, and crew chiefs. **Contact:** Michael V. Salois, 39820 Hillary Dr., Canton, MI 48187.

Seeking information and photos from those involved with **Crash Project Number 1,** at Atsugi AB, Japan, August 28–29, 1944 particularly 139th AACS Squadron, 68th AACS Group, 7th AACS Wing, and 317th Troop Carrier Group personnel. **Contact:** Mark Cato, 60 E. 15th St., #226, Edmond, OK 73013-4180.

Seeking information on **Capt. D. Hoover,** 37th Fighter Squadron, 14th Fighter Group, 15th Air Force, killed in a P-38 crash near Munich, Germany, April 1, 1945. **Contact:** Josephine H. Schulte, Mission Hills Apt. 605, 1415 Babcock Rd., San Antonio, TX 78201.

Seeking information from pilots who flew with or crew that serviced the P-26 of pilot **James A. Cox,** 72c Fighter Squadron, killed in a plane crash at Schofield Barracks, Hawaii, on May 18, 1942. **Contact:** David C. Larson, 224 Portsmouth Cove, Longwood, FL 32779

Seeking information on **James E. Tucker,** who was stationed in the UK in 1960. He may live in Buffalo, N. Y., or Iowa. **Contact:** J. Mathews, Tarza, Eastern Rd., Lydd, Romney Marsh, Kent, TN29 9EQ, UK.

For historical research, seeking contact with members of the **1254th Air Training Wing (SAM)** or others on duty at Andrews AFB, Md., November 22, 1963. **Contact:** Sean Fetter, 1117 N. Dearborn St., #611, Chicago, IL 60610.

Author seeks information on and photos, logbooks, serial numbers, and eventual fate of **Airspeed Oxfords** used by USAAF in World War II. **Contact:** Peter G. Coker, 10 Benland, Bretton, Peterborough, Cambridgeshire, PE3 8EB, UK.

Seeking information on or contact with **SSgt. DeSales Glover,** from Pittsburgh, Pa., who enlisted in the RCAF, then transferred to 8th Bomber Command, 8th Air Force, USAAF, in the UK around 1942. He flew twenty-five missions before he was discharged for being underage. **Contact:** C. J. Caligiuri, Jr., P. O. Box 701, Rushville, NE 69360-1701.

For the "Squid" mailing list, seeking aircrews of the **613th Tactical Fighter Squadron. Contact:** Lou Collomb, 1008 Sextant Ct., Annapolis, MD 21401-6887.

Seeking contact with anyone who knew **TSgt. Alvin Charles Wright,** from Kansas City, Mo., of the 125th Liaison Squadron, 9th Air Force, from January 1945 to March 1946. **Contact:** Al Korzan, 755 1st St., Alamogordo, NM 88310.

**If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Letters should be brief and typewritten; we reserve the right to condense them as necessary. We cannot acknowledge receipt of letters. Unsigned letters, items or services for sale or otherwise intended to bring in money, and photographs will not be used or returned.**—THE EDITORS

Collector seeks **military payment certificates** used in Vietnam from 1946 to 1975. **Contact:** Nick Schrier, Box 60104, Sacramento, CA 95860.

Seeking contact with **Lee**(?), who was stationed in Malvern, Worcestershire, UK, and knew **Pearl Bishop.** He left the UK in April 1956. **Contact:** Stephen Pain, 39 Magdalen Rd., Norwich NR3 4LG, UK.

Seeking the whereabouts of **Antonio Garcia,** stationed at Horham, Suffolk, UK, 1944–45. He was from California and was with the 47th, 95th, or 323d Bomb Group, 8th Air Force. **Contact:** CMSgt. Gary E. Zdanowicz, USAF (Ret.), 105 Bahia Vista Dr., Niceville, FL 32578.

Researcher seeks information and photos of the **Northrop HL-10 Lifting Body project. Contact:** Capt. T. S. Martin, 124½ Freeman Ave., Solvay, NY 13209.

Turkish pilot seeks information on and photos and memorabilia of the **C-47 Dakota. Contact:** CMSgt. Hamdi Kuşçu, 1Tak.Hv.Kv., Irt.Kt.K., Eskisehir, Turkey.

