DECEMBER 1996/$3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

The Force at Aviano

Air Force 2025

It's a New Day at Air & Space

Tough Duty at Tuzla

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December 1996, Vol. 79, No. 12

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

About the cover: An F-16 from the 31st Fighter Wing awaits another sortie outside a hardened aircraft shelter at Aviano AB, Italy. See "The Force at Aviano," p. 26. Photograph by Guy Aceto.

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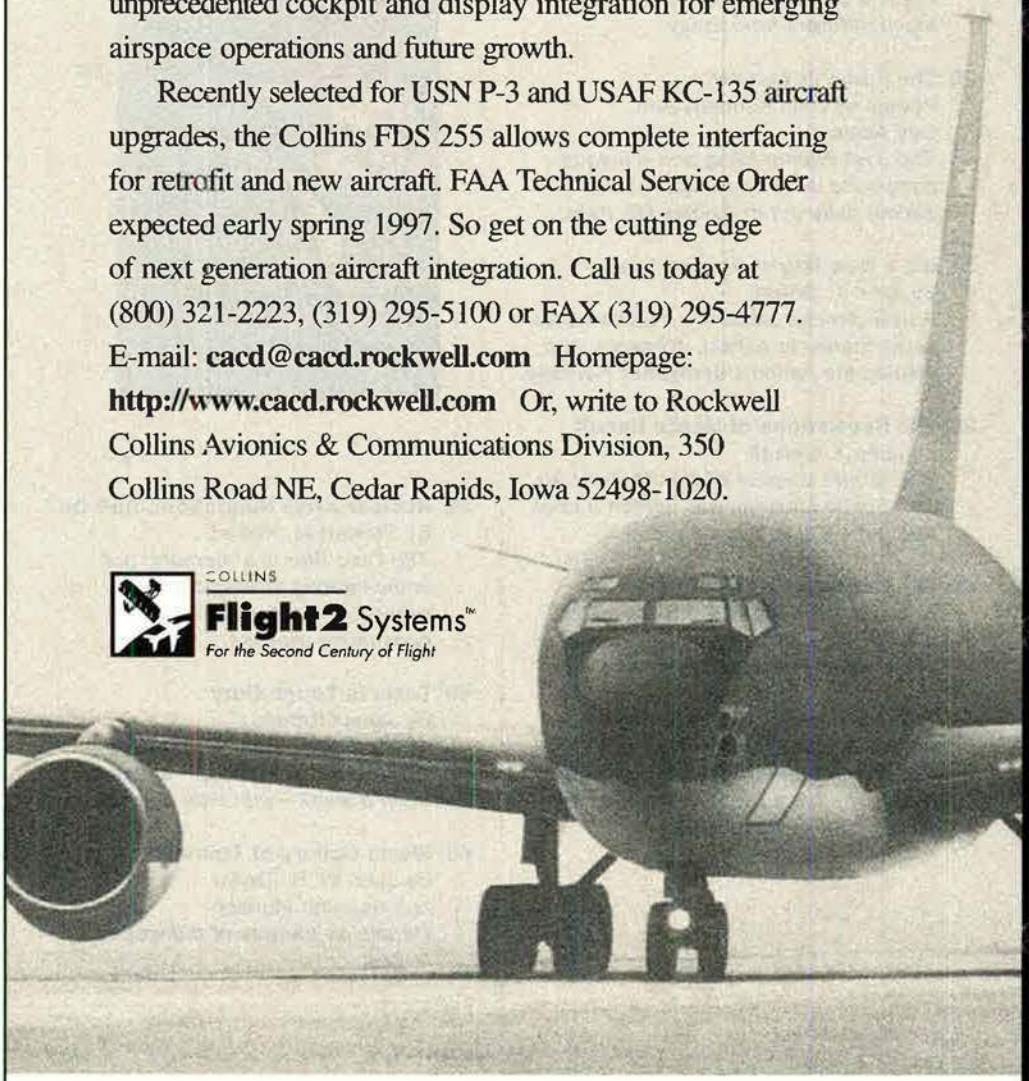

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Editorial

By John T. Correll, Editor in Chief

Warfare in the Information Age

INFORMATION warfare has come upon us suddenly. It is true that the collection and use of intelligence are as old as warfare itself and that deceptive operations date back to the Trojan horse. It would be a serious mistake, however, to perceive what is happening now as a straight-line extension of the past.

When *Basic Aerospace Doctrine of the United States Air Force* was last published, in March 1992, it did not even include "information warfare" in the forty-page glossary. The closest it came to recognizing information warfare was to list surveillance, reconnaissance, and electronic combat as "force enhancement" missions.

Since then, the conceptual universe has shifted. One of the four major trends seen by Air University in "Air Force 2025" is that "influence increasingly will be exerted by information more than by bombs." In "Joint Vision 2010," the Joint Chiefs of Staff specify the central operational concept of the future—the one from which the others will flow—to be information superiority.

Gen. Ronald R. Fogleman, Air Force Chief of Staff, believes that "we're crossing a new frontier" and that information operations have now joined land, sea, air, and space operations as "the fifth dimension of warfare." In October, the Air Force identified information superiority as one of the service's six core competencies.

The change is driven by a combination of factors, including the advancement and proliferation of technology. Available computer speed, for example, doubles every eighteen months, making it possible to employ vast amounts of information at enormous speed. The postulated "Revolution in Military Affairs" is a self-reinforcing loop of global awareness, advanced command and control, and precision strike capabilities.

The Persian Gulf War of 1991 was a preview of things to come. Coalition airpower knocked out Iraq's command-and-control systems the first night. Coalition forces, receiving reconnaissance and signal data from aircraft and spacecraft, knew exactly what to do and when to do it. The advantage was overwhelming.

We are not yet altogether sure what information warfare is, much less what it means. Useful clues are found in "Cornerstones of Information Warfare," put out by the Air Force in 1995. It makes a distinction between *information age warfare*—which uses information technology as a tool in more or less traditional combat operations—and *information warfare*, which treats information itself as a weapon and a target.

The ultimate precision guided weapon is the electron.

So far, it is the first of these, information age warfare, that has gotten most of the attention. Leading elements of information age warfare are reconnaissance, surveillance, and battle-management systems in air and space.

The concept of information as a target and a weapon is less familiar. A Presidential commission is investigating the protection of critical national infrastructures ranging from telecommunications and financial networks to utilities, emergency services, and the continuity of government. (These infrastructures are starkly vulnerable. According to Glen Buchan of RAND, four of the Federal Aviation Administration's twenty air traffic control centers were closed for five hours when a farmer burying a dead cow accidentally cut a fiber optic cable.)

In March 1994, a sixteen-year-old hacker in London broke into the computer system of Rome Air Development Center, Rome N. Y., and acquired classified documents, which he then posted on the Internet. This year, an Argentinian hacker penetrated NASA and Department of Defense computer systems from his home in Buenos Aires.

According to Sen. Sam Nunn, who takes a special interest in this problem, about 250,000 attacks occur each year against unclassified but sensitive Department of Defense information systems. He says that perhaps sixty-five percent of these attempts are successful—and that we are catching only the least competent of the penetrators.

At a hearing in June, CIA Director John Deutch declined to respond in open testimony to a question from Senator Nunn about "whether foreign governments have indeed sponsored information attacks on our infrastructure." Senator Nunn speculated about an "electronic Pearl Harbor" in the offing.

The armed forces have a comprehensive stake in the problem, not only because more than ninety percent of their communications flow through commercial channels and because they rely on commercial databases but also because critical military advantages depend on information linkages. It has not escaped notice that when it comes to information attack, we are the world's fattest target.

Offensive information warfare entails a rich array of possibilities, but plans are screened by secrecy. Enemy radars and command-and-control systems—early targets in the Gulf War—would obviously be on the hit list in future conflicts. "Air Force 2025" looks beyond that to "prepositioned trapdoors" in computer programs and "cloaking devices and multispectral camouflage" but says "the most promising technology is the creation of synthetic environments that an adversary thinks are real." Taking it further still, Mr. Deutch told Congress that "the electron is the ultimate precision guided weapon."

Warfare in the information age carries us into uncharted territory. We will find new opportunities there, as well as dangers that we will not expect or fully understand. The objectives are not yet clear, and the problems we do see will almost certainly change before we can resolve them. The best we can do is to stay alert and flexible, equip ourselves with the best technology we can muster, and go forward with all the capabilities and options that we can muster. ■

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Letters

Arsenal of Democracy

I was surprised to read the statements attributed to Air Force Chief of Staff Gen. Ronald R. Fogleman in "First Force" *[September 1996, p. 34],* in which he criticized a number of Navy programs, including, as the article puts it, the Navy's "so-called arsenal ship," for which he is said to hold "little esteem." The criticisms were based on an obvious lack of familiarity with the arsenal ship program.

The arsenal ship, packed with cruise missiles, will be linked to joint-service command-and-control assets ashore, at sea, and in space. It will be capable of reaching targets at deep-strike range. As Navy data indicate, Navy Tomahawks launched since the start of Operation Desert Storm have hit their targets some eighty-five percent of the time—without endangering pilots or aircraft. Armed with precision guided SM-2 Standard Strike missiles and extended-range guns, arsenal ships, by means of the Navy's cooperative engagement capability, which recently completed successful at-sea operational testing, will be capable of interdiction and naval surface fire-support missions.

The mix of capabilities envisioned for the arsenal ship is based on exploitation of sensor, information-processing, and weapon systems technologies that will multiply the hitting power of individual platforms, just as the AEGIS combat system and vertical launch dramatically expanded the reach of the surface fleet. The accuracy and lethality of vertically launched shipboard weapons are being enhanced to provide the capability to attack targets ashore with great precision.

The arsenal ship is planned as a bridge to a future family of SC-21 multimission surface combatants designed to maintain maritime dominance and to support land forces. That is why the Navy plans to build only a limited number.

Arsenal ships and next-generation SC-21s will operate as integral elements of forward-deployed Navy forces. And forward presence, as Secretaries of Defense and leaders of all the services have agreed countless times, is essential to the US ability to respond to crises far from home. Tomahawks launched from Navy ships were called on during the September 3 Desert Strike operation for one reason: They were there. Air Force B-52s that participated flew in from Guam.

The nation has a critical need for landbased airpower for long-range strike operations like those carried out in Desert Storm. However, Desert Storm—a major regional conflict in which the Air Force's basing needs were supported by a large, well-off power next door to the battlefield—was, in a geopolitical context, an aberration.

In the limited, often politically ambiguous crises that the US seeks to respond to, in ways such as Desert Strike, adjacent air basing may not be available. The threat of CONUS-based Air Force bombers may be far less persuasive to aggression-minded Third World dictators than a Navy battle group offshore or an AEGIS cruiser or destroyer within Tomahawk range would be.

Hugh H. Mayberry
National President
Navy League of the United States
Arlington, Va.

The Making of a Joint Fighter

As a long-retired veteran of a number of Office of the Secretary of Defense–initiated joint aircraft development programs, including the TFX, Triservice Transport, and Heavy-Lift Helicopter, I heartily agree that "it would be a vast understatement to call the [Joint Strike Fighter] program 'ambitious' " *["Strike Fighter," October 1996, p. 22].* At the same time, I recognize that we skeptics may be booby-trapped by OSD's strategy of initiating a major project without benefit of service-issued "requirements." If capabilities are sufficiently reduced, a Joint Strike Fighter that meets the "commonality" goal may emerge, only to be rejected by the operating forces.

The JSF decision to eliminate the "two engine, two crew" requirement for any A-6 replacement is certainly questionable, as is the apparent "600-mile range" capability. At initiation, the A-6 (then the XA2F-1) had about twice that figure for its radius of action (I assume the JSF "range" is actually "radius").

Also, the reasons given by the OSD spokesman for the failure of the TFX program in the 1960s are not accurate. . . .

Six contractor proposals, not three, were submitted in the initial TFX source selection. Most, if not all, designs claimed compliance with the requirements of the request for proposal (RFP). A few months earlier, the Air Force and Navy Secretaries had informed the Secretary of Defense that no single airplane could meet the primary air-to-air mission requirements of the Navy and the supersonic dash, sea-level attack mission of the Air Force.

The "requirement" documents of the TFX period were usually only a few pages in length and certainly not "more like detailed design specs," as the article stated.

The aircraft acquisition process allowed ample opportunity for "innovation" in the negotiations during the RFP, proposal, and contract phases of the program. In practice, a contractor failing to offer desirable changes would be considered incompetent.

The award for the TFX development was made by the Secretary of Defense to General Dynamics, overruling the recommendation of Boeing by the services. General Dynamics

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Letters

was not the lowest bidder but did claim a higher figure of "commonality."

Today's defense managers should learn that no amount of management attention alone will solve the problems engendered by ignoring the "technical community" within the services. Past joint development failures were not only predictable but were, in fact, predicted.

George A. Spangenberg
McLean, Va.

I believe that the people shaping our airpower for the first quarter of the twenty-first century are being penny-wise and pound-foolish.

With regard to "Strike Fighter," I was struck by the lack of dialogue regarding the concept of survivability.

The economic advantages of a single-engine aircraft over a twin-engine platform are quite impressive, at first glance. The trade-offs in range, weight, and agility, compared to price, are issues that have been addressed at length. However, nothing that implies survivability has been seriously discussed.

Let's look at the do-all, be-all answer to the tactical budget today: the F-16. It seems the F-16 can dogfight, perform reconnaissance, bomb, mow the lawn, and bring in the morning paper while looking really cool, to boot.

On the down side, the F-16 falls out of the sky a lot. This year to date, I am aware of four F-16 crashes, two returns to base because of engine problems, and at least one incident when external stores were jettisoned on a home and a civilian roadway. Not one of these was brought about by enemy action.

In the Persian Gulf War, the F-16 was forced to bomb from higher altitudes because of concerns about Iraqi antiaircraft artillery and small-arms fire. We have recognized the single-engine weakness. Why do we want to subject our children to the same hazards?

The second engine is insurance. We owe it to our attack and rescue crews to build a ground-attack airplane that can take it as well as dish it out. We owe these young people a fighting chance, in an airplane that will bring them home and not subject their rescuers to the same threat.

My guess is that with the loss of life, airplanes, and legal battles, the single-engine aircraft is not as cost-effective as it appears.

Rudolph E. Nartker
Castro Valley, Ca.

The author of "Strike Fighter" has either not done much reading about the only previous attempt to accomplish a joint-venture aircraft (the TFX) or he has ignored what he read. . . .

History never repeats itself precisely—there are always slightly different circumstances. The one circumstance that has not changed in this joint venture is that the Navy is involved. The Navy will never accept an aircraft development managed by a different branch of service, and that should be kept in the front of everyone's mind.

The caption for the picture on p. 24 of an F-111 over a carrier states, "The F-111B . . . was a failure at carrier operations." Nothing could be further from the truth. I have seen one of the few pictures ever taken of the only time the F-111 was given a chance to operate from a carrier. The picture was taken by the F-111 System Program Office (SPO) director, who, I believe, was the only Air Force officer allowed to witness the test. The Navy did not want to conduct this test and had to be ordered to do so by the Secretary of Defense. No official picture of this flight was ever released. To the Navy, it had never occurred.

What was significant about this test was that the carrier was slowed to the minimum wind-over-deck speed for the approach of the F-111 and the aircraft performed perfectly. Comments by the line Navy people on board were to the effect that the performance was outstanding. This was the slowest approach to a carrier they had ever seen by a high-performance aircraft. In fact, a few minutes later when A-6s were operating, the carrier had to speed up considerably to accommodate them.

When Secretary of Defense Robert S. McNamara launched the program, everyone connected with it in the Pentagon knew that the Navy had no intention of accepting the F-111B and that senior officers in the Air Force were not enthusiastic about the joint program. In spite of the advice he got, Secretary McNamara insisted that the program go forward. The program ended up, in its final days, with his weekly review of a report put together by the Air Staff from input by the SPO and the contractor, General Dynamics. I named this effort "Project Icarus" in one of the few lighthearted moments I had while assistant for the F-111. The SPO and General Dynamics were kept so busy with this task that they had little time for their primary business.

McNamara used these reports to brief the McClellan subcommittee on Government Operations, which had,

for obscure reasons, taken on the F-111 as its target. . . .

McNamara was solely responsible for wasting $1 billion or more by stubbornly insisting that the Navy continue with the project. Shortly after he left for the World Bank, the F-111B program was canceled. The Navy had outwaited him. The Air Force was left with an airplane hobbled by requirements laid on it by the Navy—an aircraft, nevertheless, that proved to be a success in performing the mission for which it was built.

Col. Robin Hansen, USAF (Ret.)
Prescott, Ariz.

What To Do in Space?

The editorial "The Command of Space" *[October 1996, p. 3]* states compellingly the military imperative to be able to attack an adversary's satellites and to defend our own. This issue has been around for decades, at least since the debate in the 1970s that resulted in a Congressional prohibition against testing a missile designed to be fired from an F-15 at a satellite in orbit.

However, this is not a simple issue. Some who oppose developing space control systems do so based on a quasi-religious view that space—the common heritage of mankind—should be preserved as a peaceful haven unpolluted by human strife. Others do so based on a hard-nosed conclusion that the US, as the nation relying most heavily on spacebased systems for both military and civilian purposes, has the most to lose if satellites become fair game.

The US has never made up its mind where its long-term interest on this issue lies, but the increasingly critical importance of space systems for military operations will soon demand a decision. The same sort of decision will soon be forced on us concerning information warfare—is it more in our interest to be free to interfere with an adversary's information systems, or is it more important to make our own information systems immune from attack?

The position adopted by the US on these issues will play a major role in determining the course of world opinion and international law.

Col. Phillip A. Johnson, USAF
Burke, Va.

One Target, Many Weapons

The excerpt of Dr. Paul G. Kaminski's national defense policy speech, "One Target, One Weapon" *[August 1996, p. 80]*, promotes several alarming viewpoints about the future role

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of precision guided munitions (PGMs) in meeting national objectives.

Dr. Kaminski contends that the "information revolution" has allowed us to field qualitatively better forces today, as shown in Operation Deliberate Force, than we did during Operation Desert Storm. As evidence of this, he states that only two percent of all weapons expended in Desert Storm were PGMs, while more than ninety percent expended by the US in Deliberate Force were PGMs. This increase is significant but not because our forces are now qualitatively better.

Dr. Kaminski's reasoning uses a faulty analogy. Desert Storm was a major regional conflict, with air operations lasting more than two months and involving a significant portion of US forces. Deliberate Force was smaller, with relatively fewer and select forces (no doubt selected because they can carry PGMs). Here is another case where bad conclusions are drawn based partly on the "lessons" of Desert Storm.

Today's forces may be qualitatively better, but the difference in weapons mix is a result of *objectives,* not of capability. Our ability to drop PGMs isn't the reason we did so; objectives are the reason we use specific tactics and weapons. We can conduct massive bombing strikes with our bomber force, but we didn't in Bosnia-Hercegovina. Why? Because attrition wasn't an objective and because we were constrained by a need to severely limit collateral damage (sort of a reverse objective). So, it was objectives that led to the large proportion of PGMs used.

"We are moving closer to . . . 'one target, one weapon.' . . . Now it is becoming a reality," Dr. Kaminski contends. The siren song of one bomb, one target is compelling. While more accurate weapons are certainly desirable, objectives should drive the choice of weapons. Based on the target and the desired level of damage, it may take two, three, or even six PGMs to accomplish the mission. In other cases, the best choice may be a cell of B-52s loaded with dumb iron bombs. . . .

The most alarming claim Dr. Kaminski makes is that precision weapons make it possible to attack a target "with no collateral damage." Collateral damage is a risk of war. It cannot be magically wished away through the use of accurate weapons, only minimized.

In January 1991, two F-117s dropped GBU-27 laser-guided bombs on a command bunker in western Baghdad. Soon thereafter, CNN aired pictures of civilian casualties at the Al Firdos complex, part of which had been used as a bomb shelter. The backlash stopped bombing in downtown Baghdad for several days, according to Wayne Thompson's article "After Al Firdos," in the Summer 1996 *Air Power History.* He concluded, "Precision bombing capability raised expectations that couldn't always be met." These expectations, including the dangerous myth of no collateral damage, can disrupt combat operations.

We must shake off these misconceptions about the utility of PGMs. Dr. Kaminski's comments represent a "PGM-centric" view, which has too much faith that precision weapons will meet all future needs.

The coalition destroyed Iraqi oil production, electricity, transportation, and communications with one percent of the bombs dropped in Vietnam. While PGMs made it easier, success was due to clear objectives for war planners.

Instead of focusing on the capabilities of weapons, national strategists would do better to think more carefully about how the objectives they define relate to success. Neglecting to think critically about objectives is to repeat the mistakes of the past.

Capt. Jonathan S. Dagle,
USAF
Osan AB, South Korea

Remembering Vietnam

The "Vietnam War Scrapbook" *[October 1996, p. 38]* was truly a walk down memory lane. The people and events pictured made the experience of twenty-seven years ago seem like yesterday. Well done.

One unit I would have liked to have seen wasn't mentioned, the 12th Special Operations Squadron, known as the "Ranch Hands." From February 1962 to January 1971, the men of the 12th SOS conducted aerial defoliation and crop destruction, making the mission one of the Air Forces's most enduring successes of the war.

Of the 1,261 officers and enlisted men in Operation Ranch Hand, 1,143 of us are still actively involved in the Ranch Hand mission. While we no longer begin the mission with, "Spray on, cowboys," and can't add to the 4,000-plus hits from ground fire, since 1982 almost every surviving Ranch Hand has participated in the largest, most comprehensive medical study of its type in history, the Air Force Health Study. We will continue to serve our outfit and our country in this capacity until the study ends in 2002.

In the war, we operated from Bien Hoa, Tan Son Nhut, Da Nang, Pleiku, Chu Lai, Phu Cat, Nha Trang, Phan Rang, and other places. Today we operate from Brooks AFB, Tex. While we weren't in the "Scrapbook," we are still on the Ranch.

Lt. Col. John G. Morgan,
USAF (Ret.)
Fort Worth, Tex.

I loved the "Vietnam War Scrapbook." I found a minor error concerning the photo on p. 40 of current AFA President Doyle E. Larson. Brig. Gen. Eugene Staltzer, pictured with Colonel Larson, was commander of Strategic Air Command's 4252d Strategic Wing at Kadena. The 4157th Strategic Wing identified in the caption was the KC-135 and B-52 operation at U Tapao, Thailand. I know this because I am another "Combat Apple" veteran and longtime colleague of General Larson.

Lt. Col. William Simon III,
USAF (Ret.)
State College, Pa.

The Significant Discoverer

"Space Almanac" *[August 1996, p. 28]* managed to miss the most important space event of 1960—the recovery of the Discoverer 13 capsule, the first object returned from orbit, on August 11, 1960. On August 18, 1960, the first reconnaissance photography from space was recovered when a C-119 of the 6593d Test Squadron caught the capsule from Discoverer 14.

I'm not surprised by the omission. Although the Discoverer 13 capsule has been at the Smithsonian Institution's National Air and Space Museum for years, neither of these events made the museum's list of "significant space firsts" until recently.

Col. Frank S. Buzard,
USAF (Ret.)
Rancho Palos Verdes, Calif.

Deceptive Dihedral

As a student of aviation history, I always find your magazine educational.

I am puzzled, however, about an item in "Wings" *[October 1996, p. 74].* It is asserted on p. 77 that Alberto Santos-Dumont's *Number 14 bis* had forward-swept wings. My understanding is that it was a canard with straight wings (but lots of dihedral).

Bill Hannan
Magalia, Calif.

■ *Reader Hannan is correct.*—THE EDITORS

Capitol Hill

By Brian Green, Congressional Editor

Defense Drops Again

For the twelfth consecutive year, the DoD budget is lower than the previous year's.

CONGRESS passed and President Clinton signed legislation that provides national defense spending in Fiscal 1997 of $265.2 billion, an amount exceeding the Administration request by $10.5 billion.

Despite the Congressional add-on, however, the defense budget continues to drop, and 1997 marks the twelfth consecutive year of real decline in defense. Military spending in 1997 will fall by two percent from the level in Fiscal 1996, if effects of inflation are factored out.

The $265.2 billion is contained in appropriations bills that fund DoD, military construction, and defense programs managed by the Energy Department and other agencies. The bills provide new budget authority, the amount the government can commit to spend in this and in future years.

The appropriations measure, approved in September, tracks with an earlier defense authorization bill, which sets policy.

The Air Force piece of the national defense appropriation totaled $73.1 billion, about twenty-eight percent. The so-called "blue Air Force" budget, which excludes national intelligence programs, special operations, and defense health-care funding, totaled $60 billion.

Personnel

Active Duty. The funding measures provide a three percent pay raise and a 4.6 percent increase in Basic Allowance for Quarters.

USAF end strength was pegged at 381,100, a one-year drop of 7,000.

Congress added $35 million to the DoD budget (and $150 million government-wide) for aid to school districts with a substantial military population. Impact aid also is now authorized for school districts with as few as 1,000 military-dependent students (down from 2,000) or ten percent (down from fifteen percent) of the district student population.

Guard and Reserve. Air National Guard and Air Force Reserve end strengths will both be slightly higher than the original request, but Guard personnel will fall by about 3,000 compared with last year.

The bills approved $780 million for Guard and Reserve equipment. The appropriators earmarked $450 million for eight ANG and AFRES C-130Js.

The authorization bill increased from sixty to seventy-five the number of retirement points that can be earned in one year, reflecting increased Guard and Reserve work loads.

Programs

Fighters. The legislation funded acquisition of six F-15E fighters and six F-16C/D fighters. Four of each were requested in the Administration budget.

USAF's top equipment priority, the F-22 next-generation air-superiority fighter, was funded at $2 billion, approximately the requested amount.

The Joint Strike Fighter, which is to replace the multirole F-16, was given $599 million, $10 million more than the request. The Air Force portion of the program is $263.8 million.

Bombers. Congress added money to speed incorporation of precision conventional munitions capability in the B-1 and B-2 bombers. The authorizers also directed the Air Force to maintain all ninety-four B-52Hs in the inventory. The Pentagon had planned to keep sixty-six.

Funds were also added to several precision munitions programs.

Airlift. Congress authorized procurement of nine new C-17 airlifters, but the appropriations bill provided money for only eight. The authorization bill gave USAF the go-ahead to accelerate the seven-year procurement plan and complete it in six years. This funding, however, was not approved in the appropriations measure.

The appropriators killed 1997 funding for a new 60K aircraft cargo loader because of difficulties in test and evaluation. The 60K loader is a top Air Mobility Command priority.

Ballistic Missile Defense. Both bills provided $3.7 billion for ballistic missile defense, far more than the Administration's request of $2.8 billion. Within this amount, Congress added more than $300 million to the $508 million requested for national missile defenses.

Battle Management and Command and Control. The authorization bill added funding for an additional E-8 Joint Surveillance and Target Attack Radar System aircraft—making a total of three—and another RC-135 Rivet Joint electronic reconnaissance aircraft. The appropriators, however, provided for advanced procurement of an additional Joint STARS aircraft and two Rivet Joints.

The authorization measure consolidated the imaging and mapping functions of DoD and the CIA into a National and Imagery and Mapping Agency.

Quadrennial Defense Review

The authorization bill mandated another thorough review of defense strategy, force structure, modernization plans, budget, and infrastructure by the Secretary of Defense and the Joint Chiefs of Staff.

Veterans and Retirees Legislation

The funding measures provide retirees with a 2.9 percent cost of living adjustment (COLA) as of January 1.

The appropriations bill did not include funds for the Medicare Subvention demonstration program approved in the authorization bill. The measure would have allowed the Department of Health and Human Services to reimburse DoD for health care provided to Medicare-eligible retirees and dependents in two test areas. Military retirees now lose access to the DoD health network when they become eligible for Medicare.

In other legislation, Congress approved a 2.9 percent COLA for veterans receiving disability compensation.

Another measure now authorizes the VA to provide comprehensive health care to all veterans on a space-available basis. Prior to enactment, only veterans with a fifty percent or greater disability or low incomes were eligible. ■

Aerospace World

By Suzann Chapman, Associate Editor

White Previews QDR

In its Quadrennial Defense Review—now under way—the Pentagon will take a fresh look at force-structure needs but will use a force-sizing baseline that is more comprehensive than the "two-war" concept used in the 1993 Bottom-Up Review.

So stated John P. White, deputy secretary of Defense, in an October 9 speech to the Defense Science Board.

The 1993 study concluded that DoD should have forces able to fight and win two nearly simultaneous major regional conflicts. However, Secretary White said the two-MRC scenario is inadequate because it places "too little emphasis" on "the day-to-day demands of overseas presence and smaller-scale contingencies," such as those in Bosnia-Hercegovina and Haiti.

"We need to include a wider set of potential scenarios," said the Secretary. He added, "We are committed to evaluating and testing force-structure alternatives against the full range of plausible contingencies" in what he termed "an *ad hoc* world."

Secretary White carefully avoided stating whether he thought the review would justify increases or decreases in force structure.

DoD launched the QDR in November and expects it to have a major impact on future US military forces. Secretary White said the QDR, in addition to helping set force structure, will determine what resources will be available to pay for the forces. Secretary White said it must answer several questions: Is the planned forty percent increase in funding for modernization over the next five years enough? How much savings will the department actually realize from efficiencies? Should priorities change from readiness and quality of life to modernization?

Twenty-First Century Air Force

Air Force leaders gathered at the fall Corona conference principally to develop a strategic vision for the first quarter of the twenty-first century, USAF Chief of Staff Gen. Ronald R. Fogleman said at the Air Force Association National Symposium on October 18 in Los Angeles, Calif.

Staff photo by Guy Aceto

Selected as the first enlisted retiree to become the chairman of the Air Force Retiree Council, James M. McCoy told an audience at the Pentagon October 29 that retirees, who now constitute the largest part of the Air Force family, have a lot of concerns, and although a few have been solved, "there are a lot more that need to be worked on." A former Chief Master Sergeant of the Air Force and Air Force Association Chairman of the Board, he is the seventh chairman of the Retiree Council since its creation in 1972.

He said that the Corona conference, held at the US Air Force Academy in Colorado Springs, Colo., worked on the premise that "only air- and spacepower provide the nation the ability to find and hit strategic centers of gravity directly, as well as the ability to operate at operational and tactical levels of war."

The leaders set a mid-November release date for the first Corona product, a paper now called "Global Engagement: A Vision for the Twenty-First Century Air Force." The conference also approved release in mid-January of a new long-range plan and later release of a major document, also called "Global Engagement," explaining how the Air Force fights and operates. It is a follow-on to the 1990 white paper "Global Reach, Global Power."

General Fogleman stated that the service's eighteen-month-long planning effort had led to "some adjustments to our core competencies." The new list is air and space superiority, global attack, rapid global mobility, precision engagement, information superiority, and agile combat support.

Airlift Forces Shift

In the first public manifestation of its new long-range plan, the Air Force on October 23 announced that the service will realign continental air mobility forces, moving them from Air Combat Command to Air Mobility Command.

The change comes just three years after the Air Force moved its Stateside mobility assets from AMC to ACC. This shift marks only the first change expected from USAF's fall Corona conference of senior leaders.

General Fogleman said the move will eliminate the seams created in training and deployment capabilities when USAF split up the forces and

spread aerial port, tanker airlift control elements, and operations between two commands. With the high premium placed on rapid global mobility, he said, "the shift of operational command over our airlift forces to a single agency enables us to create a seamless mobility system."

The Air Force plans to make AMC responsible for setting USAF's airlift standards, realign Stateside theater airlift C-130s from ACC to AMC, improve theater command-and-control functions for theater airlift, and realign all Stateside C-21 aircraft operations from various commands to AMC.

The changes will also realign Little Rock AFB, Ark., from ACC to Air Education and Training Command and Pope AFB, N. C., from ACC to AMC.

USAFE Advisor Named Top NCO

CMSgt. Eric W. Benken has become the twelfth Chief Master Sergeant of the Air Force, replacing CMSAF David J. Campanale, who retired on November 4 after twenty-six years of service.

Formerly the Senior Enlisted Advisor to the commander of US Air Forces in Europe, Ramstein AB, Germany, Chief Benken served in the information management career field in Air Force operational, maintenance, and support units from squadron level to major command level. His overseas tours included duty in Taiwan, South Korea, and the Republic of Vietnam, as well as a joint-service assignment at Supreme Headquarters Allied Powers Europe in Mons, Belgium. Chief Benken is a Life Member of the Air Force Association.

He was born in Cincinnati, Ohio, and entered the Air Force in 1970. He has two sons, Brian and Kyle, and a daughter, Erica. He is married to the former Johnne Ceravolo.

During his two years in the top enlisted post, Chief Campanale was a strong advocate for quality-of-life issues. Among many initiatives, he was instrumental in gaining Congressional approval for the new DoD-wide dormitory standard featuring separate rooms for single airmen.

Hot Seat: Gulf War Illness

A new Defense Department tally indicates that as many as 20,000 US service members may have been exposed to toxic chemicals during demolitions of Iraqi ammunition at the Khamisiyah weapons storage complex in southern Iraq in March 1991. The Pentagon announced the new figure on October 22.

The number of probable demolitions of chemical weapons, including sarin and mustard gas, has also grown from one to possibly three. Based on its latest findings, Deputy Defense Secretary White said that DoD wants to reach 20,000 Persian Gulf War veterans who were within thirty-one miles of the Khamisiyah site between March 4 and March 15, 1991.

"We are going beyond the area in which there were likely to have been immediate effects from any chemical agent [nerve gas] exposure," said Secretary White in an October 22 statement. He added that the Pentagon has allocated about $15 million as part of an "extensive research effort" into the possible effects of low-level exposure to chemical agents and another $12 million for general research on other possible causes of Gulf War illness.

Pentagon officials first announced the discovery of the destruction of chemical weapons in the Iraqi complex on June 21. Until then, the department had maintained that no US troops had been exposed to chemical agents. Hammered by repeated allegations of cover-ups over the Gulf War illness issue, senior defense officials are calling Khamisiyah a "watershed" in the search for information and understanding.

Secretary White emphasized on October 22, "The story of Khamisiyah is still incomplete. We are putting the puzzle together, and we want those who were there to help us fill in the missing pieces."

Testifying on September 25 before Congressional committees, Dr. Stephen C. Joseph, assistant secretary of defense for Health Affairs, said, "Now we have evidence of possible chemical warfare agent exposures. It is imperative that we now attempt to find clinical evidence that might be linked to those exposures of our troops who were in the exposure zone."

Secretary White cited the need for "new and different expertise," announcing the formation of a DoD Action Team on September 25. The team, headed by Bernard D. Rostker, assistant secretary of the Navy (Manpower and Reserve Affairs), is supposed to completely reassess all aspects of the Defense Department's Gulf War illness activities and is expected to present an initial report this month.

Additionally, Secretary White asked the National Academy of Sciences and the Institute of Medicine to evalu-

Texas Instruments successfully qualified use of the Paveway III laser-guided bomb GBU-22 on F-16 aircraft in tests conducted by USAF at Eglin AFB, Fla., from April to June. Funded by Texas Instruments, the test program included eleven flights, two of which were successful GBU releases.

USAF photo by SSgt. Jim Howard

MSgt. Louis Cordle, 100th Air Refueling Wing, RAF Mildenhall, UK, discusses family readiness issues with Kathy Swanegan, family readiness program director at Mildenhall's Family Support Center. During a European tour of USAF facilities, AFA's past President Gene Smith noted that the readiness program is now used as the Air Force standard and that several other programs, such as the center's "Parent University" and "Marriage University," are models for US Air Forces in Europe bases.

ate the Pentagon's overall approach and to advise on long-term strategy for future contingencies.

Active-duty members may call (800) 796-9699 to sign up for the Pentagon's Comprehensive Clinical Evaluation program. Veterans may register with the Department of Veterans Affairs at (800) PGW-VETS.

B-2 Weapon Hits Marks

The first live Global Positioning System–Aided Munition (GAM) drops from B-2 stealth bombers were "beautiful," according to Maj. Rex Bailey, the lead pilot for the demonstration, which took place October 8.

Major Bailey flew one of three B-2s that dropped a total of sixteen live GAMs from more than 40,000 feet above the Nellis AFB, Nev., test range. Each GAM, guided by a GPS-Aided Targeting System, destroyed its target, which measured eight feet by twenty feet.

The B-2 force hit thirteen targets directly. Two were heavily damaged, and one had fragmentary damage, according to Brig. Gen. Thomas B. Goslin, Jr., 509th Bomb Wing commander at Whiteman AFB, Mo. "We got sixteen mission kills," he told reporters at the Pentagon.

On September 17, three B-2s from the 509th conducted the first operational test, each dropping one inert GAM. The weapons landed within four feet to seven feet of their Nellis targets, according to base officials, who added that the normal circular error probable for this type of bomb is twenty feet.

The GAM is a Mk. 84 2,000-pound conventional bomb body mated with a GPS-aided guidance-and-control tail kit. The Air Force plans to buy 128 GAMs, to employ exclusively on the B-2 in the interim until fielding the more accurate Joint Direct Attack Munition. The B-2s reach initial operational capability with the GAM in 1997.

B-1B Scores With Cluster Bombs

USAF validated the first operational use of CBU-87 cluster bombs by B-1B bombers on September 17 when three B-1Bs from the 28th Bomb Wing, Ellsworth AFB, S. D., successfully released CBU-87s and Mk. 82 bombs over the Nellis AFB range.

The drops proved the conventional viability of the B-1B and successful integration of Block C software, the CBU-87 upgrade.

Additionally, the mission was the first look at the bomber's ability to employ mixed weapons from a single aircraft. The lead B-1B dropped two CBU-87s, and the second and third bombers each released both a CBU-87 and a Mk. 82.

"The B-1 is now viable against a very large target set not previously open to us," said Col. Leroy Barnidge, Jr., 28th BW commander.

F-22 EMD Progressing

Northrop Grumman in October began eighteen months of system-level integration and testing on the first developmental radar for the new USAF F-22 stealth fighter. Lew Miller, manager of the F-22 radar program, said they are "on schedule, within costs, and meeting all of our performance requirements."

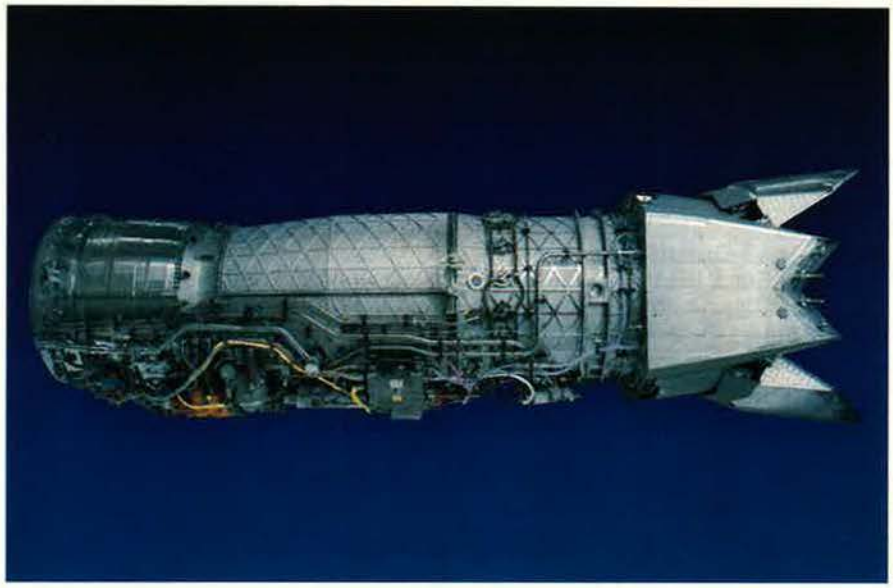
The AN/APG-77 radar is the first of

Rockwell International formally rolled out the first USAF C/KC-135 Pacer Crag July 19 with major avionics upgrades for the thirty-year-old aircraft. They include an FMS-800 Flight Management System, FDS 255 flight displays, FMR-200X weather radar, and an inertial navigation system/Global Positioning System.

eleven systems to be delivered under a joint venture between Northrop Grumman and Texas Instruments during the engineering and manufacturing development (EMD) phase of the fighter program.

Pratt & Whitney delivered the first F119 flight-test engine for the F-22 to the Air Force's Arnold Engineering Development Center, Tenn., in September to begin three months of performance, operability, and altitude testing.

Once the tests are completed, the engine will go to Lockheed Martin, the prime contractor, for installation into a flight-test F-22. First flight is scheduled for May 1997.



Pratt & Whitney started endurance qualification testing in October of its F119 engine, set to power USAF's new air-superiority fighter, the F-22. The test engine will endure 1,000 cycles, simulating actual combat missions, at the P&W facility at West Palm Beach, Fla., and undergo simulated high-speed flight at USAF's Arnold Engineering Development Center in Tennessee.

C-17 Savings Achieved

Manufacture of detail parts on the newly designed engine nacelles and thrust reversers for USAF's C-17 Globemaster III airlifters began on October 4. McDonnell Douglas, C-17 prime contractor, expects the new nacelles to save the Air Force more than $4 million per aircraft. The overall savings should be more than $300 million on the additional eighty C-17s purchased under the new multiyear contract negotiated earlier this year.

