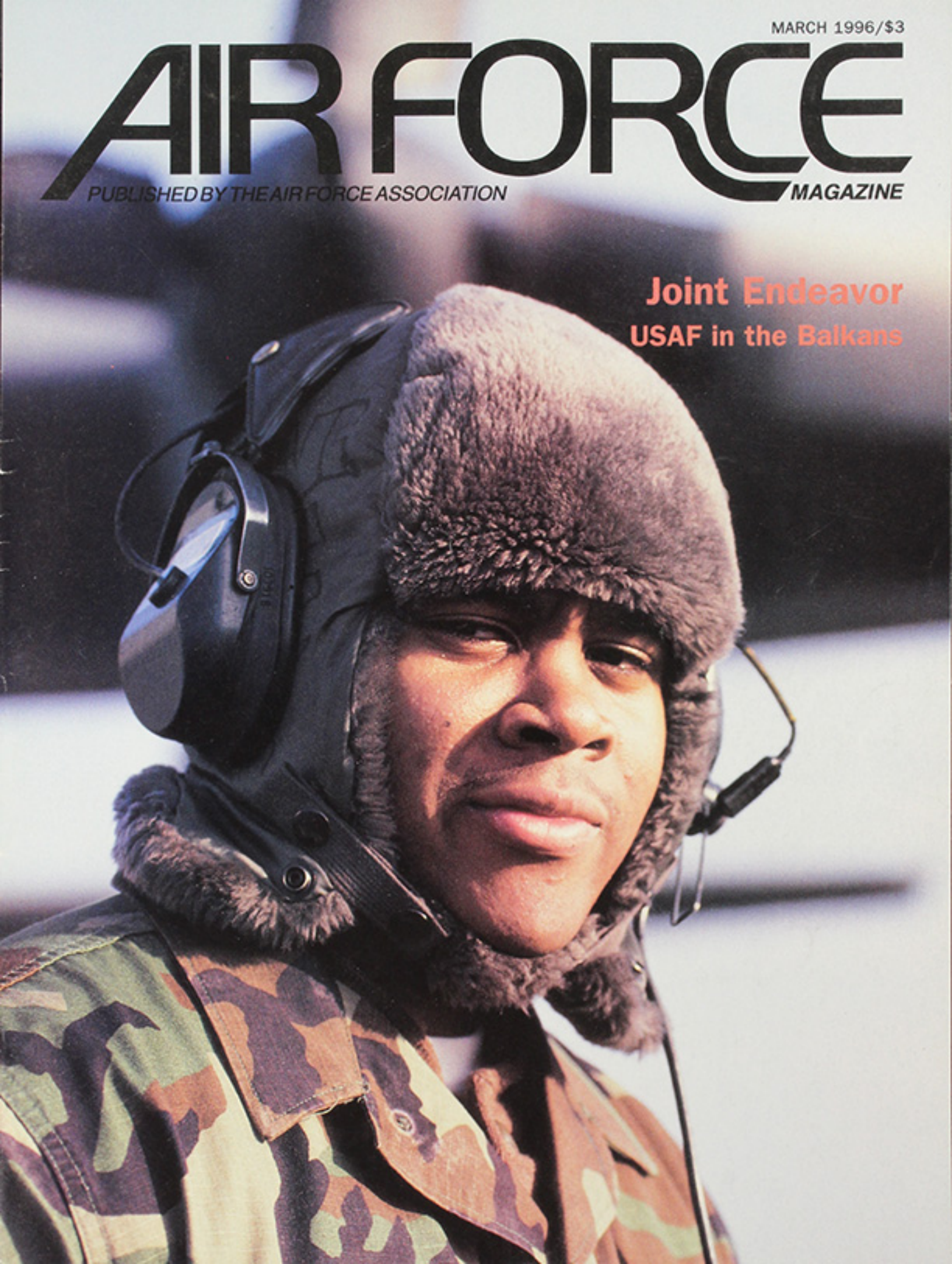
MARCH 1996/$3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

Joint Endeavor

USAF in the Balkans



THE ELEMENT OF SURPRISE HAS ALWAYS PLAYED A PIVOTAL ROLE IN WARFARE. SO, TOO, HAS DOMINATION OF THE AIR. THE F-22 IS BUILT TO ENSURE BOTH. MADE OF ADVANCED COMPOSITES, THE F-22 IS THE FIRST STEALTHY SUPERSONIC FIGHTER IN HISTORY. IN TODAY'S GLOBAL MARKET OF ADVANCED MISSILES AND MODERN EXPORT FIGHTERS, STEALTH HAS BECOME THE DIVIDING LINE IN THE SKY. THE F-22 WILL ALSO INTRODUCE ADVANCED TECHNOLOGIES LIKE SUPERCRUISE, INTEGRATED AVIONICS AND THRUST VECTORING. ALL OF WHICH MEANS ONE THING TO FUTURE AMERICAN PILOTS. IF "WAR IS INEVITABLE," SO TOO, IS VICTORY.

F22
LOCKHEED MARTIN · BOEING
PRATT & WHITNEY

March 1996, Vol. 79, No. 3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

About the cover: A1C Erik L. Cook, a C-130 crew chief from the 37th Airlift Squadron, Ramstein AB, Germany, is one of the 60,000 troops helping to keep the peace in Bosnia-Hercegovina. See "The Air Force in the Balkans," p. 26. USAF photo by MSgt. Rose S. Reynolcs.

AIR FORCE Magazine (ISSN 0730-6784) March 1996 (Vol. 79, No. 3) is published monthly by the Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Phone (703) 247-5800. Second-class postage paid at Arlington, Va., and additional mailing offices. **Membership Rate:** $30 per year; $75 for three-year membership. **Life Membership:** $450 single payment, $475 extended payments. **Subscription Rate:** $30 per year; $25 per year additional for postage to foreign addresses (except Canada and Mexico, which are $9 per year additional). Regular issues $3 each. Special issues (USAF Almanac issue and Anniversary issue) $5 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send changes of address to Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Publisher assumes no responsibility for unsolicited material.

Editorial

By John T. Correll, Editor in Chief

The Shape of Things to Come

EVEN more so than usual, the Air Force is thinking about the future. Its first set of findings was announced in January with the completion of "New World Vistas," a comprehensive study by the Air Force Scientific Advisory Board of aerospace technology options that are likely to emerge in the twenty-first century. This summer, Air University will turn in Project 2025. Air University's charter from Air Force Chief of Staff Gen. Ronald R. Fogleman was for "maverick, out-of-the-box thinking" about the next thirty years.

These well-publicized reports will eventually be sifted in detail, along with classified projections and other studies, by Maj. Gen. John A. Gordon and a special staff who are conducting, at General Fogleman's behest, a long-range planning project for the force. It will conclude next winter in time for the results to be used in preparing for a Department of Defense quadrennial strategy review in 1997.

As the people running these studies know very well, the future tends to defy specific predictions. Thomas J. Watson, chairman of IBM, never lived down his estimate in 1943 that "there is a world market for about five computers." The cover of *Popular Mechanics* in February 1951 forecast a helicopter in every garage. It was popular to imagine robots taking over all the chores of life. In reality, robots proved to be useful mainly in welding and other limited roles.

The purpose of the Air Force's future studies is not to divine exactly what will happen. It is rather to explore possibilities opened by technology, to examine evolving requirements, and to avoid the trap of "delta" thinking, which sees the future as a series of incremental gains on the baseline of the present.

Some of the assessments in "New World Vistas" have a ring of inevitability. One such is the prediction that space will become vastly more important as a "domain of conflict." The study makes a convincing case that we will depend primarily on commercial providers for spacebased navigation, communications, data links, and reconnaissance. These capabilities will be available to all, including governments unfriendly to us. "Control of space will become critical during the next decade," the report says. That entails protecting our own space assets—possibly with directed-energy weapons—and denying use of space to others.

National security and defense strategies of the future will put central reliance on operations in air and space.

The Pentagon did not publish papers done by the individual "Vistas" study panels, but one of them, leaked to the press, explored the sobering implications of space as a domain of conflict. The study said the application of force from space will become feasible and affordable within thirty years and that it would then be possible to complete the equivalent of a Desert Storm strategic air campaign in a matter of hours.

A recurring message of the future studies is that the United States cannot count on either a monopoly of power or an automatic advantage in capability. The "Vistas" report says that "Our future enemies, whoever they may be, will obtain knowledge and weapons better than those we have at present by making rather small investments."

The Scientific Advisory Board warns that some of its findings will be "wrenching" for those of traditional disposition. That is certainly the case with the forecast of "uninhabited" combat aircraft, which the study figures the Air Force will one day fly in appreciable numbers. This concept goes beyond the unmanned drones and cruise missiles of today. Uninhabited aircraft, built for speeds and pressures that humans cannot withstand, would be operated remotely from an Execution Control Center in the United States. The study adds, however, that such platforms "will not completely replace the inhabited aircraft for decades, if ever."

Indeed, the continuing role of steadily improving conventional aircraft runs through all manner of less exotic findings. Engine efficiency, for example, might increase by twenty percent, made possible by such factors as changing from mechanical bearings to magnetic or air bearings. The study also looks ahead to airlifters built for low-cost precision airdrop and "point of use delivery." They would deliver, without landing, their cargo to the exact spot where it is needed rather than to a terminal from which it would have to be trucked.

The futurists tell us to expect change on a grand scale. They foresee conflict in which the distinction blurs between threat and asset, between offense and defense, even between ally and enemy. A commercial satellite downlinking images of one-meter accuracy might be either of great value or great danger, depending on the circumstances and on how and by whom the imagery will be used.

The studies thus far indicate that we are driven forward by technology and need on three broad fronts: global awareness, global mobility, and the projection of lethal and sublethal power.

We will gain further insights in the months ahead as other studies are reported out, but one point is clear already. National security and defense strategies of the future will put central reliance on operations in air and space. Critical tasks include the ability to look deep, reach far, respond rapidly, command affairs upon arrival, and apply force with precision and finesse. These are functions performed best—or performed only—by airpower and spacepower. The US Air Force, building on its "Global Reach, Global Power" theme will be on track as the new century unfolds. ■

The Future Of Flight Display Integration Is Here Today.

At Rockwell, we have next generation LCD flight display technology down to a system. A 5 ATI Flight Display System (FDS), that is. In addition to dramatically improving operational capability, our new FDS 255 provides you with unprecedented cockpit and display integration for emerging airspace operations and future growth.

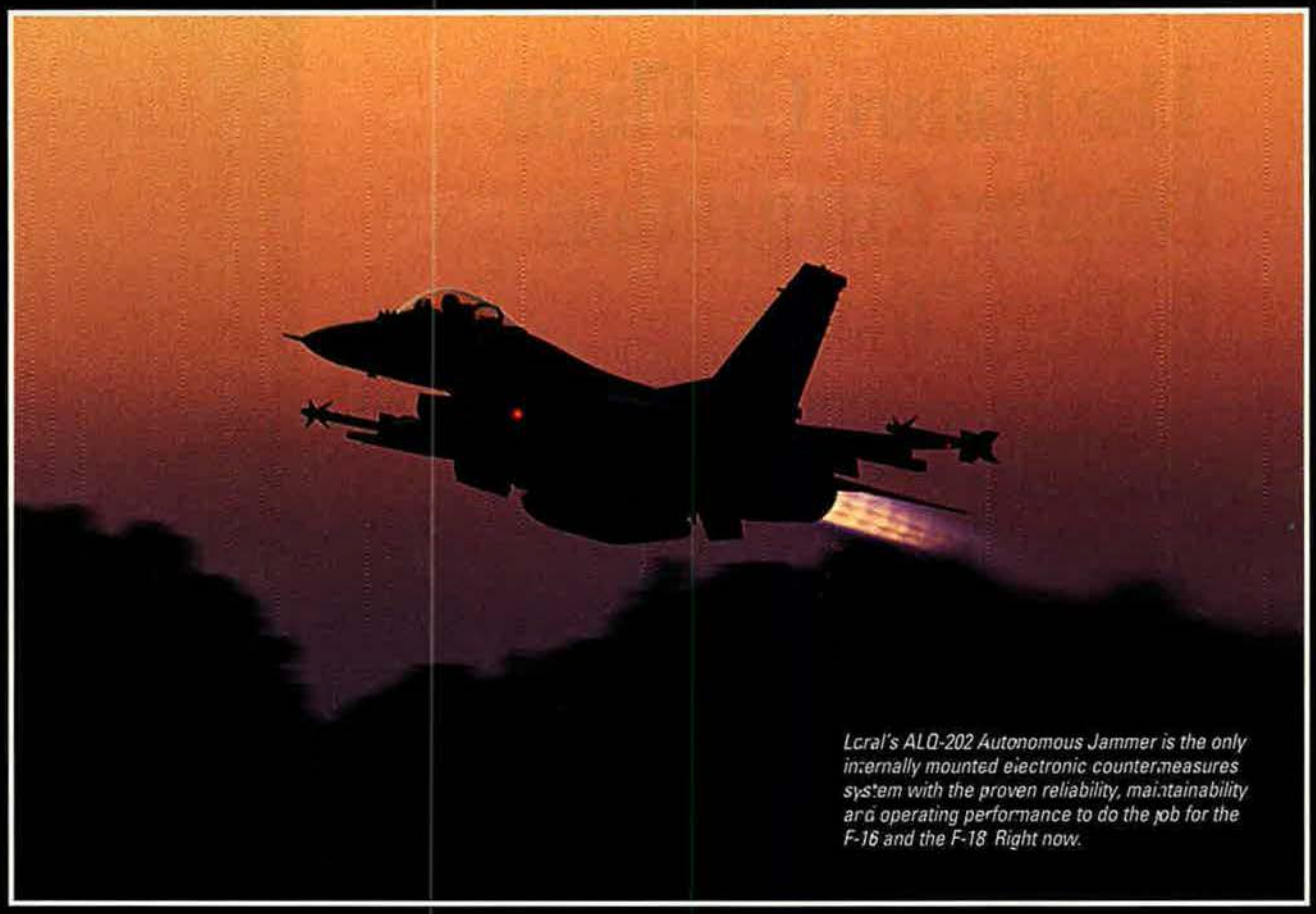
Recently selected for USN P-3 and USAF KC-135 aircraft upgrades, the Collins FDS 255 allows complete interfacing for retrofit and new aircraft. FAA Technical Standard Order (TSO) expected late summer 1996. So get on the cutting edge of next generation aircraft integration. Call us today at (800) 321-2223, (319) 395-5100 or fax (319) 395-4777. Collins Avionics & Communications Division, Rockwell, 350 Collins Road NE, Cedar Rapids, Iowa 52498.

COLLINS
Flight2 Systems™
For the Second Century of Flight

KC-135 illustration is an adaptation of Dru Blair's "Airbridge."

Rockwell Defense Electronics
Collins

NAVIGATION • COMMUNICATIONS • DATA LINKS • FLIGHT MANAGEMENT • DISPLAYS • SYSTEM INTEGRATION



Loral's ALQ-202 Autonomous Jammer is the only internally mounted electronic countermeasures system with the proven reliability, maintainability and operating performance to do the job for the F-16 and the F-18 Right now.

Electronic Combat Systems

Performance is the best strategy.

Our position as a top supplier of electronic combat systems is built on the cutting edge systems we supply for the F-15, F-16, F-18, and other aircraft. It shows itself in an attitude of total commitment. To meeting or beating specs. To living up to the spirit as well as the letter of program support.

Here to stay.

At Loral, our commitment is long term. It runs from bottom to top. And it means you can count on us for the life of the contract. Every contract.

LORAL

Electronic Combat • Training and Simulation Systems • C^3I • Tactical Weapons
Space Systems • Systems Integration • Telecommunications & Information Systems

Letters

A Base-Closure Success Story

"After USAF Leaves" *[December 1995 "The Chart Page," p. 10]* included a chart from a General Accounting Office study on selected Air Force bases identified for closure in the 1988 and 1991 base realignment and closure (BRAC) rounds. The text accompanying the chart would lead one to believe that redevelopment progress has been inadequate and that the government is retaining a large part of the property at these bases. Progress has actually been quite significant, and the affected communities should be commended for their diligence in pursuing reuse of the facilities to create jobs.

The communities report to us that almost sixty percent of the jobs lost to base closure have been replaced at BRAC 1988 and 1991 bases. At least seven of them—Chanute, Pease, Carswell, England, Myrtle Beach, Richards-Gebaur, and Wurtsmith—have replaced all or nearly all of the civilian jobs lost as a result of closure. Several more bases expect to reach that point in the very near future.

A significant amount of the property at the closed bases is in the hands of the communities and available for reuse. More than seventy-five percent of the BRAC 1988 and almost fifty percent of the BRAC 1991 base properties are in some form of reuse (this does not include those properties retained by DoD for continued military use). Even at the BRAC 1993 bases—several of which just closed in September 1995—we are already seeing reuse. One of those bases, K. I. Sawyer AFB, Mich., already has 283 people working at the base. This approaches the 376 civilian jobs lost as a result of closure.

The text also states that the government is retaining property that is environmentally contaminated. This is misleading. The contaminated portion of a base is remediated (*i.e.,* cleaned up) by the government and turned over to the new owners as soon as the cleanup is complete. The Air Force has been working aggressively with federal and state environmental regulators to develop cleanup schedules at each of the bases. More than half of the property at the BRAC 1988, 1991, and 1993 bases is environmentally ready for transfer. Most of the remaining property has been cleaned up enough to allow reuse while fully protecting both human health and the environment. . . .

The conversion process can be tedious and difficult, but the Air Force and the communities have been up to the challenge, and we are seeing positive results. . . .

Rodney A. Coleman
Assistant Secretary of the Air Force, Manpower, Reserve Affairs, Installations, and Environment
Washington, D. C.

Fasten Your Drawstrings

"Horror Weapons" *[January 1996, p. 44]* was very informative. I teach Chemical/Biological Warfare Defense and have already used your magazine to drive home many points during training. However, I have a problem with the photo used in the story. The major depicted in chemical warfare attire is improperly dressed. The drawstring on the hood is unfastened, the arm strap is over the shoulder not under it, and the jacket drawstring is unfastened. To add insult to injury, he has white markings on his helmet and Ground Crew Ensemble, a definite no-no in wartime or training.

Chemical/Biological Warfare Training is no longer an annual requirement in most commands. Field training is relied on to ensure that personnel can survive to operate in a chemical/biological scenario. Pamphlets and pictures are used to jog memories and help the individuals in the field. Your picture counters our efforts.

SSgt. Leonard T. Anzaldua, USAF
Warner Robins, Ga.

Icelandic Achievement

I was disturbed by Roger G. Ferguson's comments about Lt. Gen. Stephen B. Croker *["BUFFs in the 1960s," December 1995 "Letters," p. 5].* His letter was churlish, childish, and disrespectful.

General Croker never denigrated the accomplishments of earlier B-52 crew members, but it is not his job to pump Mr. Ferguson up. Praising past contributions, as praiseworthy as they are, does nothing to enhance the morale and performance of those who fly and fight today.

The single-minded intensity of the men and women of Strategic Air Command (SAC), among whom we find the earlier B-52 aircrews, helped restrain the USSR's imperial ambitions throughout the world. SAC can be justifiably proud of these accomplishments. General Croker's comments, however, are still accurate.

The B-52 today is more capable than it was when Mr. Ferguson was flying it. The engines have been upgraded, the avionics are far superior, and the aircraft carries more types of and more capable munitions. The crews fly a wider variety of missions and are routinely integrated into composite-force battle plans. They practice landing at sites, such as Iceland, that were once only a gleam in the eyes of contingency planners.

Landing a B-52 in Iceland was quite an achievement. It called into question many of the assumptions of SAC's contingency plans. The B-52 is a unique aircraft, and it was difficult to meet its needs on an airfield designed for prop-driven cargo aircraft. We made it work, but it took advance planning. We wouldn't want to do it every day, and we wouldn't want to do it on a moment's notice.

General Croker has been around the block a few times and is, I'm sure,

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

AIR FORCE
PUBLISHED BY THE AIR FORCE ASSOCIATION MAGAZINE

Publisher
John A. Shaud

Editorial

Editor in Chief
John T. Correll

Executive Editor
Robert S. Dudney

Senior Editor
John A. Tirpak

Associate Editors
Suzann Chapman
Tamar A. Mehuron

Contributing Editors
John L. Frisbee
Brian Green
John W. R. Taylor

Managing Editor
Daniel M. Sheehan

Assistant Managing Editor
Frances McKenney

Director of Production
Robert T. Shaughness

Art Director
Guy Aceto

Assistant Art Director
Sherryl Coombs

Research Librarian
Pearlie M. Draughn

Editorial Associates
Heather C. Martin
Wendy Alexis Peddrick

Administrative Assistant
Erica Milkovich

Advertising

Advertising Director
Patricia Teevan
1501 Lee Highway
Arlington, Va. 22209-1198
Tel: 703/247-5800
Telefax: 703/247-5855

Industry Relations Manager
Elizabeth B. Smith • 703/247-5800

US Sales Manager
William Farrell • 708/295-2305
Lake Forest, IL

European Sales Manager
David Harrison • 44-81-698-9456
Kent, England

VBPA Circulation audited by Business Publication Audit

cognizant of the abilities and accomplishments of earlier aircrews. He deserves respect not only because of his experience, rank, and position, but also on a personal level. I'd follow him off a cliff, if he asked. He deserves better than the vitriol that flowed from the pen of Roger Ferguson.