Seeking contact with **James Logrippo,** from New York, who served as a missile engineer at RAF Wetherfield, UK, until 1964. He may have served in north Africa in 1965. **Contact:** Maria McCullough, 59B College Rd., Bromley, Kent, BR1 3QG, UK. ■

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| 50-54 | 27.00 | 36.99 | 33.18 | 43.17 |
| 55-59 | 38.70 | 53.70 | 47.58 | 62.58 |
| 60-64 | 59.82 | 84.81 | 73.56 | 98.55 |
| 65-69 | 135.00 | 172.50 | 165.96 | 203.52 |
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# Pieces of History

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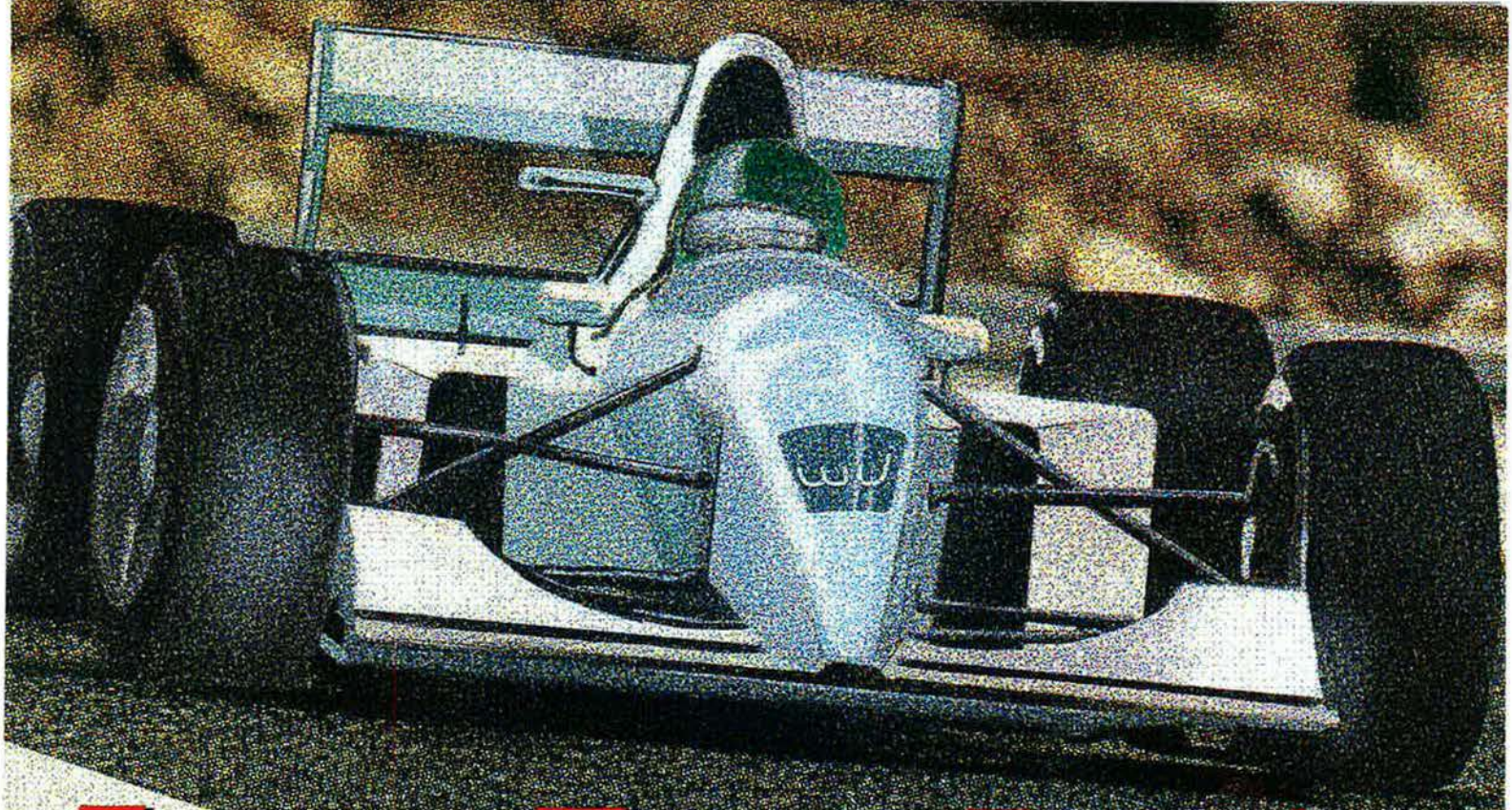

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# THERE JUST ISN'T ANY.

It has the range. It has the capability. It's built for the 21st century. And it has a combat-win record that no one else can touch. 95 to zip. Those are all the good reasons why the F-15 is the right choice for the SEAD program. (Suppression of Enemy Air Defenses). And with over 20 years experience with the F-4 Wild Weasel, no other company has the track record we have. So, this isn't only a smart place to put the SEAD budget, judging from the competition, it's the only place.

**MCDONNELL DOUGLAS**
*Performance Above and Beyond.*