An integrated product development team—including representatives from McDonnell Douglas, Northrop Grumman (the nacelle manufacturer), Pratt & Whitney (the engine maker), USAF's C-17 System Program Office, and Air Mobility Command—produced the new design during the past twenty months. The team designed the new concept entirely in three-dimensional computer models.

McDonnell Douglas officials said the major nacelle design change replaces high-cost titanium and composite parts with aluminum components, particularly the fan thrust reverser cascades. The cascades direct airflow upward and forward to slow the C-17 on landing and to allow it to back up. Additionally, Northrop Grumman improved quality and reduced cost on its assembly methods for the nacelle.

Flight tests with the new nacelles will run at Edwards AFB, Calif., from December 1997 through February 1998. The Air Force is scheduled to receive the first C-17 equipped with the new nacelles in mid-1998.

Housing Wars

The General Accounting Office hailed DoD's new housing privatization initiatives as cost-effective but said it could do much more.

In fact, GAO's September 1996 Military Family Housing report stated not only that the military services should eliminate much of their on-base housing in favor of off-base private housing, but it also supported charging rent to those who live on base. The Congressional watchdog agency claimed that charging rent to on-base residents would help equalize the average amounts paid by service members, because the housing allowances do not cover the true cost of off-base housing.

GAO found that the government, on average, spent $4,957 less for each family living in private housing in Fiscal 1995 than it paid for a family living on base. GAO derived that figure based partially on the facts that DoD paid $1,416 less annually in school impact aid for off-base residents and that the average off-base resident paid $2,016 in out-of-pocket housing costs in 1995.

The Pentagon agreed that it should not support new government housing at locations where there is adequate private housing available. It also planned to review procedures used to determine the availability of off-base housing and thus the need for government-furnished housing.

However, it did not agree with the GAO suggestion to charge rent to on-base residents. The Pentagon maintained that such a move could have "severe consequences for military retention and readiness" by reducing benefits. It also noted that the one-third of service personnel who currently reside on base does not remain static but fluctuates with assignment rotations.

DoD also stated that it would increase housing allowances to reach the fifteen percent Congressional goal for out-of-pocket expense as the mission and available funds permit. With the latest housing allowance increase, out-of-pocket expense for off-base residents will be down to about nineteen percent.

JSMB Approves MILSATCOM Strategy

The Pentagon announced October 8 that the Joint Space Management Board (JSMB) endorsed the Military Satellite Communications (MILSATCOM) plan as developed by DoD Space Architect Maj. Gen. Robert S. Dickman. The Defense Department plans to phase in the new architecture incrementally over the next twenty years.

The strategy encompasses not only military satellite systems but "systems owned by other government agencies and those owned and operated by private/corporate organizations," according to a DoD statement. It is based on a ten-month effort by the MILSATCOM Architecture Development Team, one of three ADTs working under the Space Architect.

The objectives are to provide assured, secure communications; to fully integrate with the Defense Information Systems Network; to reduce the communications footprint, including terminal radios, antennas, RF signatures, and people; and to be user friendly and interoperable.

As directed by the JSMB, Deputy Under Secretary of Defense (Space) Robert V. Davis will work with the

Joint Staff, the services, and the defense agencies to develop an organizational structure to more definitively develop the system within the architecture and also create an affordable roadmap.

First JPATS Due in 1999

The Air Force has contracted with Raytheon Aircraft for six production Beech/Pilatus PC-9 Mk. II Joint Primary Aircraft Training System (JPATS) aircraft beginning in May 1999.

The first two new trainers will undergo a six-month, multiservice, operational test and evaluation at Randolph AFB, Tex., according to Aeronautical Systems Center program officials at Wright-Patterson AFB, Ohio. USAF and Navy test pilots will fly 200 sorties for 300 flight hours to evaluate the new trainer's ability to meet both Air Force and Navy operational requirements.

The Air Force Operational Test and Evaluation Center, Kirtland AFB, N. M., and the Navy Operational Test and Evaluation Force, Norfolk, Va., will conduct the tests at Randolph.

USAF plans to purchase 372 JPATS to replace its T-37 trainer. The Navy expects to buy 339 of the new trainers to replace its T-34C.

In September, Raytheon selected FlightSafety Services Corp. and Hughes Training Inc. as the two finalists for the JPATS groundbased training system. Each company is now working with the Air Force and Navy to refine training system requirements. Raytheon plans to make a final selection in spring 1997.

Did US Leave POWs in North Korea?

Recently declassified documents have revealed that the US government knew that North Korea failed to release more than 900 American prisoners of war who were alive at the end of the Korean War. A House National Security Committee subcommittee obtained the documents from the Dwight D. Eisenhower Presidential Library in Abilene, Kan., and from other government depositories.

A December 22, 1953, memo details a conversation between President Eisenhower and Army Secretary Robert T. Stevens about the missing prisoners. According to the memo, the Army believed that the North Koreans still held 610 Army and 300 or more Air Force personnel five months after a 1953 prisoner exchange.

The memo also said that President Eisenhower was "intensely interested" in the missing POWs and wanted to be sure "everybody was doing all they could about it." Historians of the war believe that the Eisenhower Administration feared the potential for nuclear confrontation had they told the Soviets or Chinese the US would go to war again to get the POWs back.

In September testimony before the House panel, Col. Phillip Corso, USA (Ret.), a former aide to President Eisenhower, said that he had tried to tell Congress that, "in 1953, 500 sick and wounded American prisoners were within ten miles of the prisoner exchange point at Panmunjom, [North Korea,] but were never exchanged." He also stated that at least 900 others were shipped by rail to the Soviet Union. Colonel Corso blamed the Soviet Union for "Nazi-style" experiments performed on US POWs.

A former Czechoslovakian general, Jan Sejna, who defected in 1968, testified that hundreds of American POWs were used as "human guinea pigs." He said Soviet and Czech doctors in a Czech-built military hospital in North Korea experimented on American GIs with mind-control drugs and other chemicals. He said the same thing occurred in Vietnam with even more American POWs.

In June, a DoD intelligence analyst testified that some recent and "very compelling reports" led him to believe that as many as fifteen Americans were still being held in North Korea. The House subcommittee intends to investigate the possibility that some of the 900 POWs missing in 1953 might be the same Americans who have supposedly been sighted. Some American defectors do live in North Korea.

The turboprop Beech/ Pilatus PC-9 Mk. II, the new joint trainer for the Air Force and Navy, demonstrates its climbing ability.

Vietnam War Lengthens

In a move to help some veterans, President Clinton on October 9 signed a bill changing the official starting date of the Vietnam War as it pertains to Department of Veterans Affairs programs.

The new date is February 28, 1961.

On that day, US military advisors began accompanying South Vietnamese troops in the field.

Congress previously had specified the starting date to be August 5, 1964, the day of the Gulf of Tonkin incident. North Vietnamese gunboats attacked two US Navy destroyers in the Gulf of Tonkin, an act that provoked a military response from President Lyndon Johnson. Veterans groups had ar-

In October, USAF selected the Rockwell/Lockheed Martin team for the demonstration/validation phase of the low-Earth orbit component of the Spacebased Infrared (SBIR) system. In November, the service selected the Lockheed Martin team, including GenCorp Aerojet, Northrop Grumman, and Honeywell, to build the high-component SBIR satellites. The SBIR system will replace the Defense Support Program missile-warning satellite system.

gued that the 1964 date was arbitrary and unfair and that it ignored earlier years of service by 16,500 US military advisors in Vietnam.

Of those, said the VA, only about 280 would be newly eligible for disability benefits. These veterans are poor and either suffer nonmilitary disabilities or service-related ailments, such as those associated with Agent Orange, a herbicide and defoliant used by US forces in Vietnam. The law provides that veterans will be covered for Agent Orange exposure beginning from January 9, 1962, when US forces began spraying the herbicide.

The measure passed both the House and the Senate as part of the omnibus veterans benefits bill.

AMC Sets New Acquisition Priorities

Sixty days into his command of Air Mobility Command, Scott AFB, Ill., Gen. Walter Kross identified the command's top procurement priorities as the C-17 airlifter, aircraft loaders, global air traffic management systems, and information systems for global management of air mobility forces.

General Kross stated in a September message to his command and other USAF leaders that he had spent much of his first sixty days reviewing AMC's acquisition programs. He said, "Delivering and maturing the C-17 remains the number one priority in AMC," adding that it will be "the cornerstone of AMC's global mobility operations well into the next century."

He identified the "aging" materiel-

handling equipment as a top priority because there is "a fleet-wide shortage combined with low reliability and logistics unsupportability." The General said that aerial ports and tanker airlift control elements needed new loaders to "match AMC's cargo aircraft throughput."

"The command's ability to provide credible power projection stands in jeopardy," necessitating the update of the global air traffic management system, General Kross stated. He said the technological advances in communications, navigation, and surveillance equipment, driven by new air traffic management concepts, are outdating AMC aircraft. "We must modify our aircraft to meet these new standards . . . before these new restrictions take effect."

The General's fourth priority—information systems—is a "critical force-multiplier," he said. "Fullest exploitation of these systems and the new technologies they incorporate is essential to maximize airlift capacity and mission effectiveness."

Saint Louis Gateway to Close

Air Mobility Command announced in September that it will save approximately $5.3 million annually and improve service by closing its full-service commercial gateway at Lambert–Saint Louis IAP, Mo. Instead, it plans to open test operations at Seattle-Tacoma IAP, Wash., in October 1997.

The changes, which affect AMC-chartered commercial flights, known as Category B missions, will enable AMC "to operate more efficiently, much like the hub-and-spoke system of the commercial airline industry," said Capt. Abby Posner, chief of AMC's Passenger Reservation Center. By moving the operations to Seattle, the closest CONUS departure point to bases in the Pacific theater, the command will be able to offer more direct or nonstop flights to overseas locations, she said.

Scheduled flights from Saint Louis to Frankfurt, Germany, will continue until March 1, 1997. Pacific flights originating in Saint Louis will operate until September 30, 1997.

Existing Category B operating locations at Charleston, S. C.; Los Angeles, Calif.; Atlanta, Ga.; Washington, D. C.; Philadelphia, Pa.; New York, N. Y.; and NAS Norfolk, Va., will remain in place for Fiscal 1997, according to command officials.

The Missing "Turkey Feathers"

A Luke AFB, Ariz., instructor pilot and crew chief experienced a more-than-memorable orientation flight in an F-16 over northwestern Arizona in September. Despite losing the aircraft's "turkey feathers," they survived.

Capt. Don Cotton, a 308th Fighter Squadron IP, and SrA. Michael Catlett were at the end of their supersonic run, accelerating at full afterburner, when the back of their F-16 exploded, ripping off the afterburner. Captain Cotton, who has more than 1,400 flying hours, said that it felt like a round of antiaircraft fire had hit them.

"I couldn't figure out what happened. I looked at the controls, and they were normal, but we were losing altitude . . . fast." The Captain turned the fighter immediately and headed toward the base, about sixty miles away. At 4,000 feet, and still with no idea what had happened, he told Airman Catlett they might have to bail out. It was the crew chief's first F-16 ride.

Just as he had taught his student pilots, Captain Cotton went through his checklist, but nothing worked until he put the jet's engine into a secondary, alternate mode. It began to hold steady at 3,000 feet. About then another 308th FS aircraft came alongside and told the Captain that his afterburner was gone. It is not possible to detect this situation from the cockpit because the pilot cannot see the damage, and no instrument readings indicate what has happened.

Flying at low altitude and speed and burning fuel at a very high rate, the F-16 made it back to base. The entire incident was over in fifteen minutes, said Captain Cotton, "but those first couple of minutes were the worst. Twenty seconds more, and we were bailing."

On September 18, 3d Air Force dedicated the command headquarters building at RAF Mildenhall, UK, to one of USAF's living legends, Gen. Leon W. Johnson, a World War II Medal of Honor recipient and first commander of 3d Air Force in the UK. Representing General Johnson at the ceremony were Sue Vandenberg, his daughter, and her husband, Maj. Gen. Hoyt S. Vandenberg, Jr., USAF (Ret.), shown here with Maj. Gen. Tad J. Oelstrom, 3d Air Force commander.

News Notes

- Capt. Clay D. Smith, a US Air Force Academy instructor pilot, and Cadet Dennis P. Rando, a senior at the Academy, were killed September 30 when their T-3A Firefly crashed near Calhan, Colo., about thirty miles east of the school. It was the second T-3A crash at the USAFA since the Academy started using the trainers in 1994. USAF is investigating the cause.
- Beginning in Fiscal 1998, the Air Force will offer regular commissions to line and most nonline officers only on promotion to major. The change makes the process more consistent, providing an equal opportunity for all officers, regardless of their source of commission, said the Air Force Personnel Center's Lt. Col. Gayle Staten. Everyone will know ahead of time when they'll be offered regular augmentation, she said, giving an officer "more time to establish his or her credentials."
- Members of the third rotation of medical professionals with the 4100th Air Base Group (Provisional) Aeromedical Evacuation Flight have flown

the unit's 100th medevac mission, bringing to 688 the total number of patients airlifted since December 24, 1995, from Tuzla, Bosnia-Hercegovina, to Ramstein AB, Germany. The twenty-six-member flight includes active-duty medical personnel from Pope AFB, N. C., and Ramstein, plus one Air Force Reservist and two Air National Guardsmen.

■ Starting October 1, DoD began charging parents for newborn care in all military hospitals "to comply with legal requirements to recover reasonable costs," according to a USAF statement. Previously, the military services had charged only the standard family member rate ($9.90 per day) for the mother and nothing for the baby. In Fiscal 1995, DoD spent $140 million on newborn care.

■ Air Force Special Operations Command ended a thirty-year tradition September 14 when members at Hurlburt Field, Fla., conducted the final training mission with the Fulton Surface-to-Air Recovery system. Used with the MC-130E Combat Talon I, the system was designed to recover personnel or packages from the ground by snaring a 525-foot line running from an object on the ground to a thirty-foot helium-filled balloon. Increased use of helicopters reduced the demand for the system, and tight budgets sealed its fate.

■ USAF plans to create a sixth Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer unit and base it at Malmstrom AFB, Mont. It will be the first "mixed" RED HORSE unit—282 active-duty

Photo by Nate Leong

Team Canada won the top team award in the 1996 William Tell competition, held at Tyndall AFB, Fla., October 22–25, beating six Air Force teams, including AFRES and ANG teams. Canadian Capt. Steve Nierlich was named Top Gun. The team from Air Combat Command finished second overall.

CMSAF Arthur L. Andrews, 1934–1996

CMSAF Arthur L. Andrews, USAF (Ret.), the seventh individual to serve in the Air Force's top enlisted post, died October 26 in Marietta, Ga., from complications following heart bypass surgery. Chief Andrews, who retired in July 1983 after a thirty-year career, also served as a National Director of the Air Force Association for a number of years after he left active duty. A Boston native, "Bud" Andrews enlisted in January 1953 and rose rapidly in the ranks, becoming in 1967 one of the youngest first sergeants in the Air Force at the time. His career took him overseas to war in Southeast Asia, where he was posted to Ubon RTAB, Thailand, and Cam Ranh Bay, South Vietnam. In 1977, Chief Andrews became Senior Enlisted Advisor to the commander of Electronic Systems Division and, in 1978, was chosen for the SEA post at Air Force Systems Command. He became Chief Master Sergeant of the Air Force in August 1981, following a bleak period for the armed forces, and served in the first two years of the Reagan defense buildup. During this period he worked successfully to achieve better pay and benefits for the troops. Even so, his motto during most of this period was "Get Back to Basics." He exhorted the troops to think less about benefits and more about achieving day-to-day excellence in carrying out their mission. People who were in the Air Force primarily for a job, he told *Air Force* Magazine, should find another line of work because "the Air Force is a calling." After military retirement, Chief Andrews worked as a manager for Anheuser-Busch, Inc., in Atlanta, Ga.

members and 122 Air National Guardsmen. There are currently five RED HORSE outfits: two active duty, two ANG, and one AFRES.

■ First-place finishers in the 1996 Security Police Peacekeeper Challenge were AFMC, physical fitness; AETC, handgun and grenade launcher; PACAF, combat rifle; ACC, machine gun and defender challenge; and AFSPC, Chief of Staff's challenge. Flight Sergeant William Young, Royal Air Force, won the Air Force Sergeants Association award for the outstanding enlisted competitor.

■ First-place awards in the 1996 Combat Challenge went to 786th Communications Squadron, Ramstein AB, Germany, visual information; 607th Air Control Squadron, Luke AFB, Ariz., air control; 3d Control Squadron, Elmendorf AFB, Alaska, initial command, control, communications, and computers (C^4); 352d Special Operations Group, RAF Mildenhall, UK, contingency response; and 3d Combat Communications Group, Tinker AFB, Okla., sustaining C^4.

■ USAF's top Security Police units for 1995 were 39th Security Police Squadron, Incirlik AB, Turkey; 77th SPS, McClellan AFB, Calif.; 85th SPS, NAS Keflavik, Iceland; 419th SPS (AFRES), Hill AFB, Utah; and 156th SPS (ANG), Carolina, Puerto Rico.

■ The 55th Wing, Offutt AFB, Neb., Flight Safety Office won honors as the best flight safety office in the Air Force for 1995, marking its third consecutive claim on the title.

■ The 37th Services Squadron, Lackland AFB, Tex., won the 1996 Gen. Curtis E. LeMay Services Award, and the 366th SS, Mountain Home AFB, Idaho, won the 1996 Maj. Gen. Eugene L. Eubank Services Award.

■ Air Combat Command's Quality Improvement Group, Langley AFB, Va., received a Vice Presidential Hammer Award, which recognizes outstanding work in reinventing government, on July 17 for its Action Workout Program. USAF's Declassification Team won a Hammer Award on August 9.

■ USAF Recruiting Service's top ten recruiters for 1996 are MSgts. Andrew Hair and Ted Starks; TSgts. Robert Kizzire, Michael Del Pizzo, Rodrigo Rivera, and Craig Smith; SSgts. Timothy Barber, Kevin Kranick, Dinh Lawson, and Anita Wall. All winners exceeded their annual goals by 200 percent or more.

■ Capt. Rose Anne Skirtich, a flight and staff nurse with the 86th Aeromedical Evacuation Squadron, Ramstein AB, Germany, won the Confederate Air Force's 1996 Dolly Vinsant Flight Nurse Award for her support of Operation Joint Endeavor in 1995.

■ Among the eighteen DoD employees honored October 15 at the sixteenth annual DoD Disability Awards Ceremony at the Pentagon was USAF employee Mary Lynn Goblirsch.

■ The commissary at RAF Lakenheath, UK, won the Defense Commissary Agency's 1996 Dan Daniel Award for the best large commissary outside the continental US.

■ The Army and Air Force Exchange Service now has a World Wide Web site, including an on-line shopping service. AAFES checks privileges before granting access to the shopping service. The address is http://www.aafes.com/.

■ Air University celebrated its fiftieth anniversary September 3, reenacting the original dedication ceremony in Hangar 7 at Maxwell AFB, Ala. Amid remarks about its many past accomplishments, USAF Chief of Staff Gen. Ronald R. Fogleman praised AU for producing "Spacecast 2020" and "Air Force 2025"—studies paving the way for USAF's current long-range planning.

Senior Staff Changes

RETIREMENTS: L/G Lawrence E. **Boese,** L/G Bruce L. **Fister,** B/G Michael A. **Moffitt,** L/G James F. **Record.**

CHANGES: B/G Richard T. Banholzer, from Dep. Dir., JSF Prgm., Ass't Sec'y of the Air Force for Acquisition, OSAF, Arlington, Va., to Spec. Ass't to the Principal Dep. Ass't Sec'y of the Air Force for Acquisition, Washington, D. C. . . . **B/G Leslie F. Kenne,** from Vice Cmdr., Sacramento ALC, AFMC, McClellan AFB, Calif., to Dep. Dir., JSF Prgm., Ass't Sec'y of the Air Force for Acquisition, OSAF, Arlington, Va., replacing B/G Richard T. Banholzer . . . **M/G Bobby O. Floyd,** from Dir., Forces, DCS/P&O, Hq. USAF, Washington, D. C., to Dir., Log., Hq. AMC, Scott AFB, Ill., replacing retired B/G Michael A. Moffitt . . . **B/G Charles J. Wax,** from Cmdr., 89th AW, AMC, Andrews AFB, Md., to Dir., Forces, DCS/P&O, Hq. USAF, Washington, D. C., replacing M/G Bobby O. Floyd.

SENIOR ENLISTED ADVISOR (SEA) RETIREMENT: CMSAF David J. **Campanale.**

SEA CHANGE: CMSAF Eric W. Benken, to CMSAF, Hq. USAF, Washington, D. C., replacing retired CMSAF David J. Campanale. ■

■ The USAF Battle Staff Training School, run by the 505th Command and Control Evaluation Group, Hurlburt Field, Fla., celebrated twenty years of Blue Flag exercises this year. USAF approved the concept in July 1976, and the first exercise took place in December 1976. Since then, 40,000 persons from the US military and fourteen foreign nations have been through the program.

■ Hurricane Fran wreaked havoc at North Carolina's Seymour Johnson and Pope AFBs in September. Seymour Johnson was hit hardest, suffering nearly $4.5 million in damage to more than fifty homes, one hangar, and several other buildings. Pope sustained about $300,000 worth of damage, mostly from fallen trees and downed power lines. There were no fatalities, and each base evacuated its aircraft safely.

■ Civil Air Patrol leaders elected Brig. Gen. Paul M. Bergman as national commander during their fiftieth national board meeting in San Antonio, Tex., in August.

■ The 47th Fighter Squadron (AFRES), at Barksdale AFB, La., changed its A-10 role from combat to pilot training in October, following 1995 force-structure changes. The squadron will train about forty students per year in its six-week initial transition course, covering a minimum of 110 hours of academics and twenty-five flying hours. The unit also provides a forward air controller course.

■ MSgt. Greg Osterling, 89th Medical Group, Andrews AFB, Md., received the Airman's Medal August 9 for heroic actions during a jet fighter crash while he was stationed at Kunsan AB, Korea. He was off duty and at a picnic when he went to help the pilot of a Korean F-5 that crashed on takeoff. The pilot survived.

■ SSgt. David Richman, 347th Logistics Group, and SrA. Michael Alexander, 347th Communications Squadron, both at Moody AFB, Ga., helped save the life of a man thrown from his vehicle after it was struck by an 87,000-pound logging truck on July 15.

■ Capt. Pete Doty, Capt. Mike Glaccum, Capt. (Dr.) Rory Owen, and SrA. Dale Clay, stationed at Vandenberg AFB, Calif., helped rescue two critically injured hikers at Big Sur, Calif., on September 7.

■ A C-130 crew from the 304th Rescue Squadron, Portland IAP, Ore., helped rescue three Canadian fisherman stranded on a life raft 200 miles off the coast of Nova Scotia October 1. The crew, on its way home from a deployment to Turkey, circled the area for about three hours, coordinating the effort with Canadian authorities and two commercial ships about twenty miles away.

■ DoD announced September 26 that the Global Command and Control System has replaced the Worldwide Military Command and Control System. GCCS replaces the 1970s-vintage WWMCCS network of mainframe computers with modern information technology. "With GCCS, joint commanders can coordinate widely dispersed units, receive accurate feedback, and execute more demanding, higher-precision requirements," said a DoD news release.

■ USAF recalled its pre-1954 still photo collection, on loan to the Smithsonian Institution's National Air and Space Museum, and will place it permanently in the National Archives by the end of this month. NASM officials said the collection is a "popular source for aeronautical photographs." Inquiries about the collection should go to Still Pictures Branch, National Archives at College Park, 8601 Adelphi Rd., College Park, MD 20740-6001. Phone: (301) 713-6660.

■ USAF officials noted that the "101 Critical Days" of summer 1996 saw thirty-three percent fewer ground mishaps than in 1995—the lowest rate in five years. General Fogleman praised the achievement but noted that USAF still lost sixty-six "irreplaceable people" this year. "While that's almost two dozen fewer than a year ago," he said, "there's still plenty of room for improvement in Fiscal Year 1997."

■ Phillips Laboratory, at Kirtland AFB, N. M., successfully demonstrated a new ultralow-power optical communications concept for small satellites on September 15. A high-altitude research balloon, the first launched from Kirtland, carried the small satellite prototype to 103,000 feet, where data was transferred to the ground by means of a low-power laser beam. The experiment, a precursor to a low-Earth orbit demonstration, was a joint effort with the US Air Force Academy and Utah State University.

■ Adding a Cray C-90, a Cray J-90, and an IBM SP to its stable of five supercomputers in September, Aeronautical Systems Center's Major Shared Resource Center at Wright-Patterson AFB, Ohio, is ready to begin solving "the national 'grand challenge' problems" of the future battlefield. The supercomputers, including a Power Challenge Array XL and Paragon XP/S, "are capable of modeling and simulating warfighting systems without the expense of experimentally testing the actual systems," according to ASC officials. ■

USAF Celebrates Fifty Years

Major activities in January celebrating the Air Force's Fiftieth Anniversary include a Tournament of Roses Parade salute to the Air Force on January 1 in Pasadena, Calif., with Secretary of the Air Force Sheila E. Widnall and Vice Chief of Staff Gen. Thomas S. Moorman, Jr., riding in the parade. USAF's Band of the Golden West, based at Travis AFB, Calif., has the number one marching position in the Rose Parade, and Air Force pilots will perform a flyover during the Rose Bowl football game.

Index to Advertisers

A massive study considers the Air Force's place in a future that will be much different from today.

By John A. Tirpak, Senior Editor

A little over a year ago, the Air Force tasked some of its most promising midlevel officers and members of other services to look hard at technology, global politics, social trends, and other critical factors and then conjure the "most stressful" situations that might confront the US three decades hence. The Air Force, thus forewarned, could begin to prepare itself for the challenges.

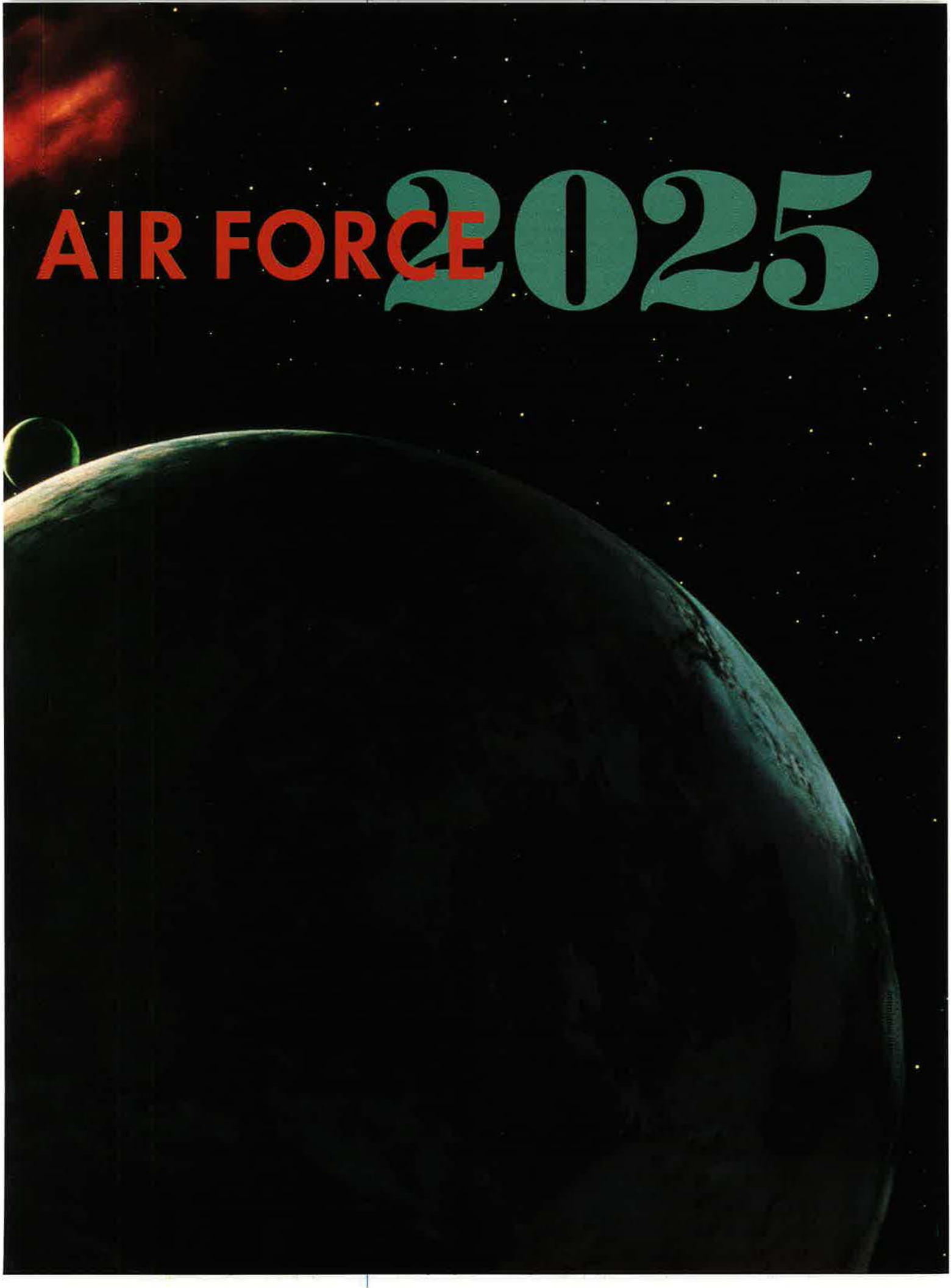
That forecast, called "Air Force 2025," is now complete, and the potential dangers that it identifies are daunting.

They include arrival on the world scene of a gigantic, hostile Asian meganation or, alternatively, a network of collaborative transnational corporations. The world of the future might well be plagued by widely dispersed weapons of mass destruction or swarms of robotic "insects" sent to attack cities. The American armed forces might have death rays capable of vaporizing aircraft.

If the forecasters are right, the Air Force in 2025 will be significantly different from that of today, despite the fact that most of the systems on which USAF will depend decades from now are already in service or development. Most strikingly, the team found that the Air Force three decades out will be oriented far more toward space than toward air. This shift in emphasis will be so profound, said participants, that they grappled with whether the Air Force should spin off an all-new "Space Force" or, at a minimum, rename itself "US Aerospace Force."

"We grappled with that," said Col. Joseph A. Engelbrecht, Jr., who headed up the Air Force 2025 effort. "But we found that the heritage of the name is still important and valuable." For most civilians, he said, the name Air Force "already connotes 'air and space'—and, increasingly, 'air, space, and information.'"

More important, however, the team decided to stick with the name because "integration of all these disciplines—air and space and information—will be the key to success. Air [forces] alone won't be effective without space and information tied in, . . . and the Air Force is pretty good at integrating them right now. So separating them into different branches or services makes less sense now than it ever did." Making that


AIR FORCE 2025

integration more seamless "is the main challenge facing the Air Force," the Colonel observed.

The 3,300-page, ten-volume report was produced at Air University, Maxwell AFB, Ala., with input from technologists, futurists, science fiction writers, scientists, historians, active-duty officers, and retired Air Force generals. It is billed as a projection of the economic, political, and military conditions that could arise around the year 2025, as well as a prescription for the capabilities USAF must have if it is to remain relevant under those conditions.

Lt. Gen. Jay W. Kelley, USAF (Ret.), who headed Air University during the 2025 effort, said that satellites "will increase in quantity and quality" and that many nations will have the ability to develop and launch them, "cutting our margin of superiority in this area." Additionally, a need is likely to arise for satellites that can "maneuver"—to avoid or fight one another in orbit—as dependency on satellite-provided information becomes greater. There will also likely be a decrease in the size of ground stations for controlling space operations.

Sword and Cyber

In 2025, General Kelley continued, "most major battles" between nations or coalitions of nations "may not be to capture territory, and they may not be fought on the Earth's surface." Instead, conflicts between technologically adept entities might occur entirely or chiefly "in space or cyberspace." According to General Kelley, the Air Force will probably develop manned and unmanned transatmospheric and hypersonic vehicles "with multiple functions." High-power lasers employed both within and outside the atmosphere will increasingly become a "weapon of choice."

"We see a trend where there will be an increase in the number of vehicles in space as opposed to vehicles in the air," said Colonel Engelbrecht. "And more of the air vehicles will be unmanned, while there will be more manned space vehicles."

The fundamental insight of the 2025 study, said General Kelley, is that the Air Force "must pursue the exploitation of information and space with the same fervor with which it has mastered atmospheric flight." USAF must become comfortable and practiced at dominating "the atmospheric, exoatmospheric, and infospheric" realms.

Completed this summer, the study is one of several forecasting efforts ordered up last year by the Air Force Chief of Staff, Gen. Ronald R. Fogleman. In one of them, called "New World Vistas," the Air Force Scientific Advisory Board evaluated the technologies now emerging, looking for the ones that, with proper investment, could yield breakthrough capabilities for tomorrow's USAF *[see "New World Vistas," March 1996, p. 20].*

The Air Force 2025 participants took a different approach. First, they determined the possible characteristics of the most stressful future worlds in which USAF might have to operate. Then, they looked for "common-denominator capabilities"—that is, systems that would be critical to military success in any of these scenarios.

The study participants emphasized that they were working in the "worst-case" realm. While the major scenarios they used were certainly possible and plausible, they "do not represent the 'most likely' potential futures," contended Colonel Engelbrecht.

He went on, "What we were trying to do was consider alternative futures that represent very difficult challenges for the Air Force. It's a way to think about the future and devise a strategy. . . . We want to try to avoid being surprised by the challenges that confront us in thirty years."

The 2025 team made several predictions:

- Information—as a commodity as well as a combat medium—will be "more influential than bombs" in thirty years, and expertise in manipulating information will offer the United States its most telling advantage over future adversaries.
- Industry, not government, will be responsible for developing critical new technologies, and government more often than not will borrow, license, or lease systems rather than buy or develop them on its own.
- Human beings increasingly will direct operations at a distance from the scene of action—"in the loop" as opposed to "in the cockpit"—as uninhabited machines assume ever-greater importance.
- Military education will become more frequent and more tailored, with gaming and simulations—of everything from air combat to running an expeditionary base—taking on greater significance. With the aid of computers and digital technology, the distinction between taking a course "in residence" and "by correspondence" will become moot.

"These evolutions may each or all have dramatic or even revolutionary effects," General Kelley wrote in his executive summary of Air Force 2025. The impact of these trends, he added, is "unavoidable."

To think systematically about what kinds of conditions may prevail three decades hence, the 2025 team decided to bound the future along three axes.

The first of the three axes was labeled the "American World View." Would the United States tend toward isolationism or remain fully engaged around the globe?

The next axis was the rate of technological change in the world, and its distribution, abbreviated "Delta TeK." Would high technology remain in the hands of a few world actors or become widespread?

The final axis reflected the "World Power Grid." Would economic, political, cultural, and military power be concentrated in a few major nations or be broadly dispersed?

The intersection of these variables defines the box that contains the range of possible futures. The study participants gave each of the box's corners a name and a "plausible history" describing how that world came to exist.

"Gulliver's Travails." The first corner features the intersection of global world view, modest technological progress, and dispersed world power grid. In this future, the US is pinned down by a host of microcrises around the world, much as Jonathan Swift's character, Gulliver, was bound by Lilliputians. The US is "overwhelmed and preoccupied with worldwide commitments, such as counterterrorism and counterproliferation efforts, humanitarian assistance, and peacekeeping operations," according to the report.

The US, the report contends, at-

tempts to be "the world's policeman, fireman, physician, social worker, financier, and mailman." Unwelcome at overseas bases, the US must maintain a high operations tempo at long distance, with tight funding.

"Zaibatsu." In the next corner, the variables change. The US is self-absorbed; technology growth around the world has become exponential; and power has been concentrated in a few transnational corporations—hence the use of the Japanese word for corporate collaboration. In this future, the military faces a struggle to demonstrate why it is even relevant as corporations rule the world in loose coalitions. Conflicts are few and brief, and the US military serves chiefly to guard access to resources, assets, and trade routes. There is a rising threat from a rapidly growing underclass, but, with foreign tensions eased, the United States turns inward and focuses on its domestic problems.

"Digital Cacophony." This is a world in which real power and technology are widely dispersed, and the US continues to focus outward. In this future, nearly everyone has access to high technology, up to and including weapons of mass destruction. However, the most likely threat to the nation comes in the form of an attack from cyberspace. For example, terrorists or hostile nations could attempt to "crash" the US banking or air traffic control systems via computer. This world would be characterized by a gradual breakdown of order and traditional forms of authority.

"King Khan." At this corner, the 2025 study speculates on the rise of a "Sino-colossus" incorporating the lands, peoples, and economies of China, Hong Kong, Malaysia, Singapore, and Taiwan. Here, the US turns inward because of severe economic problems; in the study's words, "the American Century has given way to the Asian Millennium." American defense budgets hit bottom, and only a few capabilities can be afforded. The United States, according to the study, resembles Britain in the 1950s, after losing its empire: "a superpower has-been." The King Khan scenario occupies a corner characterized by concentrated power, gradual technological progress, and a domestically oriented US.

By special request, the team produced two other future-world scenarios.

- Fifteen percent of the world's population—including the people of the US—is relatively wealthy. The other eighty-five percent lives in squalor and has nothing to lose. The threats to the United States increase. Here, the US looks outward in self-defense, but power and technology are in flux. This alternative future was requested by regional commanders in chief as a kind of "middle of the box" comparison model with other alternatives.

Peering thirty years into the future, the Air Force sees the need for stealthy air bases, high-powered lasers on trans-atmospheric craft, tiny "attack microbots," solar-powered weapons, and the biggest, fastest, most powerful information systems possible.

- General Fogleman requested exploration of a specific future, "Crossroads 2015," which arrives ten years before the other scenarios. Here, the US faces economic hard times, and the pace of technological progress has slowed. Russia, its power on the rise, attempts to seize and incorporate independent Ukraine. The US confronts the danger of fighting a major war using those forces developed with the investments of the late 1990s. The choices the US makes in this crisis—whether to strike an isolationist stance or accept the costs of remaining the military leader of Western democracies—has a lot to do with which of the 2025 scenarios becomes more likely.

Common Themes

A number of common themes shook out of these scenarios, according to General Kelley. First and foremost, he warned, the world "is not likely to be more benign" in thirty years.

The 2025 team anticipates that the world will see a rise in the number of nation-states—witness the breakup of the Soviet Union and Yugoslavia in the past decade—but each will have less influence. "Coalitions and empires may emerge," General Kelley wrote, "but the state sees much of its dominance of the twentieth century ebbing away to nonstate entities, both larger and smaller than itself."

The US will face the threat posed by weapons of mass destruction, but it will increasingly have to defend itself against information warfare attacks that are "nonviolent but powerfully destructive," said the Air Force report. The value of information itself will be outweighed by "the architecture of and infrastructure for its collection, processing, and distribution."

The forecast team believes that the ICBM—a dominant system in the Air Force of thirty years ago and a key system today—will still be around, but its importance will have diminished, with no upgrades to ICBMs or nuclear weapons anticipated.

In addition, space and information systems will more and more become the enablers of surface and air operations, while also allowing the US to keep out of such conflicts while exerting just as much power. Though there will be competitors who can challenge the US on an even footing in selected areas—such as aircraft technology, information warfare, or space systems—very few, if any, will be able to compete in all areas at once.

There will be nations or coalitions with the ability to project military power on the surface and in the air, but they won't be able to sustain high-tech combat for long. Thus, the forecast perceives a continued need for a "full-service" Air Force.

In each of the postulated scenarios, operations analyses were run to see which capabilities—real, prospective, and not-yet-invented—would prove

most useful and cost-effective to USAF. These capabilities were weighted and ranked against each other to identify a core group of technologies that would be essential regardless of the future that plays out.

The group considered a total of forty-three of these capabilities. From that group, ten systems or technologies were deemed essential for the Air Force's toolbox in 2025, having application across the spectrum of missions it might be called on to perform.

The Top Ten

"These ten systems were found to be high leverage," General Kelley noted. "No matter what kind of world you're living in, you need these [systems] . . . or something very much like them."

First on the list is a Global Information Management System (GIMS), described as a "pervasive network" of information and data collectors, processors, and analyzers. It would not only be "smart" in the sense that it "sees all and knows all," but it would also be smart enough to tailor the information at its disposal to a particular user, giving him the data he most needs, and at an appropriate level of detail. The GIMS could also provide a three-dimensional "holographic war room," summarizing instantly and in real time what it could take hours to figure out from numbers, reports, or even flat-panel images.

Another high-leverage capability is the sanctuary base. This would essentially be a stealthy air base, hard for an enemy to detect, target, or hit, and able to set up and repair, maintain, and manage itself, largely through the use of robots. Security, fire-fighting, and even ordnance-loading could be automated. Chemical or biological agents could be cleaned up by microscopic machines—called "nanobots"—and biotechnology.

A Global Surveillance, Reconnaissance, and Targeting System would be a spacebased sensor and data-distribution system that could create and relay a real-time, three-dimensional image of a target or other area of interest to a ready room or gathering of decision-makers. It would be useful for command-and-control and situational awareness "at all levels."

The combination of a high-energy laser system, a kinetic-energy weapon system, and a transatmospheric vehicle would constitute the Global Area Strike System. Groundbased lasers could be bounced off of satellite mirrors to hit ground, air, and orbital targets. Rods of denatured uranium could be dropped from orbit to hit ground targets with great precision and huge destructive effect "with and without explosive enhancers," while the vehicle could provide support for the space systems and rapidly transport special operations forces directly to the scene of action from a CONUS base.