TSgt. Kristofer J. Carlson, USAF
NAS Keflavik, Iceland

Inspirational Spicer

Maj. Gen. Henry R. Spicer was a great inspiration to all of us who came in contact with him *["A Speech Worth Dying For," October 1995, p. 72].*

His nephew, Larry Spicer, was a member of our Pilot Training Class, 57-K, and he asked the General to make the commencement address at our graduation in April 1957.

Despite his busy schedule, General Spicer graciously accepted, and he flew into Webb AFB, Tex., a short time before the scheduled event.

Resplendent in his beribboned Class A summer tans and sporting a flowing mustache, he fidgeted on the dais through a lengthy introduction by our training group commander, a well-meaning but rather unctuous sort. Nearing the end of his introduction, he said, "General Spicer flew into Webb this evening in his F-86 Sabre. The weather was terrible with low ceilings, fog, and drizzle, but it didn't bother him one little bit."

Spicer interrupted him with a raspy growl, "The *hell* it didn't, Charlie!" That effectively ended the introduction, and General Spicer then gave us a rousing speech about our greatest interest at that time, flying. . . .

Lt. Col. Edwin V. Wells, USAF (Ret.)
Brentwood, Tenn.

The Capable Prowler

As an EA-6B Naval Flight Officer who has been fortunate enough to have flown in EF-111s for an exchange tour and with combat time in both the Prowler and the Raven, I must comment on the letters regarding the two aircraft *["Economical EW," January 1996, p. 4].* In an ideal world, we would not only keep both jammers (as well as the F-4G) but also proceed with the major system upgrades originally planned for the planes. Unfortunately, real-world budget limitations constrain us to maintaining only one jammer.

From my vantage point as a member of an aircrew, I believe our services' electronic warfare (EW) needs will still be met with sole reliance on the EA-6B. With all due respect to CMSgt. David E. Smith, the Prowler is more than just "OK." It is not, in Anthony O. Macaluso's words, "sheer folly" to replace the Raven with the Prowler.

The short story is that the Prowler has always been a more sophisticated jammer than the Raven. The Raven's jamming system is basically a repackaging of the third version of the Prowler's, introduced in 1976. In 1984 the Navy introduced the fourth-generation Prowler system, and by 1989 all Prowlers had the more capable equipment. In addition, Prowlers have High-Speed Antiradiation Missile capability and a limited communications jamming capability. The Raven has some airframe advantages over the Prowler, but our forces lose nothing in EW capability with the Prowler as the only radar jamming aircraft in the inventory.

The speed issue is really a non-issue. The Prowler does not need to fly attached with a strike package. Our requirement is to be at jamming position when the strike group needs protection. That is how Ravens were mainly employed during Operation Desert Storm. The Raven's great advantage in that conflict was its tremendous range in comparison with other tactical aircraft.

Making the best of the situation, the Prowler is becoming a true joint asset as USAF crews train to integrate into EA-6B squadrons. The EA-6B will continue to support US forces as it has during the aircraft's very first Vietnam deployments in 1971 and currently, as its crews fly from carriers and out of Aviano AB, Italy, in support of Operation Deny Flight. Our main concern should be what, if anything, will eventually replace the EA-6B—that is the contentious issue.

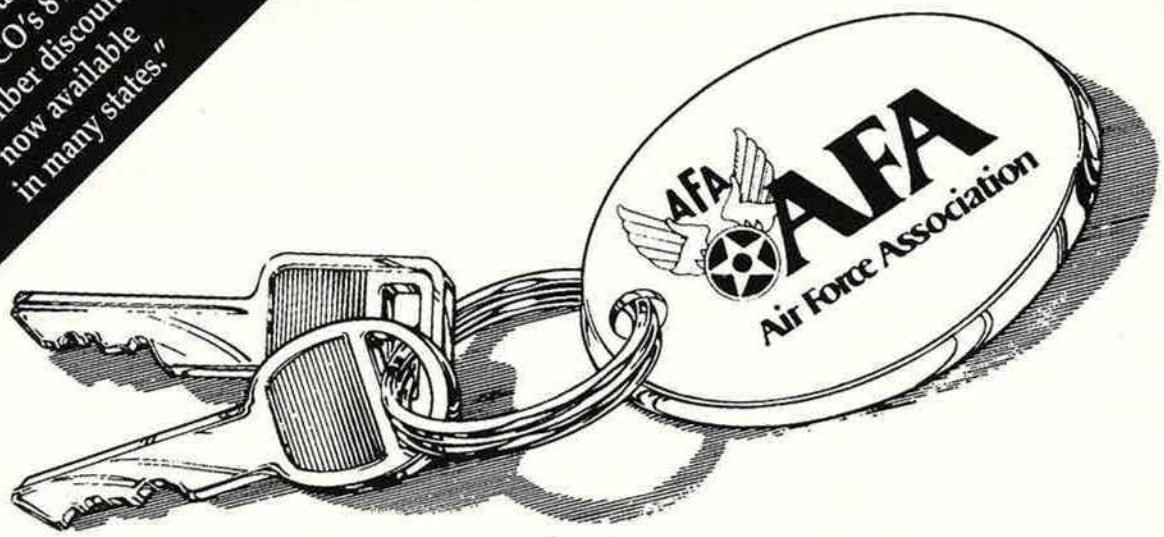
Lt. Cmdr. Fred Drummond, USN
Montgomery, Ala.

WASPs in Houston

Thanks for "Valor" in the November issue *["The WASPs of World War II," p. 37].* I discovered one slight omission: From November 1942 until May 1943, the Women's Flying Training Detachment was located in Houston, Tex., at what is now Hobby Airport. The trainees lived in motels and hotels and were picked up early in the morning in "cattle cars." Poor weather and lack of living quarters caused the move to Avenger Field in Sweetwater, Tex.

Lois Ziler
Dell City, Tex.

"Ask about GEICO's 8% member discount now available in many states."



A Few Good Reasons Why Association Members Should Be Associated With GEICO.

AFA members may save 10-15% or more on car insurance by switching to GEICO. Members with good driving records may qualify for quality, low-cost auto insurance through GEICO. It's an opportunity for you to cut your insurance costs without giving up the excellent service you deserve.

AFA members receive GEICO's round-the-clock service. Whenever you need to make a claim, report an accident, change your coverage or simply ask a question, you can! Just pick up the phone and dial our toll-free number 24 hours a day, 7 days a week, 365 days a year.

AFA members benefit from over 55 years of military experience. Since 1936, GEICO has been nationally recognized for providing quality auto insurance services to military personnel. With offices near most major military bases and a management team that includes several retired military employees, GEICO specializes in meeting the unique needs of the military. Today, over 240,000 active and retired military personnel insure with the GEICO companies.

AFA members get their choice of coverage and payment plans. If you qualify, you'll get coverage tailored to your personal needs and a choice of convenient payment plans to fit your budget.

All it takes is a toll-free phone call. Call 1-800-368-2734 and ask for your free, no-obligation rate quote. Be sure to mention your membership and you'll receive priority processing. If you're accepted, you can arrange for immediate coverage by charging your first premium on your credit card. (Not available in all states.) Call today to discover why so many AFA members are associated with GEICO.

Call 1-800-368-2734

or visit your local GEICO Representative.

GEICO

Serving those who serve the nation.

GEICO Cost Comparison ID #4545

Should you not meet all of the underwriting requirements of Government Employees Insurance Company or GEICO General Insurance Company, you may still qualify for the same quality insurance and service from another GEICO company at somewhat higher rates. GEICO auto insurance is not available in MA or NJ. In PA, this program is offered through GEICO Indemnity Company. These shareholder-owned companies are not affiliated with the U.S. Government. GEICO's pricing for this program is not based on group experience in most states. Home Office: Washington, DC 20076.

Capitol Hill

By Brian Green, Congressional Editor

The Clash on National Missile Defense

The authorization bill finally approved funding for further research but left out the controversial language directing defense of all fifty states.

THE tense political struggle over the Fiscal 1996 Defense Department budget, pitting a Republican-led Congress against the Clinton Administration throughout most of last year, dramatized fundamental disagreements about the value of national missile defenses.

In a defense authorization bill passed in mid-December, Congress included provisions requiring deployment, by 2003, of a ballistic missile defense (BMD) system able to protect all fifty states. It sought to bar US officials from establishing any demarcation between national and theater defenses that could inhibit US research efforts. Further, the legislation declared that the President should not negotiate more limits on BMD development.

President Clinton vetoed the bill, however, stating that he did so largely because he objected to the provisions concerning BMD. He argued that he saw no need to undertake a deployment program aimed at protecting the US from a long-range missile threat because US intelligence "does not foresee" the existence of such a threat "in the coming decade."

The President said the Republican plan would waste "tens of billions of dollars" and would probably violate the 1972 Antiballistic Missile (ABM) Treaty, signed by the US and the former Soviet Union.

Secretary of Defense William Perry recommended the veto. In a letter to House Minority Leader Rep. Richard Gephardt (D-Mo.), he said, "By directing that the NMD [national missile defense] be 'operationally effective' in defending all fifty states, . . . the bill would likely require a multiple-site NMD architecture that cannot be accommodated within the terms of the ABM Treaty as now written."

He added that "by setting US policy on a collision course with the ABM Treaty," the Republicans' bill "puts at risk continued Russian implementation" of the first Strategic Arms Reduction Talks (START) Treaty and Russian ratification of the START II Treaty, both of which limit offensive nuclear arms.

Lawmakers who opposed the bill made the same claims and added a new one—that passage of the bill would stimulate a new arms race between Moscow and Washington. "If Russia is permitted to deploy a defense against such missiles, as it would if the ABM Treaty should collapse, we will end up having to spend a whole lot more for a whole lot less security," asserted Sen. Robert C. Byrd (D–W. Va.).

The ranking Democrat on the Senate Armed Services Committee (SASC), Sen. Sam Nunn of Georgia, criticized the Republicans for specifying a date for deployment of NMD. "The main stumbling block was the insistence of some of the conferees that Congress go beyond language approved by either the Senate or the House and mandate a specific requirement to deploy a national missile defense system by 2003," he contended.

Several opponents cited intelligence studies that forecast a very low probability that new ballistic missile threats to the US will arise over the next decade.

Meanwhile, Congressional Republicans portrayed the missile threat as real and imminent. SASC Chairman Sen. Strom Thurmond (R–S. C.) saw "an existing and expanding threat to the US from ballistic missiles." Others noted recent Chinese missile threats against Taiwan and the US, the spread of sophisticated Russian missile technology, and continued North Korean efforts to develop an intercontinental ballistic missile.

Congressional proponents argued that the bill would not lead inevitably to a breach of the ABM Treaty and would not cost as much as some of its opponents contended. One such supporter was Rep. Curt P. Weldon (R-Pa.), chairman of the Military Research and Development Subcommittee of the House National Security Committee. He noted that the Army and Air Force believe they can deploy a one-site, treaty-compliant BMD system, capable of defending all states, in four years. The services estimate the cost at $2.5 billion to $4 billion.

Sen. Trent Lott (R-Miss.) said that committing to deployment of national missile defenses would have little effect on other arms-control agreements. If Russia does not approve START II, he contended, it "may be because of the Communists and the nationalists who were just elected to their parliamentary body, not because of this missile defense language."

Congressional Republicans also expressed anger at President Clinton for, in their view, failing to negotiate forthrightly. "We have heard the Administration say it tried in good faith to negotiate with us," said Representative Weldon. "I say, 'Hogwash.' "

Participants in the negotiations described concessions made to meet Administration objections. In the end, according to Senator Lott, "the Administration . . . [did] not want the US to be defended at all against ballistic missiles. . . . The Administration's NMD program is designed to perpetuate research and development while indefinitely delaying deployment."

Ultimately, Congress passed—and the President signed—a defense authorization bill with all controversial NMD language (including the fifty-state proviso) expunged. This was preferable to "weakening it to the point of being meaningless," according to HNSC Chairman Rep. Floyd D. Spence (R–S. C.). The $450 million added to the national missile defense accounts was retained in the new measure.

No one believes that the argument ends here. Introduction of new legislation, requiring deployment of NMD without the concessions offered in the vetoed bill, is expected soon. "This is not the end of the fight," Representative Weldon said. "This is the beginning of what promises to be a war in this country, in this session of Congress, on . . . protecting the people of America from missile proliferation and the threat of a rogue attack." ■

WE SALUTE THOSE WHO HELPED GET THE BOSNIAN AIRLIFT OFF THE GROUND.

Lockheed Martin congratulates the men and women involved in the Bosnian peacekeeping mission.

- HQ Air Mobility Command, Scott Air Force Base, IL
- Tanker Airlift Control Center, Scott Air Force Base, IL
- 22nd Air Refueling Wing, McConnell Air Force Base, KS
- 37th Air Logistics Squadron, Ramstein Air Force Base, Germany
- 50th Air Logistics Squadron, Little Rock Air Force Base, AR
- 60th Air Mobility Wing, Travis Air Force Base, CA
- 62nd Airlift Wing, McChord Air Force Base, WA
- 89th Airlift Wing, Andrews Air Force Base, MD
- 92nd Air Refueling Wing, Fairchild Air Force Base, WA
- 305th Air Mobility Wing, McGuire Air Force Base, NJ
- 319th Air Refueling Wing, Grand Forks Air Force Base, ND
- 375th Airlift Wing, Scott Air Force Base, IL
- 436th Airlift Wing, Dover Air Force Base, DE
- 437th Airlift Wing, Charleston Air Force Base, SC
- 615th Air Mobility Operations Group, Travis Air Force Base, CA
- 621st Air Mobility Operations Group, McGuire Air Force Base, NJ
- 621st Air Mobility Support Group, Ramstein Air Base, Germany
- 624th Air Mobility Support Group, Pope Air Force Base, NC

LOCKHEED MARTIN

Mission Success

Aerospace World

By Suzann Chapman, Associate Editor

Geese Caused AWACS Disaster

Pacific Air Forces released accident investigation board findings that confirmed earlier speculation that a flock of geese caused the crash of an E-3B Sentry in Alaska on September 22, 1995.

The Airborne Warning and Control System (AWACS) aircraft's two left-wing engines ingested several Canada geese, according to the official report released January 11.

"The result was an immediate, unconfined, catastrophic failure of the number two engine as well as compressor stalls in the number one engine," the report stated. It added that the E-3 began a "slow left-hand climbing turn, struck a hilly wooded area less than one mile off the departure end of the [Elmendorf AFB] runway and broke apart."

The crash killed all twenty-four crew members and destroyed the aircraft. *[See "AWACS Crash Claims Twenty-Four Lives," November 1995 "Aerospace World," p. 14.]*

What About Human Error?

The report ruled out crew error, stating that "the aircrew did everything humanly possible to fly this aircraft out of an unflyable situation." However, it did note two other factors that "substantially contributed to the accident."

One was the failure of the airfield tower controller to notify the AWACS crew or airfield management about a flock of geese that had been flushed when a C-130, using the same runway, took off just two minutes before the E-3 began its takeoff roll.

The second factor was that the base "lacked an aggressive program to detect and deter" the presence of the large birds and "did not adequately prepare for the migration season."

According to the report, the 3d Wing mistakenly believed its program was sound, based on an Air Force Safety Agency team's July 1995 endorsement of the wing's written plan to handle potential aircraft birdstrike problems.

Since the accident, according to a PACAF release, base officials have stepped up bird-control efforts to include increasing flight-line patrols and installing sound cannons to disperse the birds.

USAF photo by SrA. Kari Olson

Although they form only a small part of the US airlift fleet, C-17s have delivered, as of February 5, about 42.3 percent of the cargo airlifted for Operation Joint Endeavor. Here, SSgt. Christopher Dockery, 17th Airlift Squadron, Charleston AFB, S. C., coordinates offloading of Humvees at Sarajevo Airport.

USAF Drops Below 400,000

For the first time in decades, Air Force strength has dipped below 400,000 troops.

Data released by the Pentagon December 20 showed that USAF active-duty personnel numbered 398,560 on October 31, 1995. The Air Force has shed nearly 210,000 active-duty men and women in the past nine years.

The last time the Air Force ended a fiscal year with fewer than 400,000 troops was in 1948 during its first full year as an independent service. Air Force strength at the end of Fiscal 1948 was 387,730. USAF's postwar strength peaked in 1953 at 977,593.

Current plans call for the Air Force drawdown to bottom out at about 385,000 troops.

Perry Sees Force Structure Going

Defense Secretary William J. Perry will cut force structure further if hoped-for increases in defense spending—as well as anticipated savings from base closings and acquisition reform—don't materialize. Such cuts would also require a change in national strategy, he said.

Secretary Perry told Washington defense reporters on January 24 that the department's five-year defense plan has "embedded in it . . . important increases in modernization" and that "all" of the savings from base closures, amounting to some $10 billion in Fiscal 1997, are earmarked for development and purchase of new

Clearing the Air on More B-2s

The Clinton Suggestion

"I signed this appropriations bill [containing B-2 bomber funds], and I think it was the right decision. . . . You know I have mixed feelings about the B-2. I think it's a good plane, but I don't think we need as many as the Congress wants to build. And I think if we are going to have limited funds, we should do things that we know we need for our long-term planning—like the C-17, another thing that's of real importance to California that I have supported consistently since 1991, that I really believe in. But I signed the bill. There are going to be more B-2s built. . . .

"I think [B-2 supporters in Congress] want to build more than we need, and I think they want to build more than even the Pentagon thinks we need. But there are circumstances under which I could go along with building some more. But it depends on what our overall defense needs are and what the defense budget's going to be—not just this year, but in the outyears, as compared with the other things that we need to do in this country."

President Clinton, in a December 20, 1995, interview with Los Angeles *Times* reporters in Washington, D. C. The bill to which Clinton refers is the Fiscal Year 1996 Defense Appropriations Act, which contains $493 million in new B-2 funds.

The Perry Interpretation

"The extra twenty B-2s, which some have proposed that we buy, will cost us about $30 billion over the life cycle of that program. We have to ask ourselves the question, 'What else could you do with that $30 billion?' We have asked ourselves that question. [Under Secretary of Defense for Acquisition and Technology] Dr. [Paul] Kaminski's bomber modernization study looked precisely at that question. His study makes a compelling argument that, first of all, our bombing needs are met by a fleet of bombers—long-range, short-range, tactical, strategic, some of them stealth, some of them not stealth—and they work in harmony with each other. And, if you're putting more money into that bomber force, the highest payoff for the first $10 billion more comes not from buying more B-2s, it comes from buying more advanced precision weapons, which go on all of our bomber force, not just on our B-2s. I found that argument quite compelling. . . .

"We're building B-2s right now. We've only delivered, I think, nine to this point, out of the twenty. We'll be building B-2s for a couple of years to come. I'm not supporting and the President is not supporting funding that $30 billion for the next twenty B-2s. It's nowhere in our program. And, I might say, implicitly it's not in the Congressional Republican program that has the seven-year balanced budget. There's no way of balancing the budget with a $30 billion B-2 program in there, as I see it."

Defense Secretary William J. Perry, responding to questions posed by John A. Tirpak, senior editor of *Air Force* Magazine, at a January 24, 1996, session of the Defense Writers Group in Washington, D. C.

The White House Leak

"President Clinton has ordered aides to take 'a fresh look' at buying more B-2 bombers, causing fits at the Pentagon, which opposes more of the expensive stealth planes, but the action is certain to boost hopes in California and other key electoral states where the aircraft is made.

"White House officials say the President has not decided to seek more than the twenty bombers already ordered, but his willingness to reconsider the issue comes after three years in which his administration unflinchingly maintained that additional planes were unaffordable and unnecessary."

From the article, "White House May Beef Up Order for B-2 Bombers," published in the February 4, 1996, Washington *Post*.

The Kaminski Confirmation

"We're in a period where there's been some disagreement between the Congress and the Administration on the B-2, [resulting in] the addition of $493 million. With that new fact, any Administration would come back and look at the issue to try to understand and resolve the basis of the disagreement—so we're involved in discussions to do that. But fundamentally, from my perspective, nothing has changed in the underlying foundation of that [previous bomber] study. . . .

"The underlying rationale of the study that I spoke of—the assumptions made and the conclusions—I've not seen anything that would change that basis. . . .

"Those conclusions were that buying additional B-2s would add value, but that there were more cost-effective things to be done with additional funding. For example, it was more cost-effective to weaponize the B-2s that we had rather than to buy new ones. It was also more cost-effective to provide some of the upgrades that were available to us on the B-1 fleet. . . .

"I think from my perspective [the question of whether to buy more B-2s] has been answered, and I don't see anything at the moment that would change the conclusion. . . .

"Yes, [DoD has been asked to participate in a new White House study]. We've had discussions, and we're providing information back as you would expect."

Under Secretary of Defense Paul G. Kaminski, author of DoD's 1995 study on bomber requirements, at a February 5, 1996, Pentagon press briefing.

The White House Decision

"President Clinton met with [his senior advisors] to discuss the National Security Council review of B-2 bomber acquisition options. . . . The Administration believes that no additional B-2s are required and will not include any money for additional B-2s in its Fiscal Year 1997 budget. The Department of Defense will, however, expand an ongoing study . . . to examine tradeoffs [among] long-range bombers, land- and seabased tactical aircraft, and missiles that are used to strike the enemy's rear area."

White House Press Secretary Mike McCurry in a statement issued February 8, 1996.

systems. Success in "reaping the savings from acquisition reform," while difficult to predict, is also being counted on to enrich the modernization accounts.

"We have to get more dollars in the top line to get more into modernization," he asserted.

He then added, "If any of these three assumptions is not met—and this is what I'm concerned about—if we fail in any of those, then we would not be able to have adequate modernization."