Like "New World Vistas," Air Force 2025 portends a large role for uninhabited combat aerial vehicles (UCAVs). Without the need for a person on board, they could loiter in the target area for twenty-four hours or more, maneuver at many times the human limit of nine Gs, and carry a vast array of sensors and precision munitions. In secondary roles, UCAVs could perform jamming and bistatic radar functions.

A Spacebased High-Energy Laser System is seen as a multimegawatt chemical laser that can zap ground, air, or space targets. At lower power settings, it could disable enemy optics, perform passive sensing missions, actively illuminate a target with a laser, or even modify the weather. Between fifteen and twenty such satellites could provide global coverage.

A Solar-Powered High-Energy Laser System would perform much the same function but derive its power from the sun rather than an on-board power source.

Like a UCAV, an uninhabited reconnaissance aerial vehicle can stay airborne for long periods, can remain on station high in the atmosphere, and could perform outside of human limits. Carrying a multispectral suite of sensors, such as infrared, optical, radar, and laser, it could also collect electronic intelligence as an aerial "listening post" and as a bistatic radar sensor.

As computer chips and mechanical devices get smaller and smaller, attack microbots become more feasible. These would be one-millimeter-scale devices that could fly in a swarm and collectively attack an armored column, powerplant, or virtually any target. Launchable by almost any means, they would have "full flying and crawling autonomy," according to the 2025 text. They could spy, gum up mechanical works, designate targets, or short-circuit equipment and would be inherently stealthy and have "high penetration capabilities."

Also deemed critical is a Piloted Single Stage to Orbit Transatmospheric Vehicle. This rocket/hypersonic air-breathing hybrid would take off vertically, refuel in air or space, and land conventionally on a runway. It could lift a variable payload weighing up to 10,000 pounds and serve as a sensor or weapons platform. It would be uniquely suited to placing satellites in orbit, repairing them, or bringing them home for maintenance and eventual replacement.

Big Payoff, Big Challenge

Not surprisingly, the systems deemed to be of highest utility in the world of thirty years from now are among "the most technically challenging" of those looked at, General Kelley observed. The 2025 team also recognized that it would at present be premature to try to develop most of these systems. The technologies to make them possible must first be mastered.

The team therefore recommended investments in a number of disciplines so that the proposed critical systems will be available in three decades. The short list of highest-leverage technologies for USAF investment are data fusion, power systems, advanced materials, micromechanical devices, high-energy propellants, and high-performance computing.

As a postscript to 2025, General Kelley included "the null hypothesis"—namely, that the Air Force itself won't be around in thirty years. One of the white papers included in the study, "Paths to Extinction," suggested that the Air Force could disappear from the landscape due to forces already at work, such as the strong emphasis on joint operations and shrinking defense budgets.

The white paper also warned that the service risks its future if it fails to invest in the right technologies, loses its vision, or mismanages its people. "The only element common to all the paths to extinction," the paper concluded, "is the failure to understand the significant attributes of airpower." ■

Hughes Electronics will demonstrate technologies for the next generation of avionics. Under contract to the U.S. Department of Defense, Hughes will demonstrate an affordable, multi-function, wideband, active array for the Joint Strike Fighter (JSF) Program. This marks an important milestone in development of a Multi-functional Integrated Radio Frequency System (MIRFS) for future aircraft. MIRFS will integrate radar, electronic warfare, and selected communications functions in a single nose aperture. The JSF family of aircraft, with its MIRF subsystems, will complement the Navy's F/A-18E/F and will replace the Air Force's F-16, the Marine Corps AV-8B and F/A-18 aircraft, and the UK Royal Navy's Sea Harrier.

A new era in military pilot training has begun, with the delivery of a Unit Training Device (UTD) flight simulator built by Hughes. The simulator is one of 65 UTD trainers the U.S. Air Force has ordered for bases across the country. It will help train F-16 pilots in emergency procedures, avionics, air-to-air and air-to-ground combat, tactical fighting in a dense threat environment, and identifying targets and delivering weapons in adverse weather, day or night. While offering comparable training capability to previous generation F-16 simulators, UTDs are launching a whole new training era enabling high-fidelity simulators to be available soon in every F-16 squadron at substantially reduced acquisition and operational costs.

A new type of arsenal ship that could deliver heavy firepower to support U.S. forces in coastal and land battles is now being designed. Hughes leads one of five teams selected by the U.S. Defense Advanced Research Projects Agency (DARPA) for the concept design phase of this joint Navy/DARPA Arsenal Ship Program. The Arsenal Ship, with over 500 vertically launched missiles, will provide theater commanders with massive firepower for long-range strike, naval surface fire support, and air theater defense. This program is a radical departure from the way the U.S. Navy has previously acquired ships, turning the entire development process over to industry.

Aerial surveillance protection measures during the Bicentennial Olympics were first class, with the help of three Ground Based Sensor (GBS) radars designed and built by Hughes. Officials of the U.S. Customs Service and the Department of Defense Special Events Organization anticipated an unprecedented amount of Atlanta-bound air traffic during the games, and the need for ensuring aircraft safety was paramount. The Hughes sensors provided information on over 40 violators of the restricted airspace. The GBS system is a powerful 3D radar capable of seeing very small aircraft and noting an aircraft's altitude, direction, speed, and range. It was set up at selected locations around Atlanta, to provide coverage for all the venues of concern.

The Department of Defense has added a new satellite to its constellation of ultra-high frequency (UHF) satellites, which represent the latest in worldwide communications capability. The seventh in this series of Hughes-built satellites for the U.S. Navy, the UHF Follow-On F-7 satellite is the first to have an enhanced EHF payload, providing a total of 20 secure channels in the extremely high-frequency band. A payload for interim global broadcasting services will be added on satellites F-8 through F-10, greatly expanding warfighter communications.

For more information write to: P.O. Box 80032, Los Angeles, CA 90080-0032
Or find us at http://www.hughes.com

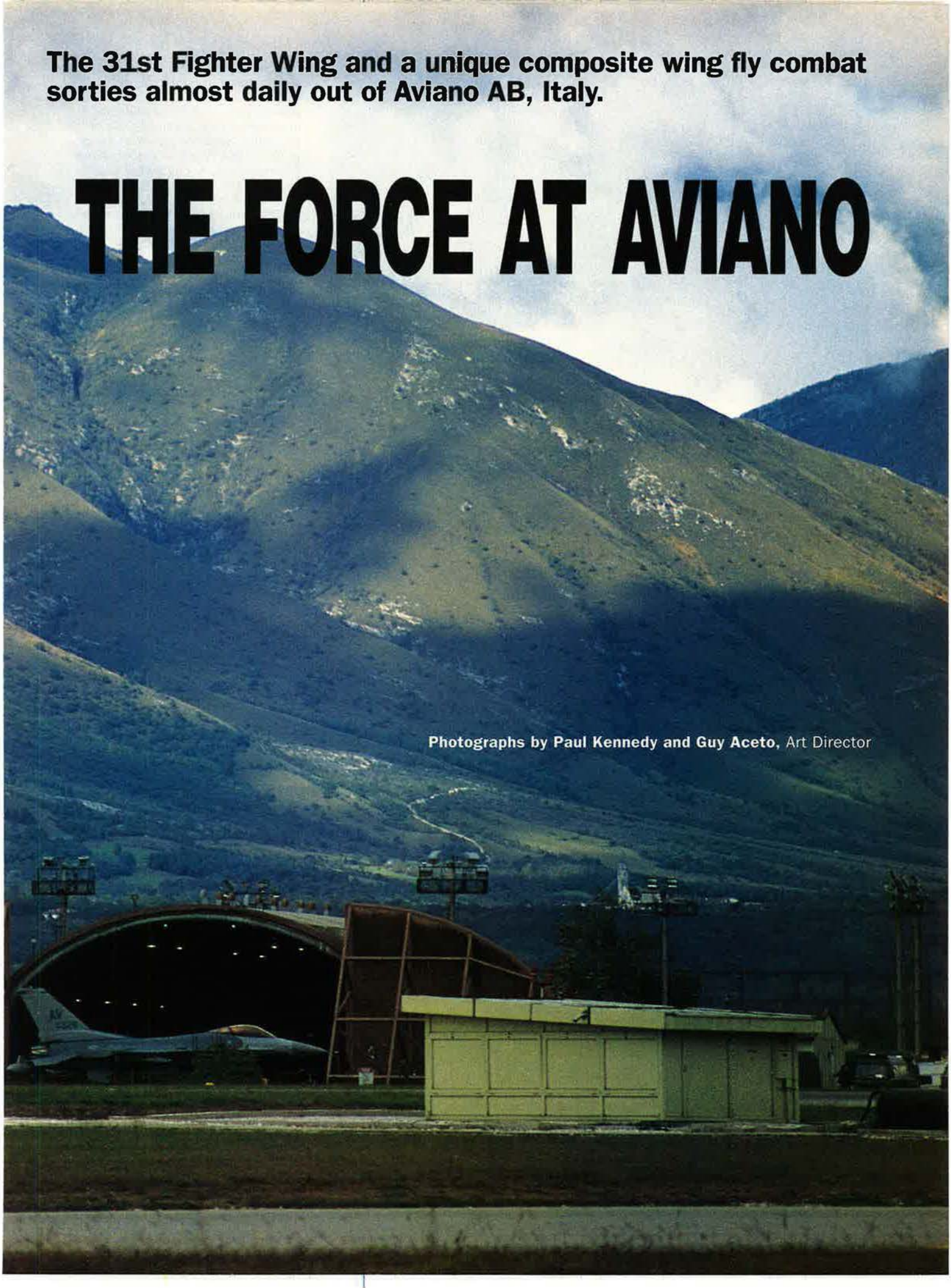
HUGHES
ELECTRONICS

Tucked into the base of the Italian Alps, hardened aircraft shelters protect the F-16s of the 31st Fighter Wing.

Photo by Guy Aceto

The 31st Fighter Wing and a unique composite wing fly combat sorties almost daily out of Aviano AB, Italy.

THE FORCE AT AVIANO



Photographs by Paul Kennedy and Guy Aceto, Art Director

Staff photo by Guy Aceto

Always significant to the USAF mission, Aviano today has even more responsibility in southern Europe, as its forces help to keep watch over a volatile part of the world. Since its arrival at Aviano in April 1994, the 31st Fighter Wing has continuously conducted and supported air combat operations for US Air Forces in Europe and NATO's southern region. The wing provided combat support for Operation Deny Flight from July 1994 to December 1995, enforcing the no-fly zone over Bosnia-Hercegovina. In August and September 1995, it generated more than 400 combat sorties for Operation Deliberate Force, the air campaign against the Bosnian Serbs. The wing now supports Operation Decisive Edge, the peace-implementation effort in Bosnia.

Above, a fully loaded F-16C from the 31st FW's 510th Fighter Squadron sits in front of a hardened aircraft shelter on a drizzly morning, awaiting its next mission.

Critical to these operations is the 4190th Provisional Wing. A truly composite organization, the wing brings Decisive Edge aircraft and personnel from other NATO countries, Army, Navy, and Marine air units, and USAF's active-duty and Guard and Reserve all under one chain of command. These units spend from two to six months under the provisional wing. Only twelve of the 31st FW's F-16s are tasked for Decisive Edge missions, under the 4190th PW, at any one time. The wing has a twenty-four-hour operations cell for command and control of all Decisive Edge operations at Aviano.

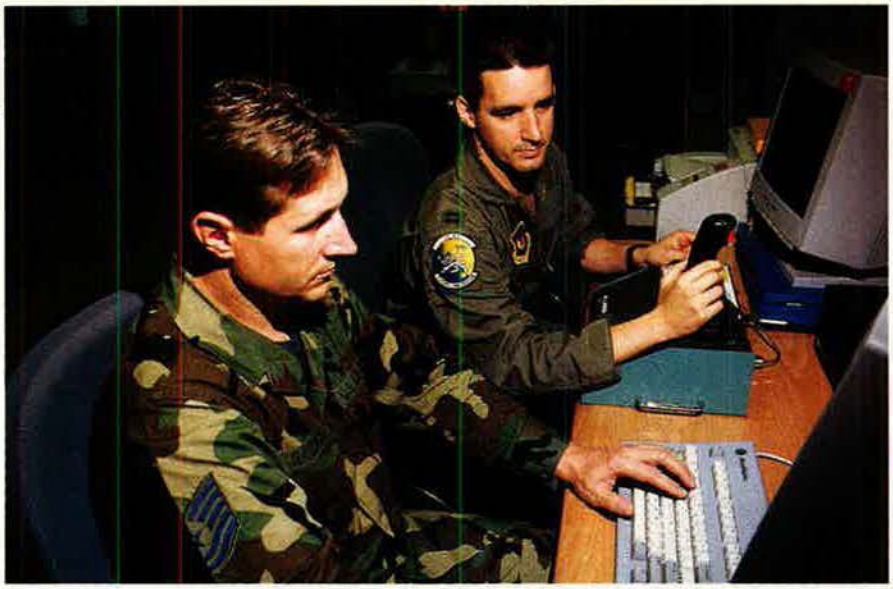
Photos by Paul Kennedy

Not far from the flight line, where this Marine F/A-18 (above) launches on another Decisive Edge mission, is the town of Aviano (left)—its Old World architecture in contrast to the surrounding high-tech military operations. Aviano has hosted USAF since the mid-1950s, when Det. 1, 17th Air Force, arrived. Not all of the 31st FW's units are located here, however; the 31st Munitions Squadron and the 31st Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer (RED HORSE) Flight are located near Padua, and the 31st Munitions Support Squadron is at Ghedi AB, Italy. Units farther afield are the 731st Munitions Support Squadron at Araxos AB, Greece, and the 496th Air Base Squadron at Morón AB, Spain.

Staff photos by Guy Aceto

As tactics in the skies over Bosnia were being developed, the 31st FW's two F-16 fighter squadrons took on a new role: airborne forward air control. The idea that an AFAC mission could be performed at high speeds and altitudes seemed improbable at first, but the F-16 pilots sought the job to become less dependent on other aircraft to locate targets for them and to gain better mission flexibility on ground-support missions. In February 1995, F-16 pilots from Aviano traveled to Davis-Monthan AFB, Ariz., for AFAC training with A/OA-10 AFAC pilots. They discovered that the F-16's speed, maneuverability, avionics, Low-Altitude Navigation and Targeting Infrared for Night pod, and laser designator offered many advantages over the A-10 usually used for AFAC. They also learned how to employ the LAU-131 rocket pod and its seven white phosphorus marker rockets, the F-16's newest weapon (mounted on the aircraft at right, along with AIM-120 and AIM-9 air-to-air missiles). By September 1995, the 31st FW was performing the AFAC role during Deliberate Force. The wing's 555th and 510th Fighter Squadrons continue to refine the art of AFAC in Decisive Edge missions.

Photos by Paul Kennedy



At Aviano, the 31st FW Intelligence Flight constantly receives updates on potential threat areas. At left, TSgt. Larry Gagliano goes over a potential target with an intel officer. To give aircrews every possible edge, intel personnel began working with computer software engineers to create a system that could plan routes, allow intel technicians to look at targets from any angle, and combine information for future missions. The resulting software, "Power Scene," allows mission planners to determine the best approach to a target. It also lets crews "fly" the mission repeatedly to iron out problems before embarking on the actual sortie.

The 603d Air Control Squadron handles several facets of the Aviano mission. As part of USAFE's Theater Air Control System, it supports NATO ground forces through collection of information on aerial activity and radar coverage for control of air forces. It supports the 31st FW's and Decisive Edge training missions and Decisive Edge northern aerial refuelings. It also links commanders at Aviano, ground forces in Bosnia, and airborne crews. From small, portable units like the one at right—where SrA. Mike Copeland communicates via satellite with a counterpart in Sarajevo—the 603d ACS can link units in Germany and Hungary. The unit's technicians maintain all of their own equipment and can deploy on very short notice.

Real-world missions require live weapons, and the munitions crews at Aviano probably see more live rounds than most. These weapons specialists not only keep pace with the daily missions, but they were also vital in designing procedures for the LAU-131 rocket pods when the new system came on line. Aviano's crews must be proficient with eleven types of weapons that the wing's Block 40 F-16C can carry. Everything from 20-mm gun rounds to laser-guided bombs are part of the day-to-day loads that these experienced, highly skilled crews handle.

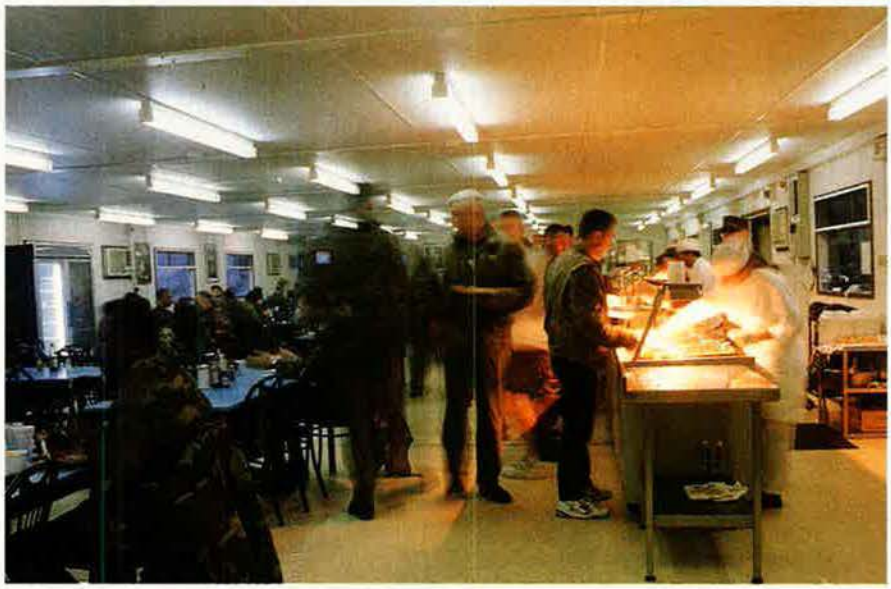
Photos by Paul Kennedy

Headquarters for 16th Air Force, Aviano AB hosts two of the numbered air force's three major elements: the 31st FW and the 616th Regional Support Group. (The third is the 39th Wing at Incirlik AB, Turkey.) The 31st FW's commander, Brig. Gen. Charles F. Wald, and the 31st Operations Group commander, Col. Marc E. Rogers, serve also as commander and operations group commander, respectively, for the 4190th PW. The wing (originally activated as the 7490th PW in June 1995) has its own budget and NATO chain of command. Packages of aircraft from squadrons on TDY to Aviano augment the provisional wing's Decisive Edge missions. Recently, these units have included RAF's No. 8 Squadron of E-3 Airborne Warning and Control System aircraft and the 103d Fighter Wing (ANG) with its A-10s (above), on its second rotation to Aviano from Bradley IAP, Conn. An EA-6B Prowler from Marine unit VMAQ-4 (right), moving out in the early morning for one of the first sorties of the day, is another part of the package. The CH-47 Chinooks (bottom right) are from the Army's Company E, 502d Aviation Regiment, one of the 31st FW's major tenants.

Photos by Paul Kennedy

Almost half of the actual base, including the commissary, support facilities, and dormitories, is in the town of Aviano, but because of the TDY population explosion, most TDY ground crews and even some pilots stay in the small community of prefabricated buildings at left. As a quality-of-life initiative for the deployed troops, $6 million was spent on upgrades for these trailers, such as hard floors, walls, heating and air-conditioning, and sound suppression.

In the temporary village—nicknamed "Tendopoli" as an attempt to Italianize "tent city"—the dining hall is one of the larger structures. Lt. Col. Cory E. Richards, AFRES, is Tendopoli's commandant, managing an operation that oversees an average TDY population of 800. Aviano's total military population is approximately 9,000.



Common at overseas bases, hardened aircraft shelters evoke memories of the Cold War. They still have their uses, as security remains a concern. Working on an aircraft under cover is safer and—on a rainy day—drier. The shelters can operate as service stations if an increased operations tempo necessitates turning the aircraft more quickly than usual. At left, an F-16 from the 510th FS prepares for a Decisive Edge mission over Bosnia, proving that the inside of a hardened aircraft shelter makes for a noisy engine start-up.

Photo by Paul Kennedy

Activity at the 31st FW shows no sign of slowing. Operations at Aviano continue to receive solid backing from the Italian Air Force hosts, NATO, and USAFE, and new construction takes place daily to improve flight line activities and support facilities in town.

A high operations tempo means getting training whenever and wherever you can. Aviano does not have a nearby range, but its squadrons can train with a variety of allies, something not many others have a chance to do. It could be mock air-to-air combat with visiting German MiG-29s or practice at the Air Combat Maneuvering Instrumentation range near Decimomannu AB, on the Italian island of Sardinia. Above, the flagship of the "Triple Nickel" comes home after training at NATO ranges in Spain. Given Aviano's central location and its vital role in Europe's southern region, the turnaround for a real-world mission could be quick. But the force at Aviano is ready. ■

Staff photos by Guy Aceto

It's a New

Donald D. Engen (right) can often be seen with his deputy director, Donald S. Lopez, walking the museum floor, where renewed attention to exhibit maintenance is apparent.

Photo by Paul Kennedy

Day at Air and Space

A new director takes the museum back to its charter to collect, preserve, and display the nation's aerospace heritage.

By John T. Correll, Editor in Chief

THE MAIN thing to know about Donald D. Engen is that he is an airman. He has been flying actively for fifty-four years and has flown 265 or 270 different types of aircraft. He's lost track of the exact number. He served in the Navy from 1942 to 1978, progressing in rank from seaman second class to vice admiral. He was in three wars, beginning with World War II. He holds twenty-nine awards and decorations, including the Navy Cross. As a dive bomber pilot flying Curtiss Helldivers off the *Lexington* in 1944, he helped sink the Japanese carrier *Zuikaku*.

Later on, he was a Navy test pilot, deputy commander of Atlantic Command and the Atlantic Fleet, and, in the 1980s, head of the Federal Aviation Administration. He is seventy-two but not yet ground-bound. "I have a glider today that I keep in Nevada, and I kind of commute to it," he says.

Since last summer, Admiral Engen has been director of the National Air and Space Museum in Washington, D. C. He carefully avoids comment on his predecessor *[see "The Revelations of Martin Harwit," p. 38]*, who left amid controversy in 1995 and under whom the museum strayed from its prime charter to collect, preserve, and display historic airplanes and aerospace artifacts. Nevertheless, as Admiral Engen declared when he was appointed, it's a "new day" at Air and Space, marked by an emphatic return to the museum's traditional mission.

Admiral Engen's first act as director was to reappoint Donald S. Lopez—World War II fighter ace, retired Air Force lieutenant colonel, and arguably the best liked and one of the most respected persons on the museum staff—as deputy director, a position he had held from 1983 to 1990. He also continues to fly when he can,

Photo by Paul Kennedy

Admiral Engen says that he and Colonel Lopez agreed that the Garber restoration facility should "resume its eminent place in our hierarchy." Here, technician Will Lee works to restore a Hawker Hurricane.

mostly a Cessna 172 but "now and then" a Stearman.

The two of them are seen frequently walking the museum floor, where fresh paint and more attention to exhibit maintenance are apparent. Restoration work and care of the museum's 344 vintage aircraft are now a priority, beginning tc correct a situation reported by the General Accounting Office in 1995 in which the collections staff felt "disenfranchised," partly because of "little or no interest shown by the museum management in restoration." GAO noted that only about four percent of the total museum staff was engaged in restoration, compared to twenty-two percent so engaged at the US Air Force Museum in Dayton, Ohio.

Astrophysics Lab Closes

Some of the changes taking place on Admiral Engen's watch come from having steered a budget cut into the most positive direction possible. Congress reduced its funding allocation to the Smithsonian Institution, of which the Air and Space Museum is a part. Air and Space took its proportional share of the reduction.

Budgets for the museum's exhibits, the aeronautics department, and space history were not affected, but the astrophysics lab—founded by former director Martin O. Harwit—has been abolished. (Among the findings of a 1995 report by the National Academy of Public Administration were that "the astrophysics laboratory's contributions to the museum's mission do not justify its presence" and that "the single most important reason the lab is located at the museum is that the former director was an astrophysicist and expressed strong interest in the lab's research and its ability to sustain his work as a scientist.")

One element of the museum, the Garber Preservation, Restoration, and Storage facility in Suitland, Md., will actually gain funding and staff. "When Don [Lopez] and I came here, we both agreed that we need to send a signal that we want the Garber facility tc resume its eminent place in our hierarchy," Admiral Engen says.

The entire museum reverberates with the enthusiasm of the staff and of the two veteran aviators in the front office. Showing off work in progress in October, Don Lopez pointed to preparations to bring in an F-86 Sabre as the centerpiece of an exhibit on airpower in the Korean War. That is the first of several exhibits and displays keyed to the fiftieth anniversary of the US Air Force, coming up in 1997. "We're going big on the fiftieth," Admiral Engen says.

The F-86 will occupy the open center space at the west end of the museum. Suspended above it at eye level from the second floor walkway is a shark-toothed P-40 fighter with "Lope's Hope" lettered on the nose. "Lope" is Don Lopez, who started out flying P-40s in China against the Japanese. "The P-40's giving the Sabre top cover," he observes.

(Actually, he also has considerable personal regard for the F-86, which he flew in combat in the Korean War. That opinion is shared by Admiral Engen, who rates the FJ-3M—the Navy designation for the F-86H—as one of the two airplanes he most enjoyed flying. The other was the F8U3, an advanced model of the Vought Crusader with a bigger engine that he flew as a Patuxent River test pilot in 1959.)

1.8 Million See *Enola Gay*

Next door to the Sabre is the most famous and most popular special exhibition in the history of the National Air and Space Museum. It houses the forward fuselage of the *Enola Gay,* the B-29 bomber that dropped the first atomic bomb on Japan in 1945. It was a plan to use the *Enola Gay* in a politically rigged show about the horrors of nuclear war that brought the museum's previous regime tumbling down.

As of mid-October, the *Enola Gay* exhibition had drawn 1.8 million visitors, approximately double the number for the previous attendance champion, a "Star Trek" program that logged 880,000 visitors in 1992.

Among the notable new programs at the museum is "How Things Fly," which opened in September with more than fifty touch-and-participate exhibits explaining such things as how a heavy airliner gets aloft and stays there. Interactive displays include a visitor-operated wind tunnel that demonstrates lift, drag, and the aerodynamic effects on airfoils. Visitors can climb into a Cessna 150 and watch the rudder, ailerons, and elevator move as they manipulate the controls. A General Electric cutaway shows the internal workings of a turbojet engine. The idea, the museum says, is to help dispel some of the mystery of flight while preserving the magic of it.

Also new is "Cosmic Voyage," an IMAX film that premiered on the five-story screen of the museum's Langley Theater August 9. It combines computer animation with live-action footage for a white-knuckle guided tour through time and space. Viewers are there for the "Big Bang" birth of the cosmos. They watch as a comet fireball races toward primor-

dial Earth. They ride the "cosmic zoom" through superclusters of galaxies, then plunge down in scale to explore the subnuclear world of quarks.

The filmmakers held themselves to rigorous scientific accuracy. For example, it took more than 950 hours of time on a Cray C-90 supercomputer to calculate the precise positions of stars and gases and simulate the colliding galaxies portion of "Cosmic Voyage." After its opening run at the National Air and Space Museum, the film will be available for showing in specially designed IMAX theaters elsewhere.

Photo by Paul Kennedy

The fully restored* Enola Gay*'s home will be the National Air and Space Museum Dulles Center (shown here in scale model) in Virginia. Admiral Engen's goal is to have the new $200 million center open by December 31, 2001.

The Dulles Center

As administrator of the Federal Aviation Administration in June 1985, Donald D. Engen signed an agreement giving to the National Air and Space Museum for one dollar a year enough land for an "annex" at Dulles Airport (which was owned by the FAA in those days) in suburban Virginia, west of Washington. Little did he imagine that the project would not really begin to move ahead until eleven years later and that it would fall to him to raise the $200 million required for its completion.

The "annex" tag is long gone. Now it's "the Smithsonian Institution National Air and Space Museum Dulles Center." The main display hangar will be a massive facility with a clear dome under which visitors can walk up to such large treasures from the museum's collection as the space shuttle *Enterprise,* the Concorde, a B-17 bomber, and the SR-71 "Blackbird" reconnaissance aircraft. In the middle of it all, says Admiral Engen, will be "the fully restored, World War II B-29 bomber that hastened the end of a terrible war, the *Enola Gay*."

For the first time, Air and Space will have not only the floor space but also the big doors, high ceilings, and reinforced floors to allow exhibition of aircraft and spacecraft too large to show in the main museum on the National Mall. Also on display at Dulles will be many of the 32,000 artifacts in the collection, less than ten percent of which can be displayed at any one time at the museum downtown. In addition to the exhibit areas at Dulles, there will be a large-format theater, classrooms, and a facility simulating a control tower where visitors can see and hear airplanes landing and departing from the airport. The archival collection and the restoration and storage operation will also move to Dulles from the dilapidated Garber facilities in Maryland.

Congress has authorized $8 million for planning and design of the Dulles Center but has made it clear that there will be no federal funds for construction. Roads, interchanges, a taxiway, and infrastructure support will be contributed by the state of Virginia. The rest of the money must come from a public fund-raising campaign.

Admiral Engen says the Dulles Center is his top priority. "My goal is to have the facility open and be able to walk through the doors on December 31, 2001," he says.

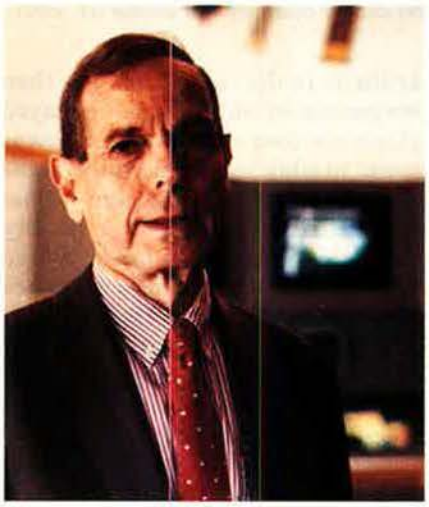
Challenging as it sounds, don't imagine that this is all that Admiral Engen is doing. In September, Secretary of Defense William J. Perry appointed him to conduct an independent review of the Department of Defense executive support air fleet. That he was chosen for the task and that he took it on in stride are further indications of the caliber of the man now setting the course at the National Air and Space Museum. ■

Photo by Paul Kennedy

The Dulles Center will house many of the musuem's 32,000 artifacts, only a tenth of which can be displayed at one time at the main museum. It will also house a large-format theater and the restoration and storage operations.

The former director of the National Air and Space Museum has written a book about the *Enola Gay* controversy.

The Revelations of Martin Harwit



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DR. MARTIN O. Harwit, formerly a professor of astronomy at Cornell University, became director of the National Air and Space Museum in 1987. He says he was chosen, contrary to the recommendation of the museum staff, by Robert McCormick Adams, secretary of the Smithsonian Institution, who had a reputation for wanting "to change the Smithsonian into a university."

Under Dr. Harwit's stewardship, the museum branched out from its charter to collect, preserve, and display aircraft, spacecraft, and other artifacts and drifted deep into ideological controversy. He resigned in May 1995, under fire from Congress, the news media, and veterans groups for his handling of plans to display the *Enola Gay,* the B-29 bomber that dropped the first atomic bomb on Japan in 1945.

Among the revelations in his recently published book (*An Exhibit Denied: Lobbying the History of Enola Gay,* Copernicus, 1996, 477 pages, $27.50) is that he did not step down willingly. The new Smithsonian secretary, I. Michael Heyman, asked for his resignation and gave him only four days to turn it in.

Dr. Harwit lays the primary blame for his troubles on the Air Force Association and *Air Force* Magazine, whose reports from March 1994 onward brought to public attention the museum's plans to use the *Enola Gay* as a prop in a political horror show. Early in the fray, AFA told Dr. Harwit that the exhibition plan "treats Japan and the United States as if their participation in the war were morally equivalent. If anything, incredibly, it gives the benefit of opinion to Japan, which was the aggressor."

Dr. Harwit acknowledges he wrote an internal memo—which was acquired and published by AFA—admitting "that we do have a lack of balance and that much of the criticism that has been levied against us is understandable." What he does not explain is why he then continued publicly to denounce *Air Force* Magazine's reports as inaccurate, unfair, and misleading.

The museum's regular tactics with veterans over the years had been to listen to their complaints but ignore what they had to say. Thus, it came as something of a surprise that "the Air Force Association had not been content just to offer advice; they insisted on seeing their wishes carried out."

"First Casualty of AFA"

The book depicts AFA as a mighty force, sweeping Congress, reporters, and public opinion along at will. "The first casualty of the AFA" is identified as Lt. Gen. C. M. Kicklighter, USA (Ret.), executive director of the Fiftieth Anniversary of World War II Com-

memoration Committee, who turned "tentative" and "cautious" toward the exhibit plan after seeing AFA's analysis of it. Commenting on a letter to the Smithsonian signed by two dozen members of Congress, Dr. Harwit says, "The hand of the Air Force Association could not have been clearer if this letter had been written on AFA stationery."

He reports a bizarre scheme in which the Smithsonian decided to seek support from the American Legion on an assumption that "the AFA, whose membership was only about 180,000, would have to defer to such giants as the American Legion, with its 3.1 million members." This notion seems to have persisted, even though museum officials soon discovered that the Legion had already drafted a resolution condemning the exhibit. Why the curators thought AFA had to "defer" to the Legion is not explained.

By late 1994, Dr. Harwit says, "the pressure on the American Legion leadership was mounting. They could not stay entirely aloof from their own membership, which had long been stirred up by the AFA's and even the Legion's own earlier propaganda." Having interpreted the Legion's position in this strange manner, Dr. Harwit was taken aback in January 1995 when the final straw before cancellation of the exhibit was a strong blast from the American Legion.

Criticism from AFA was seen as unwelcome interference, but activism from the left was a different matter. Dr. Harwit describes as "fairly accurate" reports that when eight representatives of peace and environmental groups came to see him, he said, "Where have you been? You are too late. Why haven't you been in before? Why haven't you talked to the media?"

Covering the Trail

The book traces Dr. Harwit's continuous concern about the opinion of Japanese officials, from whom the museum hoped to borrow artifacts for the "emotional center" of the exhibition.

"I knew that the AFA's ideas about an exhibition would be totally unacceptable to Japan and would precipitate an international incident if followed through," he says. He wrote in a letter that "I am most seriously concerned that the changes in the exhibition demanded by the Air Force Association would, if accepted, cause an uproar in Japan when the exhibition opens."

Worried that the Japanese might "back away from working with us" on the exhibition, Dr. Harwit felt a need in August 1994 to visit Japan "to reassure the mayors of Hiroshima and Nagasaki in person."

He and his colleagues "all agreed that I could not go to Japan now, and that we could not afford to have the Japanese come either. But we could not put this in writing. The furor such a letter would raise would top everything. Heyman adamantly wanted to avoid a 'paper trail.' Whatever we did needed to be done verbally to leave no trace."

Later on, he says, "Heyman and I were driven to the Japanese embassy. . . . I introduced Heyman to the ambassador and began apprising him of the situation, namely that we could not publicly confer with Hiroshima and Nagasaki representatives without risking the entire shutdown of the exhibition by Congress." Of another visit to the Japanese embassy, he says, "The important thing was not to leave a paper trail that might be leaked."

Outrage and Alienation

Dr. Harwit is also consistent in his sensitivity to the academic world. In early 1995, the exhibition plan had been through four revisions and was still catching flak. Secretary Heyman began to consider closing it down in favor of a straightforward display of the *Enola Gay*. Dr. Harwit recalls, "I was aghast. . . . We would have lost our last hope of support from like-minded people who also stood for education as an important national goal. I said I understood his fears, but our supporters, and particularly the academic community, would be outraged and accuse us of capitulating. In the long term, these were the groups on whom we would need to rely for help."

Veterans groups had been assured by the Smithsonian that Dr. Harwit would not be allowed to make unilateral changes to the exhibition script. He says he was unaware of that promise. On the basis of academic advice, he marked down from 250,000 to 63,000 the number of US casualties expected had an invasion of the Japanese homeland been necessary in 1945.

The reaction rocked the Smithsonian. Eighty-one members of Congress called for Dr. Harwit's resignation or removal. The Washington *Post* said planning for the exhibit had been "incredibly propagandistic and intellectually shabby." Rep. Gerald B. H. Solomon (R–N. Y.), chairman of the House Rules Committee, said that unless the exhibit was straightened out, "I will personally take measures this year to zero out the Smithsonian's Congressional appropriation. You can count on that." Dr. Harwit's reaction, incredibly, was to wonder, "What about the people from his district who had elected Solomon? Would they all want the Smithsonian's budget zeroed out?"

Feeling a need at that point for "some dispassionate advice," Dr. Harwit began placing telephone calls to members of the Smithsonian Board of Regents. Furious that Dr. Harwit had gone around him, Secretary Heyman had the under secretary, Constance Newman, deliver the cease-and-desist order. On January 25, Secretary Heyman canceled the politicized exhibition.

Dr. Harwit managed to hang on for a few more months, but he was clearly alienated from the Smithsonian's top officials. It had been "disheartening" that Secretary Heyman had said, upon taking office, that early exhibition scripts were "deficient." The day after cancellation of the exhibit, Dr. Harwit says, the secretary cast a "pall" on museum morale by making the same statement to the assembled staff that he had made to the public. Secretary Heyman and Under Secretary Newman, he says, "were totally consumed with the issue of Congressional funding," and that "with money the highest priority of the Institution, academic integrity began to take second place."

Of all Dr. Harwit's grievances against the Air Force Association—and the book is loaded with them—the one that seems to gravel him most is that we made copies of his plans and circulated them. The curators routinely sent review copies to their colleagues in Japan but fought hard to keep them away from critical eyes in the United States.

In this regard, there is one last surprise for Dr. Harwit.

He harps repeatedly on his belief that AFA, against his wishes, gave the news media and Congress copies of an exhibit script he sent to the executive director on January 31, 1994. For the record, if it matters, what we actually duplicated and distributed was a copy of the script that had come to *Air Force* Magazine from other sources two weeks previously. As Martin Harwit's boss made a habit of reminding him, museum operations in the Harwit era leaked like a sieve.

—John T. Correll, Editor in Chief

Senator Nunn's Valedictory

Sen. Sam Nunn of Georgia, ranking Democrat on the Senate Armed Services Committee, was its chairman for eight years (1987–95). He formally retires in January after twenty-four years in office, having gained a reputation as a foremost Congressional expert on military affairs. The remarks quoted here are from a September 28, 1996, speech, Senator Nunn's last in Congress.

Vital, Important, Secondary?

"What are America's vital interests? A bipartisan commission, of which I was a member, recently issued a report that brings needed clarity to the discussion of our national interests. The report, 'America's National Interests,' distinguished between vital, extremely important, important, and secondary interests.

"These distinctions are essential to the task of establishing national priorities and building public support for foreign and defense policy. And despite the common use of the term 'vital interests' to describe everything from soup to nuts, the report defines truly vital interests as only those conditions that are strictly necessary to safeguard and enhance the well-being of Americans in a free and secure nation.

"It should come as no surprise that preventing and deterring the threat of nuclear, biological, and chemical weapons attacks on the United States is at the top of the list of vital interests.

"According to the report, other vital interests are to prevent the emergence of a hostile hegemon in Europe or Asia, to prevent the emergence of a hostile major power on US borders or in control of the seas, to prevent the catastrophic collapse of major global systems (trade, financial markets, energy supplies, environment), and to ensure the survival of US allies."

"Not Vital"

"Other objectives, such as preventing the use of nuclear, chemical, or biological weapons outside our borders or countering proliferation are extremely important, but not vital, interests. Similarly, combating ter-

rorism and [preventing] major conflicts in important geographic regions are extremely important, but [those problems] do not directly threaten the American way of life.

"This hierarchy of interests does not diminish the desirability of other objectives, such as promoting democracy, human rights, and open markets. It is in no way a betrayal of our values to acknowledge that our survival takes precedence over our hopes for a better world to come. We shall have no peace, no prosperity, nor the ability to help others if our own security is threatened by successful attacks on our vital interests."

Spread of Horror Weapons

"Possession of nuclear, chemical, or biological weapons by rogue nations or terrorist groups could pose a clear and present danger to our society. US leadership will continue to be the driving force for maintaining norms against either acquisition or use of weapons of mass destruction. . . .

"In addition to the direct threat that these weapons pose to our homeland, our abilities to project military force and forge [such] coalitions as [the one] assembled in the [Persian] Gulf War could be seriously harmed by the possession of nuclear, chemical, or biological weapons by regional adversaries. Thus, our counterproliferation efforts are another important aspect of our overall nonproliferation policy.

"Much of our previous efforts to control the spread of these weapons also benefited from the ability to deny access to the technology and materials required to make them. The effectiveness of those controls has eroded due to expanding commerce in technologies that can contribute to strategic weapons production and due to increasingly porous and unguarded borders. The materials and know-how for weapons of mass destruction are more available than ever to the highest bidder.

"A widening circle of states, nonstate actors, and ideologically motivated groups may increasingly have resources and capabilities to acquire the technology and materials necessary to create weapons of mass destruction. Such groups may not need to wield battlefield-ready military weapons to wreak mass destruction. Crude bombs and low-tech delivery systems may suffice. . . . Proliferation . . . is not a relic of the Cold War headed for the dustbin of history."

Terrorism and Fanaticism

"While terrorism and fanaticism are hardly new, the medium of the terrorists' perverse message is expanding as lethal materials and technology become more readily available. . . .

"As a nation, we have just begun to come to terms with the full scope of the terrorism threat. For many years, terrorists were mainly interested in making a political statement or drawing attention to a cause through discrete acts of violence, such as an assassination, a taking of a hostage, or some violent event of limited impact. These criminals were conscious of public relations and even viewed certain acts—such as use of chemical and biological weapons—as taboo.

"The 1990s, however, have seen terrorist acts that appear intended to create casualties of the highest order. These enemies are too often zealots, filled with hate for civil society, who believe their conduct is justified or divinely inspired. Despite the vivid memories of the Oklahoma City and World Trade Center [bombings], I am not sure Americans truly comprehend the devastating effect the use a weapon of mass destruction would have on a civilian population at home."

"It is in no way a betrayal of our values to acknowledge that our survival takes precedence over our hopes for a better world to come. We shall have no peace, no prosperity, nor the ability to help others if our own security is threatened by successful attacks on our vital interests."

Only the Beginning

"I depart the Senate with a sense that this mission is just beginning. These are the known dangers that are now coming into focus. Unfortunately, we are a nation of soft targets. An effective response is possible, but it requires a willingness to think anew about our security and about the way our government and our military are organized to defend against the threats of today. We should not assume that the bureaucratic structures of our foreign policy and national security apparatus, nor the force postures that were successful for waging the Cold War, are the right ones for the threats we will face in the future."

Address Unknown

"Weapons of mass destruction are increasingly within the grasp of a growing number of developing countries, subnational groups, terrorist groups, and even individuals. . . . Although the risk of nuclear war is vastly reduced and the overall outlook for our security is greatly improved, the risk of chemical, biological, or some form of nuclear terrorism has increased. This new threat does not put our civilization at risk in the way that nuclear confrontation did, but it is much harder to deter.

"The familiar balance of nuclear terror has yielded to a much [more] unpredictable situation, where adversaries might not be dissuaded by threats of retaliation. Our massive retaliatory forces are useless against terrorists who hide among civilian populations. Our biggest threats of

the future may well be people who do not have a return address."

Struggles in Cyberspace

"The information age has brought us unimaginable efficiency and productivity—in effect, shrinking time and space. In military affairs, the power of computers and networks has helped make our armed forces the most powerful in the history of the world. Our forces are able to achieve battlefield dominance through use of information systems that receive, collate, and analyze data in real time. Elsewhere in government and in the private sector, every aspect of our society is realizing the great advantages offered by the computer. . . .

"Yet we are only now beginning to comprehend that the same information networks that we are relying on to run our society are vulnerable to disruption and penetration. The Defense Department estimates that their computers are probably subjected to as many as 250,000 computer attacks each year. When conducting vulnerability assessments of their own systems, the Defense Department successfully hacks into its own system more than sixty-five percent of the time. Already we have seen examples of hackers in foreign nations launching electronic info-war attacks on our Defense Department computers. Experts agree we are only detecting the least competent intruders. . . .

"Our intoxication with technological advantages has made us blind and deaf to information-age vulnerabilities. If we fail to embed a culture of information security early in this revolution, we will create scenarios where info-war could become a great equalizer for our enemies. Thus . . . has arrived a new method to cause mass disruption."

The Dawn of Info-War

"We have already observed anecdotal evidence of this threat. Last year, two London residents penetrated the Rome Air Development Center computers at Rome, N. Y. Earlier this year, an Argentinian national attacked NASA and DoD computer systems from his living room in Buenos Aires.

"Recently, a computer gang based in Saint Petersburg, Russia, launched a computer attack against Citibank and was discovered only after they were able to steal millions [of dollars]. Though disturbing, these incidents involved the least competent and most immature attackers. The more sophisticated and structured attack likely occurs without detection or apprehension.

"Fortunately, we have not suffered serious breakdowns in our information infrastructure. Americans have not had to endure an unexpected, prolonged, and widespread interruption of power, the indefinite grounding of air traffic, or the loss of banking and financial services and records. We should not, however, wait for an 'electronic Pearl Harbor' to spur us into rethinking the speed and nature of our entry into some of these information technologies.

"Our intelligence agencies have already acknowledged that potential adversaries throughout the world are developing a body of knowledge about Defense Department and other government computer networks. According to DoD officials, these potential adversaries are developing attack methods that include sophisticated computer viruses and automated attack routines that allow them to launch anonymous attacks from anywhere in the world."

"The 1990s . . . have seen terrorist acts that appear intended to create casualties of the highest order. These enemies are too often zealots, filled with hate for civil society, who believe their conduct is justified or divinely inspired."

Nuclear Deemphasis

"Though the transformation of Russia and emergence of China as a global power could pose new security challenges by about 2010, in the interim, the United States faces no peer competitor and is unrivaled in conventional military superiority. I say this having devoted much of my career to the betterment of our armed forces. Our current situation offers a window of opportunity to build our qualitative edge in conventional weapons technology to strengthen deterrence for the future.

"At the same time, we can continue to reduce the role of nuclear weapons in our defense strategy—if such reductions are matched by the other nuclear powers. If reductions in our own arsenal can persuade others to make comparable cuts, or not develop nuclear weapons at all, we come out ahead."

Ballistic Missile Defense

"Our promising development of needed limited missile defenses should proceed with an awareness of the unintended consequences that could result if Russia and China respond by retaining, redeploying, and building enough warheads and missiles to overwhelm any conceivable antimissile system, as they have vowed to do. I have argued for years that it is possible to advance . . . rapidly . . . with missile defenses in a way that does not result in more nuclear weapons being pointed at us. Putting aside the issue of cost for a moment, a policy that leaves us facing more of the threat we were trying to defend against in the first place is the essence of bad strategy. The error is especially shortsighted if it is possible—as it is in this case—to have missile defense and reduce the numbers of missiles pointed at us. In my view, this can be accomplished by cooperation with Russia on limited defense for both nations and modest amendments to the ABM Treaty." ■

Valor

By John L. Frisbee, Contributing Editor

All for One

Courage and ingenuity were the keys to a unique rescue in southwest China.

AS COMMANDER of the 803d Air Evacuation Squadron, based in northeast India, flight surgeon Maj. Morris Kaplan was responsible for air evacuation throughout the China-Burma-India theater. In the summer of 1944, he was informed that an American lieutenant, a member of a mapping party in a remote area of southwest China, was at a Christian mission in Lanping directed by British cleric Rev. Harry Fisher. The lieutenant was suffering from acute polio and needed to be evacuated. Major Kaplan knew this was an urgent mission that he must lead himself. He immediately flew over the Hump to Kunming, where he learned there was no landing area in the mountainous terrain near Lanping, more than 200 miles northwest of Kunming.

Against the advice of old hands, Major Kaplan insisted on being flown to Lanping, where he would bail out with his medical supplies. Twice, the flight was turned back by violent weather, with no forecast of immediate improvement. Major Kaplan then set out in a jeep with three companions on the five-day trip to Lanping. When the road became impassable, the mayor of a small village agreed to store the jeep and provide horses and an armed guard to get them through bandit-controlled territory. Once beyond that, the guards departed with the horses, leaving Major Kaplan and his men to finish the last twenty-five difficult miles to Lanping on foot. At the mission, they found six-foot three-inch Lt. Robert Wesselhoeft totally paralyzed, being kept alive with artificial respiration administered by a team of Chinese peasants Reverend Fisher had recruited.

Major Kaplan's problems seemed insurmountable. The Lieutenant could not be carried the seventy-five miles to the jeep while manual respiration was continued. They needed a mechanical respirator and an airplane to transport Wesselhoeft.

Major Kaplan (here conferring with flight nurse Lt. Pauline Curry) traveled by jeep, horseback, and foot to reach his polio-stricken patient.

Major Kaplan and his companions built the mechanical respirator using two boards hinged on one side at a separation slightly less than the thickness of Wesselhoeft's chest. A handle was attached to the upper board. By pressing on the handle, air was pushed from Wesselhoeft's lungs. As the pressure was released, fresh air flowed in.

Now, where to land an airplane at Lanping? The rescuers finally found a small flat island in the Lanping River, but it was covered with stones, small boulders, and vegetation. That problem was solved by the local warlord—with whom Reverend Fisher had a good relationship—who rounded up 200 Chinese laborers to clear a runway where a skillful pilot could land an L-5. This took three days. The next day an L-5 from Kunming touched down, flown by gung ho pilot Maj. Freddy Welsh, who had volunteered.

Everything that could be removed from the L-5 was discarded so that Lieutenant Wesselhoeft could be laid on his back with his head just behind and to the left of the pilot's seat. Some changes to the respirator also were made, among them a handle that Major Welsh could operate every twenty-five seconds with his left hand while flying the plane with his right. The Lieutenant and his respirator were laboriously fitted into the available space.

Freddy Welsh had to abort his first takeoff but succeeded on a second attempt. He later described the circuitous three-hour flight to Kunming: "I finally gained enough altitude to clear a 9,300-foot ridge . . . into the worst weather I have ever flown in. But I did not miss a single stroke with the respirator lever." He ran into torrential rain "such as I had never seen. I became alarmed that the thermal currents would tear the wings off that little plane." At times flying at less than 100-feet altitude for visual navigation, he saw a familiar river and followed it to his base. With the fuel gauge on empty, he landed at Kunming as the engine quit.

Lieutenant Wesselhoeft, a nephew of Massachusetts Sen. Leverett Saltonstall, was flown to Calcutta, placed in an iron lung, then flown to Walter Reed Hospital in Washington, D. C. He remained in an iron lung for a year before recovering enough to leave the hospital in a wheelchair. He later earned a doctorate and taught for several years. He owed his life to many caring people, including the Fisher family, but foremost among them are Morris Kaplan and Freddy Welsh. ■

Thanks to Capt. Allen Balint for calling this story to our attention and to Colonel Kaplan for providing details.

We took out 600 pounds of wiring and replaced it with MIL-STD 1553 databus architecture. Just another way the "J" saves you money over its life span.

It's amazing what you can do after losing 600 pounds.

Talk about your weight-loss success stories. When we took some 600 pounds of hard wiring out of the C-130 Hercules, it made room for an amazing array of high-technology systems. This MIL-STD 1553 databus architecture, linked to the aircraft's mission computer, forms the brain of the new C-130J.

In essence, it makes it an entirely new plane.

Systems and functions which once were controlled or monitored individually now work in effortless combination. Information moves in milliseconds. All of which means the aircraft is easier to fly, and smarter in the air.

Of course, this is just one of the technological triumphs we've installed on the "J"-- additions that will lead to significant cost savings over the life span of the aircraft.

Complete mission plans -- everything from terrain to weather conditions to drop sites -- are now put on a small 2-by-3 inch card and inserted into the mission computer.

The propellers have been redesigned to make them 18% more efficient. We've added twin HUDs for those critical low-altitude drops, or for instrument approaches at minimums.

We offer the load master remote control for safety and more precise drops. And we've added twin-spool engines, allowing for higher operating temperatures, higher altitudes and a MTBF of 5,000 hours -- five times greater than before.

We've done all this for one reason only. To help you achieve the goals of your mission. It's been our *modus operandi* since the Hercules debuted in 1955. And with this all-new, cost-efficient aircraft, it will continue to be for years to come.

LOCKHEED MARTIN

Mission Success

The Department of Defense says that those who have tried the new managed health-care system like it.

The Transition to Tricare

By Suzann Chapman, Associate Editor

KEY

Region

States
Lead Agent
Contractor
Start Date

Contract Status in Tricare Regions

1

Connecticut
Delaware
Washington, D. C.
Maine
Maryland
Massachusetts
New Hampshire
New Jersey, New York
Pennsylvania
Rhode Island
Vermont
northern Virginia

Rotates annually among Walter Reed Army Medical Center, National Naval Medical Center, and Malcolm Grow Medical Center in the Washington, D. C., metropolitan area

Pending

*August 1, 1997**

2

North Carolina
southern Virginia

Navy Medical Center Portsmouth, Portsmouth, Va.

Pending

*September 1, 1997**

3

Florida
Georgia
South Carolina

Dwight David Eisenhower Army Medical Center, Fort Gordon, Ga.

Humana Military Healthcare Services

July 1, 1996

7

Arizona
New Mexico
Nevada
extreme western Texas

William Beaumont Army Medical Center, Fort Bliss, Tex.

TriWest Healthcare Alliance, Inc.

*February 1, 1997**

8

Colorado
southern Idaho
Iowa, Kansas
Minnesota
Missouri, Montana
Nebraska
North Dakota
South Dakota
Utah
Wyoming

Evans US Army Community Hospital, Fort Carson, Colo.

TriWest Healthcare Alliance, Inc.

*February 1, 1997**

BY FALL 1997, Tricare, the Pentagon's new managed healthcare system, will be functioning in all twelve geographic regions of the continental United States. This transition to Tricare has become less bumpy for contractors and beneficiaries alike; most people now seem to think well of the new program. The word from DoD is that those who have Tricare like Tricare.

Enrollment has been heavier than anticipated for Tricare Prime, the system's health maintenance organization (HMO) option. Tricare Prime was first introduced in Region 11 and then in Region 6. In Region 11, first-year enrollments were more than twice the projected number. In Region 6, the one-year goal for enrollment was met in just five months.

4

Alabama
Mississippi
Tennessee
Florida's western panhandle, eastern Louisiana

Keesler Air Force Medical Center, Keesler AFB, Miss.

Humana Military Healthcare Services

July 1, 1996

5

Indiana
Illinois
Kentucky
Michigan
Ohio
West Virginia
Wisconsin

Wright-Patterson Air Force Medical Center, Wright-Patterson AFB, Ohio

Pending

*September 1, 1997**

6

Arkansas
Oklahoma
Texas (except extreme western Texas)
most of Louisiana

Wilford Hall Air Force Medical Center, Lackland AFB, Tex.

Foundation Health Federal Services, Inc.

November 1, 1995

Under the DoD Tricare plan, seven contracts will cover the twelve regions: Regions 2 and 5 are grouped, as are Regions 3 and 4, Regions 7 and 8, and Regions 9, 10, and 12.

9

Southern California

San Diego Naval Medical Center, San Diego, Calif.

Foundation Health Federal Services, Inc.

April 1, 1996

10

Northern California

David Grant Air Force Medical Center, Travis AFB, Calif.

Foundation Health Federal Services, Inc.

April 1, 1996

11

Washington
Oregon
northern Idaho

Madigan Army Medical Center, Fort Lewis, Wash.

Foundation Health Federal Services, Inc.

March 1, 1995

12

Hawaii

Tripler Army Medical Center, Honolulu, Hawaii

Foundation Health Federal Services, Inc.

April 1, 1996

** Estimated start date*

This fast enrollment pace and problems in the contracting process have caused some setbacks. However, DoD health officials report that they have been able to alleviate the turmoil by sharing lessons learned between regions.

The Pentagon's top health official, Dr. Stephen C. Joseph, told Congress in June that the military health-service system (MHSS) had been "successful in tackling a variety of difficulties and obstacles, from enrollment glitches to contract award protests."

For example, the Tricare contractor for Region 11 did not employ sufficient trained personnel in the first days of program implementation and had problems handling the early sign-up rush. The Region 6 contractor, which started operations some months later, took note of Region 11's backlog problems and hired and trained additional temporary workers before starting enrollments.

As each new region comes on line, administrators in search of solutions review the pitfalls encountered elsewhere.

Containing Costs

At present, three corporations have won contracts. These contractors are administering the program in nine regions. *[See chart on pp. 46–47.]* The Pentagon plans to issue seven contracts to cover the twelve regions.

One goal is to contain costs. Even before establishment of Tricare, the MHSS had been driving down its costs. Ten years ago, the bill for DoD's Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) was rising by some fifteen percent a year. Overall costs of the MHSS were increasing by almost twelve percent a year. However, between 1994 and 1996, CHAMPUS costs rose only 3.8 percent, and that, according to Dr. Joseph, includes some start-up, one-time additional costs of managed-care support contracts and buyouts of CHAMPUS claims. The cost of the overall defense health program increased by only 1.2 percent, he said.

"Considering that the national average for health-care cost inflation was over seven percent during that period, we think that's an important achievement," said Dr. Joseph. However, he added, "we do have to measure the views of our beneficiaries against those financial achievements."

Those beneficiaries report that their number one concern is lack of access to the Defense Department's military treatment facilities (MTFs). Dr. Joseph took note of the severity of this problem by listing what he called "our first three problems." They were, in his words, "access, access, access."

Part of the problem, he said, stems from the fact that the military medical force has shrunk faster than the total number of beneficiaries. He said that, since 1989, the number of operating beds has been reduced by twenty-one percent, military hospitals by thirty percent, and military and civilian medical staffs by thirteen percent. During this same period, the DoD beneficiary population decreased by only about 8.5 percent.

Those statistics have led to considerable concern on the part of beneficiaries who traditionally have received care within the MHSS on a space-available basis. Active-duty family members, as well as military retirees and their dependents, have voiced displeasure about increasingly tight restrictions on access.

There is a real problem, and Tricare is the cure, said top doctors at the Pentagon. In their Congressional testimony on the Fiscal 1997 defense budget, Dr. Joseph and the surgeons general emphasized that Tricare will not only help keep costs down but will also alleviate access problems.

In fact, Dr. Joseph said the Pentagon has "hard data" indicating "a reduced number of patient complaints and improvement in the overall access situation."

Lt. Gen. Edgar R. Anderson, Jr., while USAF surgeon general, cited positive surveys and said he was encouraged by feedback from lead-agent staffs and patients already participating in Tricare.

He said, "Results from beneficiary focus groups in the region [Region 11] conducted by a private contractor confirm that our customers feel Tricare offers improved access and continuity of care." The General added that, in a smaller telephone survey conducted by the clinic at McChord AFB, Wash., enrollees showed high rates of satisfaction with primary and specialty care.

"Great System"

An active-duty family member in Region 11 stated that, before Tricare, "You had to go to the emergency room just to get seen." She called Tricare "a great system" and said that making appointments was easy.

DoD's own 1995 health-care survey showed that access was a primary concern. Dr. Joseph said the survey reinforced "our determination to pursue Tricare."

Military members and their dependents long have been bewildered by the precise timing requirements for making routine appointments through the MHSS. When the telephone caller finally gets through to a clinic, he or she often hears something like, "I'm sorry, all pediatric appointments have been filled. Please call again on the first Tuesday of next month between 7:30 a.m. and 10:00 a.m." The beneficiary dutifully calls back, again getting a busy signal repeatedly. Once finally connected, the beneficiary realizes he or she has missed the appointment queue again and must start over the following month.

All that is changing under Tricare, officials maintain. For instance, Region 11, containing 400,000 beneficiaries, has set up a Tricare Regional Appointment Center. It employs fifty operators who field an average of 60,000 calls per month. It runs eleven hours a day and uses an automated call-distribution system.

The system's operators are connected to DoD's Composite Health-Care System, a database of information on patients worldwide. By consulting this database, they can check a caller's eligibility for health care. They can also update such personal data as home addresses and telephone numbers. Center officials say the average length of a call from initial connection to confirmed appointment is about three minutes.

Each region has access standards that apply whether treatment is given by a military or civilian provider. However, the standards apply only to beneficiaries enrolled in the HMO-type plan, Tricare Prime. As listed in a December 1995 policy letter, there are five baseline requirements:

- Same-day access to primary care manager.
- Thirty minutes of travel time from residence to health-care facility, except in remote areas.
- Thirty minutes of office wait-

ing time in nonemergency situations.

- Night and weekend coverage for urgent health-care needs.
- Emergency services within the community, available twenty-four hours a day.

The policy letter also lists maximum appointment waiting times: one day for urgent or acute (but nonemergency) care, one week for a routine visit, and four weeks for health maintenance and specialty care.

The regional service also features free phone-in health-care advice from registered nurses, the services of health-care "finders" who help locate appropriate care, and customer service centers that handle enrollment and general questions. Even military primary care managers operating under a Tricare Prime contract must set up a twenty-four-hour on-call system similar to an on-call provider in a civilian group practice.

These changes are just now beginning to permeate the MHSS. System officials say that most beneficiaries won't feel the full effect for another few years.

Defense officials also credit DoD's use of capitation financing for helping to control costs and to improve health-care delivery. Traditionally, the Defense Department used a work load–based approach to allocate medical dollars. That system, said critics, rewarded increased production regardless of outcome.

Under capitation financing, all MTFs receive a fixed annual budget based on their population of beneficiaries. The MHSS now focuses on using managed-care principles to ensure the right level of care, promote healthy lifestyles, emphasize preventive measures, and return patients to full health as quickly as possible.

The FEHBP Debate

Despite the early successes of Tricare, many beneficiaries and veterans groups still express concern about the future of the MHSS. The question of access appears to be most prominent among military retirees, especially those sixty-five and older.

Current law prohibits Medicare-eligible individuals from enrolling in Tricare Prime. Such beneficiaries lose their CHAMPUS eligibility at age sixty-five and thus cannot enroll in the military HMO plan. *[See "Military Hospitals and Medicare," June 1996, p. 63.]*

The Pentagon, members of Congress, and numerous veterans associations have been trying for years to win approval for Medicare Subvention. Under this new concept, the federal Health-Care Financing Agency would be permitted to divert Medicare funds to reimburse the Defense Department for its costs in providing care to military retirees and their dependents over the age of sixty-five.

On September 10, officials of the Department of Defense and Department of Health and Human Services

Overseas With Tricare

Tricare Europe will look exactly like its CONUS cousin—almost. Beneficiaries will have only two, rather than three, basic options. The system will offer Tricare Europe Prime (the HMO-type option) and Tricare Europe Standard, the basic fee-for-service CHAMPUS option.

Health officials expect to complete initial enrollment for Tricare Europe Prime by January 1997. Once that is done, those beneficiaries who choose to remain in the Standard option will have to pay CHAMPUS copayments and deductibles beginning July 1, 1997.

The CONUS version of Tricare requires beneficiaries to enroll annually, but enrollment in Europe will be based on the member's length of assignment. The enrollment period also extends to the date the member must report to a new duty assignment in CONUS.

The Tricare initiative covering the western Pacific started October 1. As in Europe, it will offer only Tricare Prime and Tricare Standard. However, the current enrollment period is only for one year, not the whole tour.

Alaska is working with a consortium of federal health-care providers—Veterans Affairs, Native American Health Service, and Bureau of Indian Affairs—to set up its system.

In the western Pacific area, individual services are arranging to share resources and "cross-credential" their medical staffs to make use of available MTFs. Japan will have a common server to connect computer and communications systems—treating all US medical facilities as one. The lead agent role will rotate among the services.

announced agreement on a Medicare Subvention demonstration program. The test was designed to run for three years in Regions 6 and 11, starting on January 1, 1997. However, at the eleventh hour Congress failed to pass legislation approving the test.

In addition to pushing for Medicare Subvention, veterans groups (including many in the Military Coalition, such as AFA) have moved to have the Federal Employees Health Benefits Program opened to military retirees and active-duty dependents. The Pentagon still does not think the FEHBP option is viable. Pentagon health officials say it will be more costly to beneficiaries and might have a negative impact on military medical readiness.

The Pentagon has been studying the FEHBP option over the past year but has not yet released its complete findings. Pentagon officials note that the FEHBP has more than 350 plans nationwide, making it much more complex than Tricare with its three options.

In a March 1995 letter to Congress, Dr. Joseph maintained that in comparing FEHBP's HMO-type plans with Tricare Prime, the FEHBP option would cost $800 to $4,400. Tricare Prime beneficiaries pay $0 (active-duty families) to $460 (retirees and families).

Top defense health officials also stress the necessity of keeping a wide range of beneficiaries—all ages—within the MHSS to sustain military medical proficiency. General Anderson told lawmakers, "We do not support the FEHBP as a viable alternative to Tricare, not only because of complexity and the increased costs. We also feel strongly that it would threaten medical readiness, the very reason for our existence: to provide support to the Air Force warfighting capability."

Dr. Joseph noted another risk in offering an FEHBP option: CHAMPUS-eligible beneficiaries who don't currently rely on the government for their health-care coverage—who have other primary health-care coverage—might be tempted to drop nongovernment coverage and use government care, thus generating new costs for DoD. He estimated the tab at $500 million a year.

He added that a parallel circumstance exists for Medicare-eligible DoD beneficiaries. "Offering FEHBP coverage to DoD Medicare eligibles," he said, "would require additional, new funding for DoD, estimated at up to $1.5 billion."

Enter USTFs

The Pentagon provides another, little-known option for some active-duty dependents and military retirees: Uniformed Services Treatment Facilities. In 1982, Congress designated ten former Public Health Service hospitals, now under civilian ownership, as USTFs and made them part of the DoD health-care system. Today there are seven USTF organizations:

- Johns Hopkins Medical Services Corp., Baltimore, Md.
- Brighton Marine Health Center (Saint Elizabeth's Medical Center), Boston, Mass.
- Lutheran Hospital (Fairview Health System), Cleveland, Ohio.
- Sisters of Charity Health-Care System (Saint Joseph Hospital, Houston, Saint John Hospital, Nassau Bay, and Saint Mary Hospital, Port Arthur, Tex.)
- Martin's Point Health Care, Portland, Me.
- Pacific Medical Center & Clinics, Seattle, Wash.
- Bayley Seton Hospital, New York, N. Y.

DoD has footed the bill for the USTFs. They have become increasingly expensive to operate, according to studies. Recent reports indicate they may now be more costly than CHAMPUS and other health-care providers. A 1994 DoD study found that, if USTF members changed to CHAMPUS or military hospitals for care, the Defense Department would save an estimated $93 million to $146 million per year. It also stated that to be budget neutral, the USTF program should increase cost sharing, impose enrollment fees for members under age sixty-five, and ensure that all members received all their care through the USTF.

The Congressional Budget Office presented similar findings in a 1994 study comparing USTF cost-effectiveness with that of the MHSS and civilian HMOs.

A Congressionally directed 1996 study by the Institute for Defense Analyses estimated that the USTF program cost DoD more than $193 million more per year than it would have spent had the members relied on the MHSS for their care. The institute also pointed out that many USTF members have private insurance coverage and may receive care outside the USTF, even though DoD made per capita payments to the USTFs to cover all their care.

Dr. Joseph stressed to Congress, "We think the best way to go is to try to bring the USTFs onto a level playing field within the Tricare system with retention of their independent status, but it has to be on a level playing field. GAO has attested to their higher cost per unit of service. . . . With resources as tight as they are these days, every dollar that we spend unnecessarily on one privileged group of providers is a dollar directly out of health care that's available in the MTFs for our other beneficiaries."

To help cut DoD's costs, the Fiscal 1996 Defense Authorization Act required USTFs, after October 1, to adopt Tricare enrollment fees and copayments. In the recently passed Fiscal 1997 defense authorization bill, Congress established the seven USTF organizations as "designated providers" within the MHSS.

Under the new Uniformed Services Family Health Plan (USFHP), the USTFs will provide the same coverage and benefits as the Tricare Prime program. The new plan will start by October 1, 1997. All of the nearly 125,000 persons currently enrolled in the USFHP are guaranteed enrollment in the new program if they wish. Unlike DoD's Tricare Prime, USFHP enrollees can continue in the program after reaching sixty-five. Congress also stipulated that the USTFs will not enroll more than 110 percent of the previous year's enrollment. That leaves the door open for DoD beneficiaries who live near a USTF to enroll once they become Medicare-eligible.

DoD also is trying to extend its new health program to cover beneficiaries located in areas not near an MTF. It started a test on May 1, 1996, in Region 11 offering the Tricare Prime option to active-duty dependents in remote locations.

The transformation of the vast military health-care system won't be completed for several years. However, according to Dr. Joseph, the bottom line on the Tricare program is that "we are well on track—not without problems, but well on track." ■

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The Gulf War air boss says the Pentagon hasn't grasped the importance of long-range stealthy airpower.

What We Should Have Learned in Desert Storm, But Didn't

By Gen. Charles A. Horner, USAF (Ret.)

THE COLD War ended shortly after Operation Desert Storm, giving the United States a historic opportunity to rapidly incorporate the lessons learned in the Persian Gulf War and to restructure its forces—especially its bomber force—for the twenty-first century.

Five years later, it seems clear that we have squandered much of the valuable insight gained in Desert Storm. Evidence of this can be seen in many assumptions in the Defense Planning Guidance underpinning the 1993 Bottom-Up Review (BUR) of Defense Needs and Programs and the 1995 Heavy Bomber Force Study. The most recent crisis in Iraq exposed our weaknesses. It also underscored the vital importance to the US of long-range, stealthy airpower.

To illustrate my point, I would like to review some of the lessons from the Gulf War that should have—but clearly have not—guided our bomber modernization strategy.

Lesson One

Surprise attack is inevitable and therefore must be hedged against.

The heavy bomber study assumed our enemy would give us fourteen days of unobstructed build-up time before attacking. This jibes neither with history nor military logic. We were surprised at Pearl Harbor, in Korea, and again in the Gulf. Iraq's invasion of Kuwait took us completely by surprise. We were aware that Saddam Hussein posed a military threat to his neighbors, and in late July 1990 we knew he had moved his forces into position for an attack. Yet, we and our allies had difficulty accepting the threat before us, and when the attack came, we were ill-configured to respond.

I will never forget those long dark nights in August 1990 when we struggled desperately to build up our forces knowing that at any time the Iraqi Army could easily push across Saudi Arabia's border and capture not only the majority of the world's oil supply but also the air bases and ports necessary for deploying our forces. Fortunately, Saddam stayed put in Kuwait, and the rest, as they say, is history. But he and other potential aggressors learned a valuable lesson: Don't give America six months.

In the years since, Saddam has tested our response capabilities with feints against Kuwait. In October 1994, he moved 70,000 troops and 1,000 tanks to the Kuwaiti border well before we could respond. According to the Joint Chiefs of Staff, several days elapsed in which Iraq could have once again taken Kuwait and made a run at the Saudi oil fields. This has only reinforced the notion among our likely adversaries that they can accomplish at least their initial military objectives before we can stop them. And, since surprise provides the attacking side such enormous military leverage, we must assume that any future US adversary is likely to do everything possible to mount "a bolt from the blue" attack. History shows that no matter how much you spend on intelligence, you will always be vulnerable.

Hedging against surprise should have played a key role in the BUR and the heavy bomber study. Clearly, it did not. In both studies, the premium should have been placed on forces, such as the B-2, that can respond rapidly, independently, and decisively to fast-breaking crises. Their rosy assumptions about warning obscured the value of rapid response and the B-2's vital role.

USAF photo by TSgt. Stanley Starks

Lt. Gen. Charles A. Horner, commander of the coalition's air forces (right), meets with senior officers of the 4th Wing at a southwest Asian air base during the Gulf War. General Horner believes that insufficient attention has been paid to the lessons of the Gulf War in subsequent force-sizing studies.

Lesson Two

Future adversaries will be armed with weapons of mass destruction (WMD) and the means to deliver them.

The Defense Planning Guidance posited a Gulf enemy with no nuclear capability, no biological weapons capability, and only a limited chemical weapons capability. This flies in the face of what we feared about Iraq prior to the Gulf War and the startling postwar revelations about the size, scope, and complexity of Iraq's WMD and ballistic missile programs.

Iraq's potential use of nuclear, biological, or chemical weapons dominated our thinking while planning the Gulf War air campaign. The potential for chemical warheads on Scud missiles raised the specter of massive casualties in Saudi Arabia, Israel, and Bahrain. Although in 1990 we were reasonably confident that Saddam had not developed a nuclear bomb, we were far from certain that he wouldn't use nuclear waste material to create a poisonous warhead for his missiles and airplanes to deliver.

We therefore set out to counter these threats on a broad front, including air attacks on production, storage, and deployed weapons facilities. Our strongest defense was making available to soldiers and civilians the best protective suits and masks. It was our perceived ability to survive chemical attacks that led Saddam to decide against launching them in the first place.

Many take false comfort in the notion that our nuclear arsenal deterred Saddam from unleashing his WMD. Personally, I don't think our nuclear deterrent was ever truly tested. Would Saddam have kept his WMD holstered if we'd marched on Baghdad, thus threatening his very existence? Would he have used his WMD and missile arsenals differently if he had expected the US to intervene? Might he have even deferred his invasion until after he had developed his first nuclear weapon? The Gulf War raised many more questions about the post–Cold War viability of our nuclear deterrent than it answered.

Other than our preemptive air strikes and passive defense measures, we had few options. In the end, Saddam kept WMD on the shelf. What about next time? India's former Army Chief of Staff said, "The lesson of Desert Storm is, 'Don't fight with the United States without a nuclear weapon.' " If you believe intelligence reports, potential adversaries are taking this lesson to heart.

Gen. Joseph P. Hoar, USMC, Gen. H. Norman Schwarzkopf's successor at US Central Command, has said the presence of any significant WMD in CENTCOM's area of responsibility would require the US to fundamentally rethink its ground and air components and the concept of operations that drives them. I could not agree more. The proliferation of WMD and ballistic missiles means that our current strategy

of pouring thousands of fighters and hundreds of thousands of troops into our enemy's back yard is no longer viable. The best hedge against the emerging threat is to shift as much of the power-projection burden as we can—as fast as we can—to long-range systems able to fight effectively from beyond WMD range. This should have been a core finding of the BUR, which would have led to an increased emphasis on the bomber force and thus obviated the need for a heavy bomber study.

An adequate B-2 fleet would dramatically enhance US counterforce capabilities. It would allow us to credibly threaten the destruction of aggressor WMD programs. In conflicts with WMD-armed adversaries, such a capability would allow us to conduct relatively risk-free counterforce strikes before making a large-scale and vulnerable force deployment. Long-range counterforce operations could be protracted, allowing the US to sustain strikes until it is deemed "safe" to enter the theater.

USAF photo by SSgt. Scott P. Stewart

The F-117's value during the Gulf War was beyond question—one attack planner estimated that every early F-117 sortie was "worth" sixteen sorties by nonstealthy aircraft. General Horner argues that stealth and precision weapons make a revolutionary combination.

Lesson Three

The revolutionary combination of stealth and precision must be exploited.

Desert Storm marked the first large-scale employment of stealth aircraft—the F-117—equipped with precision weapons. The combination has revolutionized warfare. The F-117's stealthiness enabled us to achieve surprise every day of the war, attack any target we wanted, and leverage the capabilities of other assets. The F-117s delivered the first strikes, destroying a wide array of critical targets and paralyzing the Iraqi air defense network. Their attacks on the radar sites and command, control, and communications bunkers that controlled the Iraqi defenses opened the door for wave after wave of nonstealthy aircraft to strike effectively and, most important, safely. The F-117's ability to paralyze the Iraqi air defense network in the opening minutes of the war was critical to gaining air superiority, a vital prerequisite to ejecting the Iraqi Army from Kuwait.

The F-117s did more than just pave the way for less-capable aircraft. They allowed us to strike the "heart" of the enemy—downtown Baghdad—with impunity, regardless of the defenses. This allowed us to maintain continuous pressure on the most vital target sets, which dramatically shortened the air campaign. Because we could depend solely on the F-117 to execute this mission, it more than likely reduced nonstealthy aircraft losses by an order of magnitude.

Stealth also provided tremendous flexibility by drastically reducing the support required for F-117 sorties. For example, if our intelligence detected a heavily defended target requiring immediate attention, and only conventional aircraft were available, we were faced with a difficult set of choices. We could either forgo the strike or pull together an elaborate package of escorts, jammers, defense suppressors, and tankers to get our attack aircraft in. This took valuable time and required major planning adjustments. With the F-117, we would just release the new target data and let the pilots take care of the rest.

In 1995, my chief master attack planner from Desert Storm calculated the "value" of stealth, or the stealth "multiplier effect," in a bomber study for the Commission on Roles and Missions of the Armed Forces. He found that, in the first twenty-four hours of the Gulf War air campaign, each F-117 sortie was "worth" sixteen nonstealth sorties. As Iraqi air defenses were whittled down, this ratio leveled off about one to eight—still extraordinary. The B-2, equally stealthy but with eight times the payload and five times the range, multiplies even the F-117 "multiplier" and opens the door to large-scale air campaigns prosecuted from outside the theater. Unfortunately, not many people know this because the commission chose not to publish the data.

Lesson Four

The need to minimize US casualties affects planning, decision-making, and operational effectiveness.

Anyone who has led young US troops into combat can appreciate firsthand how this obligation weighs on your mind. All of us wrestled with the fear that our mistakes would result in the otherwise preventable loss of life. I would visit our air bases, look at the faces of the aircrews, and wonder which ones would not be going home. The specter of pitiful Iraqi soldiers left for dead by their commanders and the knowledge that innocent women and children suffered from our bombs still haunt me.

In planning and executing the air campaign, we emphasized tactics and systems that minimized aircraft losses, even though it limited to some degree the effectiveness of our air attacks. We operated our aircraft at high altitudes, above the reach of most Iraqi air defenses. This increased aircraft survivability, but it also made target acquisition more difficult and reduced bombing accuracy. Casualty concerns also dictated which assets went "downtown." Despite the large number of critical targets in Baghdad, only the F-117 and the Tomahawk cruise missile were used to attack the heavily defended Iraqi capital.

We gave casualty avoidance priority over military effectiveness because it was the morally correct thing to do. The American people have demonstrated unbelievable tolerance at the losses of sons and daughters in battle when they believe in the cause, but no President or general can overestimate the speed at which that patience will disappear if they are perceived to be spending lives foolishly. Public sensitivity to casualties can dominate our political and military decision-making in a crisis.

Without a doubt, rising public sensitivity to casualties increased the attractiveness of airpower. Use of airpower exposes fewer lives to enemy fire than does employment of ground forces. Still, we can do much better. Long-range airpower leaves fewer aircrew and support personnel within enemy reach. Stealth technology drastically reduces the chances of our aircraft being shot down.

Consequences

The Iraq crisis, September 1996, demonstrated the limits on US options.

When Saddam Hussein ignored our warnings recently and sent three Republican Guard divisions into Irbil, in the US-protected no-fly zone in northern Iraq, most, including myself, believed that a strong military response was in order. I was not privy to the military planning that led up to our September 3 response, but I can give you a commander's perspective on what I expected it to look like.

The objectives seemed fairly clear-cut: Halt, if possible, the attack on the Kurds, but definitely hit Saddam where it hurts. "Hurting" a dictator like Saddam means attacking what gives him his hold on power—his military. Presumably, top priority would be given to the Republican Guard forces arrayed on the outskirts of Irbil and to high-value (and thus well-defended) targets in and near Baghdad. Ideally, F-16s and F-15Es operating out of Turkey and Jordan would attack the Iraqi ground forces, while F-117s from Saudi Arabia would go against Baghdad.

These options never materialized. Turkey, Jordan, and Saudi Arabia probably signaled that US air strikes could not be launched from their territory. This effectively prevented us from using USAF landbased fighters and forced us to turn to our independent options: carrier airpower, bombers, and cruise missiles. However, this also raised a set of constraints that, fortunately, I never had to deal with as coalition air commander. Republican Guard forces in the north were beyond reach of carrier airpower, and sending nonstealthy Navy strike planes into Baghdad was far too risky. B-1B and B-52 bombers had sufficient range but lacked required precision munitions and would have been vulnerable to air defenses. (To my knowledge, the precision-capable B-2 had not been integrated into CENTCOM war plans.)

Cruise missiles, meanwhile, require preprogramming, so they could not be targeted against the highly mobile Iraqi forces, and they lack the punch required to destroy the hardened facilities inside Baghdad. Sorely missing was the capability that propelled us to swift victory in Desert Storm—to penetrate Iraqi defenses safely and deliver large, powerful, precision weapons.

Their strike options limited, our planners apparently turned their attention to a strategy that supported extension of the southern no-fly zone. This meant that attacks against fixed, above-ground facilities in sparsely populated southern Iraq were the logical choice because of their vulnerability to cruise missiles. Hence, the rather limited cruise missile attack against air defenses in southern Iraq, as opposed to the Iraqi forces south of Irbil or targets in Baghdad.

These events demonstrate that our military options are limited, and other important options would be available if our military inventory included an adequate number of long-range stealth bombers. The following points summarize these deficiencies and what we can do to redress them.

US global response capabilities are inadequate. The origins of the Irbil attack are most likely found in the October 1994 and August 1995 Iraqi feints against Kuwait. In both cases, Saddam massed forces against Kuwait, then pulled back when US forces began to arrive. Saddam knew from these exercises that we could not deploy our short-range forces quickly enough to stop him from accomplishing his Irbil objectives. Post–Gulf

War efforts to shorten deployment times are laudable but amount to tinkering at the margins. If the United States wishes to deter the Saddam Husseins of the world, we must demonstrate the capability to stop them before they can reach their military objectives. This "prompt denial" capability requires one of two things: large numbers of forward-based forces or forces so rapidly deployable as to be "virtually" present abroad. Given US budget constraints and foreign political sensitivities, the first option is probably not feasible. The second certainly is but requires shifting the power-projection burden from slower-deploying short-range ground, sea, and air forces to independently deployable long-range airpower.