If that happens, the Secretary continued, "I would not go back on my priority to [maintain near-term] readiness. I do not think we dare let our modernization go below what we project, and therefore, the only alternative . . . is to cut force structure."

He quickly added that he does not want to cut force structure, because he believes the existing force size is "required" to support the national strategy of being able to fight two nearly simultaneous major regional conflicts.

Asked if he would adjust the military strategy to accommodate a smaller force, Secretary Perry said, "You'd have to."

He said that modernization accounts have been in a "slowdown . . . over the last five years" because the overall shrinkage of the military has permitted retirement of older equip-

ment while remaining units kept the newest and most capable systems.

"But the drawdown in forces is about over now, and so we have to start increasing our modernization in order to preserve long-term readiness," he said.

Pentagon Proposes C-17 Multiyear Buy

The Defense Acquisition Board has recommended multiyear procurement of the C-17 at a maximum production rate of fifteen a year, which would fulfill the planned 120-plane fleet in 2003.

The proposal, which must be approved by Congress, would cut $900 million—five percent—from the price of buying the airplanes at the slower rate of twelve a year and will conclude production nearly two years earlier. Greater efficiencies and lower overhead make the savings possible. The buy would include purchase of C-17 engines, as well.

At fifteen per year, the multiyear buy will bring C-17s in at a cost of $173 million each, in Fiscal 1996 dollars.

The eighty aircraft yet to be purchased would be bought in fiscal years as follows: 1997, eight; 1998, nine; 1999, thirteen; 2000, fifteen; 2001, fifteen; 2002, fifteen; 2003, five.

Pilot Faulted in F-15 Crash

An Air Force investigation into the August 3, 1995, crash of an F-15C in a military operating area about 110 miles east of Eielson AFB, Alaska, revealed that the pilot had maneuvered the aircraft "beyond approved flight standards," according to a January release.

The F-15 was destroyed in the crash, but the pilot ejected safely.

The pilot, Capt. Garth Doty with the 18th Wing at Kadena AB, Japan, "exceeded the maximum angle of attack while using external wing [fuel] tanks, causing the aircraft to spin out of control and crash," the investigating officer concluded in the report. The report also stated that a fuel transfer and weight imbalance problem from the external fuel tanks contributed to the accident.

At the time of the crash, the pilot was participating in attack training during a PACAF Cope Thunder exercise, held several times each year in Alaska.

French Fly Last Provide Promise

A French C-130 flying a humanitarian relief mission into Sarajevo, Bosnia-Hercegovina, on January 9 provided a ceremonial pallet of food to end Operation Provide Promise, the longest-running air supply effort in history.

The operation, which began on July 1, 1992, officially terminated on January 4.

Another French C-130 had initiated the United Nations airlift three-and-one-half years earlier.

Ten minutes before the last aircraft landed, a C-130 from the 37th Airlift Squadron, Ramstein AB, Germany, delivered its last load of supplies. The 37th AS flew more than ninety percent of the US airlift missions, according to USAF Capt. Dub Morris of the Provide Promise Operations Center at Vicenza, Italy.

In all, twenty-one participating nations flew 12,951 sorties—4,597 by US aircraft—bringing in more than 160,000 metric tons of food, medicine, and relief supplies. During some months, eighty-five percent of the city's aid came via the air bridge.

Even in recent weeks, following the peace agreement, combatants on the ground fired on aircraft, including a 37th AS C-130 in late December. Kevlar armor added to the aircraft prevented a small-arms round from penetrating the flight deck, according to a USAF release.

Ninety-three aircraft were fired on, including an Italian transport that was shot down, killing its crew of four.

After 140 missions, the senior loadmaster for the 37th AS, MSgt. Ricky C. Gehris, wondered what history would reveal about the endeavor. He said, "To me it's something most people won't comprehend."

Sergeant Gehris flew the first US mission to land at Sarajevo and the first airdrop mission, which began when landing became too dangerous. He said that, though people were apprehensive at first, they thought it would be just a routine airlift operation. As the operation progressed, he said, things got more hostile—it wasn't routine anymore.

The Sergeant also flew the last US flight. He added, "I never would have guessed it would last this long."

Watch Pilots Lock On Targets

Senior defense officials revealed in early January that US Air Force and Navy pilots helping enforce the UN-sanctioned no-fly and no-drive zones over southern Iraq routinely target Iraqi defense installations.

The news came during a January 7 visit to the Joint Task Force–Southwest Asia (JTF-SWA) by Secretary Perry. He told reporters and task force members that this tactic, more than anything else, gets Saddam Hussein's attention. "He cannot avoid it, he cannot ignore it, he sees it every day."

As reported by the Associated Press, USAF Maj. Gen. Carl E. Franklin, JTF-SWA commander, explained the Operation Southern Watch missions, saying, "Our . . . aircrews fly against targets they would be expected to pursue in our contingency plans." He added, "We do so with the intent of having our force visible to the Iraqi regime so that there is no doubt in their minds as to our resolve."

Coalition airpower provides fifty to 125 sorties daily to enforce the UN operation.

Brig. Gen. Charles D. Burnfield, North Carolina ANG commander, accepted a safety achievement award from Lockheed Martin in December for the 145th Airlift Wing's completion of 100,000 accident-free flying hours in the C-130. The 145th may be the first operational unit to reach this major milestone.

IT'S TIME TO CLEAR THE AIR ON PRECISION STRIKE WEAPONRY.

Precision strike weapons have changed the face of the modern battlefield forever. The ability to target weapons onto the head of a pin has given warriors who have them an overwhelming advantage in any conflict. And the addition of increasingly sensitive GPS-aided guidance systems and radio data links have made these weapons more accurate than ever before.

Unfortunately, increased sensitivity can also lead to increased vulnerability. And our precision strike capabilities are susceptible to RF jamming and interference from a number of sources including intentional high-power jamming, intentional low-power jamming, friendly/mutual interference and benign sources like television transmissions.

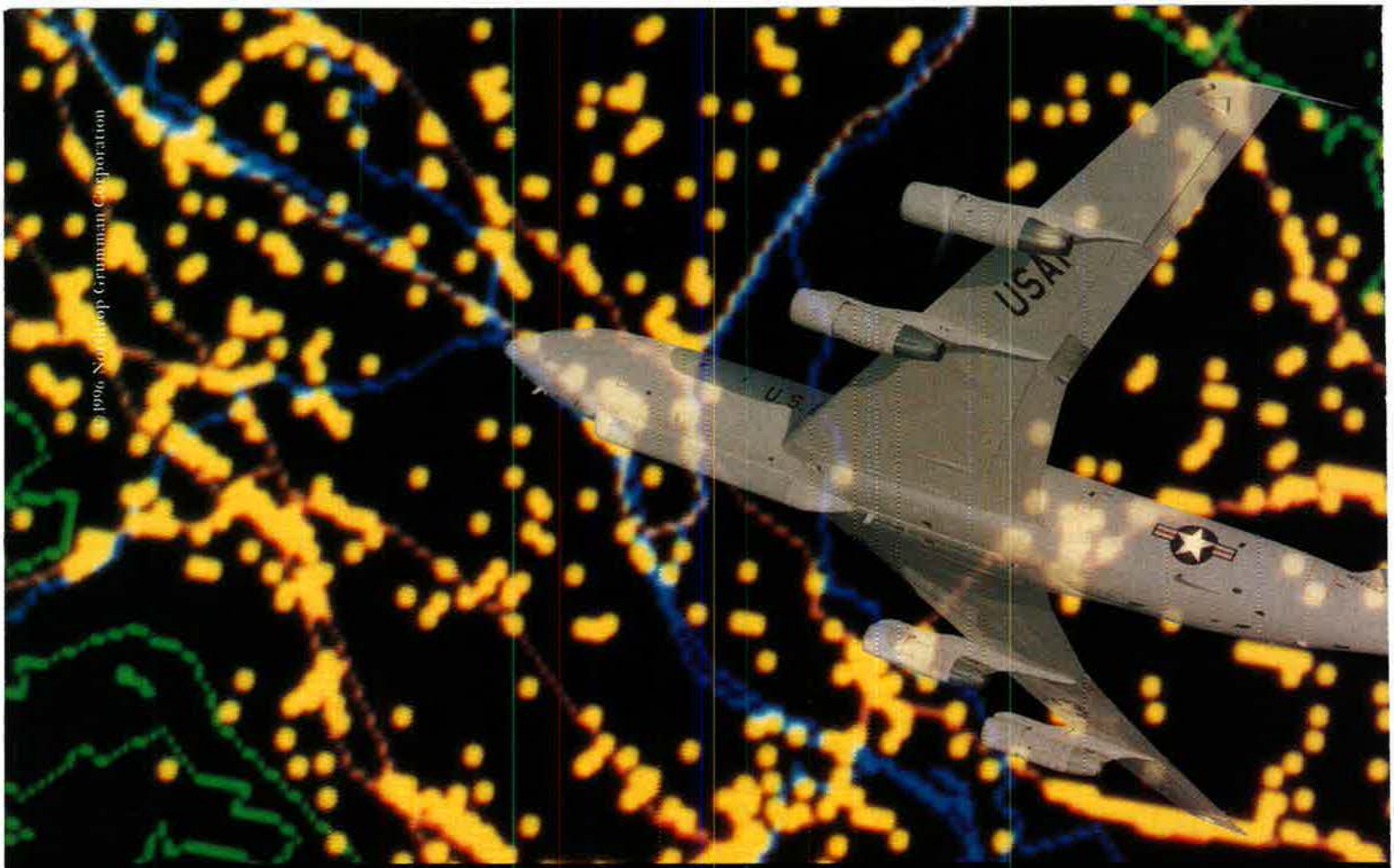
In order to ensure survivability and accuracy of our precision strike weapons on the battlefields of tomorrow, we must provide their GPS and data-link guidance systems with the jam-resistance they need against evolving RF threats today. Magnavox is committed to helping the DoD achieve this goal.

For more information and a copy of the Magnavox White Paper on this subject presented at the 1994 Precision Strike Technology Symposium, contact our Precision Strike Team.

Magnavox
Electronic Systems Company

A LEADER IN ANTI-JAM COMMUNICATIONS AND NAVIGATION

For information, contact Dick Richards at Magnavox Electronic Systems Company, 2829 Maricopa Street, Torrance, CA 90503. Phone (310) 618-1200, Ext.1935 FAX (310) 618-7020



Providing and exploiting unprecedented situational awareness make it one of America's most effective

Following threatening moves made by Iraq in October 1994, pilots are more alert for signs of advancing armored columns, according to a senior JTF officer. The officer said that if the pilots spotted a column in the restricted zone, they could attack it.

Mr. Perry further stated, "We think we won't have to fight because the capability we have here is so impressive that no sane aggressor would challenge it."

Policy Change Masks Degrees

Starting with the 1996 major's board, meeting this month, the Air Force will "mask" the advanced academic degree status of candidates from central selection boards considering line officers for promotion to either captain or major, according to Air Force Chief of Staff Gen. Ronald R. Fogleman. He announced the policy change in a January news release.

In effect, the Air Force will remove the entry that indicates completion or noncompletion of an advanced degree from an officer's selection brief, a summary of personal and career information used by a promotion board during the selection process. However, once the officer comes up for promotion consideration to lieutenant colonel, the information will again be shown in the brief.

Impetus for the change came from responses to the 1995 Quality-of-Life Survey, in which a majority of officers saw factors other than job performance playing too great a role in promotion consideration. General Fogleman noted that when service officials compared career fields, they found "a considerable difference" in timing of completion of advanced degrees.

The new policy, he said, will "level the playing field" across all career fields, some of which "do not enjoy the same opportunity for off-duty education that others do." He specifically mentioned aircraft maintenance, security police, and operators.

He stressed that the policy change does not lessen the importance of degrees but emphasizes completion "at the right time for the right reasons."

No Frocking for Enlisted Troops

During last year's enlisted evaluation system review, some enlisted members suggested that the Air Force should "frock" its enlisted members. The Air Force announced in January that current procedures "best satisfy" service needs.

Based on recommendations from CMSAF David J. Campanale, who worked with top Senior Enlisted Advisors from the Air Force and the other services, the service decided to stick with the present process of pinning on a new rank when the promotion becomes effective, rather than earlier, when selected.

Although General Fogleman noted that frocking provides "instant recognition at the higher grade," he said that the current process ensures that "we don't exceed, or appear to exceed, our grade limits."

USAF Merges SC and IM

The long anticipated merger of the information management (IM) and command, control, communications, and computers (C^4) functions will take place in early 1996, according to a December release. Secretary of the Air Force Sheila E. Widnall approved the merger, creating a new career field called "communications and information," which will retain the current C^4 office symbol of "SC."

The 85,000 officers and enlisted personnel affected by the move will receive additional training. Enlisted personnel will continue testing for promotion in their current Air Force Specialty Codes.

An Air Force statement said that the service is "sensitive to the concerns and anxieties that any merger generates." However, the statement also emphasized the "inseparable relationship" between the two functional areas. "The combination of these disciplines into a single functional area will guarantee that the vision the Air Force has for information dominance will be met."

Just a month earlier, the service had separated three career fields it had merged in 1993. In that case, USAF decided that air traffic control, air weapons control, and operations management were too diverse to be consolidated. *[See "Splitting Command and Control," February 1996 "Aerospace World," p. 20.]*

New Year Brings Ninth B-2

Two 509th Bomb Wing pilots, Maj. Bob Tilson and Capt. Frank Cavuoti, flew the ninth operational B-2 Spirit to its home at Whiteman AFB, Mo., from the Northrop Grumman plant at Palmdale, Calif., on January 11. It was the first bomber delivered in 1996.

Current plans call for Northrop Grumman to produce another eleven B-2s by early 1998. The final number of stealth bombers the Air Force will procure is still in doubt as Congress and the Clinton Administration wrangle over budget issues.

The eight earlier B-2s have all been named after various states, starting with the first, known as *Spirit of Missouri,* which arrived December 17, 1993. The other seven are named for California, Texas, Washington, South Carolina, Kansas, Nebraska, and Georgia, named in December.

AFRES To Share New C-17s

The Air Force Reserve announced December 18 that additional units currently flying C-141 transport at Charleston AFB, S. C., and McChord AFB, Wash., would convert to USAF's newest airlifter, the C-17. The move follows the Defense Acquisition Board's decision to procure eighty additional C-17s and USAF's subsequent decision on where to base them.

The timing of the changeovers depends on delivery of new C-17 aircraft to the active-duty airlift wings at Charleston and McChord. Under the associate program, Reserve personnel at those locations will share the aircraft with their active-duty counterparts, rather than maintaining separate complements of C-17s.

Charleston has the only operational C-17s, which the active-duty 437th Airlift Wing shares with two Reserve 315th AW squadrons. Based on the USAF decision to locate a second active-duty C-17 squadron at Charleston, the 315th plans to convert its two remaining C-141 squadrons to C-17s.

Likewise, USAF's plans to locate two active-duty C-17 squadrons with the 62d AW at McChord led to the Reserve decision to convert its three C-141 associate squadrons, part of the 446th AW, to C-17s.

The Air Force also announced in November that the Air National Guard's 172d Airlift Wing at Jackson, Miss., would receive six C-17s and that the service would establish a training unit at Altus AFB, Okla., with eight C-17s.

Carrier Landings Impress USAF Pilots

Six Air Force instructor pilots now have an "up close and personal" understanding of Navy flying after their exchange visit aboard USS *John F. Kennedy,* off NAS Cecil Field, Fla.

The Air Force IPs from Laughlin AFB, Tex., observed preflight briefings and preparations by Navy student pilots making their first attempts at aircraft carrier landings. They also experienced carrier landings firsthand, flying in the back seat of Navy T-45s.

"The thing I was most impressed with was the accuracy with which the [Navy] pilots had to land on the carrier," said Capt. Max Tipton, an IP with Laughlin's 86th Flying Training Squadron.

Captain Tipton and the other USAF IPs said the visit helped them understand Navy terminology and flying operations. Navy IPs from NAS Kingsville, Fla., had previously visited Laughlin, where they observed Air Force training and flew in T-38s. *[See "Training Together," p. 34.]*

Cold Plus Hot Equals Mission-Ready

Two more new aircraft maintenance training programs produced Mission-Ready Technicians (MRTs) in December. Unlike previous programs in which airmen arrived at their first duty locations as semiskilled apprentices, MRT training develops airmen who can start working on their own immediately.

According to Air Force news releases, six airmen graduated from the first 111-day C-130 crew chief training program December 15 and seven from the first 114-day F-15 program on December 22.

The new-style C-130 MRT program includes ninety-one days of fundamentals and "cold" training—learning the aircraft and its systems in the classroom at Sheppard AFB, Tex. The follow-on "hot," or hands-on, phase features twenty days working on operational C-130s at Little Rock AFB, Ark.

Similarly for the F-15 MRTs, the airmen start at Sheppard with twenty-three days of fundamentals and seventy-three days of "cold" training. They then move to Tyndall AFB, Fla., for another eighteen days of "hot" training on operational F-15s.

With these two courses, the Air Force now has four MRT programs on line. The first two courses to produce MRTs were those for the F-16 and C-141. The first HH-53 helicopter MRTs graduate next month.

Help for Cycle Test

The controversial cycle ergometry program has a new look for 1996, and USAF officials hope it will shift the focus from scores to aerobic fitness.

Air Force Surgeon General officials at Bolling AFB, D. C., announced in late December that the changes would begin January 2, 1996. They include:

- Hiring a trained exercise physiologist at each base—some have already done so—to manage the program, to train people who administer the test, and to help commanders assess repeated failures.
- Eliminating the six categories of performance in favor of a "pass-fail" system, although it will still be necessary to score in category three or higher to pass.
- Centralizing the assessments at base fitness centers.
- Using USAF-developed computer software to let monitors know what actions to take and when to take them.
- Establishing a service-wide standard process for those who fail the assessment, beginning with a retest within one week.

Two years ago, only seventy percent of USAF personnel passed the

Index to Advertisers

F-22 Team photo by John Rossino

In January, Lockheed Martin technicians placed the first of seven F-22 test canopies into a test rig where it will be pressurized then checked for leaks. Program officials will use the canopies later this year to test the F-22's modified ACES II ejection seat.

cycle test, according to the Surgeon General's staff. The most recent figures climbed to eighty percent.

MATT Completes Testing

Bringing near-real-time threat data into a fighter cockpit is a step closer now that tests are over and production of the multimission advanced tactical terminal (MATT) has started, according to Electronic Systems Center (ESC) officials at Hanscom AFB, Mass., in December.

The MATT, a miniaturized, ultra-high-frequency receiver, delivers over-the-horizon threat data using encrypted digital information from national intelligence sources, according to ESC Program Manager John Kasianowicz. He said that during recent field tests the terminal delivered continuous threat updates.

ESC expects to produce 120 MATTs initially, each costing about $150,000. The system will be used on special operations aircraft and, potentially, battle-management aircraft. It has been demonstrated using an F-15 by USAF's Space Warfare Center.

News Notes

■ The President has nominated Maj. Gen. Michael D. McGinty, USAF's director of Personnel Programs, Education, and Training, for a third star. Pending Senate confirmation, General McGinty would replace outgoing Gen. Eugene E. Habiger as the Air Force deputy chief of staff for Personnel. General Habiger is the new commander in chief of US Strategic Command.

■ USAF convened the first wing and group commander screening board in mid-January *[see "First Command Board Meets," January 1996 "Aerospace World," p. 14].* Following the board's selections and the Chief of Staff's approval, major commands then made their choices. The service expects to publish the new commander assignments next month.

■ The *Enola Gay* exhibit at the National Air and Space Museum, which opened June 28, 1995, logged its half-millionth visitor on January 16. As of the end of January, a total of 524,810 had been through the exhibition, which features the B-29 aircraft that dropped the first atomic bomb on Hiroshima in 1945. Two years ago, reports by *Air Force* Magazine and the Air Force Association alerted the public to plans by museum curators to display the *Enola Gay* as a prop in a politicized horror show. The Smithsonian Institution, of which the museum is a part, eventually canceled the flawed exhibit in favor of a straightforward display of the bomber and presentation of factual information. Public response to the revised exhibit has been very favorable.

■ Herbert Anderlik on January 11 became the first foreign employee in Europe to complete fifty years of service with US forces, according to Gen. Richard E. Hawley, US Air Forces in Europe commander, who presented the Czech Republic native with a certificate of service.

■ Columbus AFB, Miss., received $152,753 in restitution in December from Charles Bullock, a contracted housing maintenance site manager found guilty of falsifying government claims. The Air Force Office of Special Investigations uncovered the illegal practices for which Mr. Bullock also received a one-year sentence in a federal penitentiary and a $3,000 fine.

■ The Louisiana Wing, representing the Southwest Region, won the annual National Civil Air Patrol Cadet Competition held at Maxwell AFB, Ala., December 28–29. What began in 1948 as the National Drill Competition has evolved into a match testing knowledge of aerospace facts, leadership, and current events, drill and ceremonies, and physical fitness. The Illinois Wing won second place for the Great Lakes Region, and the Southeast Region won third place.

■ The Defense Base Closure and Realignment Commission closed its doors December 29 after completing its charter—in all, recommending the closure of 243 installations via closure rounds in 1991, 1993, and 1995.

■ Aeronautical Systems Center at Wright-Patterson AFB, Ohio, issued a request for proposal December 14 to upgrade the AT/T-38 avionics and aircrew training devices. The upgraded system will be the T-38C. ASC expects to complete source selection this summer.

■ Northrop Grumman announced January 3 that it had signed an agreement to acquire the defense and electronics systems business of Westinghouse Electric Corp. for $3 billion in cash. Subject to government and regulatory reviews, the companies expect to close the sale this month.