US forces are far too dependent on foreign basing. Current US warfighting strategy hinges on the deployment of short-range fighters and ground forces to foreign bases in the theater of conflict. Desert Storm and the postwar inspections of Iraq's WMD programs underscored the grave risks entailed with such a strategy. The 1996 Iraqi crisis demonstrated that foreign base access cannot be taken for granted. Once Jordan, Saudi Arabia, and Turkey opted out, the entire landbased fighter force was effectively neutralized, leaving US military capabilities seriously circumscribed. Carrier airpower could not compensate. We need the power to fight effectively from beyond the theater, and that means shifting much of the burden to long-range air.

Cruise missiles are no panacea. Cruise missiles are attractive to US decision-makers—and military commanders for that matter—because they minimize the risk of casualties. Many argue that cruise missiles obviate the need for stealthy bombers, but Donald B. Rice, the Secretary of the Air Force during Desert Storm, has pointed out, "This argument fails when considering cost and operational effectiveness." Cruise missiles are too expensive for sustained operations; cost was the reason Washington ordered me to stop firing Tomahawks during the Gulf War. The forty-four cruise missiles fired at Iraq in September cost more than $100 million—100 times more than an equivalent number of B-2-delivered precision guided munitions. More important, current-generation cruise missiles are not effective against mobile or heavily hardened targets. If the US finds it necessary to truly influence a future Saddam-initiated crisis, planners will have to target hardened and deeply buried facilities inside Baghdad and the highly mobile Republican Guard—and convince the national command authorities of a high probability that no one will get shot down. This demands stealth aircraft and direct-attack precision weapons. Period.

The Gulf War gave me a glimpse into the future of warfare. I saw adversaries who attacked without warning. I saw adversaries armed with WMD and ballistic missiles. I saw an American public that expected our wars to be swiftly won and relatively casualty-free. In 1996, I see the same things, but my confidence that we can overcome these challenges has faded. The difference? In 1991, I returned from the Gulf convinced that tomorrow's air commanders required—and would indeed have—a fleet of sixty or more long-range stealthy bombers. Inexplicably, the B-2 fleet was slashed from seventy-five to twenty, undermining our ability to employ a newly relevant strategy.

The B-2 is the only weapon system in the US inventory free of range, survivability, and lethality limitations that plagued us during the recent Iraqi crisis. B-2s could well be our only practical option for projecting truly decisive power in future regional crises. The planned force is far too small to underwrite a large-scale air campaign. Given the B-2's obvious and unique utility in the new global strategic environment, it is difficult to comprehend how the Pentagon could so actively resist expanding the fleet. ■

Photo by Randy Jolly

General Horner believes that limits on range, survivability, and lethality handcuffed the US military's response to Saddam Hussein's recent provocations. He sees the B-2 as the practical option for decisive power projection in the future.

Gen. Charles Horner, USAF (Ret.), retired in 1994 as commander in chief of North American Aerospace Defense Command and the US Space Command and commander of Air Force Space Command. He commanded all US and allied air assets in Operations Desert Shield and Desert Storm during 1990–91.

The Cold War is a memory, but implementing strategic arms reduction is a careful, time-consuming process.

Nuclear Arms Reductions Roll On

By Stewart M. Powell

Strategic Weapons

Type	Cold War (1990)	Current (1996)	START I/II (2003)	Change 1990–2003
United States				
ICBM	1,000	800	500	–500
SLBM	672	480	336	–336
Bomber	574	327	182	–392
Total	2,246	1,607	1,018	–1,228
USSR/Russia/CIS				
ICBM	1,398	966	800	–598
SLBM	940	664	424	–516
Bomber	162	130	60	–102
Total	2,500	1,760	1,284	–1,216

Nuclear Warheads

United States				
ICBM	2,450	2,382	500	–1,950
SLBM	5,760	3,904	1,680	–4,080
Bomber	2,353	1,820	1,320	–1,023
Total	10,563	8,106	3,500	–7,063
USSR/Russia/CIS				
ICBM	6,612	5,169	800	–5,812
SLBM	2,804	2,496	1,744	–1,060
Bomber	855	921	710	–145
Total	10,271	8,586	3,254	–7,017

Note: The 2003 figures for US and Russia are based on official and unofficial estimates and could change.

EVEN in a year of extreme domestic turbulence, Russia carried out all treaty-required strategic arms reductions without interruption. This development marked a notable break with the arms control experiences of the Cold War, when internal politics regularly disrupted the best-laid plans of the superpowers.

In Russia, elimination of warheads went forward throughout 1996 despite a hard-fought national election, Boris Yeltsin's health crisis, and the abrupt sacking of Russian security czar Alexander Lebed—any of which could have derailed the process. By midyear, the number of strategic warheads under Moscow's control had dropped to 8,586 (down from 10,271 in the last days of the USSR). In the US, the warhead count dropped to 8,106 (from 10,563 at the end of the Cold War).

On another front, the US, Russia, and other nations signed the Comprehensive Test Ban Treaty. For Washington and Moscow, though, the main event was still reduction of their longer-range intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and bombers.

Here, the principal emphasis was on executing the first Strategic Arms Reduction Treaty—START I—which had entered into force. At press time, a follow-on agreement—START II—still seemed like a sure thing, but it met stiff political opposition in Russia and had not formally gone into effect. Moreover, the two nations stepped up their haggling over ballistic missile defense; the 1972 Anti-ballistic Missile Treaty has returned to center stage.

START I Takes Effect

The hard-won START I accord was signed by President George Bush and Soviet President Mikhail S. Gorbachev on July 31, 1991, after nine years of fitful negotiations that superseded the discredited SALT II process of the 1970s. After the accord was ratified by the US Senate and the four ex-Soviet nuclear states (Russia, Kazakhstan, Ukraine, and Belarus), it entered into force on December 5, 1994.

Step by step, START I has begun to yield substantial results in the mid-1990s.

The United States and Russia (plus the three other post-Soviet nuclear states) were obligated under START I to drop down to 6,000 "account-

able" warheads by 2001. In October, the US and Russia published a new memorandum of understanding that detailed progress toward complying with that key provision. The MOU indicated that the United States has outpaced Russia in reductions, at least in rough numerical terms.

The MOU showed that, since the treaty went into effect, the United States had eliminated fifty-four percent of the warheads it must remove in order to take the US inventory down to the agreed 6,000-warhead limit. According to the new document, the four post-Soviet nuclear weapon states had done away with about thirty-nine percent of the warheads that they will have to eliminate.

In addition, delivery systems were being reduced at a brisk pace. Presidents Clinton and Yeltsin accelerated the START I cuts to hasten a shift from reliance on relatively vulnerable multiwarhead ICBMs to single-warhead ICBMs, submarine-borne missiles, and cruise missile–equipped bombers. The systems were considered less provocative deterrents because they were less tempting targets or were simply harder to locate and attack.

Under terms of START I, the two nations are obligated to bring their forces below a ceiling of 1,600 launchers—land- and seabased ballistic missiles and bombers.

At the end of the Cold War in 1990, the US fielded 2,246 ICBMs, SLBMs, and bombers. The latest MOU reported that the inventory has shrunk to 1,607 total delivery vehicles *[see table, p. 57]*. In other words, the United States accomplished ninety-nine percent of required vehicle reduction even though the 2001 deadline is five years away.

The Kremlin and the former Soviet states have trimmed the old Soviet strategic nuclear force to 1,760 total land-, sea-, and air-based systems, a marked cut from the 2,500 it had deployed at the end of the Cold War in 1990. Thus, Russia and the post-Soviet nuclear weapon states have carried out eighty-two percent of the required cuts in strategic nuclear delivery vehicles.

The United States already has removed warheads and missiles from all the missile launchers to be eliminated under START I and has retired and moved to a central elimination facility all of the heavy bombers scheduled to be dismantled. Consequently, the United States and the former Soviet states already have gone well below a first intermediate ceiling on deployed missile launchers (land- and seabased) and bombers and are several years ahead in their removal and inactivation of their associated warheads.

Under START I provisions, no more than 4,900 of the 6,000 permitted "accountable" warheads are to be loaded onto ballistic missiles, and no more than 1,540 of those 4,900 warheads shall be fitted atop "heavy" ICBMs—the fearsome, Soviet-produced SS-18, with ten warheads. (The US does not possess heavyweight types and is unaffected by the sublimit.) No more than 1,100 warheads can be loaded aboard mobile ICBMs, such as Russia's road-mobile, single-warhead SS-25 weapon.

START I did not mandate any specific cutbacks in bombers. The treaty did permit long-range bombers to carry several nuclear bombs on board and still be counted as one weapon for treaty purposes. Moreover, US heavy bombers could carry up to twenty long-range air-launched cruise missiles and only be counted as having ten weapons on board. These provisions could conceivably permit the United States to deploy up to 9,000 actual nuclear weapons and still remain under the 6,000-warhead "ceiling" for "accountable" warheads.

Troubles for START II

It is the follow-on agreement, START II, that most view as the crown jewel of arms control treaties. Under its terms, Russia and the United States would further reduce their inventories of nuclear weapons and accept a ceiling of 3,000 to 3,500 warheads—in effect, taking both sides back to levels of the mid-1960s. It would, moreover, eliminate the most dangerous and threatening system of the Cold War—the heavy, multiple-warhead ICBM.

However, it was taking longer to achieve ratification of this promising agreement than it took to negotiate it in the first place. The US and Russia worked on the accord through 1991 and 1992 and, on June 17, 1992, agreed to a ceiling of 3,000 to 3,500 strategic warheads. The nations immediately began drafting a new accord and signed the new treaty on January 3, 1993. However, the Senate did not ratify START II for three years, finally doing so in January 1996. The Russian parliament was taking even longer, despite an unprecedented appeal to the Duma by Secretary of Defense William Perry on October 17.

The landmark accord promised the greatest nuclear arms stability in many decades, with each nation accepting steep cuts in its most treasured strategic forces. The Russians pledged to eliminate all of their multiple-warhead ICBMs—such as the ten-warhead SS-18—and the US accepted a fifty percent reduction in the projected US warheads deployed aboard submarines.

Bomber forces faced changes, as well. For one thing, the nations agreed to abandon the deliberate undercounting of bomber weapons that had taken place under the first START agreement. The Russians and the US declared that each of the actual nuclear weapons aboard heavy bombers could be counted against the 3,500-warhead limit.

With START II in abeyance, Clinton and Yeltsin tried to keep up the political momentum, vowing to "deactivate" all nuclear weapons systems scheduled for elimination under START II once the accord entered into force. The leaders even agreed to try to achieve the START II limits two years early—by 2001. For that to happen, however, the United States would have to underwrite the costs of Russia's destruction of the weapons.

Under START II, the US landbased missile force would be restructured to contain 500 warheads loaded aboard 500 Minuteman III missiles that had been "downloaded" from a triple-warhead to a single-warhead configuration. The landbased deterrent—twenty-three percent of the Cold War–era arsenal—would then account for only fourteen percent of the US warhead count.

Also scheduled to be transformed was the US Navy's strategic submarine fleet. At the end of the Cold War, thirty-two enormous strategic missile–firing boats carried 5,760 warheads on patrols across the world's oceans. Under START II, however, the fleet would be reduced to fourteen *Ohio*-class Trident submarines carrying a total of 336 D5 missiles,

each loaded with five warheads for a total of 1,680. Sea-launched systems that had been fifty-five percent of the US deterrent in 1990 would be reduced under START II to forty-eight percent of the nation's smaller overall force.

The US heavy bomber force that was carrying 2,353 warheads in 1990—twenty-two percent of the total deterrent—would take on a greater proportion of the deterrent mission, carrying 1,320 warheads, or thirty-seven percent of the total.

The Russian force projected under START II would reflect much the same shift to a more stabilizing force of submarines and bombers. The landbased Soviet force that in 1990 could threaten the US with 6,612 warheads accounted for sixty-four percent of the Soviet strategic arsenal. That ICBM force would be reduced to 800 warheads, twenty-six percent of the total. The weapons would be loaded aboard single-warhead SS-19s and road-mobile, single-warhead SS-25s.

The Russian nuclear-powered ballistic missile submarine force, built around the massive and superquiet *Typhoon* class, would take a greater percentage of the Kremlin's nuclear deterrent, bearing 1,744 warheads on 424 SLBMs, or fifty-three percent of the post–START II force. In 1990, the Russian submarine force carried 2,804 warheads, but that represented only twenty-seven percent of the total.

Likewise, Russian Tu-95 Bear and Tu-160 Blackjack bombers would play a greater role, carrying 710 of the estimated 3,254 warheads in the post–START II force, or twenty-two percent of the deterrent. That would represent a sizable change from the Cold War force that placed only 855 of the USSR's 10,271 warheads aboard bombers—or eight percent of the force.

Neither Clinton Administration officials nor their Russian counterparts would discuss prospective START III negotiations for fear of complicating ratification of START II.

Battle of the ABM Treaty

Contributing to the delay of the START II Treaty was refusal of the Russian parliament to endorse such steep cuts in offensive forces without being assured that burgeoning US antimissile defenses would not erode the effectiveness of a smaller Russian arsenal.

The US and Russia continued to argue about whether US testing and deployment of an antimissile system developed for theater defense would violate the 1972 Antiballistic Missile treaty that prohibited either nation from giving non-ABM systems "capability to counter strategic ballistic missiles."

The White House was under considerable domestic political pressure to press ahead with antimissile defenses. Republicans in Congress agitated for faster deployment, with some calling for renegotiation of the ABM Treaty to permit full-scale development of promising ballistic missile defenses.

President Clinton took a more relaxed view of the potential missile threat from rogue nations, saying that he would reassess the situation in 2000 and decide whether deployment of an antimissile shield now in development was required.

The Clinton Administration tried to negotiate leeway with the Russians nonetheless. In September, Secretary of State Warren M. Christopher and Russian Foreign Minister Yevgeni M. Primakov formally agreed that the United States could develop defenses against theater-range ballistic missiles without breaching the constraints of the ABM accord.

This agreement makes it clear that the US is permitted to deploy Theater Missile Defense (TMD) systems using interceptors with speeds up to 1.8 miles per second, so long as they had not been tested against ballistic missile warheads with velocities faster than 3.1 miles per second or against missiles with ranges of more than 2,174 miles.

Mr. Primakov said a final agreement would "signify the line of demarcation between strategic and theater antiballistic missiles" and could have a "significant and positive effect" on President Yeltsin's efforts to persuade the cautious Russian Duma to ratify START II.

US officials said the demarcation cleared the way for US deployment of the Army's Theater High-Altitude Area Defense system as well as lower-velocity systems, such as the Army's Patriot Advanced Capability–Level 3 (PAC-3) system and the Navy's area-defense Lower Tier system. The Clinton Administration had already announced unilaterally that the Navy's theater-wide Upper Tier system, with interceptors traveling 4.5 kilometers per second, would comply with the ABM accord. The Russians had not given a specific response to that assertion.

Gestures and Gambits

Even before the two nations started to implement START I, both "detargeted" their long-range systems in a largely political gesture that spelled a symbolic end to the nuclear standoff for the man in the street. The move helped "strengthen the strategic stability" between the two nuclear superpowers, Presidents Clinton and Yeltsin said when they completed the accord in 1994.

The United States withdrew targeting information from its SLBMs and from its fifty ten-warhead Peacekeeper missiles. The Minuteman III system was targeted "at ocean area targets."

Hopes ebbed, however, for a quick end to the proliferation threat posed by huge amounts of fissile materials withdrawn from Russia's Soviet-era warheads. US-financed efforts to improve Russia's nuclear materials' security failed to ease concerns over the danger of diversion and smuggling. Progress appeared slow, as well, on a US-Russian plan for the United States Enrichment Corp. to buy 500 metric tons of highly enriched uranium withdrawn from Soviet-era warheads over the next twenty years.

Under this "megatons to megawatts" conversion program, the Russians as of August had blended down only thirteen metric tons of the weapons-grade uranium to low-enriched uranium for sale by USEC to commercial nuclear powerplants. The amount represented only three percent of the eventual amount to be converted for commercial use. ■

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At this critical Bosnian air base, airmen work long days—seven of them a week—with little backup.

Tuzla Is Tough Duty

By James Kitfield

WHEN the C-130's rear cargo door touched the tarmac at the Tuzla airfield in Bosnia-Hercegovina, the loadmaster and aerial port team swarmed into the hold, rapidly unloading pallets of spares and supplies for NATO peacekeepers. On a runway apron, an An-124 transport awaited clearance for takeoff, ready to take home a contingent of Russian troops. Nearby, more aircraft were waiting their turns to land or depart.

Tuzla, once dilapidated and virtually unused, now is bustling. With sustainment trips, troop rotations, and VIP visits, Tuzla has been handling 2,000 flights per month, making it the busiest aerial port terminal in the Air Force's busiest major command, US Air Forces in Europe (USAFE).

The strain of a high operations tempo and long deployment is etched into the faces of the airmen at Tuzla, many of whom are pulling twelve-hour shifts, seven days a week. Alcohol is banned. Officers' and NCO clubs don't exist. On a typical day recently, the base volleyball court stood empty. Rarely are Air Force personnel permitted to leave the base, and then only in heavily armed convoys.

Col. Paul Cooper, commander of the 4100th Air Base Group (Provisional), notes that air traffic operations continue without letup, and work never ceases. "We can't go downtown and have a beer," said Colonel Cooper, "and there's not a lot to do here, so even the people who get time off tend to come back to the operations building to lend a hand."

The Colonel added, "Like most people here, the last day I had off was before I arrived in Bosnia, and the next day I have off will be after I go home."

We Worry About It

Such pressures are felt throughout the Air Force but especially in USAFE, a command charged with executing many of the recent US peacekeeping and contingency operations. Lt. Gen. Everett H. Pratt, Jr., USAFE's vice commander at Ramstein AB, Germany, frankly acknowledged that USAFE has a problem. "No matter how you want to measure it," said General Pratt, "we clearly have a significant operations tempo, and it's something that we worry about."

The fact that Colonel Cooper, a Reservist, is in Bosnia illustrates part of the problem. Seldom has an AFRES officer been placed in charge of an active-duty unit, but USAFE needed such assistance.

"It is probably unique that a Reservist has been brought in to command an active-duty unit," said Colonel Cooper, "and it probably wouldn't have happened fifteen years ago. . . . My coming over . . . gives an active-duty officer a break."

Since 1990, the Air Force has cut force structure by nearly one-third, while the number of contingency operations involving its forces has increased by 300 percent. According to Air Force statistics, the number of airmen deployed to contingencies has increased steadily since the late 1980s—from fewer than 5,000 in 1988 to more than 18,000 today.

Even in a highly stressed Air Force, USAFE stands out, struggling mightily to stretch a smaller force structure to cover a dramatically larger set of operations. Once, the command's forces were sprawled across sixteen main operating bases and thirty-seven smaller installations. Today, USAFE is confined

A ground crew of the 62d Aerial Port Squadron rushes out to meet an arriving C-130 at Tuzla air base, USAF's busiest terminal in Europe. Crews from the 62d can unload a C-130 in less than twenty minutes.

DoD photo by TSgt. James Mossman, USAF

to just six MOBs and fourteen smaller installations. Its Cold War force structure of nine fighter wings with 636 aircraft has dropped to just three fighter wings and 168 aircraft. Since 1990, USAFE's troop levels have declined from 62,000 to 27,000, with more reductions in store.

This massive consolidation has caused major disruptions, but USAFE's commanders have had to cope with a steady rise in the number of crisis deployments.

USAFE forces played a major role in Operation Desert Storm. In the years since, they have flown thousands of sorties out of Incirlik AB, Turkey, to enforce a no-fly zone over northern Iraq. Air Force strength at Incirlik, a USAFE base, has grown by twenty-two percent since 1990—not including large numbers of airmen assigned there for temporary duty.

Meanwhile, USAFE units at Aviano AB, Italy, have continued to log combat flight time on missions in support of Operation Joint Endeavor, the peace mission in Bosnia *[see "The Force at Aviano," p. 26]*. Aviano's population has nearly doubled, even without counting the large number of personnel on TDY.

Elsewhere, USAFE personnel have played major roles in missions to Somalia, Rwanda, and more recently, Liberia. These operations have come on top of normal training missions that are part of every major Air Force command.

Operations Other Than War

USAFE's leaders continue to train their forces to fight in a major regional conflict, such as Desert Storm. However, they said the command is increasingly preoccupied with the demands of the smaller ventures, which drain their energy and resources on a daily basis. If such contingencies are indeed the future of military operations, as some defense analysts maintain, then USAFE will have to change its rotation policies, force structure, and organization.

"Though we still have to be prepared for the worst-case scenario and operating across the full spectrum of conflict, the most likely scenarios we face are these Operations Other Than War," said Brig. Gen. William R. Hodges, USAFE director of Logistics at Ramstein. "We just have to accept the fact that these Operations Other Than War are the nature of the beast we'll be dealing with on a day-to-day basis."

Six years of wrestling with that beast have taken a toll on USAFE. General Pratt recalled, "When I first got here in 1994, we had a pretty big flap [over] a squadron where almost every pilot had received a waiver to miss training because of deployments in the previous six months. We had some kids who were on the road and away from home for more than 200 days that year."

USAFE has been able to "drive those numbers down" over the past two years, the General noted. On a computer screen in his office, he has displayed a chart that depicts the reenlistment rates and average number of days USAFE's active-duty personnel have spent away from their home bases and from their 46,000 dependents. At the touch of a key, General Pratt can find out how many fathers recently missed a wedding anniversary or the birth of a child, for instance. The prototype software is part of a USAFE effort to accurately track operations tempo and

catalog the many intangibles that collectively constitute command readiness and well-being.

By any measure, the figures reveal that USAFE rates as one of the busiest commands in the US military structure. For example, they show that USAFE aircraft have flown more sorties over northern Iraq as part of Operation Provide Comfort than the Air Force flew in the entire Korean War. They also have been deployed far longer.

"Yet, I doubt the average American citizen could tell you what Operation Provide Comfort was or what we're doing still flying over northern Iraq," said General Hodges. "Because there is usually no [previously appropriated] funding to support these kinds of operations—some of which seem to go on forever—a lot of those costs come out of our hide."

"Highly Stressed"

A number of serious mishaps in the last few years has made some wonder if USAFE is beginning to come apart under the stress. In 1994, two USAFE F-15 fighters enforcing the no-fly zone over northern Iraq accidentally shot down a pair of Army UH-60 Black Hawk helicopters, killing twenty-six persons. An investigation identified training and procedural lapses.

It was a USAFE transport of the 86th Airlift Wing, based at Ramstein, that crashed near Dubrovnik, Croatia, on April 3, killing Secretary of Commerce Ronald H. Brown and thirty-four others. An investigation found that USAFE officials had asked for and had been denied authority to allow aircraft to fly into eastern European airports before USAFE had conducted safety inspections.

"The investigation revealed poor crew training and a commander who had asked for and been denied waivers to facilitate a high operations tempo," said one knowledgeable USAFE officer. "Both of those are signs of a highly stressed command."

General Pratt acknowledges the pressures but believes the command has relieved some of the strain. As part of its effort to reduce operations tempo, USAFE has set a goal that personnel will not be deployed away from home base for more than 120 days a year, and no more than twenty-five percent of the command will be deployed at any one time.

"I think we'll meet those goals this year, because we're just not leaving our people deployed for six months or more if we can help it. We're trying to rotate fresh blood in every 120 days," says General Pratt. Besides averting fatigue and alleviating long spells away from homes and families, he says, the 120-day rotations allow individuals—especially pilots—to sharpen their critical skills through home-base training.

"Even though pilots log combat time flying in some of these contingencies, some of their skills are degrading because they're not practicing the full spectrum of operations," said General Pratt. "While the after-action reports [on the accidents] did reveal a few problems associated with our operations tempo, we think we at least understand the problems now, and we're working to fix them."

The move to limit deployments to 120 days in the face of major operational requirements forced USAFE to lean heavily on US-based Air Reserve Component units. Reservists and Guardsmen not only routinely fly transports into Tuzla but also fly fighters over northern Iraq and Bosnia.

In Fiscal 1995, the most recent year for which complete data are available, reservists contributed more than 100,000 "man-days" of work to USAFE. According to USAFE, aircraft piloted by reserve components accounted for the following:

- Nearly sixty percent of F-16 sorties, nearly twenty percent of F-15 sorties, and more than fifty percent of defense suppression sorties flown in support of Operation Provide Comfort.
- Nearly twenty percent of F-16 sorties, forty-five percent of A-10 sorties, and twenty-five percent of tanker flights in Operation Deny Flight over Bosnia.

Burnout

Col. Robert Marshall, reserve advisor to USAFE, said that the infusion of help from the Air National Guard and AFRES is not a luxury but a necessity. "The reserve forces are doing more and more of the work in USAFE because the operations tempo [is] so high, and they were burning the active-duty guys out by deploying them all the time," he said.

He added, "With all the reserve units back in the United States eager to come over here, . . . it was a natural to just fold them into these peacekeeping operations."

Senior USAFE officials concede that their present operations tempo would probably be unsustainable without increased support from the Guard and Reserve.

USAFE officials have attempted to rein in extracurricular activities. For example, the number of so-called "joint contact events" between the command and other nations as part

USAF photo by SrA. Jeffrey Allen

Because most jobs in Bosnia are stressful, such as removal and destruction of ordnance, performed here by SrA. Mike Chamberlain (left) and TSgt. Kenny McClure, USAFE has moved to strictly limit the length of deployments.

of the Partnership for Peace program has mushroomed from sixty-five in 1993 to more than 400 events in 1996. Senior US officials, civilian and military, would visit eastern European countries and pledge USAFE's participation to various events. Now, such events must be approved and scheduled a year in advance.

"We kept getting these 'pop-up' exercises," said Lt. Col. Tony Salmonson, USAFE director of Partnership for Peace programs. "Each of those exercises requires a lot of effort from the worker bees, and we were really getting overtasked."

USAFE has evolved from its Cold War persona (a forward-deployed force prepared to fight a major war from its home bases) to a new, post–Cold War self—a forward staging base for contingency deployments on Europe's periphery.

General Hodges pointed out, "We've clearly downsized dramatically in this theater, and that's meant going from a big, fight-in-place force to a much smaller force that considers the need to deploy as a given. We've also become so small that any significant fracas we get involved in—and that means something even the size of Bosnia—requires that we receive significant augmentation from forces based in America."

It was their concept of USAFE as a forward-based but swift-deploying air arm that prompted USAFE officials to retain basing capacity in excess of what would be needed merely to bed down the command in the wake of a two-thirds cut from its Cold War size.

USAFE essentially vacated Rhein-Main AB, Germany, near Frankfurt, but concluded a base-maintenance contract to keep the facilities in working order and ready for use in an emergency. During the initial stages of Operation Joint Endeavor late last year, Rhein-Main was pressed into service as a billeting post for Bosnia-bound troops and airmen.

To better prepare for and manage such deployments, USAFE officials have also established an Air Operations Squadron at Ramstein. The AOS staff's job is to anticipate and plan for potential contingencies and to manage and execute operations in the event of a deployment decision.

"The AOS is our stay-at-home command post to plan for and execute these contingency Operations Other Than War," reported General Hodges. "Any time a crisis kicks off, the AOS becomes the nucleus of the crisis-action team."

General Hodges has seen the strain that deployments have placed on a smaller logistics structure. During the Cold War, for instance, major operating bases in Europe typically hosted a wing of seventy-two fighters, twenty-four aircraft per squadron. Today Spangdahlem AB, Germany, is home base to a single squadron of only eighteen aircraft.

Staff photo by Guy Aceto

With the increase of operations in Europe, the population at such bases as Aviano AB, Italy, has exploded, even as USAFE has shrunk by two-thirds. ANG and AFRES troops also participate, sometimes even commanding USAFE units.

Peter Is Gone

"In the past, there were a lot of synergisms to having three squadrons, with three sets of testing equipment, three packages of spare parts, and three maintenance crews," said General Hodges. "In an emergency, you could also cannibalize one squadron in order to launch two robust ones.

"Now, we don't have the luxury to beg from Peter to pay Paul. When you start to split up one squadron of eighteen aircraft, which is not unusual for these contingencies, you find that the synergisms are gone. So our logisticians start meeting themselves coming and going, trying to support these Operations Other Than War."

To compensate, USAFE has developed High-Priority Readiness Spares Packages tailored to specific aircraft types. Unlike the old War Readiness Spares Kits, which individual squadrons brought along when they deployed, the new spares packages are brought to a site in advance and are used by all arriving units.

"By predeploying these High-Priority Readiness Spares Packages for operations like Provide Comfort, we save our rotating squadrons from having to move a lot of spares back and forth as they deploy and then return home," said General Hodges.

USAFE officials believe that, barring new contingencies or a new round of force reductions, the adjustments they've made in operations tempo, organization, and procedures will be sufficient to cope with the present level of operations. The problem, they say, is that the unexpected has been occurring with almost predictable regularity. "The problem comes when something pops up that you haven't planned for," said General Pratt. "I mean, we went into Provide Comfort in Turkey as a 'contingency operation,' and we've been down there for five years." ■

James Kitfield is a defense correspondent for the National Journal *in Washington, D. C. His most recent article for* Air Force *Magazine, "Flying Safety: The Real Story," appeared in the June 1996 issue.*

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World Gallery of Trainers

By John W. R. Taylor and Kenneth Munson

Jet Trainers

E.25 Mirlo (C-101EB Aviojet), Spanish Air Force *(Paul Jackson)*

CM 170 Magister, French Air Force *(Lindsay Peacock)*

Alpha Jet

Only about 30 of its original 175 Alpha Jets remain active with Germany's Luftwaffe, 50 having been donated to Portugal and a further 60 or so still up for sale. Aircraft built for Germany have 3,175 lb thrust Larzac 04-C20 engines, a podded 27-mm Mauser gun, provision for two self-defense Sidewinder AAMs, and a characteristic "needle" nose. Those still serving are used as lead-in trainers for the Tornado strike aircraft. France still has most of the 176 built for its air force, in which the Alpha Jet had clocked half a million flying hours by the beginning of this year. The three squadrons of No. 9 Wing of the Belgian Air Force continue to fly the majority of the 33 supplied to that country from early production. Thanks to the German run-down, Portugal is now the second largest operator, although 10 of its 50 are reserved to provide spares for the remainder, which have replaced such assorted other types as the Lockheed T-33A, Cessna T-37C, Northrop T-38A, and Fiat G91. Twenty equip No. 103 Squadron for transition training, while the other 20 are used by No. 301 Squadron for close air support and attack roles. Six of the Portuguese aircraft have been equipped with Italian Elettronica ACE 2000 EW equipment, installed in the rear cockpit.

Non-European customers included 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. Ivory Coast has been trying to get two of its last five airworthy again with Dassault assistance.

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 aircraft built for Germany.

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, 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 Tsu-Chiang

After completing 80 hours of basic training on T-34Cs, student pilots at Taiwan's Air Force Academy, Kangshan AB, progress to 120 hours of advanced training, including initial combat instruction, on the AT-3. The first of 64 built was delivered in March 1984, and about 38 remain in use in these roles, some being flown also by the Thunder Tigers aerobatic display team. Twenty were converted to use the 6,000 lb external stores-carrying capability in a night and all-weather close-support role. They serve with No. 35 Squadron, Republic of China Air Force, also at Kangshan.

Contractor: Aero Industry Development Center, Taiwan.

Power Plant: two AlliedSignal 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.

C-101 Aviojet

Like most modern jet trainers, the Aviojet can be used in other military roles, with an internal bay under the rear cockpit large enough to accommodate guns, reconnaissance and ECM packages, or other combat aids. The first of four prototypes flew on June 27, 1977, followed by 88 **C-101EB** basic and advanced trainers for the Spanish Air Force, by which they are known as the **E.25 Mirlo.** About 78 continue in service, some with the Air Force's Patrulla Aguila display team. They have 3,500 lb thrust AlliedSignal 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-36CC Halcón** by the Chilean Air Force, was developed jointly by CASA and ENAER. Twenty-three production A-36CCs, with more powerful TFE731-5-1J engines, were built for the Chilean Air Force, of which 20 are operational. Four were supplied from Spain, the others co-produced by ENAER, which also upgraded the T-36s to **A-36BB** standard for tactical training. Twelve similar **C-101CC-04**s serve with Nos. 2 (weapons training) and 11 (basic training) Squadrons of the Royal Jordanian Air Force, at King Hussein Air College, Mafraq. *(Data for C-101CC.)*

Contractor: Construcciones Aeronauticas SA, Spain.

Power Plant: one AlliedSignal 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 553 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 5-in rockets, six 550-lb bombs, two Maverick ASMs, or Sidewinder or Magic AAMs.

CM 170 Magister

France and Belgium are the only original customers still operating the **CM 170 Magister** first-generation jet trainer. About 70 still fly with the French Air Force, but Belgium's are on the verge of retirement. Israel's 40 or more Magisters, which have the local name **Tzukit** ("merlin"), were rebuilt and upgraded between 1981 and 1986 by IAI's Bedek Aviation Division, but a replacement is being sought. Other Magisters, many of them secondhand, still serve with the air forces of Algeria (18 or less), Cameroon (three or four), Gabon (four or five), Ireland (six), Lebanon (three, but probably not airworthy), Morocco (18–20), El Salvador (three), and Senegal (five or less), often in both training and counterinsurgency roles.

First delivered in 1956, 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

Thirty-three years after production deliveries began, almost 120 CT-114 Tutors remain in service with Canadian Forces, including more than 80 with No. 2 CF Flying Training School, and 14 with No. 431 Squadron, which provides the service's Snowbirds aerobatic display team, all 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. A program to rewire and otherwise refurbish Tutors is under way, to extend their service life to 2010.
Contractor: Canadair, Bombardier Inc, 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

More than 120 straight-winged **G-2A Galeb** ("seagull") trainers were built for the former Yugoslav Air Force during 1963–83, but their replacement from 1985, on a one-for-one basis, by the sweptwing, anhedral-tailplane **G-4 Super Galeb,** makes it unlikely that very many G-2As remain in service. One squadron of the 172d Regiment at Podgorica was reported to be flying G-2As in 1995, but the numbers of either type in use, and their disposition, has become increasingly difficult to quantify since the civil war in that country. Initially the G2-A/G-4s were operated only by the Serb forces, together with the G-2A's single-seat attack derivative, the J-1 Jastreb, but about 10 aircraft of these three types were captured at Udbina by Croatian forces in 1995, the G-2As then being used for both reconnaissance and transition training while the G-4s were used in the attack role with BL755 cluster bombs. An improved **G-4M** ground-attack prototype appeared in 1991 but is unlikely to have entered production before Soko's badly damaged Mostar factory was abandoned in May 1992. Unconfirmed reports have suggested that the Utva facility at Pančevo, Serbia, to which some G-4 jigs and tools were transferred, has built two prototypes of a single-seat development, designated **G-5.** Optimized for ground attack, this aircraft 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.

About two-thirds of the 120 G-2A-Es supplied to Libya before 1984 may still survive, though not all may be operationally available. Two of Zambia's original six are thought to remain. More recently, at least six of a Myanmar order for 12 G-4s are known to have been delivered. *(Data for G-4.)*
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.
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 medium-range 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. From April 1994, seven T. Mk 1s were loaned to the Fleet Requirements and Aircraft Direction Unit to provide target facilities and EW training for the Royal Navy. Eight more are to follow.

Hawk T. Mk 1A, Royal Air Force
(Sgt. Rick Brewer)

I-22 Iryda, Polish Air Force
(Lech Zielaskowski)

IA 63 Pampa, Argentine Air Force

Even before its 1981 selection by the US Navy (as the T-45A Goshawk, which see), the Hawk had attracted export orders. Customers for the 30 percent heavier **Hawk 50** series, with a 5,200 lb thrust Adour 851, 70 percent greater disposable load, and 30 percent longer range, were Finland (57 Mk 51/51A, with a 12.7-mm centerline gun), Kenya (12 Mk 52), and Indonesia (20 Mk 53). The further improved **Hawk 60** series, with four-position flaps, modified wing leading-edge devices, and other refinements, has been bought by Zimbabwe (13 Mk 60/60A), Dubai (nine Mk 61), Abu Dhabi (16 Mk 63, since upgraded, and four Mk 63C), Kuwait (12 Mk 64), Saudi Arabia (30 Mk 65 and 20 Mk 65A), Switzerland (20 Mk 66), and South Korea (20 Mk 67). Thirteen of the 16 Abu Dhabi Mk 63s have been upgraded to Mk 63A and two to Mk 63B, with Adour 871 and new wings with four pylons and 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 (40 Mk 109/209), Malaysia (10 Mk 108, 18 Mk 208), and Oman (four Mk 103, 12 Mk 203), most with wingtip rails for Sidewinders, a Sky Guardian radar warning receiver, and laser rangefinder. The Malaysian and Omani 200s have a fixed refueling probe. With the Super Tucano (which see), the Hawk 100 is currently being bid by Bombardier and the Canadian Forces for the prestigious NFTC (NATO Flying Training in Canada) 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 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, combat radius with 5,000-lb weapons load 620 miles, with 2,000-lb load 900 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; five 1,000-lb bombs; 36 x 80-lb runway denial bombs; five 600-lb cluster bombs; four Sidewinder or two Magic AAMs; two Maverick ASMs; or two 156-gallon drop tanks.

HJT-16 Kiran

Between 1968 and 1989, HAL delivered 118 Viper-engined **Kiran Mk I** basic trainers, 72 **MK IA**s with a hardpoint under each wing to carry armament for weapons training, and 61 **MK II**s with a more powerful Orpheus turbojet, updated instruments and avionics, improved hydraulics, and two additional underwing stations. About 160 Kirans of all three versions continue to equip the Indian Air Force Academy and Flying Instructors' School; 12 Indian Navy aircraft serve with No. 551 Squadron, which also provides the service's Phantoms aerobatic display team. The long-anticipated decision on a replacement has yet to be announced. *(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-93 Iryda

The Polish aircraft industry developed the Iryda ("iridium") to cover the spectrum of pilot, navigation, air combat, reconnaissance, and ground-attack training, with day/night and adverse weather capability, as a replacement for the Polish Air Force's TS-11 Iskra (which see) and LiM-6 (MiG-17) basic and advanced trainers. The first of five prototypes flew March 5, 1985.

The first 12 production aircraft (one of which has since been lost) were **I-22**s, with 2,425 lb thrust PZL-5 engines and zero-height/94 mph Polish ejection seats; the next six are **M-93K**s, with more powerful K-15 turbojets, Martin-Baker zero/zero seats, Fowler flaps, and modified avionics. A French SAGEM avionics suite was flight-tested in an **M-93S** prototype, but the avionics contract has now been awarded to Sextant Avionique. The 11 I-22s are to be brought up to this M-93K standard by the end of 1997, by which time a further six new-build M-93Ks should also have been delivered. PAF operator is the No. 58 Air School Regiment at Dęblin; the Iryda was also expected to be evaluated by the Polish Navy in 1996. Another prototype, with an eye toward possible export orders, is the **M-93V,** powered by 3,307 lb thrust Rolls-Royce Viper 545 engines and first flown in April 1994.

The Iryda can operate from unprepared airfields and tolerate substantial battle damage, and PZL Mielec has projected a number of possible future variants. The **M-93R** and **M-93M** are, respectively, reconnaissance and maritime attack versions of the M-93K; **M-96** would be an aerodynamically improved M-93K with LERX, leading-edge flaps, and auxiliary tailfins. A two-seat reconnaissance/close-support variant, the **M-95,** would have 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 are **M-97S** and **M-97MS,** respectively; an **M-99 Orkan** ("eagle") would have a larger wing, more powerful turbofans, and carry 8,818 lb of stores on eight external stations. *(Data for M-93K.)*
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 10,251 lb, gross 14,771–19,180 lb.
Performance (at 13,007 lb clean gross weight except where indicated): max speed at 16,400 ft 590 mph, stalling speed (gear and flaps down) 127 mph, ceiling 44,950 ft, T-O run 2,200 ft, landing run (with brake-chute) at 14,550 lb weight 1,380 ft, radius at 19,180 lb weight with max external stores 155 miles, *g* limits +7.3/–4.
Accommodation: crew of two, on tandem zero/zero 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 total load of bombs (up to 1,102-lb size), cluster bombs, gun pods, guided or unguided rockets, camera pods, or (inboard stations only) 100-gallon drop tanks.

IA 63 Pampa

The first of three prototypes of this basic, advanced, and weapons training aircraft flew October 6, 1984, and delivery of an initial batch of 18 to the Argentine Air Force began in April 1988. About four of these have since been lost, and with Argentina's other basic trainer, the Morane-Saulnier Paris, now around 40 years old, a requirement for a further 46–50 Pampas for the air force and navy remains. However, its lack of success in the recent USAF/USN JPATS contest, and the absence of further domestic funding, seem to suggest that further manufacture is unlikely unless additional (*i.e.*, export) orders can be obtained to make a production restart economically viable. Existing aircraft, six of which were fitted with an AAF-developed HUD, a new Elbit weapon delivery and navigation system, a podded 30-mm gun, and underwing weapon stations, serve with the Fighter Group Fighter School at Mendoza but are now said to be encountering spares and maintenance problems.
Contractor: Lockheed Aircraft Argentina SA (formerly FMA), Argentina.
Power Plant: one AlliedSignal TFE731-2-2N turbofan; 3,500 lb thrust.
Dimensions: span 31 ft 9½ 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 clean 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

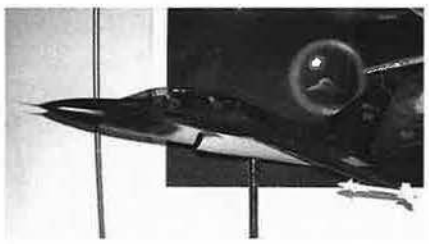
The Romanian Air Force is reported to have ordered 50 **IAR-99 Şoims** ("hawks") for intermediate and advanced training, with light attack capability; but only 26 are known to have been delivered, in 1987–91. Bedek Aviation Division of Israel Aircraft Industries assisted Avioane in upgrading the aircraft by installing state-of-the-art avionics in a demonstrator, known as the **IAR-109 Swift,** which flew for the first time in Israel in November 1993. Proposed production versions were 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. No orders for the IAR-109T/TF have been announced. *(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 550-lb or smaller bombs, two twin 7.62-mm gun pods, four 16-rd pods of 57-mm rockets or 32-rd pods of 42-mm rockets, infrared AAMs, drop tanks (inboard stations only), or other stores.

K-8 Karakorum 8

Although Pakistan has a 25 percent share in the K-8 program, and its Air Force was the only confirmed customer and operator in the summer of 1996, the single assembly line is at Nanchang, China. The K-8 is a conventional jet basic trainer and light ground-attack aircraft. The first of three flying prototypes made its initial flight November 21, 1990. It was followed by a preproduction batch, of which the first has been used as a demonstrator; six others were delivered to Pakistan in November 1994, for a 1,200-hour evaluation at the PAF Academy, Risalpur. According to that nation's secretary for defense production, up to 100 K-8s are required to replace Cessna T-37s and possibly also the Chengdu FT-5 combat trainer; a further six have been ordered to date. The Air Force of the Chinese People's Liberation Army is expected to receive several hundred eventually, for which the indigenous Woshan WS11 turbofan is being developed. Interest has been shown by other countries, including Bangladesh, Eritrea, Laos, Myanmar, Sri Lanka, and Zambia.
Contractor: Nanchang Aircraft Manufacturing Company, People's Republic of China.
Power Plant: one AlliedSignal 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 501 mph, stalling speed (gear and flaps down) 94 mph, ceiling 42,650 ft, T-O run 1,392 ft, landing run 1,641 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 for a total 2,080 lb of external stores. Twin-store inboard stations each for two small bombs; single-store outboard stations can each carry a PL-7 AAM, 12-rd pod of 57-mm rockets, a single 550-lb or smaller bomb, or a 66-gallon drop tank.

KTX-2

As part of the offset deal centered on South Korea's F-16 program, Lockheed Martin has provided Samsung with assistance in designing the KTX-2 supersonic advanced trainer, lead-in fighter trainer and light combat aircraft, which has much in common with the US fighter. Work began in 1992, and the design was frozen in 1995, with wing sweep on only the leading-edge of mid-mounted wings, and large curved leading-edge root extensions (LERX) over the engine air ducts. Features include digital fly-by-wire control, color multifunction cockpit displays, a HUD, a nav/attack system for lead-in training, and radar for combat versions. Full-scale development is planned to begin in 1997, under a partnership agreement with Lockheed Martin signed in the summer of this year. Production will be at Samsung's Sachon plant, with Lockheed Martin responsible for wings and certain subsystems. Samsung hopes to fly the first prototype KTX-2 in 2000, allowing delivery of 100 production aircraft for the RoKAF to begin in 2005. *(Data provisional.)*



Model of KTX-2 *(Paul Jackson)*

L-29 Delfin, Russian Air Force *(Paul Jackson)*

Contractor: Samsung Aerospace Industries Ltd, Republic of Korea.
Power Plant: one turbofan (probably General Electric F404) in 16,000 lb thrust class.
Dimensions: span 29 ft 10 in, length 42 ft 0 in, height 14 ft 5 in.
Weight: gross 18,960 lb.
Performance: max speed Mach 1.4, ceiling 45,000 ft, *g* limits +9/–3.
Accommodation: crew of two in tandem; rear seat raised.
Armament: one internal 20-mm gun; hardpoints on centerline, two under each wing, and at each wingtip for AAMs, ASMs, bombs, rocket pods, or gun packs.

L-29 Delfin

The **L-29 Delfin** ("dolphin") first flew April 5, 1959, and was followed by 3,568 production Delfins built between 1961 and 1974. About 3,000 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 80, Czech (20) and Slovak (16) Republics 36, Romania 30+, Russia 800 (plus some in Azerbaijan and Kazakhstan), and Ukraine 20; Russian and some other inventories have been depleted in recent years by secondhand sales to other air forces and the civil market. At least nine other nations received L-29s, of which Afghanistan (24), Cuba (30), Ghana (eight), Mali (six), Syria (60), and Uganda (few, status unknown) still operate the Delfin, often for counterinsurgency roles. 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, Czech Republic.
Power Plant: one 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-39/139 Albatros

In continuous production since 1971 except for a two-year hiatus in 1991–92, more than 2,800 L-39s have been built (including 2,094 **L-39C** basic and advanced trainers for the former USSR), bringing the Aero factory's jet trainer output to an unrivaled total of more than 6,400. Latest L-39 customers are Bangladesh and Thailand.

Apart from the Czechoslovak Air Force (36), other L-39C recipients include Afghanistan (12), Cuba (30), Ethiopia (20), and Vietnam (24). Ex-Soviet L-39Cs have been acquired by Lithuania (four) and Latvia; Ukraine also is now disposing of some surplus Cs. 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 transferred to Hungary in 1993), 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), Bangladesh (eight), Bulgaria (36), Czechoslovakia (31), Nigeria (24), Romania (32), Syria (44), and Thailand (40, RTAF designation **BKF.1**). The last-named (designated **L39ZA/ART** by Aero and having Elbit avionics) were delivered for Nos. 101, 102, and 401 Squadrons in 1994 and 1996. Cambodia is reported to have six secondhand L-39ZAs upgraded by Israel. Current Czech and Slovak strengths are 20 Cs/six Vs/18 ZAs and eight Cs/two Vs/nine ZAs, respectively.

Although too late to find a partner to enter the US JPATS competition, the Albatros is being offered in Westernized form for world markets. Principal differences in the **L-139 Albatros 2000** are an AlliedSignal turbofan, Flight Visions HUD, and Bendix/King avionics. First flight was made May 8, 1993. *(Data for L-39C, with L-139 in parentheses.)*
Contractor: Aero Vodochody, Czech Republic.
Power Plant: one Progress/Ivchenko AI-25TL (AlliedSignal TFE731-4-1T) turbofan; 3,792 lb (4,080 lb) thrust.
Dimensions: span over integral tiptanks 31 ft 0½ in, length 39 ft 9½ in, height 15 ft 7¾ in.
Weights: empty 7,617 lb (7,628 lb), gross 9,976–10,362 lb (10,031–13,117 lb).
Performance (L-39C at 9,921 lb clean gross weight): max speed at S/L 435 mph, at 16,400 ft 466 mph,

stalling speed 103 mph, ceiling 36,100 ft, T-O run 1,740 ft, landing run 2,135 ft, range with max internal fuel 633 miles, *g* limits +8/–4.

Performance (L-139 at 10,031 lb clean gross weight): max speed at 20,000 ft 478 mph, stalling speed 105 mph, ceiling 38,715 ft, T-O run 1,706 ft, landing run 2,002 ft, range with max internal fuel 1,050 miles.

Accommodation: crew of two, on tandem zero-height/94 mph (zero/zero) ejection seats. Rear seat raised.

Armament: centerline pod for 23-mm GSh-23 twin-barrel gun. Two underwing pylons for up to 626 lb of practice weapons or drop tanks. L-39Z0 has two underwing stations on each side for a total of 2,535 lb of stores including bombs, rocket pods, IR AAMs (outer pylons only), or (port inner pylon only) a reconnaissance pod. External load increased to 2,844 lb on L-39ZA and 3,307 lb on L-139.

L-59/159 Albatros

First flown in definitive form September 30, 1986, the prototype of this L-39 derivative was originally designated **L-39MS;** the **L-59** designation, acknowledging it as essentially a new type, was adopted in about 1990, although the Czech and Slovak Air Force aircraft retain the earlier designation. Its new and more powerful DV-2 turbofan, of Russian (Ivchenko/Lotarev) design, is built in the Slovak Republic. Other major differences include a strengthened fuselage with slightly longer nose, enlarged tiptanks, powered aileron and elevator controls, and upgraded avionics. The first five production aircraft were delivered to the Czech and Slovak air forces (three and two, respectively) in 1991–92, and deliveries of 48 L-59Es to the Egyptian Air Force followed in 1993–94. Twelve L-59Ts have been delivered to the Tunisian Air Force.

Under development, to fly next year, is the **L-159,** a single-seat advanced trainer/light attack derivative of the L-59 to be powered by a 6,300 lb thrust AlliedSignal/ITEC F124 turbofan. Czech government approval was given in April 1995 for 72 to be ordered for the country's air force. Deliveries should begin by 1999. The L-159 will have a nose-mounted radar, armored cockpit, and Western avionics, plus an additional fuel tank in place of the L-59's second seat. *(Data for L-59.)*

Contractor: Aero Vodochody, Czech Republic.

Power Plant: one PS/ZMKB Progress DV-2 turbofan; 4,850 lb thrust.

Dimensions: span over tiptanks 31 ft 3½ in, length 40 ft 0¼ in, height 15 ft 7¾ in.

Weights: empty 8,885 lb, gross 12,257–15,432 lb.

Performance (at 12,257 lb clean gross weight): max speed at 16,400 ft 544 mph, stalling speed (gear and flaps down) 114 mph, ceiling 38,475 ft, T-O run 2,100 ft, landing run 2,365 ft, range on internal fuel 752 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, with up to 150 rds, 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

Only six original Aermacchi **MB-326** tandem-seat trainers with a 2,500 lb thrust Viper 11 turbojet, and **326Es** with strengthened wings and six underwing hardpoints, remain in service with the Italian Air Force. Others continue to fly with the air forces of Australia (50 **326H** for lead-in training; some in store), Ghana (five **326F**), and Tunisia (four **326B**). The trainer/light attack **MB-326GB** combines the wings of the E with the more powerful Viper 540; versions built by Aermacchi serve with the Argentine Naval Aviation Command (two) and the air forces of Zaïre (five) and Zambia (15). Others, license-built by Embraer, are used by the Argentine Navy (nine) and air forces of Brazil (100, as **AT-26 Xavante**), Paraguay (six), and Togo (four). Final Italian-built variants were the single-seat **MB-326K** for operational training/ground attack, and two-seat **MB-326L** advanced trainer, each with a 4,000 lb thrust Viper 632; three Ks and two Ls serve with the United Arab Emirates Air Force (Dubai) and four **MB-326KGs** in Ghana. Atlas Aircraft Corp. in South Africa built **MB-326Ms** under license as **Impala Mk 1** trainers, and MB-326Ks as **Impala Mk 2s.** Replacements are being studied for the 60 Impalas still operational and for Australia's 326Hs. *(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

The first production **MB-339A** for the Italian Air Force (4,000 lb thrust Viper 632-43 engine) flew July 20, 1978; the total of 105 eventually delivered included three **MB-339RM** (radiomisure) calibration aircraft (since restored to trainer duties) and 21 **MB-339PANs** for the Frecce Tricolori aerobatic display team, with added smoke generator but with wingtip tanks deleted to aid formation keeping. Most IAF MB-339As are camouflaged for use as an emergency close-support force. MB-339As were also delivered to Argentina (Navy, 10 AA), Dubai (seven), Ghana (four), Malaysia (13 AM, with MB-339C-standard avionics and Marte 2A antiship ASMs), Nigeria (12 AN), and Peru (16 AP). With Lockheed Martin, Aermacchi bid a "missionized" **T-Bird II,** with 4,000 lb thrust Viper 680-582 and detail improvements, in the US JPATS competition. An earlier prototype/demonstrator, the **MB-339B** of 1984, had a 4,400 lb thrust Viper 680-43, larger tiptanks, and more recently EFIS displays and air-to-air refueling capability.

A first flight on December 17, 1985, introduced the **MB-339C,** produced for the Royal New Zealand Air Force (18 CB) with uprated engine, 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. These equip No. 14 Squadron and the Pilot Training School. Later variants are the **MB-339CD** (C digital) and **MB-339FD,** with Viper 632-43 and 680-43 power plants, respectively. Italy is to receive 15 of the former, with all-digital avionics, HOTAS controls, and provision for in-flight refueling, as lead-in trainers for Tornado crews. The export FD (full digital), ordered by Eritrea's fledgling air force (six) and competing with the Hawk for Australia's MB-326H replacement requirement, has twin HUDs, three-color liquid crystal multifunction displays, inertial navigation with embodied GPS, an advanced nav/attack computer, and HOTAS controls. *(Data for MB-339CB.)*

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 1 in.

Weights: empty 7,562 lb, gross 10,983–14,000 lb.

Performance (at 10,983 lb clean gross 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 1,610 ft, landing run 1,510 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 or Magic AAMs, AGM-65 Maverick ASMs, Marte Mk 2A sea-skimming antiship missiles, and other weapons.

MiG-AT

The prototype MiG-AT flew for the first time on March 21, 1996, and is being evaluated in competition with the Yak-130 to replace Aero L-29 and L-39 Albatros trainers in Russian service. The configuration is conventional, except for the overwing engine ducts to reduce risk of FOD; but the airframe is state-of-the-art. The aluminium alloy wings are honeycomb-skinned; 40 percent of the fuselage is covered with carbonfiber and glassfiber. Control is fly-by-wire, with carbonfiber honeycomb fin, tailplane, and control surfaces. The avionics, integrated by GoSNIIAS research institute in Russia and Sextant Avionique of France, include two liquid-crystal color MFDs in each cockpit, helmet-mounted displays, and a wide-field HUD with input from color video and TV camera. The standard suite provides for onboard simulation of maneuvering targets, meteorological conditions, and system failures via the HUD, as well as specific training for all operational modes of individual types of Russian and foreign combat aircraft. Emergency equipment includes a "panic button" on the control stick, to restore the aircraft to a wings-level, nose-up attitude in flight.

The basic **MiG-AT** is available for training and combat use with AAMs in conjunction with a helmet-mounted target designator, and with unguided weapons against land and sea targets. In **MiG-ATS** form, it carries a guidance pod for ASMs. The **MiG-AS** will be a single-seat light tactical fighter with a built-in gun, and radar for all-weather use of weapons carried on seven hardpoints. Manufacture of 15 preproduction aircraft is already under way. The Russian requirement is for 200–250 trainers in this category. *(Data for basic MiG-AT.)*

Contractor: MAPO-MiG, Russia.

Power Plant: two Turbomeca-SNECMA Larzac 04-R20 turbofans; each 3,175 lb thrust. Production engines for domestic market to be license-built by Chernyshev.

Dimensions: span 33 ft 4 in, length 39 ft 5 in, height 15 ft 2 in.

Weight: gross 10,163–15,430 lb.

Performance (estimated): max speed at 8,200 ft 621 mph, at S/L 528 mph, ceiling 50,850 ft, T-O run 1,017 ft, landing run 1,870 ft, range 745 miles at Mach 0.5, ferry range 1,615 miles, *g* limits +8/–3.

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

Armament (MiG-AS): up to 4,410 lb of guided and unguided missiles, guns, and bombs, on seven hardpoints.

S.211

First flown on April 10, 1981, the basic **S.211** was supplied to the air forces of Singapore (30) and the Philippines (24). The first six aircraft for Singapore were delivered as kits and the remainder produced locally. Most of the 29 still active fly with No. 130 Squadron 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, but attrition has reduced the fleet to 18, of which only 10 are believed to be airworthy. They are used for advanced training by No. 100 Training Wing at Fernando AB and for combat training by No. 5 Fighter Wing at Basa AB.

An uprated version, the **S.211A,** with a more powerful (3,190 lb thrust) JT15D-5C turbofan and supercritical wings with drooped tips, made its first flight September 17, 1992, but has not yet attracted customers. Compared with the original S.211, the A has higher gross weights (6,393–8,818 lb) and a max speed of 476 mph at 25,000 ft. New wing fittings raise the *g* limits to +7/–3. *(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)

In service since 1966, the Saab 105 has since 1987 been the Swedish Air Force's only training aircraft, covering all aspects from primary to advanced, weapon, and tactical tuition. A total of 150 were delivered in five 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-seat liaison; and **SK60E** four-seat liaison, with civil avionics. About 140 remain in service with the Basic Flying School of F5 Wing at Ljungbyhed and No. 5 Light Attack and Basic Tactical Training Squadron at Uppsala. The Ds and Es (about 20 aircraft) are shortly due for retirement. Of the remaining 120 or so, 105 are now embarking on their third lease of life, following a wing strengthening/life extension program carried out during 1988–91. These aircraft (about 40 As, 25 Bs, and 40 Cs) are being refitted with 1,800 lb thrust Williams-Rolls FJ44-1C turbofans, with which they are redesignated **SK60W** and destined to continue in service until 2015. Instruments and avionics are also being upgraded. The first reengined aircraft flew October 6, 1995, and redelivery to the Swedish Air Force began September 6 this year. The program will continue through 1998.

Also in service is the Saab **105XT,** with General Electric J85 engines, strengthened structure, more internal fuel, more advanced avionics, and much greater weapon-carrying capability than the original domestic version. 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 (General Electric J85-GE-17B turbojets); each 1,636 lb (2,850 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

A quarter-century ago, the XT-2 prototype was the first supersonic aircraft designed and manufactured by Japan's aerospace industry. Ninety production aircraft were manufactured for the Air Self-Defense Force, of which 28 were configured as **T-2** unarmed advanced trainers and the rest as **T-2A** armed combat proficiency trainers. Standard equipment includes Mitsubishi Electric AWG-11 radar, HUD, and SIF/IFF. Twenty-five T-2s and 54 T-2As are currently in service.
Contractor: Mitsubishi Heavy Industries Ltd, Japan.
Power Plant: two Ishikawajima-Harima TF40-IHI-801A (license-built 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 21,616–28,219 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 up to 4,410 lb of drop tanks or weapons. Wingtip attachments for Sidewinder AAMs.

T-2 Buckeye

Although the US Navy's **T-2C** Buckeyes are being replaced gradually by T-45A Goshawks, nearly half of the 231 delivered from April 1969 remain active. They provide jet pilot, navigator, NFO, and weapons training, plus the carrier qualification part of the strike training syllabus.

The Venezuelan Air Force acquired 24 **T-2Ds**, generally similar to the C except for their avionics and deletion of carrier landing capability. Eighteen of these continue in service as advanced trainers with No. 142 Squadron of the Air Academy at Maracay, some with a secondary attack capability. The attack kit was developed originally for 40 **T-2Es** supplied to the Hellenic Air Force; 36 of these are used by Squadrons 362 and 363 at Kalamata, for advanced and weapons training, respectively, 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 13,180 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.

T-4

First flown on July 29, 1985, this intermediate trainer and combat support aircraft was developed to replace the Lockheed T-33As and Fuji T-1s of the Japan Air Self-Defense Force. Including the four prototypes, 171 had been ordered and 141 delivered by spring 1996. As well as equipping Nos. 31 and 32 Squadrons of the 1st Air Wing of Air Training Command at Hamamatsu and Nos. 21 and 22 Squadrons of the 4th Wing at Matsushima, they are used by the instrument rating and communications flights of combat squadrons. The basic requirements of the specification to which they were designed called for high subsonic maneuverability and provisions for external stores. Four underwing hardpoints can carry drop tanks or travel pods; an underfuselage pylon can be used for target-towing equipment, an ECM/chaff dispenser pod, or air sampling pack.

Eight specially prepared T-4s equip the JASDF's Blue Impulse aerobatic team. These have windscreens more resistant to birdstrikes, increased rudder movement, and one fuel tank replaced by an oil tank for smoke trails. Fuji and Mitsubishi each have a 30 percent share in manufacture of the T-4, under Kawasaki's leadership. A total of about 200 is required by the JASDF.

MiG-AT prototype *(Photo Link)*

T-4, JASDF Blue Impulse aerobatic team *(Katsumi Hinata)*

T-38A Talon, Republic of China Air Force *(P. R. Foster)*

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 eight air forces. In addition to **T-33A** pilot trainers, **AT-33A** counterinsurgency versions are still flown by Bolivia (nine) and Mexico (30), while Pakistan still operates two of the **RT-33A** tactical reconnaissance version. Largest T-33A fleets are those of Canada, whose 45 **CT-133A Silver Stars** still have their original 5,100 lb thrust Rolls-Royce Nene engines; Greece (47); Japan (40); and Turkey (75). Other T-33A operators are the air forces of Bolivia (15), South Korea (25), Pakistan (nine), and Uruguay (seven). The Royal Thai Air Force is continuing to fly four T-33As and three RT-33As until spares are exhausted. Japan's T-33As are now used only for liaison and other duties following their replacement by T-4s. Turkey, whose T-33As also are used chiefly for liaison, was expected to retire its fleet by the end of this year. Canada's CT-133As serve with combat support squadrons. Ten are modified as **ET-133** "electronic aggressors"; others are used for maritime support. A digital cockpit upgrade has recently been prototyped and costed for 35 aircraft, with an option for the other 10. *(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

More than 40 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 the JPATS PC-9 Mk II is ready for service. As of September 1995, USAF listed 461 active, with an average age of 32.5 years. All are being upgraded by SLEP kits manufactured by Sabreliner Corp. The majority are operated by AETC, but a number serve at ACC bases. Twelve were transferred to Bangladesh, to replace Magisters, at the end of last year. Germany has 35 T-37Bs, based in the US.

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, a gunsight, and reconnaissance camera. Mixed fleets of T-37Bs and Cs are operated today by the air forces of Chile (20), Greece (35), Pakistan (50), Thailand (12), and Turkey (62). Colombia's air force has five T-37Cs and South Korea 25. *(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/AT-38 Talon

The first US supersonic aircraft designed from the start as a trainer, the YT-38 prototype first flew April 10, 1959, and was followed by 1,187 production **T-38As** over the next decade. More than 1,100 of these were for USAF, which still had 402 on charge in late 1995, mostly with AETC but also including some allocated for Companion Trainer Program duty with ACC. The original total included 46 (of which 41 remain) allocated for US-based training of German pilots. NASA has 31; the US Navy received 18 (of which about six remain). Other current T-38A operators are Taiwan (40 leased) and Turkey (69). South Korea has announced plans to lease 30 from early next year until its indigenous KTX-2 is available in about 2005.

A total 132 of the USAF aircraft were modified to **AT-38B** configuration for specialized weapons training, with an underfuselage gun pod or practice bomb dispensers; 69 of these remained in September 1995.

A SLEP named Pacer Classic will extend the service life of USAF's T-38s until 2020. McDonnell Douglas, with Israel Aircraft Industries as major subcontractor, is to upgrade two Talons to **T-38C** standard with HUD, cockpit MFDs, HOTAS controls, INS with embedded GPS, and a collision avoidance system. First flight is slated for June 1998, with the prospect of up to 425 production upgrades to follow from 1999. *(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 Mach 1.23 (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 AT-38B.

T-45A Goshawk

Basec on the British Aerospace Hawk, the Goshawk began as winner of a 1981 competition for an undergraduate jet pilot trainer to replace the US Navy's T-2C Buckeye and TA-4J Skyhawk. Changes introduced by the US prime contractor, McDonnell Douglas, include 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 are replaced, avionics and cockpit displays changed for compatibility with USN front-line fighters, and full-span leading-edge slats added. Production was initiated by an FY 1988 Lot 1 contract for 12 production T-45As. At present, 197 T-45As are planned to enter USN service by 2003, of which 84 had been contracted by the beginning of 1996. A prototype with a digital/"glass" Cockpit 21, HUD, and GPS/INS navigation flew March 19, 1994, and this upgrade is intended to be standard from the 73d production aircraft with retrofit on early Goshawks.

A first group of US Navy student pilots began flying T-45A Goshawks of Squadron VT-21, Kingsville, Tex., in early 1994 and graduated October 5. Clearance for fleet introduction was recommended July 5, 1994, with USS *Forrestal* as the primary sea platform. The T-45 training syllabus calls for 175.5 flying hours in 132 flights and 98 hours on simulators.

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 14 ft 0 in.
Weights: empty 9,834 lb, gross 12,750–14,081 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*

Despite its rather dated appearance and modest performance, the Iskra has had a long service life. Developed for the Polish Air Force in preference to the Czech L-29 Delfin, the prototype first flew in February 1960, and the first of 423 production examples entered service in 1964. About 100 remain with the PAF, some with the official aerobatic display team. 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. There were four basic mission 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. Polish Air Force downsizing has resulted in several Iskras being sold in the civil market.

Six DFs were converted to **TS-11R** configuration for the Polish Naval Air Force's 7th Regiment a few years ago. With a Bendix/King RDS-81 weather radar in the nose, and the rear cockpit dual controls replaced by a radar display screen and artificial horizon, they fulfill a dual attack and coastal reconnaissance role. Eleven others are employed as standard trainers.

About 30 of the 50 Iskras acquired in 1975–76 for the Indian Air Force Academy at Hakimpet are still in service. *(Data for Iskra 200 SB-Bis DF.)*

Contractor: 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

Developed by Yakovlev in partnership with Aermacchi of Italy, the prototype Yak-130 first flew on April 25, 1996, and is competing with the MiG-AT to replace Aero L-29 and L-39 jet trainers of the Russian Air Force. It has a three-channel digital fly-by-wire control system but is 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 and will be slightly smaller than the prototype. The winglets fitted originally have been removed, pending redesign.

The advanced configuration of the Yak-130 is intended to permit flight at angles of attack up to 35°. Basic power plant comprises new RD-35M turbofans, with underwingroot air intakes. Each of the tandem cockpits is equipped with two liquid-crystal color MFDs, with a front cockpit HUD forming part of a collimated flight and sighting display linked with the pilot's helmet-mounted target designator. Radar is optional. Roles will include everything from basic pilot training to weapons training and light fighter/attack/reconnaissance missions. A projected naval version, with folding wings, will make possible aircraft carrier deck training. *(Estimated data for production Yak-130.)*

Contractor: Yakovlev OKB, Russia.
Power Plant: two RD-35M (Klimov-modified ZMKB Progress DV-2) turbofans; each 4,852 lb thrust.
Dimensions: span 31 ft 10¾ in, length 36 ft 10½ in, height 15 ft 5 in.
Weight: gross 11,905–19,841 lb.

Yak-130 prototype *(Yefim Gordon)*

Airtrainer CT4B, Royal Thai Air Force *(Denis Hughes)*

Bulldog T. Mk 1, Royal Air Force *(Paul Jackson)*

Performance: max speed at height 590 mph, ceiling 41,000 ft, T-O run 1,215 ft, landing run 2,000 ft, max range 1,242 miles, *g* limits +8/–3.
Accommodation: crew of two, on tandem zero/zero ejection seats. Rear seat raised.
Armament: provision for seven (optionally nine) hardpoints for up to 6,614 lb of weapons training and attack stores, including laser-guided weapons.

Piston-Engine Trainers

Air Beetle

There has been no news of this fully aerobatic military primary trainer since the three prototypes completed 1,750 hours of flight testing in 1993 and the Nigerian Air Force ordered 60 basic **T 18** Air Beetles to replace its BAe Bulldogs. The design was based on the US Van's RV-6A homebuilt lightplane, with the assistance of Dornier of Germany. It is of basic 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 has a Bendix/King IFR package as standard. The T 18 represents Nigeria's first production aircraft. Future versions are planned to include the 160 hp **T 16** and the 200 hp **T 20,** with export marketing to begin when production builds up to three per month. *(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

Twenty-three Airtrainers are in service with No. 1 Flying Training School of the Royal Thai Air Force, with whom they have the service designation **BF.16.** Six are **CT4Bs**, built to supplement the remaining 17 of 24 **CT4As** delivered in the 1970s and recently modified by the RTAF to extend their wing-fatigue life. Pupils at No. 1 FTS at Kampensaeng fly 65 hours on the CT4 before changing up to the PC-9s of No. 2 FTS. The Royal Australian Air Force retired its 51 CT4As (nicknamed "Plastic Parrots") in 1993, although 12 CT4Bs built for the BAe/Ansett Flying College in 1991–92 still provide pilot training for the RAAF. The Royal New Zealand Air Force, with 18 of its original 19 CT4Bs, is the only other military operator of this small primary trainer. These serve with the CFS and Pilot Training School at Ohakea. Three took part in conspicuity trials in 1995, painted in different black, white, and yellow color schemes and fitted with strobe lights.

No orders have yet been announced for the **CT4E,** certificated to FAR Pt 23 in May 1992 with a 300 hp Textron Lycoming AEIO-540 aerobatic engine, or 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

This two/three-seat piston-engined primary trainer continues in military service in five countries, and a turboprop version is also available; but no new orders have been announced for some years. Subtypes with a 180 hp Textron Lycoming engine include 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. Estimated numbers in current service are 35 with No. 101 Primary Training Squadron of the Indonesian Air Force, at Jogjakarta; 20 with the Iraqi Air Force; 10 at the Moroccan Training School, Marrakech-Ménara AB; four with the Royal Flight of Oman; and four at the Uganda Central Flying School.

The **AS 202/32TP Turbine Bravo** is similar to the AS 202/18A4 but has a 420 shp Allison 250-B17D turboprop. 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 (utility) 2,380 lb.

Performance (at max gross weight): max speed at S/L 150 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

The first 98 production Bulldog **Series 100**s were followed by the **Series 120,** with a strengthened wing center-section and higher aerobatic takeoff weight. Eighty-five of the RAF's 102 surviving Bulldog **T. Mk 1**s (Model 121) equip University Air Squadrons/Air Experience Flights and are to be replaced by new civilian-operated trainers, probably T67 Fireflies; 11 others are used by No. 3 Flying Training School at RAF Cranwell, UK. Bulldogs also serve with the air forces of Jordan (15 Model 125), Kenya (12 Model 103/127), Lebanon (five Model 126), Malaysia (10 Model 102), and Sweden (60+ Model 101/**SK61**s). Jordan's Bulldogs serve with No. 4 Squadron of Training Command at Mafraq; 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 hardpoints for up to 640 lb of air-to-surface weapons, machine gun pods, bombs, grenade launchers, or other stores.

CAP 10

Some of the 56 fully aerobatic **CAP 10**s and later **CAP 10B**s bought by the French Air Force to pregrade cadet pilots have been replaced by Epsilons and sold to private owners. Eight CAP 10Bs serve at Rochefort-Soubise with No. 51 Escadrille de Servitude of the French Navy. Two are attached to the Moroccan Air Force's aerobatic team of single-seat CAP 231s. The Republic of Korea Air Force acquired two CAP 10Bs for evaluation in 1994 and may order more to replace its elderly Cessna T-41s. *(Data for CAP 10B.)*

Contractor: Avions Mudry et Cie, France.

Power Plant: one Textron Lycoming AEIO-360-B2F piston engine; 180 hp.

Dimensions: span 26 ft 5¼ in, length 23 ft 6 in, height 8 ft 4½ in.

Weights: empty 1,213 lb, gross 1,675–1,829 lb.

Performance (at 1,829 lb max gross weight): 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.

CJ-6A

This Chinese primary trainer was developed from the veteran Soviet Yak-18, which was itself license-built at Nanchang, as the CJ-5, between 1954 and 1958. Shenyang's original **CJ-6** (first flight August 27, 1958) was underpowered with only a 145 hp Mikulin M-11ER engine but improved two years later when this was replaced by a 260 hp Ivchenko AI-14R. A new prototype flew July 18, 1960, and further redesign by Nanchang, which then took over development, resulted in flight of the first production-standard aircraft October 15, 1961. More than 2,200 CJ-6s have been built, and some 1,500 are still in Chinese service. Standard version since December 1965 has been the **CJ-6A** (Westernized designation **PT-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 and fully retractable landing gear, with low-pressure tires for operation from grass strips. Export examples are currently operated by Albania (20), Bangladesh (38), North Korea (100 or more, including some CJ/PT-5s), Vietnam (up to 20), and Zambia (10). *(Data for PT-6A.)*

***CJ-6A** (Paul Jackson)*

G 115T Acro, United Arab Emirates Air Force

Contractor: Nanchang Aircraft Manufacturing Company, People's Republic of China.

Power Plant: one SMPMC (Zhuzhou) HS6A radial piston engine (Chinese development of AI-14R); 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 428 miles.

Accommodation: crew of two, in tandem.

Armament: none.

F33 Bonanza

The **F33C** and nonaerobatic **F33A** are conventional-tailed versions of Beech's V-tailed Model 35 Bonanza. The Islamic Republic of Iran Air Force has a few of each, now used mostly for communications duties. The Mexican Air Force's flying school at Zapopan has more than 30 F33Cs and its Navy's counterpart six F33Cs and five F33As. The Spanish Air Force uses eight F33As (designated **E.24A**) at the Air Academy's navigation school, San Javier, with 18 more in 422 Squadron at Getafe to provide refresher training for transport pilots during staff appointments and for communications. Four F33Cs serve with the Ivory Coast Air Force, and the Colombian Naval Air Arm has two. Three, owned by the airline Lufthansa, are used for pilot grading by the German Air Force training squadron at Goodyear, Ariz. *(Data for F33A.)*

Contractor: Raytheon Aircraft Company, 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 3,400 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 17,850 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.

Armament: none.

G 115

Two versions of this all-composites side-by-side two-seat light aircraft have been selected for military pilot training. Short Brothers of the UK operates five **G 115D2**s, known as **Herons,** to provide elementary training for cadet pilots at the Plymouth-based Royal Navy Flying Grading Flight. This model is fully aerobatic, with a guaranteed airframe life of 12,000 hours between inspections, a 160 hp AEIO-320 fuel-injection engine, and fuel and oil systems suitable for inverted flight.

Top-of-the-range model, developed originally for USAF's Enhanced Flight Screener competition, is the **G 115T Acro,** which has beaten established competition aircraft in aerobatic contests and has a 15,000-hour life between inspections. A 260 hp engine, three-blade constant-speed propeller, and retractable landing gear ensure a greatly enhanced performance. It was first flown June 11, 1992, and 12 are now being delivered to the United Arab Emirates Air Force, which has options on 12 more. *(Data for G 115D2; G 115T Acro in parentheses.)*

Contractor: Burkhart Grob Luft- und Raumfahrt GmbH & Co KG, Germany.

Power Plant: one Textron Lycoming AEIO-320-D1B (AEIO-540-D4A5) piston engine; 160 hp (260 hp).

Dimensions: span 32 ft 9¾ in (both), length 24 ft 11¼ in (26 ft 10¾ in), height 7 ft 10½ in (8 ft 5¼ in).

Weights: empty 1,455 lb (1,962 lb), gross 2,183 lb (2,866 lb).

Performance: max speed at S/L 151 mph (205 mph), max cruising speed at 5,000 ft 136 mph (190 mph), stalling speed, flaps down 59 mph (66 mph), ceiling 16,000 ft (18,000 ft), T-O run 1,116 ft (1,021 ft), landing run 591 ft (722 ft), max range with reserves 652 miles (814 miles), *g* limits +4.4/–1.76 (+6/–4).

Accommodation: two seats side by side.

Armament: none.

HPT-32 Deepak

The fully aerobatic HPT-32 was designed for multi-role capability, but with the key requirement to perform two consecutive training missions 50 km (31 miles) from base before needing to refuel. Of 99 production Deepaks built, eight serve as trainers with No. 550 Squadron of Indian Naval Aviation at Cochin. Most of the others are used for primary training at the Indian Air Force Academy, Allahabad, and at its Instructor Training School at Tambaram.

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.

L-70 Vinka

A few Vinkas are detached for communications duties with combat wings of the Finnish Air Force, but most of the 28 in the inventory equip the Basic Training Division of the Air Academy at Kauhava. Their main roles are primary, aerobatic, night, instrument, and tactical training before pupils progress to jet-powered Hawks, but they can be used also for liaison, 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 Tiga

When the first two production Tigas were handed over to the Royal Malaysian Air Force on December 7, 1995, following a first flight May 25, they represented the first aircraft of any type completely manufactured by that country's embryonic aircraft industry. Two more, of 20 ordered for the RMAF, had been completed by year end, and deliveries have continued through 1996.

Design of the **MD3-160** basic, aerobatic, and instrument trainer originated in Switzerland in the late 1960s, although the prototype was not flown until August 12,

1983. This lengthy gestation reflected care taken by 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 fin and tailplane tips. Wing inner and outer interspar panels can be used on either wing, as can the glassfiber wingtips and the four metal sections that make up the leading-edge. Further refinement deferred the second prototype's flight until 1990, but FAR Pts 21 and 23 certification was obtained in September 1992. Additional Swiss activity has included refitting the first prototype to **MD3-116** standard, with a 116 hp Lycoming O-235-N2A engine, and constructing an **MD3-160A** prototype with an aerobatic AEIO-320 engine and modified fuel and oil systems.

The MD3 was always intended for manufacture outside Switzerland, and in 1993 the rights were sold to SME Aviation, which is producing 20 for the Indonesian Ministry of Communications' Curug flight training center as well as those for the RMAF's No. 1 Flying Training Center at Alor Setar. Interest has also been shown by Cambodia and Thailand. *(Data for MD3-160.)*

Contractor: SME Aviation, 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 1,411 lb, gross 1,852–2,337 lb.

Performance (at 1,852 lb aerobatic gross weight): max cruising speed at 5,000 ft 150 mph IAS, stalling speed (flaps down) 53 mph IAS, T-O run 455 ft, landing run 570 ft, max range 677 miles, *g* limits +6/–3.

Accommodation: crew of two, side by side; space to rear for up to 110 lb of baggage.

Armament: none.

Mushshak, Safari, and Supporter

The initial versions of this family of two/three-seat light aircraft produced in Sweden by Saab were the civil **Safari,** with underwing hardpoints for stores, such as relief supplies, food, and medicines for disaster areas, and the military **Supporter** with weapon-carrying capability. The wings' 5° of forward sweep enhances the view from the cockpit, and provision is made for full IFR instrumentation and radio. Current operators of these aircraft, for training and other duties, include the air forces of Denmark (28, designated **T-17**), Norway (17), and Zambia (15, dual training/counterinsurgency).

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 1975–81. Meanwhile, in 1981 the Aircraft Manufacturing Factory (AMF) of the Pakistan Aeronautical Complex had been established 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 early 1996 a further 149 had been delivered, with production continuing. Twenty-five have been delivered to Iran and up to 10 to Bangladesh; others were presented in 1994 to Oman (three, with four more ordered) and Syria (six); the remainder serve with the Pakistan Army (currently about 120) and Air Force (45). *(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 661 lb of external stores; typical loads can include two 7.62-mm or 5.56-mm machine gun pods, two pods of seven 75-mm or 2.75-in rockets, four pods of seven 68-mm rockets, eighteen 75-mm rockets, or six Bantam wire-guided antitank missiles.

MX-7-180 and MX-7-235

More than 2,000 Maule M-7 series light aircraft have been built since 1984, currently in 14 versions with two to five seats, Lycoming piston engines of 160 to 235 hp or a 420 shp Allison 250 turboprop, and on tailwheel or tricycle landing gear, or floats. The first military customer, in 1991, was Mexico, which has 20 MX-7-180s in the Primary Training Squadron of the Air Force's Military Aviation Flying School at Zapopan; 12 are used for a similar role by the Mexican Naval Aviation School at Veracruz and for patrol duties by a Naval Air Flight at Tulúm. A single MX-7 is assigned to coastal patrol by the Turkish Coast Guard, alongside three JetRanger helicopters.

Mushshak, Pakistan Air Force
(Lindsay Peacock)

SF.260MB, Belgian Air Force
(Paul Jackson)

E.26 Tamiz (T-35C Pillán), Spanish Air Force

The only other military operator is the Royal Thai Army Air Division, which bought 12 MX-7-235s in 1992 for its fixed-wing training unit at the Army Aviation Center, Lop Buri. *(Data for MX-7-180; MX-7-235 in parentheses.)*

Contractor: Maule Air Inc, USA.

Power Plant: one Textron Lycoming O-360-C1F (O-540-J1A5D) piston engine; 180 hp (235 hp).

Dimensions (both): span 30 ft 10 in, length 23 ft 6 in, height 6 ft 4 in.

Weights: empty 1,350 lb (1,475 lb), gross 2,500 lb (both).

Performance: max cruising speed 145 mph (160 mph), stalling speed (flaps down) 40 mph (35 mph), ceiling 15,000 ft (20,000 ft), T-O run 200 ft (150 ft), range 645 miles (490 miles).

Accommodation (both): four persons in pairs.

Armament: none.