■ On January 8, Lockheed Martin and Loral announced a series of interrelated transactions with an estimated value exceeding $10 billion. These will include combining the companies' defense electronics and system integration businesses, formation of Loral Space and Communications Corp., and purchase by Lockheed Martin of an equity position in Loral Space.

■ Fire destroyed the fitness center at March AFB, Calif., on January 17. Base officials estimate the damage at more than $3 million. The cause is under investigation.

■ DoD began accepting bulk donations from US citizens and organizations for transport to US military units in Bosnia in February. The Defense Logistics Agency is coordinating the program and provides information via a twenty-four-hour recording at (703) 767-5266.

■ Anyone who would like to write to a service member deployed in support of the Bosnian peacekeeping operation may address mail to: Any Service Member, Operation Joint Endeavor, FPO AE 09397. For those aboard ship: Any Service Member,

Operation Joint Endeavor, APO AE 09398. For families in Germany: Any Family Member, Operation Joint Endeavor, APO AE 09399.

■ The Joint Direct Attack Munition Acquisition Team won the 1995 Outstanding Achievement Award for Acquisition Reform and the Air Force Acquisition "Lightning Bolt" Award. JDAM is a joint USAF-Navy program that developed an adverse-weather, accurate guidance kit for 1,000- and 2,000-pound bombs currently in the military inventory for use on the B-1, B-2, B-52, F-15, F-16, F/A-18, F-22, and AV-8B aircraft.

■ Maj. Scott E. Neilson, 304th Rescue Squadron, Portland IAP, Ore., and Maj. Max H. Della Pia, 95th Airlift Squadron, General Mitchell IAP/ARS, Wis., are the first Air Force Reserve representatives serving on Capitol Hill under the Legislative Fellows Program. They will work as Congressional staffers until December 1996.

■ More than 2,000 Tinker AFB, Okla., employees received medals December 11 for their disaster response actions in the Oklahoma City federal building bombing on April 19, 1995. About 1,700 military members received the Humanitarian Service Medal and more than 430 civilians, the Exemplary Civilian Service Medal.

Obituaries

Aviation pioneer **Robert McCulloch** died at home in Dallas, Tex., on November 30 at the age of ninety-two. He worked his way up in the aviation industry and, during World War II, headed North American Aviation production, which built the P-51 at the company's Grand Prairie, Tex., facility. When the plant closed after the war, he reopened it with another former NAA executive, founding the Texas Engineering & Manufacturing Co., later known as Temco Aircraft Co. It evolved into LTV (Ling-Temco-Vought) Corp. Temco Electronics & Missiles Co. became E-Systems. He was named LTV's chairman of the board and CEO in 1961.

Retired **Col. Richard Moody Suter** died suddenly January 11. He was sixty years old. An Air Force fighter pilot for more than twenty-five years, he is perhaps best remembered as the creator and designer of Red Flag, USAF's premier fighter training program, conducted at Nellis AFB, Nev. Air Force Chief of Staff Gen. Ronald R. Fogleman has already stated that the Red Flag Building 201 will be dedicated in Colonel Suter's name.

During his career, he served as an undergraduate pilot training instructor pilot, flew more than 200 Vietnam combat missions, and instructed at Nellis's Fighter Weapons School. Following a tour at the Pentagon, where he conceived Red Flag, Colonel Suter commanded the 555th Fighter Squadron at Luke AFB, Ariz. On his last tour, he created a wargaming center, the Warrior Preparation Center, at Ramstein AB, Germany. USAFE has also proposed that a building at that center be named in his honor. ■

Senior Staff Changes

RETIREMENTS: B/G Dwight M. **Kealoha,** B/G Stephen C. **Mannell,** B/G Floyd K. **Tedrow.**

PROMOTIONS: To be **General:** Eugene E. **Habiger.**

To be **Brigadier General:** Brian A. **Arnold,** John R. **Baker,** Richard T. **Banholzer,** John L. **Barry,** John D. **Becker,** Robert F. **Behler,** Scott C. **Bergren,** Paul L. **Bielowicz,** Franklin J. **Blaisdell,** John S. **Boone,** Clayton G. **Bridges,** John W. **Brooks,** Walter E. L. **Buchanan** III, Carrol H. **Chandler,** John L. **Clay,** Richard A. **Coleman,** Jr., Paul R. **Dordal.**

Michael M. **Dunn,** Thomas F. **Gioconda,** Thomas B. **Goslin,** Jr., Jack R. **Holbein,** Jr., John G. **Jernigan,** Charles L. **Johnson** II, Lawrence D. **Johnston,** Dennis R. **Larsen,** Theodore W. **Lay** II, Fred P. **Lewis,** Stephen R. **Lorenz,** Maurice L. **McFann,** Jr., Timothy J. **McMahon,** John W. **Meincke,** Howard J. **Mitchell,** William A. **Moorman,** Teed M. **Moseley.**

Robert M. **Murdock,** Michael C. **Mushala,** David A. **Nagy,** Wilbert D. **Pearson,** Jr., Timothy A. **Peppe,** Craig P. **Rasmussen,** John F. **Regni,** Victor E. **Renuart,** Jr., Richard V. **Reynolds,** Earnest O. **Robbins** II, Steven A. **Roser,** Mary L. **Saunders,** Glen D. **Shaffer,** James N. **Soligan,** Billy K. **Stewart,** Francis X. **Taylor,** Garry R. **Trexler,** Rodney W. **Wood.**

To be **ANG Major General:** James F. **Brown,** William A. **Henderson,** Timothy J. **Lowenberg,** James **McIntosh,** Melvyn S. **Montano,** Guy S. **Tallent,** Larry R. **Warren.**

To be **ANG Brigadier General:** James H. **Baker,** James H. **Bassham,** Gary A. **Brewington,** William L. **Fleshman,** Allen J. **Henderson,** John E. **Iffland,** Dennis J. **Kerkman,** Paul D. **Knox,** Stephen M. **Koper,** Anthony L. **Liguori,** Carl A. **Lorenzen,** Kenneth W. **Mahon,** Terry A. **Maynard,** Fred L. **Morton,** William H. **Phillips,** Jerry H. **Risher,** Loran C. **Schnaidt,** William J. **Shondel,** Bruce F. **Tuxill.**

CHANGES: B/G David E. Baker, from Vice Dir., Operational Plans and Interoperability, J-7, Jt. Staff, and Dep. Dir., Jt. Staff, Mil. Education, Washington, D. C., to Dep. Dir., National Sys. Support, J-3, Jt. Staff, Washington, D. C. . . . **Col. (B/G selectee) Richard A. Coleman, Jr.,** from Dir., Security Police, ACC, Langley AFB, Va., to Chief, Security Police, Hq. USAF, Washington, D. C., replacing retired B/G Stephen C. Mannell . . . **L/G (Gen. selectee) Eugene E. Habiger,** from DCS/Personnel, Hq. USAF, Washington, D. C., to CINC, Hq. USSTRATCOM, Offutt AFB, Neb. . . . **M/G Michael V. Hayden,** from Special Ass't to the Cmdr., AIA, Kelly AFB, Tex., to Cmdr., AIA, and Dir., Jt. Command and Control Warfare Ctr., Kelly AFB, Tex., replacing M/G John P. Casciano.

B/G Charles R. Henderson, from Spec. Ass't to the Cmdr., 8th AF, ACC, and Cmdr., Combined Task Force, Operation Provide Comfort, USEUCOM, Incirlik AB, Turkey, to Dep. Dir., Operational Requirements, DCS/P&O, Hq. USAF, Washington, D. C., replacing Col. Russell J. Anarde . . . **B/G Donald A. Lamontagne,** from Dep. Dir., Roles and Missions, J-5, Jt. Staff, Washington, D. C., to Commanding Gen., Combined Task Force, Operation Provide Comfort, USEUCOM, Incirlik AB, Turkey, replacing B/G Charles R. Henderson . . . **Col. (B/G selectee) Timothy A. Peppe,** from Cmdr., 47th FTW, AETC, Laughlin AFB, Tex., to Dir., Contingency Ops., 16th AF, USAFE, Vicenza, Italy . . . **Gen. Joseph W. Ralston,** from Cmdr., Hq. ACC, Langley AFB, Va., to Vice Chairman, JCS, Washington, D. C.

SENIOR EXECUTIVE SERVICE CHANGES: W. Wade Adams, to Chief Scientist, Materials, Wright Lab, Hq. AFMC, Wright-Patterson AFB, Ohio . . . **James A. Cunningham,** to Program Dir., Training Systems, ASC, AFMC, Wright-Patterson AFB, Ohio, replacing Dr. Robert R. Barthelemy . . . **David N. Erwin,** to Dir., Occupational and Environmental Health, Armstrong Lab, AFMC, Brooks AFB, Tex., replacing John Mitchell . . . **Robert A. Lach,** to Dir., Centralized Request for Proposal Support Team, Hq. AFMC, Wright-Patterson AFB, Ohio . . . **Kenneth J. Payne,** to Dep. Dir., Requirements, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing Robert A. Lach. ■

THIS IS WHAT SOME PEOPLE MEAN BY FIELD PROVEN.

A LOT OF COMPANIES CLAIM TO HAVE EXPERIENCE IN ATC SURVEILLANCE SYSTEMS.

Unfortunately, most of them got it in places where the air traffic isn't quite as challenging as it is at say, JFK or Chicago O'Hare. Westinghouse, on the other hand, has been supplying the world's most sophisticated ATC radar systems to provide safe air travel throughout the United States for over 25 years. All the while meeting the world's toughest performance requirements—those of our own DoD and FAA. And we've now been selected to provide those same systems to twelve other countries around the world. So as you consider which company is best suited to provide the safest, most reliable solution to your future ATC surveillance needs, remember that real experience counts. And we've got more of it than anybody else.

Westinghouse

For additional information, call 1-800-443-9219.

The world leader in ATC Surveillance Systems.

New World Vistas

The Air Force Scientific Advisory Board explores what the future may hold. The expected changes will be on an epic scale.

By Peter Grier

As THE Air Force prepares for the next century, it must be ready to adapt to technological changes as profound as those the Army experienced in moving from horse to tank and those the Navy faced switching from sail to steam.

The "domain of conflict" may shift from Earth's atmosphere into space—and perhaps into cyberspace. The nation's commercial communications and information systems will become intimately intertwined with military counterparts. Advanced sensors and data processing capabilities will provide commanders unprecedented detail on global conditions.

Stealthy, "uninhabited" combat aircraft could well become significant weapons in the Air Force arsenal.

These are among the principal findings of "New World Vistas: Air and Space Power for the 21st Century," a major new study issued by the USAF

Twelve Vistas Behind "Vistas"

In its New World Vistas study, the USAF Scientific Advisory Board made twelve assumptions. They are:

- The Air Force will have to fight at long distances from the United States. Some operations may be staged directly from the continental United States. Operations may persist for weeks or months, and they must be executed day and night in all weather.
- The site of the next conflict is unknown. The Air Force must be prepared to fight or to conduct mobility or special operations anywhere in the world on short notice.
- Weapons must be highly accurate, must minimize collateral damage, must minimize delivery and acquisition costs, and must enhance—and be enhanced by—aircraft capabilities.
- Platforms that deliver weapons must be lethal and survivable. They must establish air superiority in areas heavily populated with surface-to-air missiles (SAMs), and they must carry the attack to all enemy targets, fixed and mobile.
- Adversaries may be organized national forces or terrorist groups.
- Targets may be fixed or mobile and may be well concealed. Target classes will span the range from personnel to armored vehicles and protected command centers and information systems. Operational geography will range from classical battlefields to cities and jungles.
- Adversary capabilities will steadily improve and will be difficult to anticipate. For example, the Air Force must be prepared to defend against improved SAMs, low-observable aircraft, cruise missiles, directed-energy weapons, and information attack.
- The Air Force must detect and destroy nuclear, biological, and chemical weapons and their production facilities.
- There will be peacetime missions in areas of local conflict. Aircraft must be protected against SAMs and ground fire by means other than offensive attack.
- Increasing the pace of operations increases the effectiveness of all operations.
- Cost will be equal in importance to capability.
- The number of people in the Air Force will decrease. Individual performance must be optimized.

Illustration by Randy Lyhus

Scientific Advisory Board. Commissioned in November 1994 by Sheila E. Widnall, Secretary of the Air Force, and Gen. Ronald R. Fogleman, USAF Chief of Staff, the New World Vistas study strives to identify technologies that could guarantee US air and space superiority for decades to come.

It also attempts to forecast potential force directions at a time of ultrarapid innovation.

"There has never been a period in our country's history when 'swift adaptation to new developments' was more important," wrote Secretary Widnall in a directive launching the study.

The 2,000-page, fifteen-volume report, an executive summary of which was released January 31, was consciously modeled on "Toward New Horizons," a seminal, 1945 technology study produced by the legendary Dr. Theodore von Kármán in response to a request from Gen. of the Army H. H. "Hap" Arnold. The von Kármán work predicted many of the systems and technologies that have appeared in the Air Force in the past fifty years and served as a founding document of the independent Air Force. Air Force officials hope the new paper will prove to be of similar worth.

"Broad, Superior Capabilities"

In a seventy-page summary of their work, the report's authors conclude, "It is appropriate to return to the idea that development of broad superior capabilities through application of new technology will maintain the United States Air Force as the most powerful and effective aerospace force in the world."

One reason to do this is the pace of research into microelectronics and stealth technologies, says the report. That, however, is not the only factor making today a good time to restudy the focus of USAF science and technology efforts, say the authors. They assert that, given the demise of the Soviet Union, the emphasis of USAF technology efforts must change.

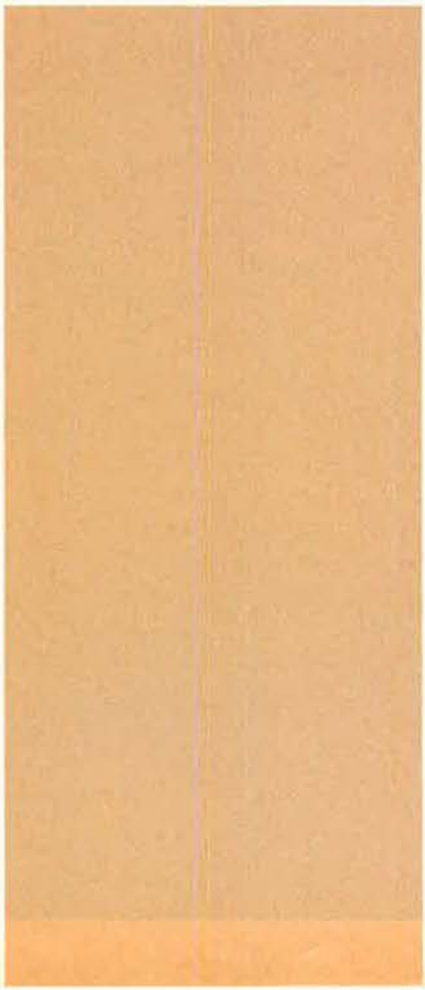
Today the US has no single well-defined enemy, and the global situation makes it difficult to predict threats. Military technology, then, must in the future be able to respond to diverse and rapidly shifting situations—and it must be more cost-effective than it was in the 1970s, 1980s, and 1990s.

The New World Vistas analysts assumed that, in the future, the Air Force will fight far from bases in the continental United States. Furthermore, they assumed that combat aircraft will need highly accurate weapons that minimize collateral damage yet destroy targets that may be mobile or well concealed.

It is likely that the military capability of potential adversaries will improve steadily and be difficult to predict, according to study planners. It is also likely that the Air Force will continue to shrink—meaning more military productivity will have to be squeezed out of every man and woman in the Air Force.

Against this background, the planners anticipate that efficiency will be improved by dramatically picking up the pace of combat operations. The study points out that striking faster and "cycling" the attacks more rapidly will make the force appear larger to an adversary. So, too, will an increase in weapon accuracy, allowing more targets to be struck in a given period of time.

"Because of budget limitations, it is unlikely that we can justify large increases in numbers of aircraft, weapons, or people. Therefore, we will concentrate on technologies [that] increase the apparent force size through increased tempo of operations," write the Vistas' authors.



The future Air Force depicted in Vistas' scenarios shapes up to be far more than a mere evolutionary improvement in today's aircraft and missiles. It is based, instead, on what the authors call "discontinuous change"—quantum leaps in combat power over that provided by current technology.

Evolution, Revolution

The authors maintain, for example, that the Air Force's forthcoming F-22 advanced fighter, while undoubtedly superior to the rest of the world's fighters, will nevertheless provide an evolutionary, not revolutionary, improvement over the current F-15 fighter.

What, in fact, does the study mean by "discontinuous change"? In its view, firearms provided discontinuous improvement over weapons propelled by human power, such as spears and bow-launched arrows. The motorized tank provided a discontinuous change for armies that long had relied on foot power, horse cavalry, and horse-drawn artillery. The arrival of the airplane over the battlefield counts as a discontinuous change.

The Scientific Advisory Board predicts the Air Force could make similar leaps in technology in the near future. These include:

Uninhabited Aircraft. Current unmanned aircraft have limited capabilities, serving either as cruise missiles or as relatively expendable reconnaissance probes. New information technologies, however, are likely to soon allow the creation of uninhabited combat aerial vehicles (UCAVs) flown by pilots who never leave the ground.

The future force is thus likely to be a mix of manned aircraft and UCAVs, according to the advisory board. Unconstrained by the need to accommodate a human body and an ejection seat, UCAVs could provide superior capability for many high-value missions.

Uninhabited aircraft could maneuver beyond the physical limits of human endurance, for instance. Their radar cross section, when compared to that of stealthy manned aircraft, could reduce the effective range of enemy aircraft by a factor of two and area coverage by a factor of four.

"There is the possibility of extending UCAV performance into the hypersonic range to enable strikes from the [continental US] on high-value targets in minutes," according to the Vistas study.

Weapons Projected From Large Airframes. Today, big aircraft serve as bombers, tankers, airlifters, "eyes-in-the-sky" systems, or cruise-missile platforms. In the near future, such airplanes are also likely to play a greater role in tactical engagements.

They will be the first airframes to be outfitted with directed-energy weapons, for instance—something that promises a revolution in air-to-air combat. They may also serve as launch platforms for UCAVs, providing intercontinental standoff capability.

According to advisory board participants, these large aircraft will likely be outfitted with weapon types ranging from inexpensive enhanced weapons without sensors to Global Positioning System–directed weapons with better than one-foot accuracy to microsensor-directed microexplosive systems that kill moving targets using only "grams of explosives."

Extended Airlift Capabilities. While the addition of the C-17 will certainly improve the mobility situation for decades to come, evolutionary improvement in lift capability will not be enough to address US military needs. "Even the addition of the Civil Reserve Air Fleet (CRAF) cannot provide enough airlift capacity for the future," says the Vistas study.

One way to solve the problem might be the development and production of a huge airlifter with a gross takeoff weight of one million pounds. Precision airdrop should also become a routine method of delivering US military equipment and troops. A full airdrop capability could reduce the need for theater infrastructure for both the Air Force and the Army and greatly increase their potential operations tempo.

According to the study, "Worldwide coverage will require aircraft that can fly 12,000 miles, deliver cargo, and return without refueling at the terminal point. . . . Cargo capacity for airlifters of the [next] century should be 150,000 pounds."

Information Technologies. While today's information networks provide an unprecedented picture of operations to Air Force commanders, similar systems of tomorrow promise a giant leap forward in communications ability. Surveillance and reconnaissance will be done worldwide, from commercially owned platforms, while a new ultraprecise Global Positioning System (GPS) will provide improved position and timing information to forces in the field.

"Communication of information and instructions throughout the force will be instantaneous over fiber and satellite networks," predicts the new Scientific Advisory Board report.

The use of "information munitions" against adversaries may also become an essential feature of war. At its most basic, so-called information warfare (IW) actions might use computers and software to fool and destroy enemy data networks. Attacks might occur over the Internet or special communications systems or even through surreptitious action by individuals.

Defensive IW is also likely to become an issue, at least for US corporations, "because of the obvious effects that malicious mischief can have on commerce," say Vistas' authors.

Space Munitions, Brilliant Sensors. The future force will include a mix of weapons, both space- and groundbased, able to shoot photon- and kinetic-energy munitions against enemy space and ground assets. Protection of US space assets and denial of this high ground to an enemy will become essential to military success.

No longer will a fighter aircraft's on-board sensors be its main source of information for combat operations. The future force will likely see a massive proliferation of information sources—from small, distributed satellite constellations to uninhabited reconnaissance aerial vehicles (URAVs) to weapon sensors and groundbased sensors delivered by URAVs.

The power of these new systems will lie in their ability to work together to correlate data automatically and rapidly. One sensor alone gives a necessarily limited view of the battlefield. In the future, many sensors together may provide operators with a complete and instantaneously updated picture of an operational area.

When assembling these building blocks in the Air Force of the next century, service planners will have to keep in mind their affordability as well as their potential performance. The cost of precision guided munitions (PGMs), for instance, might be kept in check by buying reusable close-approach delivery platforms—two UCAVs, perhaps—equipped with on-board electronics to aim relatively inexpensive bombs or missiles.

Operational planning and procurement management may also need to advance along with Air Force hardware. If high-rate operations are to be sustained, military plans must be made and executed in parallel, rather than in series, note Vistas' authors. The rate of commercial development means that for space, communications, and information systems, the time from concept to deployment cannot exceed two years.

"We must demand reduced cycle time in procurement just as we will demand it in execution," says the advisory report.