SF.260

The SF.260 no longer enjoys the high production rates it achieved in the 1970s and 1980s, but more than 860, in various forms, have been delivered to civilian customers and to more than 20 air forces worldwide. The basic military **SF.260M** flew for the first time October 10, 1970, becoming the Italian Air Force's standard primary trainer, capable of basic flying training, instrument flying, aerobatics including spinning, night flying, navigation instruction, and formation flying. From it was developed the **SF.260W Warrior** dual-role trainer/tactical support version. Countries still operating the M, the W, or a mix of both include Belgium, Bolivia, Brunei, Burundi, Chad, Ireland, Italy, Libya, the Philippines, Singapore, Sri Lanka, Thailand (RTAF designation **BF.15**), Tunisia, Uganda, Zaïre, Zambia, and Zimbabwe (local name **Genet**). Forty improved and updated civil **SF.260D**s, 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 acquired eight SF.260Ds to supplement survivors of its original 36 SF.260Ms. Earlier this year, under a program named Project Layang, the Philippine Air Force began converting its 18 SF.260Ms and Ws to turboprop-powered **SF.260TP** standard. *(Data for SF.260D.)*

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 1,664 lb, gross 2,425 lb. (SF.260W, max gross 2,866 lb.)

Performance: max speed at S/L 215 mph, max cruising speed at 10,000 ft 205 mph, stalling speed (gear and flaps down) 70 mph, ceiling 19,000 ft, T-O run 1,575 ft, landing run 1,132 ft, max range 925 miles, *g* limits (aerobatic) +6/–3.

Accommodation: two seats, side by side, with third seat to rear.

Armament: none in SF.260D; Warrior, two underwing pylons for up to 661 lb of weapons or other stores when flown solo.

Su-49

This tandem two-seat primary trainer and general-purpose aircraft embodies many features of the Su-26 and Su-29 aerobatic aircraft. The first prototype is scheduled to fly in the first half of 1997. If all goes according to plan, it will be followed by up to 1,500 Su-49s, to succeed Romanian-built Yak-52s, in two initial models. The basic aircraft will be delivered to DOSAAF training units; those for the Russian Air Force will have more extensive equipment. The fuselage longerons and wing spars are made of carbonfiber; wing, fuselage, and tail unit skin panels are of a composite similar to Kevlar and glassfiber. The cockpit is air-conditioned and pressurized, with a raised rear seat. The landing gear is fully retractable and is pneumatically actuated like that of the Yak. Also similar is the Su-49's initial M-14PF nine-cylinder radial engine, which is expected to give way speedily to a license-built P&WC Klimov PK6A-25 turboprop if funding permits. Options include provision for a radar pod, an integral gun, bombs, antitank missiles and AAMs for combat use.

Contractor: Sukhoi OKB, Russia.

Power Plant: one VOKBM M-14PF radial piston engine; 395 hp.

Dimensions: span 27 ft 10¾ in, length 23 ft 10¾ in, height 8 ft 6½ in.

Weights: empty 1,874 lb, gross 2,866–3,307 lb.

Performance (estimated): max speed 230 mph, stalling speed (flaps down) 56 mph, ceiling 22,965 ft, T-O run 755 ft, landing run 820 ft, range with max payload 745 miles, with external tanks 1,242 miles, *g* limits +11/–8.

Accommodation: two seats, in tandem, with SKS-94 ejection system (through canopy, without seats).

Armament: none in primary trainer.

T-25 Universal

The Brazilian Air Force is the only remaining operator of the all-metal, side-by-side, two-seat Universal. About 60 serve with the 2d Air Training Squadron of the Air Force Academy at Pirassununga in two forms: students fly 65 hours of basic training, mostly in standard **T-25A**s, but with some five hours of IFR training on **T-25C**s with uprated instrumentation, before progressing on to Tucanos. Other T-25s are used in support roles by a variety of units.

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: none in training roles.

T-35 Pillán

The Pillán is a fully aerobatic and instrument flying trainer that was designed by Piper to embody components of the PA-28 Dakota and PA-32 Saratoga. The first of two Piper-built prototypes flew March 6, 1981. After small refinements, series production was started in Chile by ENAER in September 1984. Sixty **T-35A** primary trainers and 20 **T-35B** instrument trainers were delivered to the Chilean Air Force, of which a total of 64 are used at the Basic Training School, El Bosque AB, Santiago, and by the Operational Training Flight of 11 Group at Los Cerillos AB.

Kits for 41 **T-35C**s (of which 36 remain) were supplied by ENAER to Spain, where they were assembled by CASA for the Spanish Air Force Academy at San Javier; equipped as primary trainers, they serve with No. 791 Squadron, with the Spanish designation and name **E.26 Tamiz.** Eight **T-35D** instrument trainers are flown by the Panamanian Air Force and 11 T-35Bs by the Paraguayan Air Force. *(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.

T-41 Mescalero and Cessna 150/152/172

The smallest of this family of high-wing lightplanes, the side-by-side two-seat **Model 150,** first flew 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. Aircraft with an F or FR prefix were built in France by Reims Aviation.

The **T-41A Mescalero** represented off-the-shelf procurement of 204 Cessna 172s for USAF, the last of which were only recently withdrawn. 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. Other nations train with about 160 T-41s (mostly Ds), some 50 Cessna 150/152s, and about 50 Model 172s, including Bolivia (twelve 152/172s), Botswana (one 152), Burundi (Army, three FRA150s), Chile (Army, fourteen 172s), Colombia (10 T-41Ds), Dominican Republic (four T-41Ds), Ecuador (Air Force, two T-41Ds; Army, three 172s), Greece (21 T-41Ds), Guatemala (four 172s), Haiti (three 150s), Honduras (six T-41Ds), Indonesia (10 T-41s, two 172s), Ivory Coast (two F150s), Madagascar (four 172s), Mexico (eleven 150/152s), Nicaragua (two T-41Ds), Peru (12 T-41Ds, two 150s), the Philippines (12 T-41Ds), El Salvador (two T-41Ds), Saudi Arabia (13 F172s), the Seychelles (Coast Guard, one A150), South Korea (15 T-41Ds), Sri Lanka (five 150s), Thailand (Army, seven T-41Ds), Turkey (Air Force 32 T-41Ds, Army 25), Uruguay (six T-41D/172s), and Zaïre (12 FRA150s). Many others are used for communications and other light duties. *(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.

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 270 of which had been delivered to military and commercial customers in 13 countries by the beginning of 1996. The top-of-the-range **T67M260,** designed specifically to meet the EFS requirement, first flew May 1991, and early this year USAF accepted the last of 113 as the **T-3A,** all except the first few shipped as kits for assembly by Northrop Worldwide Aircraft Services at Hondo Airport, Tex. Half (57) were for the 3d Flying Training Squadron at Hondo, where student pilot training started in March 1994; the remaining 56 were for the US Air Force Academy (557th FTS), Colorado Springs, Colo., for training courses that began in early 1995. Extra features include electric elevator trim, plus cockpit air-conditioning for the aircraft at Hondo.

The basic **T67C3,** 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, among others. The lowest-powered military model 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. Customer countries include Japan, the Netherlands, and Switzerland. Seventeen are in service at RAF Barkston Heath, UK, where Hunting Aircraft Ltd operates a Joint Elementary Flying Training School for student pilots of the RAF, Army, and Royal Navy. This fleet is currently being augmented by 23 of the M260 version. The intermediate **T67M200,** serving government and private agencies in Hong Kong (four), the Netherlands (four), Norway (six), and Turkey (16), has a 200 hp AEIO-360-A1E and a three-blade propeller. *(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.
Weights: empty 1,780 lb, gross 2,550 lb (aerobatic and max).
Performance: max speed at S/L 175 mph, max cruising speed at 8,500 ft 161 mph, stalling speed (flaps down) 71 mph, ceiling 19,000 ft, T-O run 1,045 ft, landing run 1,315 ft, max range 469 miles, *g* limits +6/–3.
Accommodation: two seats, side by side.
Armament: none.

TB 30 Epsilon

The prototype of this all-metal basic and primary trainer first flew December 22, 1979. Delivery of 150 to the French Air Force began in 1984. Direct-entry pupils (as opposed to career officers) complete full *ab initio* and basic training on these aircraft with EPAA (Air Force Pilot School) 315 at Cognac/Chateaubernard, then progress directly to an operational type without intermediate transition training. Epsilons have replaced CAP 10Bs for pilot grading at the École de l'Air, Salon-de-Provence.

Esquadrão 101 of the Portuguese Air Force, at Beja, still has 16 of its original 18 Epsilon primary trainers, all but one of which were assembled locally by OGMA. Togo's three Epsilons are of an armed version, which can 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 7½ in.
Weights: empty 2,046 lb, gross 2,756 lb.
Performance: max speed at S/L 237 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 (Togolese aircraft only): 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 six 68-mm rockets, or four survival-kit pods.

T67M260 Firefly, Hunting-operated JEFTS *(Photo Link)*

TB 30 Epsilon, French Air Force *(Paul Jackson)*

TB 20 Trinidad

First flown November 14, 1980, and certificated by the FAA in January 1984, the Trinidad is essentially a higher-powered, retractable-gear version of Socata's TB 10 Tobago, and both have been selected by a number of civil or government agencies, such as SFACT in France (45 Trinidads) and CAAC in China (28), to provide flying training for air traffic controllers and airline pilots. Dual controls are standard at the two front seats, and the flight deck can be equipped for VFR or IFR flying. The three-person rear bench seat is removable. Six Trinidads were delivered during the early months of 1995 to Topel, Turkey, to fulfill an FMS contract with the Turkish Navy. These are being used by No. 301 Squadron, a former S-2E Tracker unit, to maintain pilots' flying hours until an S-2 replacement is found. They came from the Texas assembly line of Socata's parent company, Aerospatiale, as did a more recent order from Israel for 22 Trinidads. Intended to replace Cessna U206 Stationairs for liaison duties, the French aircraft are known in IDF/AF service as **Pashosh** ("lark").
Contractor: Socata Group Aerospatiale, France.
Power Plant: one Textron Lycoming IO-540-C4D5D piston engine; 250 hp.
Dimensions: span 32 ft 0¼ in, length 25 ft 3½ in, height 9 ft 4¼ in.
Weights: empty 1,763 lb, gross 3,086 lb.
Performance: max speed 192 mph, max cruising speed at 8,000 ft 187 mph, stalling speed (flaps and gear down) 62 mph, ceiling 20,000 ft, T-O run 968 ft, landing run 755 ft, max range at 10,000 ft 1,109 miles.
Accommodation: four or five persons.
Armament: none.

Utva-75

First flown May 19, 1976, more than 150 of these adaptable little aircraft were produced by the Utva ("sheldrake") factory at Pančevo, near Belgrade, from about 1978 until 1986. By early 1992, before the disintegration of Yugoslavia, about 70 were in service with the Yugoslav Air Force and some 30 to 40 with civilian flying clubs, most of the former being retained by the Serbian/Montenegran faction after the outbreak of hostilities.

Sturdily built and able to operate from grass or unprepared strips of 500 ft or less, the Utvas were originally used for basic training, glider towing, and a range of utility duties. However, they can also carry light weapon loads and have been used in this capacity in the ensuing conflicts, with their red and white trainer livery replaced by a camouflage finish. A few were captured from Serb forces by the newly formed Croatian Air Force.
Contractor: Utva–Sour Metalne Industrije, Ro Fabrika Aviona, Yugoslavia.
Power Plant: one Textron Lycoming IO-360-B1F piston engine; 180 hp.
Dimensions: span 31 ft 11 in, length 23 ft 4 in, height 10 ft 4 in.
Weights: empty 1,510 lb, gross 2,116 lb.

Performance: max speed 133 mph, max cruising speed 115 mph, stalling speed (flaps down) 51 mph, ceiling 13,120 ft, T-O run 410 ft, landing run 330 ft, max range on internal fuel 497 miles, *g* limits +6/–3.
Accommodation: two seats, side by side.
Armament: pylon under each wing for a bomb, two-rd rocket launcher, machine gun pod, 220-lb cargo container, or drop fuel tank.

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. Production under license was delegated to Romania, and the type has been built at Bacău since 1979, the Romanian prototype having first flown in May 1978. More than 1,800 have so far been built, mainly for the air forces of Romania and the former Soviet Union. Production continues, though at a fairly low rate in recent years. Russia, from whom about 20 were acquired recently by Lithuania, probably still has more than 1,000 and Ukraine about 250. Only about a dozen still serve with the Romanian Air Force. In spring 1994, Aerostar delivered 12 to the Hungarian Air Force Fighter Training School at Szolnok. Several Yak-52s have come on to the UK and US civil registers in the past few years. Basic configuration and structure 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, offering greater safety in a wheels-up emergency landing
Contractor: Aerostar SA, Romania.
Power Plant: one Romanian-built 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.

Zlin Z-142 and 242

More than 400 of these Czech lightplanes have been produced since the prototype **Z-142** flew in December 1978. It continues as the current production version of the Z-42/42 M/43 family 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 Czech Air Force's eight, equipping No. 343 Squadron, are designated **Z-142 CAF.** The Bulgarian Defense Ministry recently acquired four Z-142s, with more to follow, to provide some 20 hours of preselection flying for civilian candidates for military service. Other Z-142s are used by the Algerian Army and by Cuban border patrol forces.

The relatively new **Z-242L,** first flown in February 1990, has a US engine and some aerodynamic detail refinements. The Slovenia Territorial Defense Force has three. *(Data for Z-142; Z-242L in parentheses. Aerobatic category in both cases.)*
Contractor: Moravan AS, Czech Republic.
Power Plant: one LOM M 337AK piston engine; 210 hp (Textron Lycoming AEIO-360-A1B6; 200 hp).
Dimensions: span 30 ft 0½ in (30 ft 7¾ in), length 24 ft 0½ in (22 ft 9¼ in), height 9 ft 0¼ in (9 ft 8¼ in).
Weights: empty 1,609 lb (both), gross 2,138 lb (both).
Performance: max speed at 1,640 ft 143 mph IAS (146 mph CAS), stalling speed (flaps down) 55 mph IAS (59 mph CAS), ceiling 15,580 ft, T-O run 760 ft (690 ft), landing run 625 ft, range 364 miles (308 miles), *g* limits +6/–3.5 (both).
Accommodation: two seats, side by side.
Armament: none.

Turboprop Trainers

EMB-312/S312 Tucano and Super Tucano

The Embraer **EMB-312** Tucano prototype flew August 16, 1980. Deliveries to the Brazilian Air Force (designation **T-27,** or **AT-27** in armed configuration) began in September 1983 and eventually totaled 133. Including the 158 British-built versions, orders currently total 623, most of which have been delivered. Export customers for Embraer-built Tucanos include the air forces

Zlin Z-142, Cuban Border Guard

EMB-312 Tucano, Paraguayan Air Force *(Denis Hughes)*

PC-7 Turbo-Trainer, Chad National Flight *(Press-Office Sturzenegger)*

of Argentina (30), Colombia (14), Egypt (54), France (50), Honduras (12), Iran (25), Iraq (80), Paraguay (six), Peru (30), and Venezuela (31, Air Force designations **A-37** and **T-37**). The French **EMB-312F** version, which entered service in 1985, 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 mainly British equipment. A total of 130 **T. Mk 1**s for the Royal Air Force were delivered between June 1986 and January 1993, of which 66 are currently active and the remainder in store. Strengthened flying controls, modified com/nav equipment, and structural improvements to extend fatigue life to 12,000 hours have been retrofitted. Shorts also delivered 12 **T. Mk 51**s to the Kenyan Air Force in 1990–91 and 16 **T. Mk 52**s to No. 19 Squadron of the Kuwait Air Force in 1995.

On September 9, 1991, as a potential JPATS candidate, 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). Two production-standard **EMB-312HJ**s, with a 1,250 shp PT6A-68A, five-blade propeller, and "glass" cockpit, flew for the first time May 15 and October 14, 1993. Although unsuccessful for JPATS, this version, together with the BAe Hawk, forms part of the package proposed by Bombardier to meet the NATO Flying Training in Canada (NFTC) requirement. A light attack (**ALX**) version is now under development for a major Brazilian border surveillance program requiring up to 100 aircraft in both single-seat (**A-29**) and two-seat (**AT-29**) versions. The EMB-312HJs will be modified as prototypes. *(Data for standard EMB-312, with EMB-312HJ in parentheses.)*
Contractor: Empresa Brasileira de Aeronáutica SA, Brazil.
Power Plant: one Pratt & Whitney Canada PT6A-25C (PT6A-68A) turboprop; 750 shp (1,300 shp). S312 has a 1,100 shp AlliedSignal 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 (5,335–7,033 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 1,215 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 346 mph, stalling speed (gear and flaps down) 90 mph EAS, ceiling 35,000 ft, T-O run 1,150 ft, landing run 1,805 ft, max range on internal fuel 974 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-tube rocket launchers. Optional max stores load on S312 increased to 2,315 lb.

Fantrainer 400, 600, and 800

Following its decision to equip with Pilatus PC-9s, the Royal Thai Air Force is reported to have withdrawn from use its Fantrainers. Details can be found in the "World Gallery of Trainers" in the December 1995 *Air Force* Magazine.

KTX-1 Woong-Bee

The first two prototypes of this tandem-seat primary trainer, originally named Yeo-Myoung ("dawn"), are each powered by a 550 shp PT6A-25A turboprop. The third flew for the first time in August 1995 with a 950 shp PT6A-62. Development is shared with Korean Air and is scheduled to continue until 1998, permitting delivery of the 100 production trainers required by the Republic of Korea Air Force to begin in 1999. They will have the PT6A-62 engine in an 8-in shorter nose, modified horizontal tail surfaces, and provision for carrying guns and rockets for weapons training. The name Woong-Bee means "great flying." *(Data for third prototype.)*
Contractor: Daewoo Heavy Industries Company Ltd, South Korea.
Power Plant: one Pratt & Whitney Canada PT6A-62 turboprop; 950 shp.
Dimensions: span 35 ft 2 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.

M-290 TP RediGO

The RediGO has changed hands since the last edition of this "Gallery," Finnish manufacturer Valmet having sold the production rights to Aermacchi of Italy at the beginning of this year. After testing prototypes with Allison 250 and Turbomeca TP 319 turboprops, Valmet chose the Allison for its production L-90 TP RediGOs. It optimized the design to cover primary and basic, aerobatic, night, instrument, navigation, formation, and tactical flying training. The Finnish Air Force, however, allocated its 10 RediGOs to replace Piper Arrows in liaison and communications roles. Exports from Finnish production comprised 10 aircraft for the Mexican Naval Aviation School at Bajadas, Veracruz, and eight for the Eritrean Air Force. Aermacchi, which has reported further large orders from Mexico, is due to restart production in early 1997.
Contractor: originally Valmet Aviation Industries Inc, Finland; now Aermacchi SpA, Italy.
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 and PC-7 Mk II Astra

The **PC-7,** first flown August 18, 1978, 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 deliv-

ered to some 20 countries, for the air forces of Abu Dhabi (24), Angola (18), Austria (16), Bolivia (36), Botswana (seven), Chad (two), Chile (Navy, 10), France (six), Guatemala (12), Iran (45), Iraq (20), Malaysia (44), Mexico (75), Myanmar (17), the Netherlands (10), Suriname (one), Switzerland (40), and Uruguay (five). South Africa has inherited the three delivered earlier to Bophuthatswana. Nigeria has ordered seven.

The most significant recent contract was from the South African Air Force in 1993, for 60 **PC-7 Mk II Astras** to replace its veteran T-6 Harvard primary trainers. To avoid conflict with UN sanctions then in force, Pilatus developed the Mk II with two (instead of six) underwing hardpoints, plumbed only for auxiliary fuel tanks. The airframe is based largely on that of the aerodynamically cleaner PC-9 and fitted with a more powerful engine, mainly South African avionics, and Martin-Baker CH-11A ejection seats instead of the usual fixed or optional CH-15A ejection seats. The Mk II prototype first flew September 28, 1992. Pilatus kits are being assembled and outfitted by Denel (formerly Atlas) Aviation in South Africa; deliveries to the SAAF began in 1994. *(Data for standard PC-7, with Mk II Astra in parentheses.)*

Contractor: Pilatus Flugzeugwerke AG, Switzerland.
Power Plant: one Pratt & Whitney Canada PT6A-25A (PT6A-25C) turboprop; 550 shp (flat rated) (700 shp).
Dimensions: span 34 ft 1 in (33 ft 2½ in), length 32 ft 1 in (33 ft 2¾ in), height 10 ft 6 in (10 ft 8¼ in).
Weights: empty 2,932 lb (3,682 lb), gross 4,188–5,952 lb (4,960–7,054 lb).
Performance (PC-7 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.
Performance (Mk II at 4,960 lb clean gross weight): max speed 345 mph EAS, max cruising speed at 10,000 ft 288 mph, stalling speed (gear and flaps down) 81 mph EAS, ceiling 30,000 ft, T-O run 905 ft, landing run 1,200 ft, max range 886 miles, *g* limits +7/–3.5.
Accommodation: two seats, in tandem; ejection seats optional (standard on Mk II). 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 (Angola is one) can be seen carrying a wide variety of stores on underwing weapon pylons installed under separate contract by armament manufacturers.

PC-9 and PC-9 Mk II

A more powerful turboprop, stepped cockpits, 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 the main differences between the **PC-9** and its PC-7 predecessor. The first preseries PC-9 flew May 7, 1984, and more than 200 have been built for, or ordered by, the air forces of Angola (four), Australia (67 **PC-9/As**), Iraq (20), Myanmar (four), Saudi Arabia (46), Slovenia (three, ex–US Army), Switzerland (16), and Thailand (22); the Cyprus National Guard has two, and the German Air Force leases 10 **PC-9Bs** from a private company to provide target-towing services. The RAAF PC-9/As 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; two with No. 76 Squadron have taken on the forward air control role previously performed by Winjeels; and one is allocated to the RAAF Chief of Air Staff's office at Fairbairn, near Canberra.

For the USAF/USN JPATS competition, Pilatus teamed with Beech (now Raytheon) in offering the **PC-9 Mk II,** which was selected as the winning candidate in June 1995. Beech built two "missionized" production prototypes with a 1,200 shp flat-rated PT6A-68 engine, modified tail unit, increased fuel, single-point fueling, new Bendix/King 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. Current requirements are for up to 711 (USAF 372 to replace the T-37B, USN 339 to replace the T-34C). Initial production contracts are for one manufacturing development aircraft and the first nine production examples, with delivery beginning in early 1999. The USAF/USN procurement is now to stretch over 20 years instead of the previously planned 12. Export prospects look good. No US service designation had been announced at press time. *(Data for standard PC-9.)*

Contractor: Pilatus Flugzeugwerke AG, Switzerland.
Power Plant: one Pratt & Whitney Canada PT6A-62 turboprop; 950 shp (flat rated).
Dimensions: span 33 ft 5¼ in, length 33 ft 4¾ in, height 10 ft 8¼ in.
Weights: empty 3,715 lb, gross 4,960–7,054 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 1,370 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 Orlik

Originally a piston-engined design, the Orlik ("spotted eaglet") switched to turboprop power when the third prototype, refitted with a PT6A-25A engine, flew July 13, 1986. Two further prototypes, designated **PZL-130TM** and **PZL-130TP,** were then flown with, respectively, a Czech 750 shp Walter M 601 E power plant and a 550 shp PT6A-25A in January 1989 and early 1990. The **PZL-130TB,** first flown September 18, 1991, was the initial Polish Air Force production model. Based on the TM, it had a fully aerobatic M 601 T engine, increased span and incidence, double-slotted flaps, new ventral fin, Polish ejection seats, six (instead of four) underwing stations, and other changes. Two of the nine production TBs were lost early on; the remainder have been upgraded to **PZL-130TC-1s**, with Bendix/King avionics and Martin-Baker seats, which is now the Polish Air Force standard version. By early 1996, the PAF strength was 31 Orliks: three TMs, one TP, eight delivered as TBs upgraded to TC-1s, and 19 new-build TC-1s. An export **TC** prototype, first flown June 2, 1993, but lost in January 1996, had the TC-1 improvements plus a 950 shp PT6A-62 engine and Flight Visions HUD; development of a **TC-2** prototype, similar except for a 750 shp PT6A-25C turboprop and simplified avionics, has been postponed. *(Data for PZL-130TC-1.)*

Contractor: PZL Warszawa-Okecie, Poland.
Power Plant: one Walter M 601 T 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 clean gross weight): max speed at 19,685 ft 311 mph, at S/L 282 mph, ceiling 33,000 ft, T-O run 730 ft, landing run 605 ft, range on internal fuel 714 miles, *g* limits +6/–3.
Accommodation: crew of two, on tandem zero-height/104 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.

PZL-130TC-1 Orlik, Polish Air Force *(Lech Zielaskowski)*

SF.260TP, Sri Lanka Air Force *(Denis Hughes)*

T-5, Japan Maritime Self-Defense Force *(Katsumi Hinata)*

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 in July 1980. More than 60 have been sold to various air forces, several of which use them in a secondary light attack role. Current operators include Dubai (five), Ethiopia (12), Haiti (three), the Philippines (18), and Sri Lanka (11). At least three Sri Lanka SF.260TPs have been lost. The survivors are assigned to No. 1 FTW at Anuradhapura, but several have been detached for use in a counterinsurgency role at Jaffna with locally produced 110-lb or 200-lb bombs and 2.75-in or 70-mm unguided rockets. No. 6 Squadron of the Air Force of Zimbabwe has some SF.260TPs converted locally from piston-engine SF.260s; the Philippine Air Force is also converting its SF.260s to the TP model. *(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 2,645–2,976 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

The prototype T-5 was produced by replacing the piston engine of a KM-2 primary trainer (developed by Fuji from the license-built Beech T-34 Mentor) with an Allison 250 turboprop. First flown June 28, 1984, as the KM-2D, this aircraft was selected by the Japan Maritime Self-Defense Force to replace its existing KM-2s, after additional changes to the cockpit structure and equipment. Deliveries began in August 1988. By January 1996, a total of 36 T-5s had been ordered for service with No. 201 Squadron of Ozuki Air Training Group, and most 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-34

The US Navy inventory still lists about 280 of the 353 turboprop **T-34Cs** it received from November 1977. They are scheduled to be replaced eventually by the JPATS PC-9 Mk II (which see). About 120 **T-34C-1** armament systems trainers, with FAC and light attack capability, continue in service with Algeria (six), Argentina (Navy, 10, used also to train Brazilian Navy pilots), Ecuador (Air Force 19, Navy three), Gabon (three), Indonesia (24), Morocco (10), Peru (Navy, five), Taiwan (36), and Uruguay (Navy, two).

Original piston-engine **T-34A/Bs** remain in service in Argentina (Air Force, 30), Colombia (10), Dominican Republic (10), El Salvador (three), Uruguay (Air Force 12, Navy four), and Venezuela (14, local name **Manta**), though by no means are all of these still fully airworthy. *(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. ■

Infrared Invaders

Photo by Col. Sigmund Alexander, USAF (Ret.), via Robert F. Dorr

The glow of Baghdad at night was a defining image of the Persian Gulf War. But it wasn't the first battle to see infrared systems used to illuminate enemy targets. During the Korean War, the noses of a few Douglas B-26 Invaders, such as this one, were fitted with infrared capability. The night-fighting systems were heavy and bulky, but they allowed the B-26s to intercept North Koreans and Chinese as they tried to move troops and equipment under cover of darkness. None of the modified aircraft, flown by the 13th Bomb Squadron, 3d Bomb Group, have been preserved, but the technology they pioneered has become entrenched in warfighting strategy.

Verbatim

Really Bad News . . .

"The Russian nuclear command-and-control system is being subjected to stresses it was not designed to withstand as a result of wrenching social change, economic hardship, and malaise within the armed forces. . . . Despite official assurances, high-level Moscow officials are concerned about the security of their nuclear inventory. . . .

"[The Strategic Rocket Forces units] have the technical ability to launch without authorization of political leaders or the general staff. . . . [The threat of blackmail] conspiracies within nuclear armed units . . . has become a concern as living conditions and morale have deteriorated in the military, even among elite nuclear submariners, nuclear warhead handlers, and SRF. . . .

"Political authorities probably could neither execute a nuclear strike—even from a command post—without the cooperation of the general staff nor prevent the general staff (or perhaps some other national-level command post) from launching on its own. . . . Russian military writings still portray Western policies as hostile, and . . . Moscow's exercises have simulated short-warning nuclear attacks against Russian strategic forces and their supporting command structure."

***Excerpts from the September 1996 CIA report "Prospects for Unsanctioned Use of Russian Nuclear Weapons," quoted by reporter Bill Gertz in the October 22, 1996, Washington* Times.**

. . . And a Second Opinion

"The Russian Strategic Rocket Forces are probably their most elite, or among their most elite, forces. We believe that they're well disciplined and well commanded. The Russians have recently completed a strategic nuclear exercise similar to ones that they've carried out . . . each of the last four years, and their forces appeared to be in good shape. It's no secret that we're concerned about the custody of nuclear weapons everywhere in the world, including the United States. This is an issue of grave concern to us. The Russian forces are also concerned about the security of nuclear weapons in Russia. We think they've taken prudent steps to keep the forces safe and secure."

Defense Department spokesman Kenneth H. Bacon, in an October 22, 1996, Pentagon press briefing in reaction to the* Times *article.

The Timetable

"Today, I want to state America's goal: By 1999—NATO's fiftieth anniversary and ten years after the fall of the Berlin Wall—the first group of countries we invite to join should be full-fledged members of NATO."

President Clinton, in an October 22, 1996, speech in Detroit, Mich., concerning NATO enlargement.

Blood, Toil, Tears, Sweat

"Part of the problem that the Air Force faces . . . is that, while we can develop a clear vision of what airpower can do, describing and analyzing how airpower acts has never been easy and not very well understood by the nonbelievers or the uneducated. We should not feel badly about this, because we are in pretty good company in not being able to describe this. In fact, it was Winston Churchill who once remarked, 'Airpower is the most difficult of all forms of military force to measure or even express in precise terms.' Now if Churchill, with his command of the English language, could not do it. . . . Put it this way: I am trying to keep this quote away from the long-range planners, lest they give up in despair."

Gen. Ronald R. Fogleman, USAF Chief of Staff, in an October 18, 1996, address to AFA's National Symposium in Los Angeles, Calif.

Perry's Position

"My going-in view on force structure [in the upcoming Quadrennial Defense Review] is that we need to maintain the numbers we have—the divisions, wings, and approximate number of ships we have. But it might be possible to find some efficiencies in support areas."

***Defense Secretary William J. Perry, in remarks quoted in the October 3, 1996,* Wall Street Journal.**

Miracles

"There was a real prospect of war in a country where we had 37,000 soldiers. We were head to head with North Korea. They had a million men under arms and a totally unpredictable nature, but they actually signed up to what we wanted: an end to their [nuclear] program. And somewhat miraculously, it has stuck."

***Ashton B. Carter, former assistant secretary of defense for International Security Policy, as quoted in the October 28, 1996,* New York Times.**

Strobe Light

"One challenge America faces . . . is to overcome Russian suspicions, Russian conspiracy theories, and Russian old-think. More to the point, I'd say that is a challenge the Russians themselves face; they must overcome their lingering Cold War stereotypes about us. . . . If the Russians overindulge their misplaced suspicions that we want to keep them down, then words like partnership and cooperation, translated into Russian, will become synonyms for appeasement, subservience, [and] humiliation at the hands of the West. The result then could be that we will indeed cooperate less, and compete more, on precisely those issues where it is in our common interest to cooperate more and compete less. . . . It would be bad for everyone but—without doubt—it would be particularly bad for the Russians themselves. They would risk repeating at least some of the mistakes that made nine-tenths of the twentieth century such a disaster for them. Those mistakes included defining their security at the expense of everyone else's and misdefining security itself as the expensive and wasteful capacity to destroy and intimidate."

Strobe Talbott, deputy secretary of State, in an October 29, 1996, speech at The Harriman Institute in New York. ■

AFA/AEF National Report

By Frances McKenney, Assistant Managing Editor

Step Up to the Mission, AFA President Urges

The fiftieth anniversary of the US Air Force, coming up next year, will bring special opportunities and obligations to the Air Force Association, Doyle E. Larson, AFA National President, said to a meeting of the Association's state presidents November 1 in Arlington, Va.

"Our mission is to promote public understanding of airpower and the Air Force," he said. "All of the activities in observance of the anniversary—our own 'Air Force Fifty' event in Las Vegas in April being foremost among them—are going to generate public interest in military airpower.

"AFA will be an important source of information at the national, regional, and local levels. Our chapters need to make sure that libraries, schools, news media, civic clubs, community groups, and others know that we can be there, not only with materials and information products but also with people who can talk about the Air Force and airpower."

Photos by Paul Kennedy

At AFA headquarters in November, more than thirty of the Association's state presidents met for two days of orientation and information sessions. Here, National Secretary Mary Anne Thompson (standing, left) fields a question from Colorado State President Mark J. Worrick (standing).

In a discussion at the state presidents' meeting, Kansas State President Samuel M. Gardner, North Dakota State President George E. Masters, Tennessee State President Phillip V. Maywald, and New Mexico State President Charlie Thomas (l–r) are joined by Jim Simpson (standing), director of AFA Volunteer and Regional Activities.

President Larson said that, in addition to making full use of *Air Force* Magazine and other popular AFA products, every chapter should establish access to the Internet and download and use materials from the AFA site (http://www.afa.org/) on the World Wide Web.

"We recognize that the strength of AFA is in its members and in its field organizations, especially the local chapters," he said. "This is the time for us to demonstrate that as we step up to our basic mission in the fiftieth-anniversary year."

Among the communications opportunities, President Larson cited two as worthy of special attention—working with local schools, getting them involved in the programs of AFA's affiliate, the Aerospace Education Foundation, and "making sure that our representatives in Congress not only know our positions on the issues but also why we take those positions."

Medicare Subvention Targeted for 1997

In the last hours of the 104th Congress, efforts to include Medicare Subvention in the Fiscal 1997 Omnibus Appropriations Act broke down. The Subvention measure would have allowed the Department of Health and Human Services to reimburse the Department of Defense for medical treatment given to Medicare-eligible military retirees and dependents in the DoD health-care network—making it possible for these people to remain in the DoD health network beyond age sixty-five, which now they cannot.

"Optimism for a meaningful test program was high since a Subvention agreement was included as an integral part of the FY 1997 DoD Authorization Act," said Thad A. Wolfe, chairman of AFA's Veterans/Retiree Council. "AFA members did an outstanding job of getting the Subvention message to the members of Congress. However, in the end, eleventh-hour opposition from the House Ways and Means and Senate Finance Committees precluded inclusion.

"We have established an excellent foundation for the future. The start of the 105th Congress in January will offer a new opportunity to enact this much needed legislation. AFA has and will continue to take a leadership role in this effort. We will again ask our members to work this initiative with their Congressional delegations. In addition, we are encouraging the other organizations in the 5.5-million member Military Coalition to work with us again in the 105th Congress."

Gen. Bernard Schriever, USAF (Ret.) (right), and Vice Chief of Staff Gen. Thomas Moorman (left) view the new Schriever Era Exhibit at the Air Force Space and Missile Museum, Cape Canaveral AS, Fla., with Maj. James Rosolanka of the General B. A. Schriever Los Angeles (Calif.) Chapter.

A New Schriever Era

USAF Vice Chief of Staff Gen. Thomas S. Moorman, Jr., three former Space and Missile Systems Center commanders, and some "Schriever Old-Timers" were among the distinguished guests who gathered at the Air Force Space and Missile Museum at Cape Canaveral AS, Fla., in September to honor Gen. Bernard A. Schriever, USAF (Ret.), at the dedication of the museum exhibit in his name.

The Schriever Era Exhibit commemorates the achievements of the General, who was SMC's first commander in 1954, when it was the Air Force Western Development Division in Inglewood, Calif. There, he directed the development of ballistic missile programs and USAF's initial space programs. He went on to command Air Research and Development Command (later Air Force Systems Command) and retired from active duty in 1966. Today, he is a management consultant in Washington, D. C.

Maj. James J. Rosolanka, of the **General B. A. Schriever Los Angeles (Calif.) Chapter,** headed a team of Air Force historians who planned the exhibit. The Schriever Chapter raised funds for the project and managed its construction.

In his remarks at the dedication of this permanent exhibit, General Moorman described General Schriever as his personal hero and a role model

More than five decades after her late husband, Walter Beyea, earned them, Doris Beyea (second from right) accepted his medals from USAF Chief of Staff Gen. Ronald Fogleman. Mario Gottfried, Miss Jane Fogleman, and Frank Luke (Ariz.) Chapter President Nena Wiley (l–r) were also at the ceremony.

for Air Force officers. Also attending the event were Lt. Gen. Forrest S. McCartney, USAF (Ret.), Lt. Gen. Richard C. Henry, USAF (Ret.), and Maj. Gen. Ben I. Funk, USAF (Ret.), all former SMC commanders.

On the Border

John Wickman, president of the **Tennessee Ernie Ford (Calif.) Chapter,** was among thirty civic leaders from the San Francisco Bay area invited for an Air Force–Air National Guard tour of the Mexican border and Vandenberg AFB in August.

The group flew aboard a 129th Rescue Wing (ANG) HC-130 from Moffett Federal Airfield to San Diego. Then, they flew along the US-Mexico border in an HH-60 Pave Hawk to learn how the California ANG uses night vision goggles and infrared sensors to help the US Border Patrol and state and local law enforcement agencies slow drug trafficking into this country. They also visited several customs facilities at points of entry into the US.

The next day, at Vandenberg AFB, the civic leaders received a briefing from Maj. Gen. David L. Vesely, 14th Air Force commander and component commander, USAF Space Operations, US Space Command. The group also toured launch-control facilities, the Agena launch site where the nation's first spy satellites—in the Corona program in 1959—were launched, and a 750th Space Group detachment tracking station.

Col. Tim Roberts, commander of the 750th Space Group at Onizuka AS, Calif., and Col. Steve Speer, 129th RQW commander, sponsored the two-day event.

Earlier that month, at a board meeting, the chapter honored Juanita Ryan, from Toyon Elementary School, San Jose, Calif., as the Far West Region's Aerospace Education Teacher of the Year. Mrs. Ryan, who has taught for twenty-three years, received $500, an AEF jacket, and a plaque showing a reproduction of the January 1946 *Air Force* Magazine cover featuring Gen. H. H. Arnold.

Five-Decade Wait Rewarded

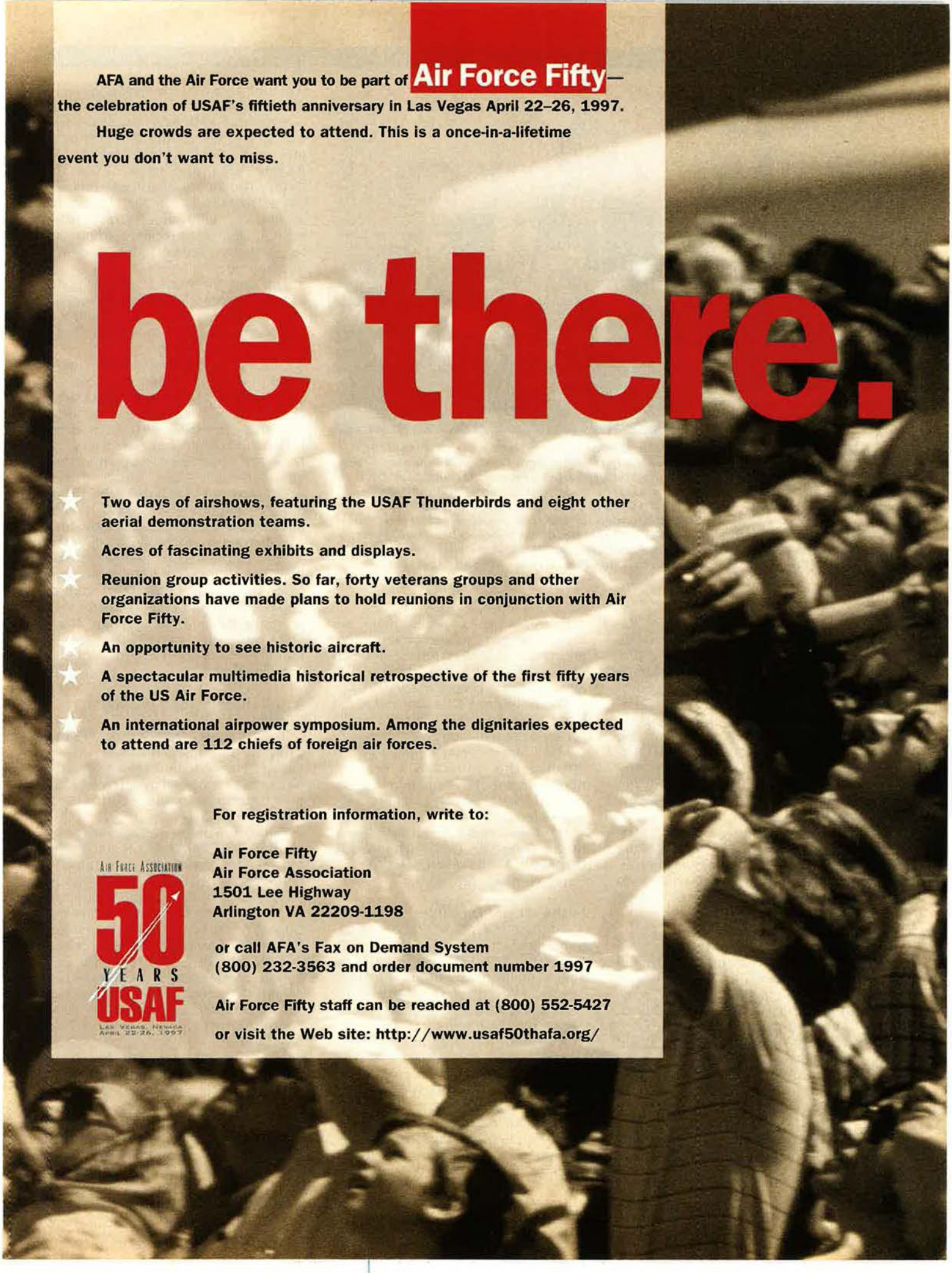
USAF Chief of Staff Gen. Ronald R. Fogleman and his wife, Miss Jane Fogleman, presented to the family of the late TSgt. Walter E. Beyea of Prescott, Ariz., his Distinguished Flying Cross and seven other awards that had been lost for more than fifty years. The **Frank Luke Chapter** sponsored the ceremony at Luke AFB, Ariz.

Sergeant Beyea had been a top turret gunner in a B-17 that was hit by enemy fire while flying over Europe in 1944. The pilot's oxygen line was severed, so Sergeant Beyea gave his own oxygen supply to him. The pilot was then able to land the plane, and Sergeant Beyea was awarded the DFC for his selfless action.

However, the medal and other decorations for Sergeant Beyea languished in a Charlton, Mass., railroad depot until 1955, when the station closed. At that time, the stationmaster cleared unclaimed freight from the facility and passed the package of medals on to his son, who eventually passed it on to his son, Walter Walsh. Mr. Walsh, of Fort Myers, Fla., didn't open the package until 1992.

A veteran himself, Mr. Walsh began searching for Sergeant Beyea and through General Fogleman's office found the Beyea family last May.

Rep. Donald Manzullo (R-Ill.) (center) met Illinois State President Henry Hufnagel (left) and John Bailey, president of the Greater Rockford (Ill.) Chapter, when he addressed the Illinois State Meeting in August. Twenty AFA state and chapter officers attended the event.



AFA and the Air Force want you to be part of **Air Force Fifty**—the celebration of USAF's fiftieth anniversary in Las Vegas April 22–26, 1997.

Huge crowds are expected to attend. This is a once-in-a-lifetime event you don't want to miss.

be there.

- Two days of airshows, featuring the USAF Thunderbirds and eight other aerial demonstration teams.
- Acres of fascinating exhibits and displays.
- Reunion group activities. So far, forty veterans groups and other organizations have made plans to hold reunions in conjunction with Air Force Fifty.
- An opportunity to see historic aircraft.
- A spectacular multimedia historical retrospective of the first fifty years of the US Air Force.
- An international airpower symposium. Among the dignitaries expected to attend are 112 chiefs of foreign air forces.

For registration information, write to:

Air Force Fifty
Air Force Association
1501 Lee Highway
Arlington VA 22209-1198

or call AFA's Fax on Demand System
(800) 232-3563 and order document number 1997

Air Force Fifty staff can be reached at (800) 552-5427

or visit the Web site: http://www.usaf50thafa.org/

Air Force Association
50 YEARS USAF
Las Vegas, Nevada
April 22-26, 1997

"We'll take that." At the AFA National Convention, National Vice President (South Central Region) Ivan McKinney (second from right) and Louisiana Tech University Cadet Jeff Carter collected $100 from Thomas Normile, Maj. Gen. Oris B. Johnson (La.) Chapter president. Mr. Normile had challenged Mr. McKinney, of the Ark-La-Tex (La.) Chapter, to sign up the most Community Partners in 1996. Mr. McKinney rounded up 102. The money went to the Louisiana State University AFROTC Supplementary Scholarship Fund. Henry Boardman, former National Vice President (South Central Region), and Gene Smith, AFA Chairman of the Board, back row (l–r), witnessed the payoff.

At the ceremony in September, the Foglemans presented Mrs. Doris Beyea with her late husband's Distinguished Flying Cross, an Air Medal with four oak leaf clusters, the European-African–Middle Eastern Campaign Medal with four bronze service stars, a Good Conduct Medal, the Distinguished Unit Badge (Presidential Unit Citation), the American Campaign Medal, the World War II Victory Medal, and the Honorable Service lapel button.

"Walter would be so proud," Mrs. Beyea said. "He was so proud of the medals he'd received during the war, and he often wondered what happened to his Distinguished Flying Cross."

A Mighty Eighth Museum

Even if Eighth Air Force didn't count Gen. Ira C. Eaker or Gen. James H. Doolittle among its leaders—or *Enola Gay* pilot Brig. Gen. Paul W. Tibbets, Jr., or fighter ace Col. Francis "Gabby" Gabreski, or seventeen Medal of Honor recipients among its veterans—it would still be special to the residents of Savannah, Ga.: It was created at Savannah Army Air Base in January 1942.

In Pooler, Ga., in May, the Mighty Eighth Air Force Heritage Museum opened its doors, offering a 90,000-square-foot display area, library, archives, art gallery, memorial garden, and meeting and study rooms, all aimed at preserving the history of the largest air force in the history of aviation.

The **Savannah Chapter** met at the museum in September for a tour and to hear a presentation by Philip Wayne Corbett, the museum's public affairs director. The retired Air Force colonel spoke about the museum's progress and shared background on several exhibits.

Maj. Gen. Lewis E. Lyle, USAF (Ret.), of the **Ouachita (Ark.) Chapter,** is president of the Mighty Eighth Air Force Heritage Museum.

In the Wright Direction

Through the Wright Flight educational program, the **Gen. James R. McCarthy (Fla.) Chapter** is helping schoolchildren in Florida to study harder, remain alcohol- and drug-free, and learn about courage, integrity, and leadership.

A ten-year-old program that originated in Arizona with former AFA Under-40 National Director Bruce Robin Stoddard, Wright Flight has students sign contracts to meet certain educational goals. Chapter members then teach nine classes covering aerospace topics on the Wright brothers, Jimmy Doolittle, World War II aviation battles, the Tuskegee Airmen, women in aviation, and NASA.

When the kids have passed their exams and completed the contract, they earn a Fly Day. In the McCarthy Chapter area, that means a visit to Embry-Riddle Aeronautical University at Daytona Beach, Fla., for a turn at one of many simulators at the school, a tour of the facilities, a chance to meet the cadets, lunch, and an airplane ride.

The chapter started Wright Flight in 1994 at Campbell Middle School in Daytona Beach. This year, it will introduce the program at Atlantic High School in Port Orange.

Chapter President David R. Cummock has been joined by Chapter Vice President Robert Perry and Maj. Molly K. Moon in teaching the courses. From his experience as an instructor for several segments, Mr. Perry, a Delta Air Lines pilot, says that the kids especially enjoy watching the video of World War II dogfights. The chapter members generally teach three cycles of classes per school year.

With training materials, a souvenir Wright Flight T-shirt, and reimbursing Embry-Riddle for the culmination plane ride, it costs the chapter about $60 for each child who completes the program. Despite the expense, says Mr. Cummock, "somebody's got to turn these kids on to a lifetime of accomplishment."

Aviation Education in South Florida

The **John W. DeMilly, Jr. (Fla.), Chapter** and a Community Partner, the First National Bank of Homestead, hosted a seminar on aviation education programs in the south Dade County, Fla., area.

Educators at the August event exchanged information on activities available for students from the elementary school up to the community college level: Principal Sharon Hench described the Aviation Theme School approach used at Irving and Beatrice Peskoe Elementary School in Homestead, where teachers are called commanders, students are called pilots, and hallways are named The Flying Tigers Concourse, The Tuskegee Airmen Concourse, and The Amelia Earhart Concourse. Aerospace science instructor Lt. Col. Richard O'Neill, USAF (Ret.), from Homestead High School, presented an overview of Air Force JROTC programs in the area. Civil Air Patrol representatives Calvin Morton and Bateman Blair described an after-school CAP program being planned

for Homestead Middle School. Dr. Roy Phillips, president of Miami-Dade Community College's Homestead campus, spoke about an Aviation Education Center, which will offer an associate degree in aviation management.

Col. Richard Eustace, commander of the 482d Fighter Wing, Majs. Dennis Daley and Bobby D'Angelo, also from the 482d FW, and Maj. "Buck" Burney, commander of Det. 1, 125th Fighter Wing, discussed AFRES and ANG programs available to support educators. These include tours of the base and classroom visits from Air Force members.

As a result of this seminar, an aviation-aerospace section will be incorporated into the annual Dade County Youth Fair held in March.

South Dade County educators also are planning to form an Advisory Committee to help the DeMilly Chapter promote aviation education. In addition, the chapter compiled a list of aerospace education points of contact for the symposium attendees, naming people in the area from the Air National Guard, AFA, CAP, Embry-Riddle Aeronautical University, and local schools who can serve as resources.

A Call for Membership

At Offutt AFB, Neb., in early October, Nebraska AFA hosted the annual Midwest Regional Conference for the first time in seven years.

Newly elected National Vice President (Midwest Region) John J. Politi, of the **Central Missouri Chapter,** called for increased membership and more active participation by current members in the coming year. Brig. Gen. Michael S. Kudlacz, 55th Wing commander at Offutt and an **Ak-Sar-Ben (Neb.) Chapter** member, was another keynote speaker at the meeting. He delivered a briefing on the wing's mission. National President Larson presented outgoing National Vice President (Midwest Region) Samuel M. Gardner, now Kansas State President, with a Special Citation to thank him for his service.

After the meetings and presentations, the conference attendees toured the base, stopping at the site of the Martin Bomber Plant (now an office building), where the *Enola Gay* and *Bockscar* were built. They also visited the Strategic Air Command Museum in Bellevue.

Nebraska State President Robert Williams and his daughter Cathy L. Williams, an Ak-Sar-Ben Chapter board member and the state vice president for Communications, worked with Maj. Cynthia Colin of the 55th Wing Public Affairs Office in planning the regional meeting.

The Fiftieth in Oklahoma

Brig. Gen. David R. Love, 97th Air Mobility Wing commander, was the keynote speaker at an **Altus (Okla.) Chapter** Community Partner Appreciation Luncheon in September. The chapter's first Community Partner of the Year award was given to Joan and Eddie Wilcoxen.

In his comments, the General noted the fiftieth anniversaries of AFA and USAF and said AFA and its Community Partners "need to get out and tell the Air Force story and help people recognize that airpower has fundamentally changed the nature of warfare."

The Altus Chapter also reported that it donated a framed poster of artist Lawrence M. Romorini's AFA fiftieth-anniversary collage to the new Consolidated Support Center under construction at Altus AFB. The original artwork is eighty-four inches across and brings together more than 225 mementos and miniaturized pictures and *Air Force* Magazine covers.

As a result of efforts by Charles R. Ford, **Tulsa (Okla.) Chapter's** vice president for Government Affairs, Oklahoma Governor Frank Keating saluted AFA's golden anniversary by proclaiming Air Force Association Day in the Sooner State. The Governor hosted Chapter President Harry B. Burt III, Ed Greven from the **Enid Chapter,** who was then Oklahoma State President, and Mr. Ford at a ceremony in his office.

A Dedicated Volunteer

She began registering players for the **Eglin (Fla.) Chapter's** annual golf tournament just to be helpful in the scholarship fund-raising effort of her husband's chapter. That was twenty-one years ago. Shirley R. Hamrick of Fort Walton Beach, Fla., said she continued signing up people for the tournament every year for more than two decades because one day a young woman hugged her and said that without the scholarship, she wouldn't have been able to finish her education. "That's all it took," explained Mrs. Hamrick. "Knowing for sure that the work was helpful" kept her motivated year after year.

She doesn't golf, but she always sponsors her four sons in the tournament. Gen. William L. Kirk, USAF (Ret.), former commander in chief of US Air Forces in Europe, presented Mrs. Hamrick with a plaque in September at the chapter's latest tournament, where the event raised $16,000 to help area students with their education.

Have AFA/AEF News?

Contributions to "AFA/AEF National Report" should be sent to *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Phone: (703) 247-5828. Fax: (703) 247-5855. ■

Photo by Susan Kennedy

General James R. McCarthy (Fla.) Chapter's David Cummock shares the cockpit with Majid Vasigh from Campbell Middle School in Daytona Beach. Majid and fellow students (l–r) Lexie Jesup, Lindsey Morse, Maxwell Prentice, J. C. Hollis, Rebecca Simonds, and Jessica Jones earned a Fly Day at Embry-Riddle University in Daytona Beach through the chapter's Wright Flight program.

Unit Reunions

Port Lyautey Alumni Ass'n. May 20–23, 1997, at the Holiday Inn Emerald Beach in Corpus Christi, Tex. **Contact:** J. R. Calloway, 10714 Kingwood Dr., Corpus Christi, TX 78410. Phone: (512) 241-1821.

Sewart AFB, Tenn., personnel (formerly the 314th Troop Carrier Wing/Tactical Airlift Wing). May 22–25, 1997, at the Marriott Hotel in Nashville, Tenn. **Contact:** Wilma Welsh, P. O. Box 160384, Nashville, TN 37216-0384. Phone: (800) 251-8434.

8th Tactical Fighter Squadron, Takhli RTAB, Thailand. April 24–26, 1997, in Las Vegas, Nev. **Contact:** Paul E. Raudenbush, 1725 Weston Brent Lane, El Paso, TX 79935. Phone: (915) 592-3700.

11th, 12th, and 6166th Tactical Reconnaissance Squadrons, Korea (1950–60). Late April 1997 in Washington, D. C. **Contact:** James J. Van Hare, 2517 Highpointe Dr., Kalamazoo, MI 49008-2076. Phone: (616) 342-8192.

Pilot Class 43-H (Marfa Field, Tex.). February 6–8, 1997, at the Shades of Green in Lake Buena Vista, Fla. **Contact:** Lt. Col. Raleigh H. McQueen, USAF (Ret.), 50 Ramsgate Rd., Savannah, GA 31419. Phone: (912) 925-6575.

55th Fighter Group and 442d/97th Air Service Groups. May 21–24, 1997, in Albuquerque, N. M. **Contact:** Robert Littlefield, P. O. Box 3644, Carmel, CA 93921. Phone: (408) 624-5293.

81st Fighter Wing Ass'n. May 24–27, 1997, at the Holiday Inn Select in Nashville, Tenn. Fighter squadrons and attached service units are invited. **Contact:** Lt. Col. Roy D. Simmons, Jr., USAF (Ret.), 3730 Edgewater Dr., Nashville, TN 37217-4620. Phone: (615) 366-1191.

1938th Airways and Air Communications System. CORRECTION: The reunion date has been changed to March 1998. The reunion also includes all veterans who served at Ramey AFB, Puerto Rico. **Contact:** Kenneth I. Coombs, P. O. Box 422, East Wakefield, NH 03830-0422. Phone: (603) 522-8365.

The following reunions will be held in conjunction with USAF's fiftieth-anniversary celebration:

Pilot Training Class 49-B. April 23–27, 1997, in Las Vegas, Nev. **Contact:** Lt. Col. John A. Stolly, USAF (Ret.), 11323 Cotillion Dr., Dallas, TX 75228-1910. Phone: (972) 681-8290.

Class 66-C (Reese AFB, Tex.). April 25–27, 1997, in Las Vegas, Nev. **Contact:** Steve Dean, P. O. Box 610, Gilmer, TX 75644-0610. Phone: (903) 843-2457. Fax: (903) 843-3123.

449th Bomb Group Ass'n "Flying Horsemen" (World War II). April 22–26, 1997, at the Stardust Resort and Casino in Las Vegas, Nev. **Contact:** Lee F. Kenney, 445 Maple Bluff Cir., Melbourne, FL 32940. Phone: (407) 242-8654.

6147th Tactical Control Group "Mosquitos" (Korea). April 21–27, 1997, at the Tropicana Resort and Casino in Las Vegas, Nev. **Contact:** James F. Kelly, 3378 Seneca Dr., Las Vegas, NV 89109. Phone: (702) 796-5554.

Seeking personnel stationed in **Berlin, Germany,** between 1945 and 1994, for a reunion in 1997. Airlift crews invited. **Contact:** Charles Farrell, P. O. Box 1678, Largo, FL 33779-1678. Phone: (813) 530-0207. Fax: (813) 535-1401.

Seeking contact with personnel stationed at **Birkenfeld AB, West Germany,** between 1948 and 1969, for a reunion in 1997 in New Orleans, La. **Contact:** Jackie D. King, 212 Islandia Ct. West, Nashville, TN 37217. Phone: (615) 366-5626.

Seeking contact with **17th Troop Carrier Squadron/17th Tactical Airlift Squadron** "Firebirds" personnel for a reunion. **Contact:** Nolan W. Bailey, 309 Gene Lane, Natchitoches, LA 71457-5505. Phone: (318) 352-2610.

Seeking radar intercept officers from **Aviation Cadet Class 53-11** for a reunion in 1997 in conjunction with the Air Force Navigators and Observers Ass'n reunion. **Contact:** John P. Fitzpatrick, 66 New England Ave., Summit, NJ 07901. Phone: (908) 277-3611. ■

Bulletin Board

Seeking the whereabouts of **James O'Brien,** a chef in the officers' mess at Shepherds Grove, UK, and RAF Mildenhall, UK, 1954–61. **Contact:** Donna Pratt, Donard, Back Lane, Badwell Ash, Bury St. Edmonds, Suffolk IP31 3DW, UK.

Seeking contact with former F-84 pilots and ground crews of Air Defense Command's **14th, 33d, and 78th Fighter-Interceptor Groups.** Also seeking F-84 pilots who flew in the **Fox Able** and **Fox Peter** missions. **Contact:** David R. McLaren, 1709 W. Fayette Ave., Springfield, IL 62704-2308.

Seeking information on US Army Medical Department **Sgt. A. C. Burkhalter,** assigned to the 163d Aero Squadron, France, 1918–19. **Contact:** Col. A. C. Burkhalter, Jr., USAF (Ret.), 22 Shorelake Dr., Kingwood, TX 77339.

Seeking contact with the crew of Lt. Dan M. Williams, Jr., **338th Bomb Squadron,** 96th Bomb Group, Snetterton Heath, UK, shot down October 10, 1943, over Münster, Germany. **Contact:** Dan M. Williams, Jr., 5078 Fairmont Rd., Smyrna, GA 30082-5113.

Seeking contact with **Lt. Jeff Wiegand,** stationed in Boise, Idaho, in 1994. **Contact:** Melissa Umberger, 1784 Carol Sue Ave., Apt. #1-L, Gretna, LA 70056.

Seeking a set of blue aviation **cadet shoulder boards** from the early 1950s. **Contact:** John P. Fitzpatrick, 66 New England Ave., Unit 13, Summit, NJ 07901.

Seeking **military memorabilia,** including uniforms, patches, photos, propaganda leaflets, and wartime periodicals. **Contact:** Capt. David Bower, USAF, 408 Saylor Dr., Biloxi, MS 39531.

Seeking sixteen-inch recordings of **Armed Forces Radio Service** broadcasts from the 1940s. Especially seeking recordings of Mystery Theatre, Sherlock Holmes, and Glenn Miller. **Contact:** Daniel J. Morrow, 105 East Ct., Blackwood, NJ 08012.

Seeking information about the **344th Bomb Group,** 99th Bomb Wing, 9th Air Force. **Contact:** Charles F. Ackerman, 4224 S. W. 314th Pl., Federal Way, WA 98023.

Seeking information on and contact with the "Carpetbaggers" of the **801st and 492d Bomb Groups** and **OSS teams** led by Maj. William E. Colby. **Contact:** Col. C. V. Glines, USAF (Ret.), 1531 San Rafael Dr., Dallas, TX 75218-4444.

Seeking information on and photos of **Merville Field, France,** during World War II. Especially seeking contact with 5th Strategic Air Depot members who salvaged parts from planes that crashed at Merville. Also seeking contact with former members of the **21st Fighter Wing,** Chambley AB, France, in the 1950s. **Contact:** Jocelyn Leclercq, 51 rte. de Fromelles, 59249 Aubers, France.

Seeking contact with any US military personnel currently or formerly assigned to the **White House** or supporting units. **Contact:** James F. Roy III, Presidential Service Ass'n, 163 Linwood St., Lynn, MA 01905-1218.

Seeking contact with **P-61C** Black Widow squadron members who participated in the **Thunderstorm Project** at Pinecastle AAB, Fla., in 1946, and at Clinton County AFB, Ohio, in 1947. **Contact:** Dan Smith, National Weather Service, 819 Taylor St., Room 10A26, Fort Worth, TX 76102-6171.

Seeking contact with **Lou Bendon and Paul Pincus,** Pilot Class 43-I graduates from Ellington Field, Tex., who may have flown B-24s in 8th Air Force. **Contact:** J. K. Havener, 9317 Garden Woods Dr., Cordova, TN 38018-4729.

Seeking information on and a photo of a B-47E from the **340th Bomb Wing,** Whiteman AFB, Mo., that was struck by lightning and lost part of its vertical stabilizer in the late 1950s or early 1960s. **Contact:** Bill J. Cantwell, 4806 Webster Rd., Oakdale, CA 95361-7849.

Seeking information on **Robert Nash,** an aircraft maintainer, originally from West Virginia, stationed at RAF Burtonwood, UK, 1951–54, and at Sheppard AFB, Tex., in 1969. **Contact:** SMSgt. Larry A. Kyle, USAF (Ret.), P. O. Box 305, Wolfforth, TX 79382.

Seeking information on former B-36 pilot **Philip Case, Francis Case,** or their family members. **Contact:** Lt. Col. Henry Delaney, USAF (Ret.), 68 Avenue of the Oaks, Beaumont, TX 77707.

For a museum display, seeking information on or contact with **American Indians** who have served in the military. **Contact:** Edwin G. LaQuay, 29 Richmond St., Pittsburgh, PA 15205.

Seeking contact with **James A. Bryan, William J. O'Donnell, James M. Remaley, and Charles**

AFA'S THIRTEENTH ANNUAL

AIR WARFARE SYMPOSIUM

January 30–31, 1997 • The Buena Vista Palace Hotel • Orlando, Fla. • 800/327-2990

Invited Speakers

Recent long-term planning has generated new visions of air warfare requirements, weapon systems modernization, and technology developments that will shape the Air Force of tomorrow. Top military leaders will explore the impact of these efforts on the future of the Air Force. Planned speakers include the Secretary and Chief of Staff of the Air Force and the commander of Air Combat Command. For more information, contact Jennifer Krause **703/247-5838** or Barbara Coffey **703/247-5805,** or call the AFA Fax Reply **800/232-3563** and follow the voice prompts. Your document number is **#360.**

Golf Tournament

AFA's Central Florida Chapter will sponsor a golf tournament on Walt Disney World's Magnolia and Palm Courses on Wednesday, January 29. Contact Jim DeRose **407/356-5750.**

Gala

The chapter will sponsor its thirteenth annual black-tie Gala on Friday, January 31. Proceeds will benefit AFA's Aerospace Education Foundation and the Air Force Memorial Foundation as well as AFROTC scholarships and other aerospace education activities. Contact Marty Harris **407/356-4810.**

For hotel reservations, call the Buena Vista Palace Hotel **800/327-2990** or nearby Caribe Royal Resort Suites **800/823-8300.** Mention the AFA Symposium for special rate.

Registration Form

1997 Air Force Association National Symposium

Advance registration closes Thursday, **January 23, 1997.** No refunds can be made for cancellations after this date.

Mail this form to:

Air Force Association
Attn.: Jennifer Krause
1501 Lee Highway
Arlington VA 22209-1198

Phone: 703/247-5838
Fax: 703/247-5853

name (print) _____ title _____ affiliation _____

address _____

city _____ state _____ zip _____ telephone (with area code) _____

Symposium fee for AFA Individual or Industrial Associate member is **$475.** Fee for nonmember is **$525.** Fee includes coffee breaks, sandwich lunch, reception/buffet, and continental breakfast.

__ Mark here to request an extra reception/buffet ticket and/or lunch ticket. Enclose **$100** for the additional reception/buffet ticket, **$19** for the extra lunch ticket.

Name of guest: _____

__ Check or money order enclosed (make payable to Air Force Association).

Charge to: __VISA __ M/C __ AmEx

Account number _____ Expiration date: ___ / ___

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Signature _____

R. Valente—members of the 46th Fighter-Interceptor Squadron, Dover AFB, Del., in the 1950s. **Contact:** Lt. Col. George W. Peckham, USAF (Ret.), 254 Quail Ridge Cir., Highlands Ranch, CO 80126-2239.

Seeking the whereabouts of **Charles B. Branam** of Jellico, Tenn., who stayed with Mr. and Mrs. Jean Junien in Saint Sauvant, Charente Maritime, France, in the early 1950s. **Contact:** Christina Peronnet, La Criere Verte, rte. de Montreuil Largille, 27330 La Barre en Ouche, France.

Seeking contact with personnel from the **54th Weather Reconnaissance Squadron,** Andersen AFB, Guam, and the **55th WRS,** McClellan AFB, Calif., in the early 1950s. **Contact:** Donald P. Nelson, R. R. 1, Box C-96, Chrisney, IN 47611.

Seeking contact with members of the **50th Maintenance, Repair, and Recovery Squadron,** whose names are on a propeller from Maastricht, the Netherlands, dated October 1944. **Contact:** Donald J. Smith, P. O. Box 817, Danville, KY 40422.

Seeking contact with **C/AC-119** aircrew and ground crew members. **Contact:** Col. Wendell E. Cosner, USAF (Ret.), 1300 Hertz Dr. S. E., Albuquerque, NM 87108.

Seeking **patches** from the 6th and 19th Air Divisions, 1603d Air Transport Wing, 3500th Pilot Training Wing, 3500th Maintenance and Supply Group, and the Flying Training Air Force. **Contact:** TSgt. Ollie F. Cook, USAF (Ret.), 5531 Bonanza Dr., Fort Worth, TX 76137-2525.

For an association, seeking contact with former **5th Air Force** members assigned or attached to units at Nagoya or Komaki ABs, Japan, 1945–59. **Contact:** CMSgt. John M. Campo, USAF (Ret.), 8212 E. 103d Terr., Kansas City, MO 64134-2101.

Seeking a copy of the SM-62 Snark missile insignia of the **702d Strategic Missile Wing,** Presque Isle AFB, Me., 1960–61. **Contact:** Richard H. Eselby, 11626 Jureane Dr., Orlando, FL 32836-7005.

Seeking a four-volume set of **"Studies and Observation Group Military Assistance Command, Vietnam, Studies,"** by Harve Saal. **Contact:** John B. Grasser, 7555 S. W. 164th St., Miami, FL 33157-3833.

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

Seeking contact with **Sgt. J. W. Lutz, Cpl. F. J. Leehowiez, Pfcs. E. D. Berry and H. B. Orledge, and Pvts. W. Alexander and S. Baton,** who worked at Clovis AAF, N. M., in 1944. **Contact:** Walter D. Schau, 2112 Poeprairie Rd., Millsap, TX 76066.

Seeking a color "Phantom Phixer" **patch** (ghost holding wrench), preferably from the 1960s. **Contact:** Mark Ellis, 20019 Gilbert Dr., Canyon Country, CA 91351-4811.

Seeking information on or contact with **Lt. James H. Gillison,** a lead bombardier with the 94th Bomb Group, 8th Air Force, 1944–45. **Contact:** Capt. S. L. Rapoport, USAF (Ret.), 407 Noxon Rd., New York, NY 12540.

Seeking contact with **2186th Communications Squadron** members stationed at San Pablo AB, Spain, 1966–67. **Contact:** Jan-Willem Seip, Jan Schoutenstr. 19, 3311 KL Dordrecht, the Netherlands.

Seeking contact with **Meredith, Barbara, and Tom Bean,** possibly stationed in West Ruislip, UK, who lived in Pinner, Middlesex, UK, 1976–78. **Contact:** Kevin Sefton, 5 Daymer Gardens, Pinner, Middlesex HA5 2HW, UK.

Seeking the whereabouts of **David Andren,** whose airplane crashed near the Solomon Islands during World War II and who was rescued by Nathan Kera. **Contact:** Russell Parker, P. O. Box 242, Tenterfield, NSW 2372, Australia.

Seeking contact with former members of Air Materiel Command's **Special Weapons (Control Equipment) Branch** at Wright Field, Ohio, or other World War II temporary duty bases, who

worked on guided weapons and pilotless aircraft. **Contact:** Maj. Philip G. Mack, AFRES (Ret.), 17521 155th Ave. S. E., Renton, WA 98058-9087.

Seeking contact with former **F-105 maintenance** personnel. **Contact:** Phillip Ormes, 109 S. E. 421, Warrensburg, MO 64093.

Seeking the whereabouts of **John Francis Simmons,** a USAF Medical Corps noncommissioned officer originally from Missouri, stationed at Burtonwood, UK, 1953–56, and in West Germany in the early 1960s. **Contact:** Margaret Laidler Kirkwood, 621 S. Barfield Dr., Marco Island, FL 33937.

Seeking information on the **54th Troop Carrier Squadron** after it left Alaska in 1956. **Contact:** Harry Yonkman, Box 907, Leland, MI 49654-0907.

Seeking patches from the **4th Fighter-Interceptor Squadron,** Misawa AB, Japan, late 1950s through the 1960s. **Contact:** MSgt. Walter A. Vickery, USAF (Ret.), 6212 W. Wolf St., Phoenix, AZ 85033.

Seeking the whereabouts of **Leonard Gott,** from Los Angeles, Calif., and **Willard Lowman,** from Chattanooga, Tenn., both stationed at Horsham Saint Faith, UK, in 1943. **Contact:** Joyce Audoire, 5508-B Cinderlane Pkwy., Orlando, FL 32808-4716.

Seeking information, photographs, documents, wings, and patches relating to Army Air Forces **bomber staging bases in Nebraska** (World War II). Especially seeking items from bases at Kearney, McCook, Harvard, Bruning, Fairmont, and Scribner. Also seeking information about a **B-17 crash** north of Bertrand, Neb., in April 1944. **Contact:** Dale M. Bunsen, Kayser Hall 107D, University of Nebraska at Omaha, Omaha, NE 68182-0163.

Seeking the whereabouts of **Asa Fred Baldwin,** a Jefferson, N. Y., native stationed near Savannah, Ga., possibly at Hunter AFB, in 1956. **Contact:** CWO3 John H. Gremer, USMCR (Ret.), 2195 Welty Rd., Jasper, NY 14855-9763.

Seeking information on and contact with family members of personnel who were stationed on or operated out of **Malta** during World War II. **Contact:** Servet "Steve" Haktanir, 903 W. Kansas Ave., Midland, TX 79701-6123.

Seeking information on **Nicholas V. Latella and George B. McGrath,** August 1944 graduates of gunnery school at Laredo AFB, Tex. **Contact:** Vincent A. Palmer, 4254 Lake Rd., P. O. Box 148, Pultneyville, NY 14538-0148.

Seeking photos of **Hamilton AFB,** Calif., especially from the 1950s and 1960s. Also seeking **patches** from the 83d and 84th Fighter-Interceptor Squadrons, the 78th Fighter Group, and Air Defense Command. **Contact:** Dick Hilgendorf, W. 6901 Hwy. P, Endeavor, WI 53930.

Seeking autographs of **Frank M. Andrews, John B. Brooks, Everett S. Davis, Lionel H. Dunlap, Millard Fillmore Harmon, and Clarence L. Tinker. Contact:** Steven Keyser, P. O. Box 1464, El Cajon, CA 92022.

Seeking recollections and photographs of and memorabilia from **Dow Field, Me.,** World War II to 1968. **Contact:** Curator, Bangor Historical Society Museum, 159 Union St., Bangor, ME 04401.

Seeking the whereabouts of **Clinton E. Wimble,** a Pittsfield, Mass., native, who served as reporter and soldier in France during World War II and was married to Françoise Blanche Marbague. **Contact:** Alfred Andre Wimble-Clinton, Les Pins rte. de Dues, 16100 Ouilly le Vicomte, France.

Seeking **T-28 maintenance manuals. Contact:** Steven E. Smith, 2141 E. 32d Pl., Tulsa, OK 74105.

Seeking to donate slides of the 1958 **Farnborough Air Show. Contact:** MSgt. Rudolf W. Keil, USAF (Ret.), 10503 Georgetown Dr., Rancho Cordova, CA 95670.

Seeking the whereabouts of **Lt. Thomas Sugg,** a graduate of Stuttgart Advanced Pilot Training Class 44-H who was stationed at Hendricks Field, Fla. **Contact:** Martin J. Stricker, 14127 Harbour View Oval, Strongsville, OH 44136.

Seeking contact with **Jimmy Colaizzo,** an education advisor at USAF bases in France in the 1950s, and his family. He may have been stationed at McGuire AFB, N. J., in 1958 or 1959. **Contact:** R. R. Leslie (née Dmitrevsky), 43 Evelyn Dr., Hatch End, Pinner, Middlesex HA5 4RL, UK.

Seeking contact with **Roy Wendell, Jr.,** an Army Air Forces B-17 navigator from Queens, N. Y., who was stationed at Mitchel Field, N. Y., in 1942. **Contact:** Norman E. (Gusler) Andrews, P. O. Box 311, Boothbay Harbor, ME 04538-0311.

Seeking contact with thirty-two US pilots stationed at **Bari,** Italy, in 1944, who were shot down over Yugoslavia and rescued by a Soviet pilot. **Contact:** Vladimir Pavlov, c/o Russian Committee of War Veterans, Foreign Section, 4 Gogolevsky Blvd., No. 348/7, Moscow 119885, Russia. ■

Pieces of History

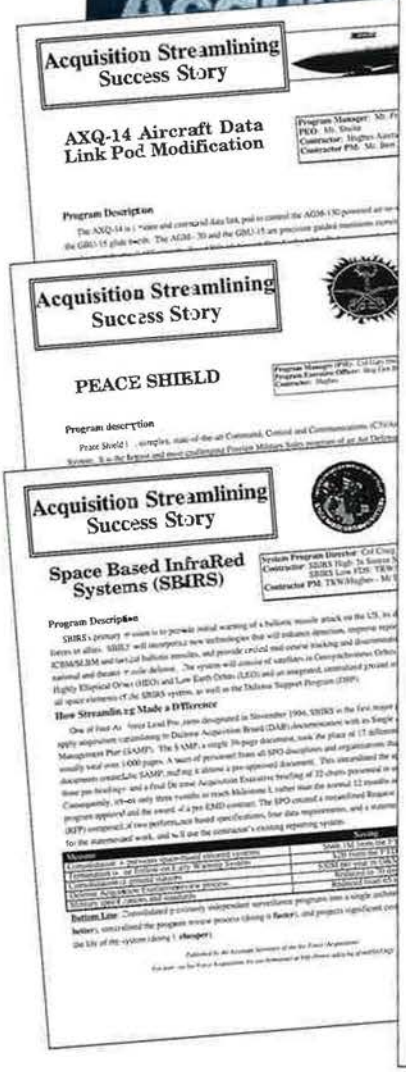
Photography by Paul Kennedy

From Sextants to Sensors

Memorabilia courtesy Mike Keefe

Though their numbers are dwindling, navigators continue to play a key role in many USAF cockpits. During long flights over unfamiliar territory, the navigator guides the aircraft to its destination and back home again, using data on airspeed, distance, visual clues, and even the curvature of the Earth. New sensors and the Global Positioning System now help the navigator. Some new aircraft are being built without provision for a navigator, but you still will find them in B-1s, B-52s, KC-135s, and Airborne Warning and Control System aircraft—aboard the long-range, long-loiter aircraft at home and deployed worldwide.

LEADERS IN ACQUISITION REFORM AND TEAMWORK.



Acquisition Streamlining Success Story

Advanced Medium Range Air-to-Air Missile (AMRAAM)

Program Manager: Col Rick Dickson
PEO: Mr. Harry Schulte
Contractor: Hughes Aircraft Co., Raytheon Co
Contractor PM: Mr. Chuck Anderson, Hughes
Mr. Jim Wilson, Raytheon

Program Description

The AIM-120 AMRAAM is a new generation air-to-air missile. It has an all-weather, beyond-visual-range capability and is scheduled to be operational beyond the year 2000. AMRAAM is the premier air-to-air weapon of choice by America's aviators against low-altitude targets. It incorporates an active radar with an inertial reference unit and micro-computer system, which makes the missile less dependent upon the fire-control system of the aircraft. Once the missile closes on a target, its active radar guides it to intercept. This enables the pilot to aim and fire several missiles simultaneously at multiple targets. The pilot may then perform evasive maneuvers while the missiles guide themselves to their targets.

How Streamlining Made a Difference

By replacing oversight with insight, the AMRAAM program office teamed with industry to create an environment where the primes are now equal partners in striving for AMRAAM success. Planning and executing a strategic block concept for hardware/software changes, improved integration with aircraft platforms was acheived. As a result, **reliability exceeds the warfighter's requirement by 400 percent** and a 10 year bumper-to-bumper warranty--the first for munitions--was obtained. However, the real success story is the Buy To Budget philosophy which bought the warfighters 407 more AMRAAMs.

Measure	Lot 10
Source selection team	**Reduced by 50%**
Paper	**Cut by 55%**
Required data	**Decreased by 30%**
Certified cost and pricing data	**Eliminated**

Bottom Line: Empowered government's contractor plant inspectors with equipment certification and engineering change approval authority (doing it **better**), **spearheaded transition to IPTs** by both government and contractor (doing it **faster**), **prices slashed by 33%** over last four years(doing it **cheaper**).

Published by the Assistant Secretary of the Air Force (Acquisition).

For these and other success stories visit the Air Force Acquisition Home Page: http://www.safaq.hq.af.mil

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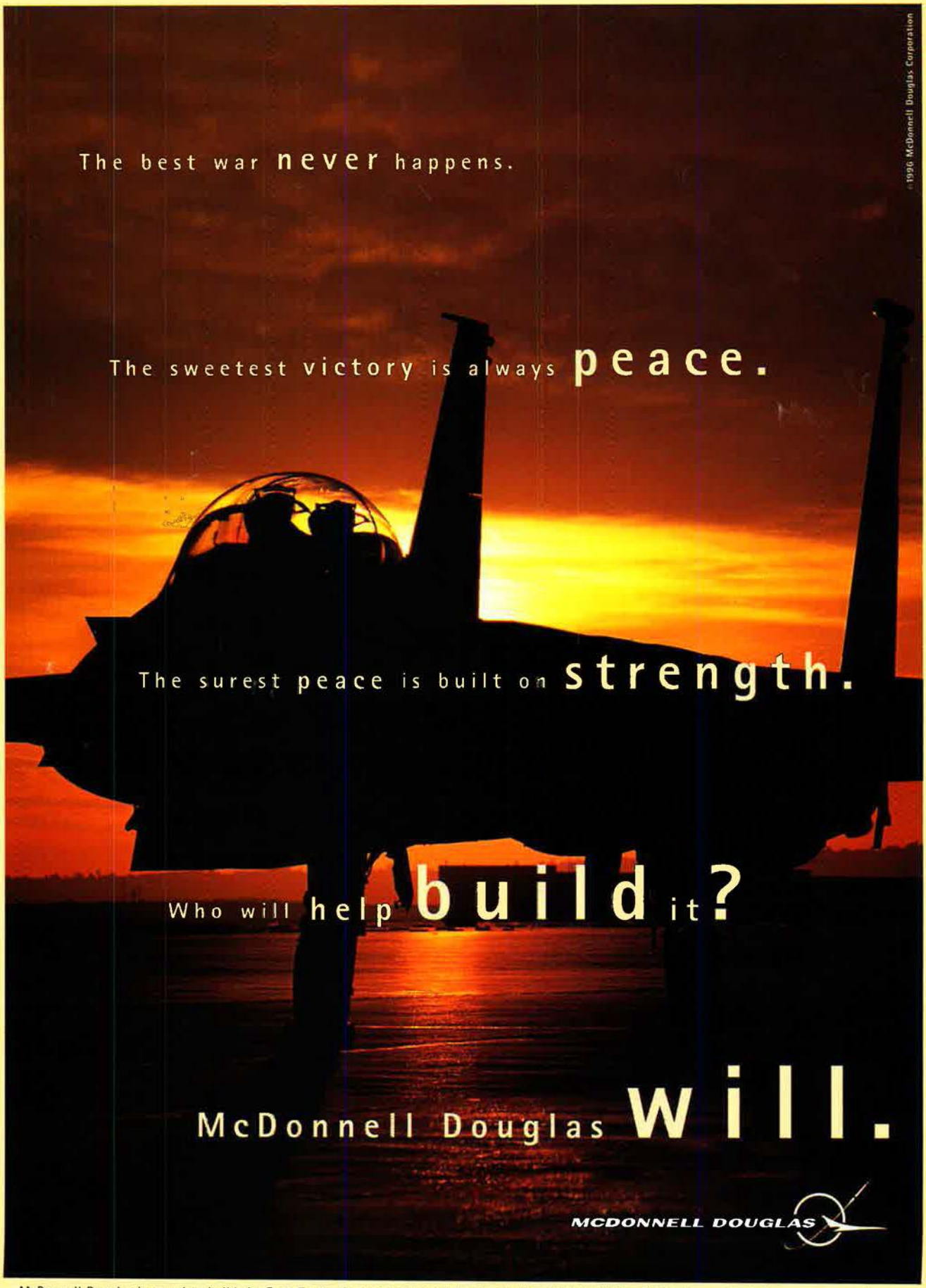

McDonnell Douglas is proud to build the F-15 Eagle, the most advanced air superiority and interdiction fighter in service today. www.mdc.com