Technologies produce capabilities. To spark discussion between scientists and warfighters, the New World Vistas study group drew up a short list of capability categories it thought could be logical results of the study's technology vision. The categories are broad for a reason, say Vistas' authors: They are intended not as replacements for today's mission areas but as a means to encourage broad thinking about important problems.

■ **Global Awareness.** To the Scientific Advisory Board, this first capability category means, in essence, that everyone in the Air Force can get whatever operational information they need fast enough for it to be of use, but the technology to acquire it must not be too expensive.

This sounds simple enough, but its implications are enormous. One Air Force goal, according to Vistas' authors, should be to equip every aircraft and planning system with a map of the entire world, accurate to one meter. Using data-compression techniques, this "on-board world" will take up about ten to twenty terabytes of computer memory.

"The 'on-board world' will enable the ultimate in moving-map navigation and self-contained, undetectable, terrain avoidance," says the report.

The foundation of global aware-

ness would be a distributed constellation of 100 to 300 small satellites, linked to ground and airborne sensors.

When planning such a system, says the report, Air Force officials should not use spatial resolution as their sole criterion for judging satellite performance. To keep the constellation affordable, Vistas' authors recommend that the space system provide a less than state-of-the-art continuous ten-meter multispectral resolution.

Satellites should also be able to target radio frequency emitters to within ten meters at all times and carry a synthetic aperture radar (SAR) that provides a one-meter-resolution picture, once per hour. Finally, the global awareness satellites should be able to provide both SAR and multispectral data in submeter resolution, once per day.

The global awareness effort might also include standoff URAVs that loiter some 200 to 300 miles away from an area of interest, snapping its picture with high-resolution staring sensors and SARs. If allowed to overfly enemy territory, URAVs might provide images to within a few centimeters' resolution and sniff for telltale signs of biological or chemical agents. They might also drop tiny ground sensors capable of monitoring the local weather.

URAVs are strong candidates to replace the E-3 Airborne Warning and Control System (AWACS) and E-8 Joint Surveillance and Target Attack Radar System (Joint STARS) aircraft as Air Force surveillance systems of the future, claim Vistas' authors. High-speed processors should enable next-generation systems to exceed current Joint STARS capability by a factor of 1,000 and current AWACS performance by a factor of 10,000.

The Scientific Advisory Board strongly urges the Air Force to develop a new GPS system that has thirty-centimeter spatial accuracy and one-nanosecond timing ability. "Almost all of the processes related to global awareness need precise and absolute positioning and timing," the study notes. They also need a means of data dissemination. Direct-broadcast television will be an important interim technology, say Vistas' authors, but groundbased fiber networks may provide the ultimate answer.

■ **Dynamic Planning and Execution Control.** This second capability entails exploiting information gained through global awareness. Operations tempo cannot be increased unless planning is speeded up. The goal, according to the advisory board, should be to reduce planning time from days to hours or even minutes.

Vistas' authors chose the phrase "execution control" over "battle management" to emphasize that commanders should integrate mobility and attack planning in both war and peace. Speeding up this whole process might require such developments as automatic interpretation of voice commands and automatic translation from one language to another.

"Many situations use highly stylized language, which should be amenable to machine interpretation and translation," says the report.

High-speed parallel computing systems will be needed to make the dynamic planning and execution control system work. Likewise, two-way digital communications for aircraft will be an important part of future warfighting. Improvements over current systems, such as the Joint Tactical Information Distribution System, present a challenge. The Scientific Advisory Board suggests the exploration of digital "gateways" on URAVs or large AWACS-like aircraft.

"We recommend that technologies appropriate for direct satellite links to fighters be explored, but the Air Force should continuously evaluate the cost and utility of direct satellite links compared to links through aircraft," says the study.

■ **Global Mobility.** Whatever the attack capability of the force, mobility can be the limiting factor in many military operations, and mobility remains a problem for the Air Force. Even if CRAF is counted in, system capacity remains short of requirements.

The Scientific Advisory Board's answer: search for improvements independent of the number of mobility carriers. "We seek technologies that reduce the time en route by other methods and that reduce the amount of materiel needed," say Vistas' authors.

That does not mean they do not have a new kind of airlifter to recommend. Future needs will call for an aircraft that can fly 12,000 miles, deliver cargo, and return—without refueling, either in the air or at the terminal point. With a cargo capacity of 150,000 lbs., this behemoth would tip the scales at a million pounds in gross takeoff weight. A big jump in the lift-to-drag ratio of wings, coupled with evolutionary engine improvement and fast-response controls, among other things, could make this giant airlifter possible.

But the Vistas report further points out that major mobility gains can be had through such things as all-weather operation made possible by autolanding systems. In the end, says the report, the Air Force should aim for revolutionary "point-of-use delivery," which combines all-weather operations, improvements in handling equipment, and precision airdrop capability, to produce a true on-demand delivery system for the Army.

Airdrop is now basically an emergency procedure. In the future, Air Force crews should be able to deliver cargo, without landing, to an accuracy of ten to twenty meters, from altitudes up to at least 20,000 feet. A combination of GPS electronics with some kind of steerable parachute system might make this possible.

"The problem of airdrop should be treated as seriously as the problem of bomb drop," insists the Scientific Advisory Board report.

■ **Projection of Lethal and Sublethal Power.** PGMs have already wrought revolutionary change in the projection of airpower—but the Air Force still needs to consider ways to build on that revolution and make PGMs more effective. One such method whose time might be approaching is the UCAV, according to the Vistas report. Improvements in sensors, processors, and information networks may soon make UCAVs possible. The issue may then become one of economics: Which option is more cost-effective, transmitting large amounts of information needed for precision missions to an overworked pilot in a crowded cockpit or simply sending low-bandwidth control information from groundbased pilots to uninhabited aircraft scooting toward targets?

Air Force UCAVs might be flown from a centralized execution control center located in the US and connected to aircraft via massively redundant fiber and satellite commu-

nications routes. The absence of displays, controls, pilots, and support equipment would make UCAVs smaller and cheaper than manned counterparts, according to the Scientific Advisory Board. With the fragile human body removed, they could be made fast and maneuverable enough to simply outfly most air-to-air missiles. Keeping pilots at home would mean they would be well rested, and the number of personnel in-theater would be reduced.

Control technologies for UCAVs are not mature, admit Vistas' authors, but, they add, the Air Force should pursue the design of such vehicles. "It appears logical to begin with cruise missile parameters, such as those of the Advanced Cruise Missile, and then to increase capabilities by scaling," says the study.

For fixed targets, such as command centers and railyards, USAF might consider improving PGMs by reducing their complexity. Removing the sensors currently carried on some expensive bombs and improving aircraft sensors, release mechanisms, and weapon cases could produce accuracy comparable to a rifle bullet's, while saving money. Briefly exposed targets, such as mobile ballistic missile launchers, have long proved difficult to find and hit even with advanced PGMs; the advisory board believes that targeting information supplied by global awareness improvements, combined with the speed of dynamic planning and execution, might go a long way toward solving this problem.

■ **Space Operations.** In the next century, space operations will become increasingly important in military affairs, claim the study's authors. Commercial firms have been operating space communications systems for years, yet the Air Force has not really defined its relationship with the private space sector. Now, says the Scientific Advisory Board, is the time to start.

Currently, the military use of space is limited by the high cost of placing satellites in orbit—around $20,000 per kilogram. As a beginning toward lowering this price, the Air Force should undertake substantial research into the computational design of energetic materials, such as rocket fuel, says the study.

It should also look hard at ways to cut the cost of space vehicle preparation, which can be greater than the cost of the satellite itself. Automated control and monitoring systems should be designed to reduce the number of people in launch and mission control by a factor of ten; electric propulsion might reduce the cost of transfer from low-Earth orbit to geosynchronous orbit.

The US should also be prepared to project force into space, according to the Vistas study, both to protect US and allied space assets and to attack assets that threaten friendly forces. Kinetic antisatellite weapons are complex and expensive to keep ready, while lasers are difficult to direct at orbiting space vehicles. The Vistas' authors recommend development of groundbased directed-energy weapons to attack spacebased threats. They also judge that the benefits of developing low-observable technology to protect US satellites will not be worth the cost.

The authors acknowledge that projecting force from space toward Earth is a politically delicate subject. If it becomes reality, they predict, it will be in the form of groundbased lasers bounced off spacebased relay mirrors.

■ **Air Force Personnel.** Finally, the Scientific Advisory Board points out that increased tempo of operations and reduced force size will require Air Force people to work with their weapon systems more efficiently than ever before.

This advance means there must be improved and specialized training, more extensive use of flight simulators, and greater funding for technical degrees at the master's level. It also means more research into improving the efficiency of human-computer interaction.

Entertainment firms are among the leaders at developing new ways for people to interact with machines. "We urge the Air Force to establish continuing contact as closely as possible with entertainment organizations," says the study.

If the vision of New World Vistas is ever to become a reality, the Air Force will have to take concerted action on many fronts. Global awareness will require new active sensors and methods of signal processing. Global mobility will require new airlifter engine components and next-generation airframe design. UCAVs will not become a reality without greater understanding of the aerodynamics of tiny "micro-air vehicles," while the optics needed for high-power-laser directed-energy weapons are still not well enough understood.

Overall, the Scientific Advisory Board urges the Air Force to invest fifteen percent of its science and technology resources, over the next five years, in new-start projects directly related to New World Vistas' proposed technologies. Such an investment policy "will cause the Air Force to invest in long-term key technologies that are not under the current mandate of immediate short-term pay off," concludes the study. "Such activity will make possible the longer-term view needed to create the quantum leaps in capability in the next century." ■

Peter Grier, Washington bureau chief of the Christian Science Monitor, *is a longtime defense correspondent and regular contributor to* Air Force *Magazine. His most recent article, "ROTC's New Way," appeared in the January 1996 issue.*

USAF has a major role as NATO's implementation force attempts to sustain a fragile peace.

The Air Force in the Balkans

Since 1991, when Yugoslavia began to tear itself apart, international organizations have struggled to halt the violence. The UN and NATO have mounted various operations, both diplomatic and military, aiming to bring peace in Europe's deadliest conflict since 1945. The latest of these—Operation Joint Endeavor—began after Serbs, Croats, and Muslims signed a peace accord in Dayton, Ohio, on November 21, 1995. IFOR's 60,000 troops (20,000 Americans) have been put in place to ensure the fighting does not flare up again.

The Air Force delivers NATO's forces to Bosnia-Hercegovina and protects them once they are in place. This F-16C from the 555th Fighter Squadron, Aviano AB, Italy, is loaded with AIM-9 and AIM-120 missiles and has been fitted with an electronic countermeasures pod to help outwit the SAM threat. Such aircraft on patrol have kept the skies clear of hostile aircraft.

The First Wave of the Balkan Airlift

(December 4, 1995–January 18, 1996)

Aircraft Type	Missions Flown	Passengers Carried	Cargo Hauled (tons)	Fuel Off-Loaded (tons)
C-5	132	2,351	4,795	—
C-17	337	3,166	9,250	—
C-130	490	445	1,542	—
C-141	348	2,392	4,085	—
KC-10	11	114	67	
KC-135	159	25	41	4,769 (combined)
CRAF	28	2,440	1,011	—
Totals	**1,535**	**10,933**	**20,791**	**4,769**

In the early going, Air Mobility Command's lifters and tankers (as well as some C-130s from Air Combat Command and US Air Forces in Europe) provided significant transportation support for Operation Joint Endeavor. "CRAF" means Civil Reserve Air Fleet, a pool of civilian aircraft from which AMC selected 747, 757, L-1011, and DC-8 aircraft for Balkan missions.

USAF photos by MSgt. Rose S. Reynolds

The typically foul Balkan winter hampered airlift at the start of the operation, and some of the first troops had to arrive by truck or bus. The weather cleared, and airlift operations started with a rush. Air Mobility Command C-17s (above right) and C-141s (above left) brought in the thousands of tons of equipment necessary for the operation.

Joint Endeavor also employed C-130s (and KC-10s, KC-135s, and Civil Reserve Air Fleet aircraft) to bring in troops and cargo. This C-130 has just landed at Tuzla, Bosnia.

Among the first USAF personnel to deploy were aerial port squadron personnel, like Sgt. John Allen (left) of the 615th APS, Travis AFB, Calif.

Photo by Gert Kromhout

Though it is not scheduled to achieve initial operational capability until next year, the E-8 Joint Surveillance and Target Attack Radar System aircraft is already a star performer. Its effectiveness at spotting vehicles and troops on the ground prompted Col. Robert Debusek, 4500th Joint STARS Squadron commander, to assert that if any of the factions break the peace accord, "they can't hide."

Deployed Forces (as of February 1, 1996)

Elements of these active-duty, Air Force Reserve, and Air National Guard units *deployed* in support of Operation Joint Endeavor.

Unit and home station	Deployed location
1st Special Operations Support Squadron, *Hurlburt Field, Fla.*	Brindisi, Italy
9th Reconnaissance Wing units and assets, *Beale AFB, Calif.*	Istres, France
16th Special Operations Squadron, *Hurlburt Field, Fla.*	Brindisi, Italy
20th Special Operations Squadron, *Hurlburt Field, Fla.*	Brindisi, Italy
22d Services Squadron, *McConnell AFB, Kan.*	Rhein-Main AB, Germany
23d Aeromedical Evacuation Squadron, *Pope AFB, N. C.*	Aviano AB, Italy; Tuzla, Bosnia
37th Airlift Squadron, *Ramstein AB, Germany*	Ramstein AB, Germany
42d Airborne Command and Control Squadron, *Davis-Monthan AFB, Ariz.*	Aviano AB, Italy
43d Electronic Combat Squadron, *Davis-Monthan AFB, Ariz.*	Aviano AB, Italy
47th Fighter Squadron (AFRES), *Barksdale AFB, La.*	Aviano AB, Italy
48th Security Police Squadron, *RAF Lakenheath, UK*	Tuzla, Bosnia
50th Airlift Squadron, *Little Rock AFB, Ark.*	Ramstein AB, Germany
52d Civil Engineering Squadron, *Spangdahlem AB, Germany*	Tuzla, Bosnia
55th Wing units and assets, *Offutt AFB, Neb.*	RAF Mildenhall, UK
56th Services Squadron, *Luke AFB, Ariz.*	San Vito dei Normanni AB, Italy
60th Civil Engineering Squadron, *Travis AFB, Calif.*	Taszar, Hungary
62d Aerial Port Squadron, *McChord AFB, Wash.*	Sarajevo, Bosnia
76th Space Operations Squadron, *Falcon AFB, Colo.*	Vicenza, Italy
81st Fighter Squadron, *Spangdahlem AB, Germany*	Aviano AB, Italy
86th Security Police Squadron, *Ramstein AB, Germany*	Tuzla, Bosnia
90th Fighter Squadron, *Elmendorf AFB, Alaska*	Aviano AB, Italy
91st Air Refueling Squadron, *Malmstrom AFB, Mont.*	Istres, France
100th Civil Engineering Squadron, *RAF Mildenhall, UK*	Tuzla, Bosnia
175th Fighter Wing (ANG), *Baltimore, Md.*	Aviano AB, Italy
235th Air Traffic Control Flight (ANG), *Fort Wayne IAP, Ind.*	Taszar, Hungary
302d Fighter Squadron (AFRES), *Luke AFB, Ariz.*	Aviano AB, Italy
303d Fighter Squadron (AFRES), *Whiteman AFB, Mo.*	Aviano AB, Italy
344th Air Refueling Squadron, *McConnell AFB, Kan.*	Istres, France
436th Aerial Port Squadron, *Dover AFB, Del.*	Zagreb, Croatia
457th Fighter Squadron (AFRES), *Carswell ARS, Tex.*	Aviano AB, Italy
469th Air Base Squadron, *Rhein-Main AB, Germany*	Rhein-Main AB, Germany
510th Fighter Squadron, *Aviano AB, Italy*	Aviano AB, Italy
555th Fighter Squadron, *Aviano AB, Italy*	Aviano AB, Italy
615th Aerial Port Squadron, *Travis AFB, Calif.*	Rhein-Main AB, Germany
615th Air Mobility Communications Squadron, *Travis AFB, Calif.*	Taszar, Hungary
621st Aerial Port Squadron, *McGuire AFB, N. J.*	Tuzla, Bosnia
823d Civil Engineering Squadron, *Hurlburt Field, Fla.*	Tuzla, Bosnia
4500th Joint STARS Squadron, *Melbourne, Fla.*	Rhein-Main AB, Germany

According to the Air Force, a unit is considered "deployed" if it has been placed under the operational control of the commander in the area of responsibility.

Supporting Forces (as of February 1, 1996)

Elements of these units support Operation Joint Endeavor on *a mission-by-mission basis.*

Active-Duty

Headquarters, Air Mobility Command	Scott AFB, Ill.
Tanker Airlift Control Center	Scott AFB, Ill.
22d Air Refueling Wing	McConnell AFB, Kan.
60th Air Mobility Wing	Travis AFB, Calif.
62d Airlift Wing	McChord AFB, Wash.
86th Airlift Wing	Ramstein AB, Germany
89th Airlift Wing	Andrews AFB, Md.
92d Air Refueling Wing	Fairchild AFB, Wash.
305th Air Mobility Wing	McGuire AFB, N. J.
319th Air Refueling Wing	Grand Forks AFB, N. D.
375th Airlift Wing	Scott AFB, Ill.
436th Airlift Wing	Dover AFB, Del.
437th Airlift Wing	Charleston AFB, S. C.
615th Air Mobility Operations Group	Travis AFB, Calif.
621st Air Mobility Operations Group	McGuire AFB, N. J.
621st Air Mobility Support Group	Ramstein AB, Germany
624th Air Mobility Support Group	Pope AFB, N. C.

Air Force Reserve

315th Airlift Wing	Charleston AFB, S. C.
349th Air Mobility Wing	Travis AFB, Calif.
433d Airlift Wing	Kelly AFB, Tex.
434th Air Refueling Wing	Grissom ARB, Ind.
439th Airlift Wing	Westover ARB, Mass.
445th Airlift Wing	Wright-Patterson AFB, Ohio
446th Airlift Wing	McChord AFB, Wash.
452d Air Mobility Wing	March AFB, Calif.
459th Airlift Wing	Andrews AFB, Md.
507th Air Refueling Wing	Tinker AFB, Okla.
512th Airlift Wing	Dover AFB, Del.
514th Air Mobility Wing	McGuire AFB, N. J.
916th Air Refueling Wing	Seymour Johnson AFB, N. C.
927th Air Refueling Wing	Selfridge ANGB, Mich.
931st Air Refueling Group	McConnell AFB, Kan.
940th Air Refueling Wing	McClellan AFB, Calif.

Air National Guard

101st Air Refueling Wing	Bangor IAP, Me.
105th Airlift Wing	Stewart IAP, N. Y.
107th Air Refueling Wing	Niagara Falls IAP/ARS, N. Y.
108th Air Refueling Wing	McGuire AFB, N. J.
126th Air Refueling Wing	O'Hare IAP/ARS, Ill.
128th Air Refueling Wing	General Mitchell IAP/ARS, Wis.
134th Air Refueling Wing	McGhee Tyson Airport, Tenn.
141st Air Refueling Wing	Fairchild AFB, Wash.
151st Air Refueling Wing	Salt Lake City IAP, Utah
155th Air Refueling Wing	Lincoln MAP, Neb.
157th Air Refueling Wing	Pease ANGB, N. H.
161st Air Refueling Wing	Sky Harbor IAP, Ariz.
163d Air Refueling Wing	March AFB, Calif.
164th Airlift Wing	Memphis IAP, Tenn.
171st Air Refueling Wing	Pittsburgh IAP/ARS, Pa.
172d Airlift Wing	Allen C. Thompson Field, Miss.
186th Air Refueling Wing	Key Field, Miss.
190th Air Refueling Wing	Forbes Field, Kan.

This list contains only Air Force units. Many Air Force individuals have taken part in the operation as augmentees. Moreover, the list contains only the initial or primary deployed locations. Many units have operated from multiple sites.

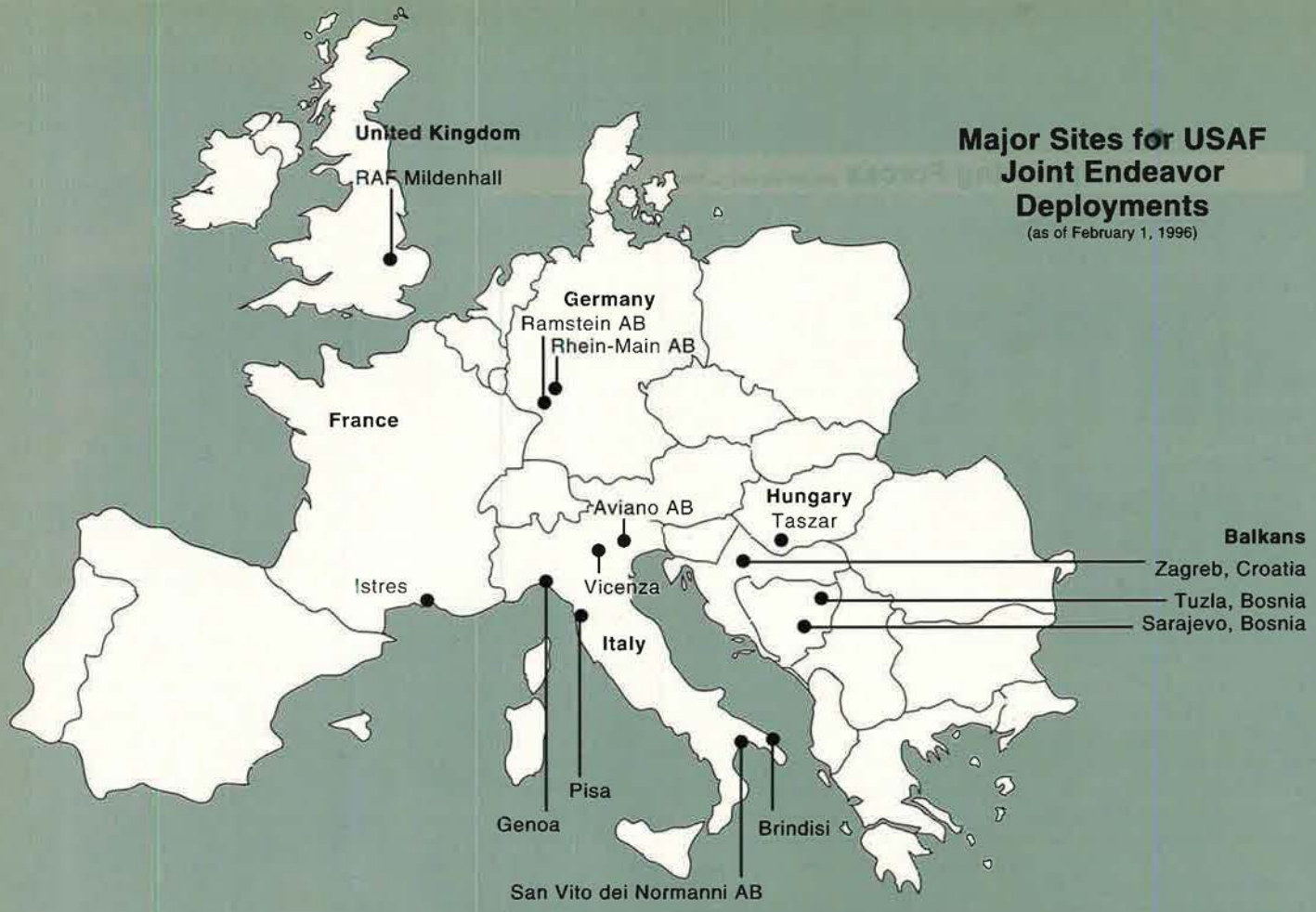
USAF photo by Amn. Sonny Cohrs

Landmines and snipers are major concerns for the deployed troops. Above, A1C Timothy Bulger of the 48th Security Police Squadron, RAF Lakenheath, UK, patrols the air base perimeter at Tuzla. Below, SSgt. Christopher Dockery, a C-17 crew chief from Charleston AFB, S. C., dons his flak vest just prior to touchdown in the Bosnian capital, Sarajevo.

USAF photo by SrA. Kari Olson

Major Sites for USAF Joint Endeavor Deployments

(as of February 1, 1996)



Major USAF Systems Deployed

(as of February 1, 1996)

Fighter/Attack
A/OA-10
F-15E
F-16
Electronic Warfare
EC-130H Compass Call
Reconnaissance/Surveillance
U-2
RC-135
C³I/Battle Management
EC-130E ABCCC
E-8 Joint STARS
Aerial Refueling
KC-10
KC-135
Medical Lift
C-9
Tactical Airlift
C-130
Strategic Airlift
C-5
C-17
C-141
Special Operations
AC-130H
MH-53J
HC-130P/N
Spacecraft
GPS
DMSP
Milstar
DSCS
Others

USAF photo by MSgt. Rose S. Reynolds

It would be charitable to call Tuzla and some of the other Balkan bases "austere." Such units as the 823d Civil Engineering Squadron RED HORSE of Hurlburt Field, Fla., had to work furiously to achieve some semblance of comfort for the arriving troops—a far cry from recent major deployments to Haiti and Kuwait, where subzero temperatures were the least of their worries.

USAF photo by TSgt. James Bowman

Some ANG and AFRES units deployed to Europe with their A-10s and OA-10s to be ready to provide close air support to the troops on the ground. ANG's 175th Fighter Wing, and the Reserve's 47th and 303d Fighter Squadrons brought their aircraft to Aviano AB, Italy (above), less than an hour away from Bosnia as the "Warthog" flies.

AP photo by Robert King

USAF's special operations assets have turned out in force for the peacekeeping mission. Above, a MH-53 Pave Low gets a jolt of fuel from an HC-130 tanker over the Adriatic.

USAF photos by MSgt. Rose S. Reynolds

C-130 Hercules loadmaster TSgt. Douglas Sanders of the 37th Airlift Squadron accompanies another load of supplies to Tuzla from Ramstein AB, Germany. ■

Valor

By John L. Frisbee, Contributing Editor

Operation Varsity

A small contingent of Air Force officers played a unique role in the final defeat of Nazi Germany.

On the morning of March 24, 1945, an enormous air armada crossed the Rhein River near Wesel in western Germany. The column, two-and-a-half hours long, consisted of more than 1,500 IX Troop Carrier Command airplanes and gliders. To their left were about 1,200 RAF airplanes and gliders. The entire assemblage was supported by 880 US and RAF fighters. This was Operation Varsity, the airborne support for the US Ninth and British Second Armies' crossing of the Rhein.

Varsity was unique not only in magnitude. Three weeks before D-Day, Maj. Gen. William M. Miley, commander of the Army's 17th Airborne Division, briefed the glider operations officers of the 53d Troop Carrier Wing's five groups on the impending operation. His 194th Glider Infantry Regiment needed one more infantry company to carry out its assignment. He asked for one of the troop carrier groups to provide that company, to be made up of glider pilots after they had landed in their designated zones. It would be an all-officer company, maybe the first in the history of modern warfare. Capt. Charles O. Gordon, glider operations officer of the 435th Troop Carrier Group, accepted this unusual assignment. He was to become commander of the provisional company. Personnel of the 194th Regiment trained his glider pilots for two weeks in infantry tactics and weapons.

The vast majority of the glider pilots were second lieutenants or flight officers. None had ever expected to serve as infantry, but they accepted that duty enthusiastically. These men were organized into four platoons, one for each of the group's squadrons. Most squad leaders were second lieutenants. They were to assist the 17th Airborne Division in securing a designated area northeast of Wesel, establish roadblocks, and make contact with British forces northeast of the town. For the first time, each of the 435th's C-47s would be towing two gliders; and, for the first time, their landing zones would not have been secured by paratroopers.

When the 435th's 144 gliders, loaded with airborne infantry and equipment, cut loose over the landing area, they came under heavy ground fire with substantial casualties among the infantry and glider crews. Once on the ground, they continued to be hit by sniper and mortar fire that had to be subdued before they could move to their assigned area of two crossroads—one that would earn the name "Burp Gun Corner." There they cleared several houses, taking a large number of prisoners before digging in for the night.

Several times, small groups of German soldiers attempted to infiltrate their defensive positions but were driven off in a series of firefights. The defenders knew that German troops, retreating ahead of British forces, would attempt to overrun their position, probably supported by armor and mobile guns. The ground held by the glider pilots was at the top of a ridge, the country sloping away toward Wesel, the direction from which an enemy attack would come. The reverse slope would allow enemy forces to advance almost to the 435th's area before coming under fire.

About midnight, the first attack by a German tank, supported by a large number of infantry, hit the crossroad defended by the 75th Platoon. They came under heavy fire and retreated. Thirty minutes later, a German tank and approximately 200 German infantry, supported by two 20-mm flak guns, attacked the position defended by the 77th Platoon. As soon as the enemy troops were in close range, the glider pilots of that platoon, where the attack was concentrated, opened fire. Small-arms fire took a heavy toll on enemy infantry during the hour-long battle.

Flight Officers Chester Deshurley and Albert Hurley held their positions, firing their machine guns until the tank came within fifteen yards of them, as did Flight Officer Robert Campbell, armed with a tommy gun. At that point, Flight Officer Elbert Jella severely damaged the tank with his bazooka. The retreating tank ran over one of its flak guns; the other was captured by the glider pilots.

At daybreak, the glider pilots defeated several smaller attacks and joined up with British forces coming out of Wesel. Their job was done with the professionalism of veteran infantry troops. They soon were relieved from further duty as ground soldiers. Overall, they suffered thirty-one casualties in the operation, killed a large number of enemy troops, and captured several hundred prisoners.

"The Battle of Burp Gun Corner," a unique event in Air Force history, was covered by *Stars and Stripes* but then slipped into obscurity. In March 1995, Air Force Chief of Staff Gen. Ronald R. Fogleman learned from retired Maj. Charles Gordon of the heroic actions of these glider pilots turned infantry and directed that appropriate awards be made to those who took part in the fighting. At the 435th Troop Carrier Reunion in October 1995, Flight Officers Jella, Deshurley, Campbell, and Hurley each were awarded the Silver Star. All others who fought in the battle were awarded the Bronze Star, but many of those more than 280 men had died before their heroism was recognized. ■

Thanks to Maj. Charles Gordon, USAF (Ret.), author of "Crossing the Rhine With the 17th Airborne," a detailed report on this 435th Troop Carrier Group operation, and to retired Col. Phillip Rawlins, who, as a major, had commanded the 77th Troop Carrier Squadron.

TO THE AIR FORCE AND NAVY TEAM THAT SELECTED THE BEECH MK II AS THEIR PRIMARY TRAINER, WE THANK YOU. TO THE STUDENT PILOTS WHO WILL FLY THE WORLD'S BEST TRAINER, WE ENVY YOU.

Our win in the competition for the Joint Primary Aircraft Training System (JPATS) demonstrates one thing very clearly, Raytheon Aircraft's continuing leadership in the highly competitive aerospace market. But what is more important, by selecting the Beech Mk II as their primary trainer, the US Navy and US Air Force have provided their students with the best possible training environment, and their instructors with the best possible aircraft. We are extremely grateful for this trust and honor, and look forward to a rewarding partnership.

❖

Raytheon Aircraft

Beech
Hawker

Air Force and Navy student pilots win their wings side by side in consolidated primary flight training.

Training Together

By John A. Tirpak, Senior Editor

Photos by Randy Jolly

Learning how "the other guys" train their flyers is an ideal way to develop "better fighting skills in the battlespace," say officials from the joint USAF-Navy pilot training program. For now, the primary aircraft used in the program are USAF's T-37 Tweet (opposite) and the Navy's T-34 Mentor (above).

GREEN flight suits tend to look alike, especially at a distance. Look more closely, however, at the pilots and trainees at NAS Whiting Field, Fla., and you will see Air Force silver wings on some flight instructors and on the skipper of the Navy's training squadron VT-3.

Then go to the Air Force's 35th Flying Training Squadron at Reese AFB, Tex. The commander wears the gold wings of a naval aviator, as do some of the instructors. Some of the students are Navy ensigns.

This is not a mere exchange program. The flyers in these two squadrons constitute the first wave of a consolidated primary flight instruction system for the Air Force and Navy. The 35th FTS and VT-3 are prototype units for the system. Eventually, such units will provide a common, eighty-nine-hour, basic course for student pilots. After taking the basic course, aircrews will get specific training to learn the special skills needed for their service's mission.

Unlike most of the "jointness" initiatives launched since the defense drawdown started in earnest five years ago, the joint flight training program is not aimed primarily at saving money or consolidating force structure. Rather, the goal is to generate operational benefits; the Pentagon sees an advantage in having pilots who are well versed in how "the other guys" do business in airplanes.

"The goal is better fighting skills in the battlespace," explained Maj. Gen. Donald L. Peterson, director of


CAUTION:
DANGER
THIS AIRPLANE CONTAINS EJECTION SEATS, CANOPY REMOVERS AND EXPLOSIVE CHARGES. SEE T.O.-2 FOR INSTRUCTIONS.
MANUAL CANOPY OPERATION

Photo by Randy Jolly

Both this T-37 and its home base, Reese AFB, Tex., are not long for the Air Force. The T-37 will be replaced by the JPATS aircraft shortly after the turn of the century, and Reese turned up on the 1995 base realignment and closure list.

Plans and Operations for USAF's Air Education and Training Command (AETC), Randolph AFB, Tex.

General Peterson added, "The lessons we learned from [Operation] Desert Storm—in the cooperation between ourselves and our allies—made us believers" in the value and necessity of bringing jointness all the way down to primary aircrew training. "I was in fighters in the Pacific and in Europe," he said, "and it was clear to me that we had more commonality with our allies than with our own sister service. This will help bring us closer together."

"Grow Up Together"

Since the 1991 Persian Gulf War, the Defense Department has conducted two analyses of the roles and missions of the armed services, and both ended up recommending further consolidation of fixed-wing pilot training. The steps were strongly recommended as a means of promoting an "intimacy with other-service procedures and techniques," General Peterson said.

The student pilots "grow up together and learn to fight together," he noted. "In many cases, an Air Force officer with very little active duty will spend his entire first assignment . . . with the Navy. So he will understand the sister service's techniques, culture, and institution very well."

The effect spreads "beyond the lieutenants and ensigns," General Peterson continued. "Planning this out has brought us a lot closer [to] the Navy. There have been a lot of good ideas on both sides."

Though the goal is to create a common undergraduate pilot training (UPT) program, General Peterson emphasized that the objective is not to homogenize the services, or the culture of military aviation, but to strengthen mutual understanding and draw the best methods from both.

Capt. F. Brown Word, the Navy liaison officer to AETC, said good ideas have already been picked up through the cross-training.

For example, said Captain Word, "the Navy likes the strong commitment in the Air Force to standardization" of flight instruction. "We like the way the Air Force grades [student pilots]," he went on. "It's very objective grading and gives a better picture of how a student progresses. We've taken that [lesson] away from this already."

He believes that, on their side, "the Air Force folks are seeing ways to be more flexible and less lockstep in their methodology. They are bringing more flexibility to their approach" to instruction, he said. "We've learned there are pluses to each system."

Navy and Air Force officials spent two years studying their services' basic flight instruction requirements and writing a joint training syllabus acceptable to both. The Air Force had separate screening and training programs, and the training element was in two parts—primary and advanced. The Navy's single program included screening, as well as an "intermediate" phase. The joint syllabus is still evolving as experience is gained with each class and with each of the two primary aircraft, USAF's T-37 Tweet and the Navy's T-34 Mentor.

"The joint syllabus is a little closer to [that of] the T-37 than [that of] the T-34," a program officer observed, "but they were pretty close to begin with."

Photo by Randy Jolly

As the joint syllabus develops, students and instructors at the 35th Flying Training Squadron at Reese (above) and VT-3 at NAS Whiting Field, Fla., glean valuable concepts from each service's methods and culture.

Two Ways of Winnowing

While the Navy screens its pilot candidates in its early T-34 instruction phase, the Air Force uses the T-3A Firefly to weed out those not likely to succeed. "The Navy tries to teach flying skills and build on them . . . right away," noted the program officer. "The Air Force doesn't do that. The Firefly is not a trainer. We use it to find out who the right people are to send on to flying training. . . . It reduces attrition in the more expensive airplane."

The first pilots have come through the joint primary program. Compared to those pilots on the regular pilot training track, they are doing "equally well," General Peterson said.

Syllabus development has been going on in concert with the development of the Joint Primary Aircraft Training System. Plans call for JPATS to provide common hardware and courseware to complement the common flying schoolhouse.

The centerpiece of the JPATS program is the aircraft, which will replace the Navy's T-34 turboprop and USAF's T-37. Raytheon's Beech Aircraft Division won the JPATS competition last June with its variant of the Swiss Pilatus PC-9, called the Beech Mk. II. The company will serve as the aircraft producer and system integrator. Protests of the award by Rockwell and Cessna were resolved last month, clearing the way to award Beech the contract for what ultimately will be a $7 billion program. Plans call for 372 planes for USAF and 339 for the Navy.

Beech will be the "single point of contact" with the government for all JPATS procurement and as system integrator will choose a subcontractor to supply what is known as the Groundbased Training System. The company expects to award a GBTS contract—covering simulators, course materials, and all other training aids—sometime this fall.

Barring any program delays, the first JPATS-equipped USAF squadron will begin operations in 2001. The first such Navy squadron will begin in 2003. The final Air Force squadron will be equipped in 2011, and the Navy's in 2017.

Initially, delivery of the aircraft was to be the pacing factor for the speed at which the services converted squadrons to joint status. Thus far, however, the joint program has worked so well that the pace will be accelerated, regardless of the JPATS delivery schedule, General Peterson said.

Staff photo by Guy Aceto

Before USAF begins training its flyers, it sends them up in the T-3 Firefly (above) to determine which candidates are likely to succeed as pilots. This "reduces attrition in the more expensive airplane," says one program officer.

The T-37, he said, is "working well" in the new joint training operation, adding, "We don't have to wait for JPATS" to convert units. Likewise, despite its advanced age, the Navy's T-34 can handle the requirements of the program until it is relieved by JPATS.

Greater Optimism

General Peterson said that the T-37 will last until it is replaced by the JPATS airplane "without too many" modifications. It may need some structural enhancement, but an avionics overhaul or engine change is not deemed necessary to get it to last another fourteen years.

This prediction is considerably more optimistic than the Air Force's projections during the 1980s, when the service was trying to convince Congress to fund the T-46. That aircraft program was canceled as a result of technical and budget problems.

By 1998, the Air Force and Navy will be exchanging roughly 200 students annually, according to current service plans. Though that is "not a small number," a program official said, "it means that a lot of pilots are going to be trained strictly within their own service as this progresses. . . . We are doing this gradually, and the joint experience will begin to be more common among the operational crews."

The JPATS aircraft will enable students from the Navy and Air Force to receive nearly identical training, and this will yield cost savings as logistics and support tails are consolidated. The JPATS aircraft is also expected to be cheaper to operate per flying hour than the mix of aircraft now used. Thus, even though saving money wasn't a primary aim of the joint program, it's a "good by-product," General Peterson said.

He also noted that working with the Navy on the JPATS aircraft selection—making sure that the aircraft picked would serve the purposes of both services—was a valuable exercise in itself.

"The requirements and plans came together on JPATS," General Peterson said. "We built a relationship, . . . and it was a good lesson for us all."

The transition to JPATS will be slow—a squadron or two every two or three years—because of limited funds for equipment purchases, so there will be no sudden, neck-wrenching turns in Navy or Air Force flying culture. As the aircraft are received and shaken out, the syllabus will be refined so that each service gets aviators ready to move on to advanced training.

Reese AFB appeared on the last base realignment and closure list, so USAF plans to start joint pilot train-

The Aircraft

Contractor	Beech Aircraft Corp.
Basic design	Pilatus PC-9, modified
Production site	Wichita, Kan.
Propulsion	Turboprop
Cost	$7 billion (budgeted)
Planned run	711 (USAF, 372; USN, 339)
Predecessors	USAF T-37B, Navy T-34C
Advances	Missionized ejection seats, improved birdstrike protection, electronic flight instrumentation, digital cockpit display, pressurized cockpit
First flight	December 1998
Squadron IOC	USAF, 2001; Navy, 2003
Note	Cessna and Rockwell protested the Beech contract award, but the choice has been upheld by the General Accounting Office.

the two; whenever a Navy officer is in command, a USAF officer will serve as the top deputy and vice versa.

At the request of participating countries, the Euro-NATO Joint Jet Pilot Training program will not be affected by the Air Force and Navy move toward consolidated training.

Empty "Bank" Account

The demand for pilots in the active Air Force has started to increase after several years of downsizing. During that period, more pilots were produced than could be accommodated in aircraft. Some of these pilots were awarded their wings but went directly to nonflying jobs. When a flying opportunity arose, they were recalled from the "pilot bank," given refresher training, and sent to their operational aircraft.

The last "banked" pilot will soon be in training for an operational airplane, and the UPT production rate is on its way up. In 1994 and 1995, about 500 active pilots graduated. In 1996, the figure will be 525, and in 1997, 650 will be needed.

The requirement is expected to peak in 2002 at some 1,100 pilots per year. With Guard, Reserve, and foreign trainees added, the production rate will be about 1,500 pilots per year.

Pilots are not the only rated members affected. All navigator/weapon system officer training is going joint, with navigator candidates to start at ing operations at Vance AFB, Okla., in July. The next base likely to get a joint squadron is Laughlin AFB, Tex.

The Air Force and Navy divide the specialized training work, as well. Because the Navy operates more types of turboprops than USAF does, it is responsible for training all turboprop-bound pilots, such as C-130 crews. The basic turboprop training is done in the Navy's T-44 at NAS Corpus Christi, Tex. The Air Force trains all "heavy" jet pilots for the Navy; these pilots will fly the E-6 Take Charge and Move Out (TACAMO) aircraft, a variant of the 707, in its "tanker/transport" specialized track.

As they are created, each joint training squadron will be staffed roughly fifty-fifty with officers from both armed services. Leadership of the squadrons will rotate between

Staff photo by Guy Aceto

The Air Force is set with the T-1 Jayhawk (above) to handle the tanker/transport end of its advanced training, and the Navy has the T-45 Goshawk for its advanced training. The Air Force will also stick with the T-38 until the 2020s.

NAS Pensacola, Fla. "In some ways, the back-seater training is way out in front of the pilot training," General Peterson noted.

At Pensacola, students will get academics and airmanship basics in the T-34. After that, the navigator track "splits, like it does for pilots," General Peterson said. Those continuing on to be fighter back-seaters will continue at Pensacola, while those headed for "panel nav" positions, such as offensive systems operators on the B-1, go to Randolph AFB for further training.

General Peterson pointed out that the joint program is already well under way, but the navigator instruction program will be the last element to receive JPATS aircraft, with deliveries expected around 2017.

Helicopter pilot training is also changing. The Air Force is now sending helicopter pilots through UPT before dispatching them to helicopter training at the Army's Fort Rucker, Ala., facility.

"Our [helicopter] mission is different from the Army's," General Peterson observed. "We fly more on instruments. A good deal of our helicopter pilots end up in special operations, . . . and we find that that extra flying experience pays off."

Having a fixed-wing UPT education allows a helicopter pilot, later in his or her career, to return to the cockpit of a fixed-wing aircraft, the General said.

"We've brought back to fixed-wing some of the helo pilots, . . . and there's not a problem in them having to unlearn [habits]," he noted. "It's fairly transparent to them."

The Navy conducts its own helicopter training, and there are no plans to integrate with that training because "the Navy uses its helicopters differently" than the Air Force and the Army do, and little benefit can be derived from collocating or merging helicopter training with the Navy.

General Peterson said no serious consideration has been given to bringing Army fixed-wing pilots into the Air Force's UPT effort, despite the joint effort with the Navy.

"The Army has very little in the way of fixed-wing aircraft," he said. Though the Air Force does do some training of foreign pilots headed for the C-12 aircraft, "we're getting out of that." With the Army, "there's no common mission or platform," so joint pilot training has been deemed of little value.

Advanced training for the two services will not merge anytime soon because of their vastly different missions. For example, USAF pilots are rarely called on to make carrier landings as this T-45 is doing. But both sides are pleased with the effectiveness of joint primary training.

The Limits of Jointness

At present, the Air Force and Navy do not plan to merge their more advanced training tracks—bomber/fighter in the Air Force and fighter/strike in the Navy—because these sectors do not have operational aircraft in common, and the carrier-based mission is far different from the landbased mission.

The Navy has already made a considerable investment in its advanced trainer—the T-45 Goshawk, a variant of the British Hawk trainer—but the Air Force plans to stick with the T-38 Talon as its advanced trainer well into the 2020s, General Peterson said.

"Structurally, it's in pretty good shape," he noted.

The Pacer Classic program of structural upgrades has kept the T-38 in good repair, but soon it will be necessary to give it a substantive avionics upgrade to make it more like the "glass-cockpit" fighters and bombers for which it is supposed to prepare pilots.

The avionics upgrade will "get started in 1999," and the Air Force expects to convert 425 aircraft by "the 2004 time frame," General Peterson said.

"The transferability of skills" from the T-38 to operational aircraft "is very important, and we feel this upgrade is critical to that," he asserted.

Among other improvements, the T-38 will get a head-up display like that found in most combat airplanes today. It will also get some structural replacements, such as longerons and bulkheads. AETC is studying the possibility of replacing the ejection seats and canopies and re-engining the fleet.

Though the Air Force and Navy won't be merging advanced training anytime soon, current resistance to that step might change in the next decade, say some officers. Once the Air Force, Navy, and Marines field the Joint Strike Fighter—intended to be a common combat aircraft derived from technologies explored under the Joint Advanced Strike Technology program—a common graduate-level flying program may indeed emerge, General Peterson said.

Until then, the two services will have no combat aircraft in common, as they did not too long ago when both services flew the A-7 and F-4, so joint advanced training is not a near-term probability.

Already, however, the transformation of the way the Air Force and Navy do business has been substantial. The move toward joint aircrew training is "a big change from the way I grew up," General Peterson said, adding, "It's definitely a change for the better." ■

The Air Force is still meeting recruiting and retention goals, but warning lights have begun to blink.

Uncertainty on the Personnel Front

By Suzann Chapman, Associate Editor

Figure 1 **Projected Recruiting Goals**

FY	1996	1997	1998	1999	2000	2001
New enlisted	30,700	30,200	30,000	33,500	32,700	35,800
Prior-service enlisted	300	50	50	50	50	50
Total enlisted	**31,000**	**30,250**	**30,050**	**33,550**	**32,750**	**35,850**
Line officer	3,337	3,139	3,353	4,020	4,176	4,076
Nonline officer	1,724	1,533	1,550	1,580	1,588	1,654
Total officer	**5,061**	**4,672**	**4,903**	**5,600**	**5,764**	**5,730**

THE Air Force made its Fiscal 1995 recruiting goal, but it was a tough year. USAF managed to achieve its objectives because individual recruiters, on average, proved to be more productive, bringing in more recruits per month. Still, officials worry that recruiters will have to do even better. They say the recruiting outlook for the near future looks worse than 1995's.

Like the other services, USAF in 1995 had to overcome the inevitable effect of years of massive cuts in military forces and end strength. The drawdown led many in the public to conclude not only that the armed forces did not need any new recruits but also that the military no longer offered a stable career.

The services continued to struggle with the problem of diminishing interest in military service among today's young men, who are decidedly less likely to want to enlist than were their counterparts of several years ago.

Recruiting new troops was not the only worry. The drawdown and years of high operations tempo caused service officials to fear that the force might encounter severe problems in retaining high-quality, experienced military personnel and maintaining their morale. Thus, DoD and service leaders placed new emphasis on programs and policies designed to enhance military "quality of life."

So far, Air Force enlisted retention has been fairly stable. Pilot retention is actually up somewhat.

The three military departments each year enlist roughly 200,000 young people, with another 50,000 new non–prior service recruits needed for the Guard and Reserve. The total number of enlistees entering the rolls during the last fiscal year was 175,783, but DoD projects a requirement of 208,000 in Fiscal 1996 (which began last October 1) and 226,000 in Fiscal 1997 (starting next October 1). About 20,000 newly commissioned officers enter the services each year.

Much like last year, the Air Force in 1996 needs to recruit 31,000 young people for the enlisted force (only 300 of whom may be prior service) and 5,061 new officers. Those numbers drop slightly over the next two years, then rise again. (See Figure 1, above.)

Thus far, the Air Force has had no difficulty finding qualified applicants for its officer ranks. In Fiscal 1992, the service was able to choose from 9,161 applicants to meet its requirement for 4,856 new officers. In Fiscal 1995, it had 13,950 applicants for 5,042 officer openings.

Shrinking Pool

What concerns personnel officials, however, is a different problem: There are simply fewer seventeen- to twenty-six-year-olds in the country today than there have been since the baby-boom generation began to reach maturity in the 1960s. That youth cohort, which peaked in the 1970s, has been shrinking for a decade. Thus, the military will have to recruit a larger portion of the smaller pool of available youth.

Over the past twenty years, the Defense Department has learned to heed the results of surveys that an-

nually question some 10,000 young men and women about their interest in and attitudes toward military service. Those surveys, taken each year since 1975, have provided "strong indicators of potential recruits," according to DoD manpower studies.

If the surveys can be believed, they show a major change in attitude. Four years ago, one in every three males aged sixteen to twenty-one showed some interest in joining the military. By 1994, however, the ratio had dropped to one in four. (See Figure 2, at right.) Pentagon officials noted, however, that the enlistment propensity of sixteen- to twenty-one-year-old females appeared stable.

In a surprising and troubling turn of events, enlistment interest has fallen even faster and further among black youths. The Air Force Chief of Staff, Gen. Ronald R. Fogleman, in an address to the Tuskegee Airmen Convention in Atlanta, Ga., in August, reported that the "propensity" of blacks to enlist had dropped from fifty-four percent in 1989 to only thirty-two percent in Fiscal 1995.

To help determine possible reasons for the lower interest level among all young men, the Defense Department conducted research in several focus areas, including Raleigh, N. C., Dallas, Detroit, and Baltimore. Even before the final report was released, the data seemed to indicate that one reason is that the young men want to "exceed their parents' lifestyles."

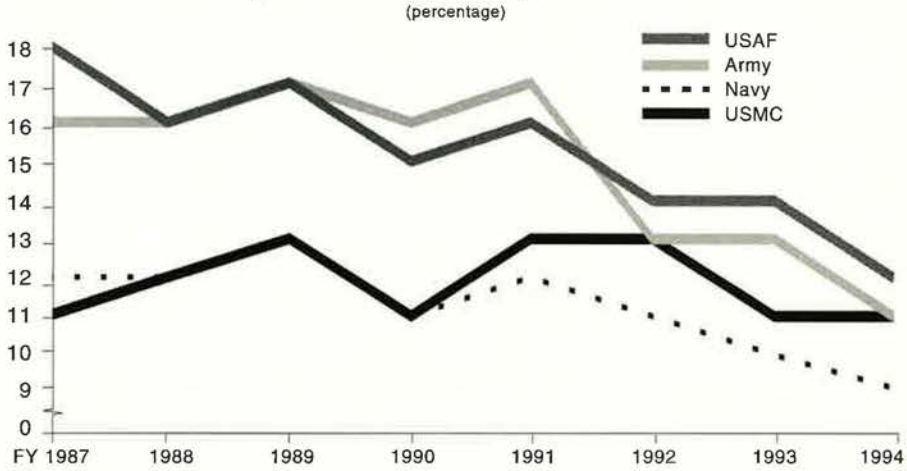
Anita Lancaster, assistant director of the Defense Manpower Data Center, said that, although parents may be successful, students tend to see them as struggling to make ends meet. Today's young people want to go beyond the achievements of their parents—earning a comfortable living, paying their bills with money left over—by going to college.

"Over and over, almost everyone we spoke with said education was the way to success and that [the] education process can't stop at high school," said Ms. Lancaster in an October interview with American Forces Information Service.

Not a Boost, but a Drag

Increasingly, military-age people regard the four-year military commitment as something that would delay their quest for a better-paying job, rather than as a means to achieve a higher civilian standard of living. Even the military's higher-education incentive, the Montgomery GI Bill, falls short, in their view. Many students prefer to use other options—attending community college, working part-time during school, or taking a break for a semester or a year to earn money for tuition.

Figure 2 **Propensity to Enlist**



Today's youth also apparently want more stability in their careers—not something easily achieved with the increasing use of the military in peacekeeping missions. According to the Pentagon surveys, the frequent and largely unpredictable deployments to trouble spots around the world has had a negative impact on the propensity of young persons to serve.

Overcoming these perceptions and attitudes, which would not be easy in any case, was made more difficult by the DoD decision to cut the number of recruiters and recruiting budgets during the drawdown. DoD officials said two-thirds of its recruiters worked more than sixty hours per week this past year. Many recruiters also covered larger territories than in past years.

The Air Force operated in Fiscal 1995 with about 850 recruiters nationwide. The authorized strength was 1,000, which the service recently increased to 1,200. During the drawdown, the overall USAF recruiting force—including officers, enlisted personnel, and civilians—dropped about twenty percent from Fiscal 1989 to Fiscal 1995.

Typically, the service has had trouble filling recruiting vacancies in some high-cost-of-living areas and some isolated locations, but USAF officials believe the recent attention to quality-of-life issues, including increases in cost-of-living and housing allowances, will help them fill recruiter positions. In addition, service officials pointed out that recruiters received promotions to technical sergeant and master sergeant at a slightly higher than average rate in the Fiscal 1995 cycle.

The job is not for everyone, stated Gen. Henry Viccellio, Jr., former commander of Air Education and Training Command and now commander of Air Force Materiel Command.

In a July 1995 commentary designed to encourage airmen to apply for recruiting duty, the General said, "It's demanding work for the man or woman who welcomes great responsibility and who relishes working independently." Starting with "Wanted: Enthusiastic young men and women for exciting job opportunities," General Viccellio also emphasized that recruiters must have "impeccable records and impeccable appearance" with "integrity and determination." He cautioned that the Recruiting Service was not desperate enough to take just anyone.

More Money, More People

To help its front-line representatives, who probably worked harder in 1995 than at any time since the Vietnam War era, the Pentagon also stepped up its recruiting and advertising funding.

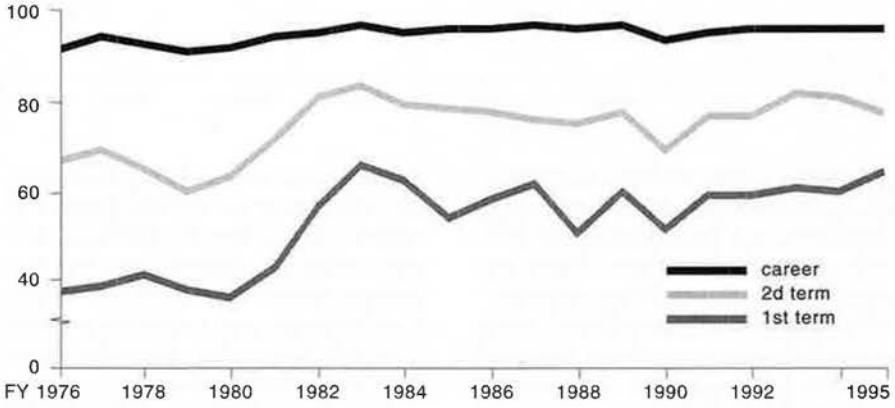
In Fiscal 1994, DoD reprogrammed $41 million into recruiting. For Fiscal 1995, the department's recruiting budget increased by $89 million, bringing the total recruiting investment to $2 billion, with about $1.4 billion of that for active-duty forces. The advertising fund increased from $145 million

Figure 3 **USAF Recruiting Budgets** ($ millions)

FY	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Advertising	$16.8	$14.8	$14.8	$16.3	$8.6	$8.7	$7.7	$7.6	$13.6	$10.3	$15.3	$16.1	$16.7	$17.2	$17.7
Operations and maintenance	34.7	30.8	31.8	31.1	25.1	27.0	27.5	32.8	34.6	39.6	37.8	39.4	40.4	42.6	44.2
Total	**51.5**	**45.6**	**46.6**	**47.4**	**33.7**	**35.7**	**35.2**	**40.4**	**48.2**	**49.9**	**53.1**	**55.5**	**57.1**	**59.8**	**61.9**

Figure 4 **Reenlistment Rates**

(percentage)



in Fiscal 1994 to about $185 million each for Fiscal 1995 and 1996.

The Air Force used some of its recruiting dollars in Fiscal 1994 to launch a radio-advertising campaign. USAF continued the campaign in Fiscal 1995 and will keep it active through at least Fiscal 1996. The increased funding, which essentially restored USAF's recruiting budget to its pre-drawdown level, also covers personal letters mass-mailed to each senior graduating in 1996 and continues direct-mail campaigns by local recruiters.

For Fiscal 1996, the service's total recruiting budget is $49.9 million, compared to $33.7 million in Fiscal 1991. Projections call for a steady increase through the turn of the century. (See Figure 3, above.)

Despite the expansion of budgets and the recruiter force, Air Force officials predict that next year will be tough, perhaps tougher than the most recent years. In fact, recruiters started the new year at a disadvantage; the Air Force had to borrow from the Fiscal 1996 delayed enlistment pool to meet its 1995 goal.

"This puts us at a deficit, but I'm confident we'll rebound," Maj. Gen. Kurt B. Anderson, USAF Recruiting Service commander, said in a November recap of the year's effort.

However, General Anderson added, "that's not to say that we don't expect more difficult times in Fiscal 1996." He said that competition among the services for quality recruits is intense. In a September interview, the General characterized last fiscal year as "a strong concern." This fiscal year, he said is "a serious concern."

Congress saw the value in enlarging recruiting budgets, providing additional funds to ensure the military pay raise and an increase in the housing allowance. At the same time, however, some lawmakers attacked both the Montgomery GI Bill and features of the military retiree pay system.

Congress first attempted to increase the amount of money an airman would have to pay into the education program *[see "GI Bill Hike May Hurt Recruiting," December 1995 "Aerospace World," p. 15].* Despite indications from young people that the bill may not be the drawing card it once was, it is still a highly useful tool. DoD officials believe it helps attract prospective recruits who might be on the fence.

Similarly, the services viewed the latest Congressional move, known as "High One," to restructure computation of retired pay without a "grandfather" clause as a breach of faith. Senior civilian and military leaders told Congress that High One would seriously erode morale for existing troops, many of whom might decide not to remain in the services, and send the wrong signal to young people who might be thinking about joining. *[See " 'High One' Defeated," November 1995 "Aerospace World," p. 15.]*

Neither measure passed. To a large extent, however, the damage was done. Moreover, other proposals are likely to spring up as Congress and the Clinton Administration struggle to balance the federal budget.

Concern Number One

Adequate pay ranks as the number one concern for most military members. In fact, DoD ranks it as the strongest single stimulus in generating the retention of top-quality people.

According to USAF personnel officials, military pay raises since 1982 have lagged behind inflation by a cumulative 4.6 percent. Even with the 2.4 percent pay raise in Fiscal 1996, the Employment Cost Index (ECI) gap between military pay growth and that of the private sector will increase from a cumulative 12.6 percent to 13.2 percent.

Furthermore, they project that the current law, which limits pay growth to 0.5 percent below the ECI, will cause the ECI gap to widen to more than eighteen percent by 2001. At the same time, the inflation gap would increase to more than ten percent.

The fact that the inflation gap has remained relatively small has led Air Force officials to believe that the current ECI gap has had minimal impact on retention and recruiting. However, they cautioned that the cumulative effects of inflation and pay-increase differences will eventually reduce the ability of the military to attract and retain highly qualified people.

Considering the initial indications from the youth surveys, young people

may already feel that the military does not offer competitive pay. However, competitive pay or not, the Air Force has maintained a fairly stable enlisted retention rate over the past few years.

In Fiscal 1976, the retention rate for first-term airmen was 37.3 percent, for second-term airmen, 67.4 percent, and for career airmen, 91.1 percent. Twenty years later, those numbers are 63.6, 77.1, and 95.7. As seen in Figure 4 on p. 42, Fiscal 1983 was the high year for each category. The years since have seen slight ups and downs, but the numbers have not dropped much.

The Air Force's 1995 quality-of-life survey seems to bear out the retention rates. Of the survey respondents, junior enlisted members were the most ambivalent about their career intentions. About thirty-six percent indicated they would not remain in the service, and another thirty-five percent were undecided.

Rated vs. Nonrated

That same survey highlighted a traditional dichotomy in the officer corps. The responses from rated officers indicated they were less satisfied with the promotion, evaluation, and assignment systems than nonrated officers were. The rated officers felt that performance should count for more than it does.

USAF personnel officials could not say why the perceptions varied between the two groups of officers. They plan to refine questions on the issue and to resurvey, possibly in 1996.

However, pilots and navigators might well have had cause for concern with much of the service's heavy operations tempo falling on their heads. They might have fared well in performance sections of evaluations, but deployments probably left little time for them to pursue professional or advanced academic education. To help alleviate this concern, the service recently decided to "mask," or exclude, having an advanced academic degree as a factor in promotion to captain and major for all line officers.

Despite their perceptions about promotion, rated officers are sticking with the Air Force in record numbers. The pilot retention rate in Fiscal 1989 was at thirty percent, then dropped to twenty-six percent three years later. In Fiscal 1994, the rate jumped to seventy percent, then seventy-two percent last year, nearing a record seventy-three percent set in Fiscal 1983. (See Figure 5, below.)

Navigator retention has held fairly steady over the years, with only a couple of significant drops. It reached a low of twenty-one percent in Fiscal 1993. However, for the last two years, their retention rate has been sixty-five and sixty-six percent, respectively.

These high rates could be based on a variety of factors, including the fact that airline hiring is at a low point and the availability of new Aviator Continuation Pay (ACP)—or pilot bonus—agreements.

It could also be that rated officers are getting more bang for their buck. Instead of disliking the high operations tempo, rated officers participating in the various peacekeeping missions find more satisfaction in their jobs.

The Fiscal 1996 ACP program also opens the pilot bonus to helicopter pilots for the first time. The retention rate for rotary-wing pilots has undergone a steady decline, unlike the rate for their fixed-wing counterparts.

Additionally, service officials hope the new ACP will alleviate the long-term pilot shortage—projected to reach a high of 805 in Fiscal 2001. (See Figure 6, above.)

The pilot glut of a few years ago is over. Programs designed to reduce the flow into the cockpit will end. USAF expects to empty its "pilot bank," those awaiting flying positions, at the close of this fiscal year. The last "third pilots," those awaiting flying training, will enter training by the end of Fiscal 1997.

As a further hedge against the shortage, the Air Force has started a voluntary recall of hundreds of former pilots now serving with the Guard or Reserve or just recently separated. The service approved fifty pilots for return to active duty last year and plans to accept another 100 this fiscal year.

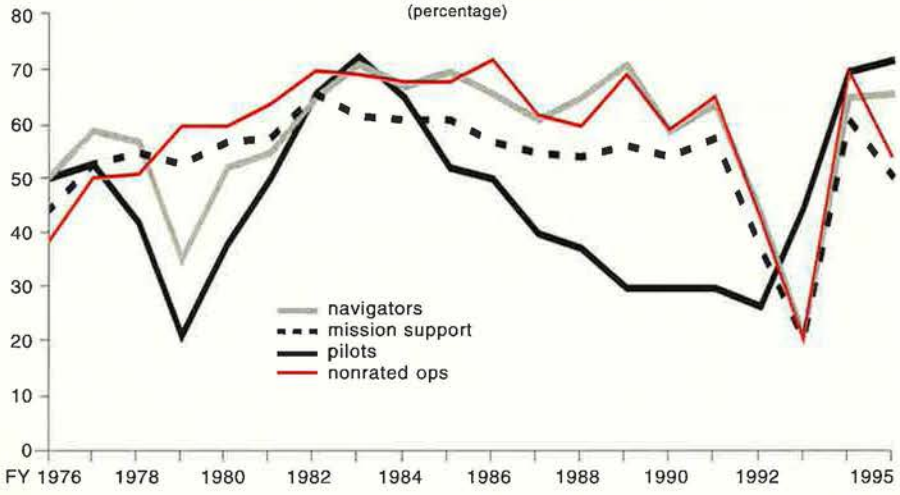
The number of officers projected to complete flying training also will increase from 525 this fiscal year to 1,100 in Fiscal 2002.

It is still too early to calculate the actual impact on recruiting and retention of DoD's quality-of-life improvements, many of which have yet to get beyond the press release and planning stages. The Air Force is doing well with retention right now, but, as with recruiting, the challenge never really ends. ■

Figure 6 **Pilot Inventory vs. Requirements**

FY	1996	1997	1998	1999	2000	2001	2002
Inventory	15,024	14,464	13,733	13,219	12,961	12,932	12,980
1997 Budget Estimate Submission requirements	14,558	14,211	13,859	13,714	13,683	13,737	13,737
Surplus (shortfall)	466	253	(126)	(495)	(722)	(805)	(757)

Figure 5 **Officer Retention Rates**

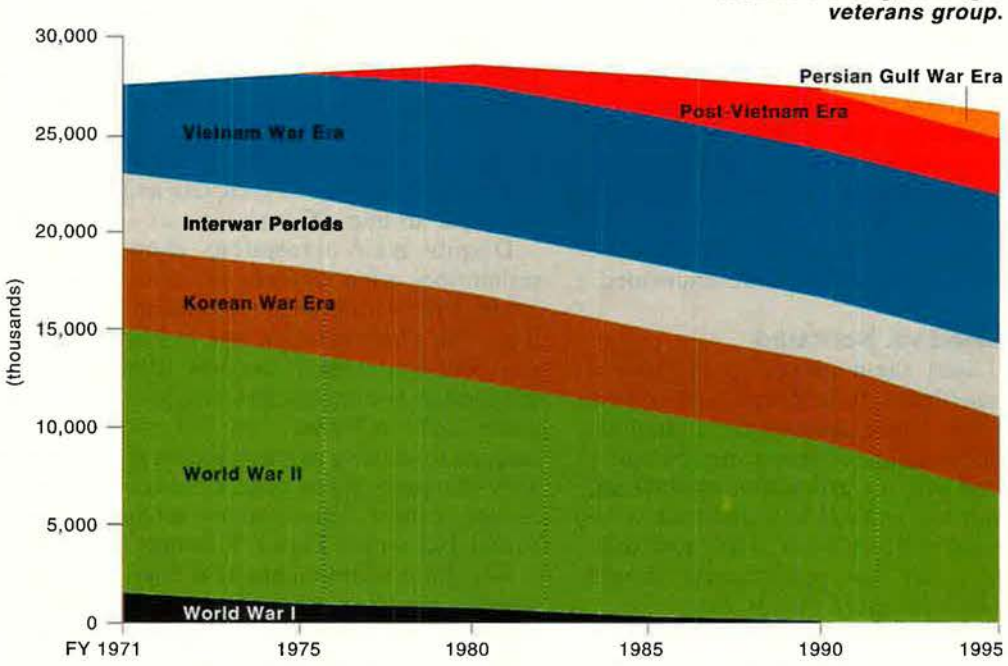


Here's a statistical profile of Americans who have served in the armed forces.

VETERANS

Compiled by Tamar A. Mehuron, Associate Editor

The population of US military veterans has been shrinking for fifteen years. After peaking in 1980 at nearly twenty-nine million, the number has fallen to about twenty-six million. In 1994, Vietnam War Era servicemen and -women became the largest single veterans group.



World War I April 1917 to November 1918

World War II December 1941 to September 1945.

Korean War Era June 1950 to January 1955

Vietnam War Era August 1964 to May 1975

Post-Vietnam Era May 1975 to August 1990

Desert Storm Era August 1990 to 1995

Figures for these periods denote those members having no prior service. Veterans who served in more than one wartime period are counted only once.

Interwar Period 1 November 1918 to December 1941

IP 2 September 1945 to June 1950

IP 3 January 1955 to August 1964

Figures for these periods denote those members who served *only* between these dates.

Information in this section was derived from the Department of Veterans Affairs publications, "Trend Data" and "National Survey of Veterans," unless otherwise noted. Numbers in this section may not sum to totals because of rounding or different cutoff dates.

US Veterans 1971–95

(thousands)

Fiscal Year	World War I	World War II	Korean War Era	Interwar Periods 1, 2, 3	Vietnam War Era	Post-Vietnam War Era	Persian Gulf War Era	Total
1971	1,306	13,713	4,225	3,791	4,488	0	0	27,523
1972	1,192	13,532	4,275	3,766	5,192	0	0	27,956
1973	1,084	13,343	4,324	3,741	5,634	0	0	28,125
1974	981	13,147	4,365	3,716	6,009	0	0	28,218
1975	884	12,943	4,392	3,692	6,370	0	0	28,281
1976	793	12,733	4,395	3,667	6,740	77	0	28,405
1977	686	12,451	4,385	3,635	7,078	292	0	28,526
1978	605	12,216	4,371	3,609	7,245	500	0	28,546
1979	530	11,972	4,352	3,582	7,367	801	0	28,605
1980	493	11,841	4,340	3,568	7,409	989	0	28,640
1981	426	11,628	4,330	3,416	7,472	1,247	0	28,519
1982	365	11,404	4,315	3,390	7,513	1,444	0	28,432
1983	310	11,171	4,298	3,364	7,542	1,631	0	28,316
1984	261	10,927	4,277	3,338	7,568	1,835	0	28,207
1985	217	10,673	4,254	3,312	7,590	2,029	0	28,075
1986	178	10,410	4,226	3,284	7,612	2,235	0	27,946
1987	144	10,137	4,196	3,254	7,628	2,444	0	27,803
1988	113	9,854	4,162	3,225	7,645	2,651	0	27,650
1989	86	9,561	4,125	3,194	7,666	2,866	0	27,497
1990	63	9,258	4,084	3,162	7,681	3,072	0	27,320
1991	45	8,841	4,016	3,124	7,697	3,067	363	27,152
1992	34	8,499	3,958	3,092	7,718	3,060	618	26,980
1993	25	8,150	3,897	3,059	7,740	3,054	863	26,789
1994	19	7,029	3,832	3,790	7,750	3,048	1,035	26,503
1995	13	6,698	3,764	3,723	7,753	3,041	1,206	26,198

Veterans by Service Branch

The VA attributes to the services these percentages of the total veteran population, using data from the 1990 US census. The numbers of veterans in this table are estimates, derived from VA percentages, and show the likely composition of the veteran population in Fiscal 1995.

Service	Number	Percent of Total
Army	13,518,168	51.6
Navy	6,130,332	23.4
Air Force	4,060,690	15.5
Marine Corps	2,122,038	8.1
Coast Guard	366,772	1.4
Total	**26,198,000**	**100.0**

Growth of the Retired Force

Veterans Receiving Military Pay, 1971–95

Fiscal Year	Air Force	Army	Navy	Marine Corps	Total
1971	251,331	297,653	230,696	42,955	822,635
1975	363,701	354,031	272,381	53,810	1,043,923
1980	452,821	424,898	322,547	64,259	1,264,525
1985	501,319	456,960	347,584	67,904	1,373,767
1990	538,622	489,310	370,621	73,576	1,472,129
1995	581,873	536,739	402,350	82,146	1,603,108

Today, more than 1.5 million veterans receive retired pay, reflecting two factors: maintenance of a large, standing military during the long Cold War period and creation in 1973 of the All-Volunteer Force, both of which stimulated the growth of a large career enlisted force. The Air Force has for twenty years had the largest retired force, reflecting the fact that more USAF personnel stay for a full twenty-year career.

Source: *FY 1994 DoD Statistical Report on the Military Retirement System*

Federal Spending on Veterans

Department of Veterans Affairs Outlays in Constant 1995 Dollars (thousands)

Fiscal Year	Medical Programs	Compensation, Pensions	Vocational Rehabilitation, Education	Construction	General Operating Expenses	Other	Total
1971	$7,514,012	$21,541,356	$6,212,927	$320,179	$978,924	$6,951,656	$43,519,054
1972	8,606,105	22,034,039	7,124,354	400,648	1,059,202	7,164,051	46,388,398
1973	9,092,970	22,053,293	9,216,253	326,366	1,088,441	6,186,887	47,964,210
1974	9,107,640	20,445,740	9,858,200	337,608	1,063,140	6,304,927	47,117,255
1975	9,859,535	20,915,283	12,467,110	347,667	1,242,598	6,164,758	50,996,952
1976	10,265,788	20,892,226	13,713,431	510,209	1,239,936	5,560,985	52,182,575
1977	11,444,918	22,318,603	9,732,729	573,932	1,312,906	5,630,018	51,013,106
1978	11,940,954	22,102,095	7,816,276	584,620	1,344,519	5,150,416	48,938,880
1979	11,713,810	21,668,056	5,774,031	534,231	1,313,539	5,553,632	46,557,299
1980	11,173,909	20,426,877	4,345,679	555,443	1,119,358	5,263,143	42,884,408
1981	11,017,801	20,496,085	3,841,186	685,307	1,052,234	5,162,345	42,254,957
1982	11,592,932	20,718,616	2,794,629	711,085	1,042,115	5,638,103	42,497,480
1983	12,288,029	20,959,497	2,575,558	675,977	1,058,369	4,984,283	42,541,713
1984	12,360,557	20,165,380	2,070,625	708,314	1,021,560	5,997,185	42,323,620
1985	13,068,675	19,881,569	1,649,052	788,462	1,083,564	5,111,816	41,583,137
1986	12,994,037	19,771,893	1,495,255	788,649	1,023,981	6,406,027	42,479,843
1987	13,249,714	19,105,403	1,135,994	790,008	1,026,134	7,370,420	42,677,672
1988	13,475,021	19,276,330	940,037	851,050	1,022,877	2,791,376	38,356,690
1989	13,205,427	18,446,597	724,232	864,032	942,005	2,738,675	36,920,967
1990	13,505,177	17,110,790	526,850	770,843	945,329	953,870	33,812,860
1991	13,955,528	17,992,353	605,677	680,739	988,606	703,802	34,926,704
1992	15,006,060	17,686,073	754,746	694,153	999,848	1,683,091	36,823,972
1993	15,390,663	17,792,582	909,743	655,315	952,944	1,671,539	37,372,785
1994	15,867,702	18,774,162	1,151,060	714,572	931,734	1,021,727	38,460,957
1995	16,255,259	17,938,665	1,107,786	640,719	953,896	872,974	37,769,299

Medical Programs

VA Outlays in Constant 1995 Dollars (thousands)

Fiscal Year	Medical Care	Medical and Prosthetic Research	Administration and Other	Total
1971	$7,200,463	$237,590	$75,959	$7,514,012
1972	8,273,300	251,420	81,385	8,606,105
1973	8,737,864	269,144	85,962	9,092,970
1974	8,759,513	252,193	95,935	9,107,640
1975	9,484,319	271,360	103,856	9,859,535
1976	9,914,908	261,667	89,212	10,265,788
1977	11,072,267	273,478	99,173	11,444,918
1978	11,566,265	274,794	99,894	11,940,954
1979	11,352,860	263,608	97,343	11,713,810
1980	10,833,439	253,456	87,014	11,173,909
1981	10,693,499	238,718	85,584	11,017,801
1982	11,288,197	217,809	86,926	11,592,932
1983	11,955,293	246,580	86,155	12,288,029
1984	11,985,239	279,131	96,187	12,360,557
1985	12,656,935	318,547	93,193	13,068,675
1986	12,662,165	257,026	74,846	12,994,037
1987	12,917,773	275,608	56,333	13,249,714
1988	13,163,416	258,582	53,023	13,475,021
1989	12,922,708	227,297	55,422	13,205,427
1990	13,211,182	240,864	53,131	13,505,177
1991	13,663,099	238,775	53,654	13,955,528
1992	14,736,561	219,595	49,904	15,006,060
1993	15,066,637	259,301	64,725	15,390,663
1994	15,544,311	247,671	75,721	15,867,702
1995	15,933,320	251,101	70,838	16,255,259

Disability Compensation

VA Outlays in Constant 1995 Dollars (thousands)

Fiscal Year	World War I	World War II	Korean War	Vietnam War	All Others	Total
1971	$590,992	$6,236,291	$1,297,631	$1,337,158	$808,010	$10,270,082
1972	520,264	6,031,369	1,281,826	1,583,932	796,950	10,214,340
1973	482,267	6,199,522	1,333,830	1,837,463	832,536	10,685,619
1974	402,945	5,700,428	1,251,179	1,828,741	972,828	10,156,121
1975	377,493	5,931,836	1,313,705	2,095,999	1,037,717	10,756,749
1976	343,834	5,942,506	1,332,258	2,281,304	1,065,956	10,965,858
1977	312,669	6,258,366	1,425,491	2,630,972	1,197,087	11,824,585
1978	273,792	6,165,877	1,417,009	2,737,924	1,273,290	11,867,893
1979	229,954	5,942,068	1,387,442	2,772,439	1,327,114	11,659,018
1980	191,957	5,635,539	1,327,530	2,766,561	1,367,189	11,288,777
1981	169,308	5,688,116	1,348,834	2,930,950	1,496,529	11,633,738
1982	146,867	5,741,026	1,378,751	3,094,132	1,619,255	11,980,031
1983	126,109	5,755,130	1,397,767	3,244,483	1,728,178	12,251,667
1984	99,744	5,431,238	1,335,474	3,195,322	1,732,982	11,794,760
1985	81,245	5,279,011	1,314,832	3,246,306	1,791,990	11,713,385
1986	65,500	5,129,411	1,301,977	3,310,102	1,844,267	11,651,257
1987	50,917	4,845,347	1,261,781	3,318,637	1,824,816	11,301,498
1988	39,614	4,795,341	1,259,968	3,450,125	1,884,233	11,429,281
1989	29,348	4,420,049	1,211,285	3,429,653	1,893,060	10,983,394
1990	21,574	3,110,868	1,184,704	3,484,187	1,920,313	9,721,646
1991	15,750	4,017,682	1,153,978	3,583,454	1,984,603	10,755,468
1992	11,226	3,926,619	1,142,004	3,749,937	2,066,546	10,896,333
1993	8,604	3,911,018	1,158,603	3,777,473	2,258,052	11,113,750
1994	6,130	3,635,960	1,147,869	4,121,768	3,556,422	12,468,148
1995	N/A	N/A	N/A	N/A	N/A	N/A

Disability Pensions

VA Outlays in Constant 1995 Dollars (thousands)

Fiscal Year	World War I	World War II	Korean War	Vietnam War	All Others	Total
1971	$2,930,897	$2,089,570	$160,569	$12,854	$22,871	$5,216,761
1972	2,722,885	2,425,960	195,214	20,078	19,539	5,383,676
1973	2,298,096	2,513,773	216,024	26,238	14,375	5,068,505
1974	1,852,699	2,448,144	220,754	30,010	9,722	4,561,329
1975	1,574,476	2,583,984	251,350	38,092	7,631	4,455,533
1976	1,297,959	2,652,288	280,074	44,605	5,506	4,280,432
1977	1,293,768	2,925,139	339,344	60,824	4,381	4,623,456
1978	1,163,170	2,907,867	360,241	69,538	3,394	4,504,210
1979	1,003,812	3,024,443	404,135	78,690	2,796	4,513,876
1980	801,395	2,795,273	426,269	94,482	1,596	4,119,015
1981	677,781	2,740,112	460,486	110,947	1,217	3,990,543
1982	580,349	2,673,131	493,938	130,158	865	3,878,441
1983	495,306	2,642,789	525,942	149,187	664	3,813,888
1984	411,361	2,538,939	542,944	161,421	552	3,655,216
1985	347,347	2,437,508	548,823	167,294	513	3,501,485
1986	295,593	2,392,239	569,076	179,223	452	3,436,584
1987	242,936	2,264,468	577,330	188,559	474	3,273,767
1988	201,721	2,255,027	611,234	210,633	704	3,279,319
1989	158,208	2,098,407	614,133	221,194	615	3,092,556
1990	124,107	2,110,211	630,935	243,629	864	3,109,746
1991	91,330	1,969,462	644,612	270,569	1,215	2,977,189
1992	65,156	1,621,310	658,080	292,436	768	2,637,751
1993	37,535	1,552,286	588,152	324,312	36,374	2,538,660
1994	24,261	1,318,966	584,008	383,359	41,527	2,352,121
1995	N/A	N/A	N/A	N/A	N/A	N/A

Disabled Veterans

Those Receiving Compensation for Service-Related Disabilities

Fiscal Year	World War I	World War II	Korean War	Vietnam War	All Others	Total
1971	78,261	1,395,911	239,606	244,567	187,740	2,146,085
1972	71,151	1,372,083	240,325	308,812	189,838	2,182,209
1973	65,163	1,351,425	240,756	354,062	191,635	2,203,041
1974	59,148	1,329,774	240,406	388,851	192,577	2,210,756
1975	54,679	1,308,914	240,038	422,536	194,002	2,220,169
1976	49,934	1,288,457	239,780	458,111	195,931	2,232,213
1977	43,131	1,261,159	239,204	496,815	207,006	2,247,315
1978	38,166	1,240,788	238,464	519,142	222,230	2,258,790
1979	34,217	1,217,522	237,102	537,208	240,194	2,266,243
1980	29,720	1,193,196	235,654	553,326	261,693	2,273,589
1981	25,417	1,167,481	233,820	568,234	284,118	2,279,070
1982	21,556	1,140,144	231,475	579,451	302,008	2,274,634
1983	18,078	1,110,971	228,651	587,032	318,603	2,263,335
1984	15,078	1,080,364	225,542	594,938	334,860	2,250,782
1985	12,293	1,048,976	222,630	603,889	352,489	2,240,277
1986	9,870	1,015,380	220,155	612,937	366,947	2,225,289
1987	7,894	981,534	217,743	623,430	381,702	2,212,303
1988	6,106	946,767	214,981	633,068	397,935	2,198,857
1989	4,631	911,791	211,804	642,642	420,681	2,191,549
1990	3,444	876,359	208,517	651,756	444,186	2,184,262
1991	2,620	841,143	205,384	661,884	468,091	2,179,122
1992	1,928	805,212	201,961	671,480	500,355	2,180,936
1993	1,372	768,618	198,492	682,352	546,801	2,197,635
1994	927	730,724	194,577	693,811	597,869	2,217,908
1995	602	691,942	190,531	704,785	647,815	2,235,675

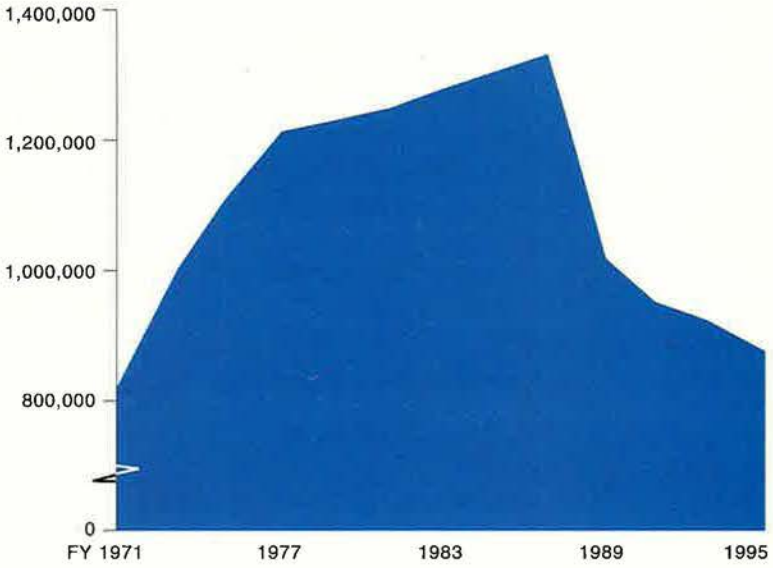
Educational Assistance Veterans Enrolled in Federal Programs

Fiscal Year	Post–Korean War Veterans Education Program	Post–Vietnam War Veterans Education Program	Montgomery GI Bill, Active Duty Only	Montgomery GI Bill, Reserve Only	Total
1971	1,584,866	0	0	0	1,584,866
1972	1,864,158	0	0	0	1,864,158
1973	2,125,595	0	0	0	2,125,595
1974	2,358,603	0	0	0	2,358,603
1975	2,691,566	0	0	0	2,691,566
1976	2,821,514	0	0	0	2,821,514
1977	1,937,874	0	0	0	1,937,874
1978	1,521,840	37	0	0	1,521,877
1979	1,278,538	456	0	0	1,278,994
1980	1,106,889	1,947	0	0	1,108,836
1981	948,526	8,324	0	0	956,850
1982	777,686	11,156	0	0	788,842
1983	644,390	29,508	0	0	673,898
1984	528,468	38,310	0	0	566,778
1985	402,281	48,110	0	0	450,391
1986	307,637	63,221	0	31,678	402,536
1987	238,798	76,726	130	52,459	368,113
1988	202,769	87,486	5,599	72,846	368,700
1989	163,912	83,787	23,830	90,584	362,113
1990	86,225	70,870	101,781	102,233	361,109
1991	0	56,186	143,431	102,323	301,940
1992	0	44,901	194,948	114,269	354,118
1993	0	35,118	246,057	110,457	391,632
1994	0	25,529	284,108	103,061	412,698
1995	0	18,347	291,958	94,900	405,205

Patients

Veterans Treated in VA Hospitals and Other Medical Facilities

Fiscal Year	VA Hospitals	Other Care	Total Veteran Patients
1971	818,579	93,763	912,342
1972	846,298	97,891	944,189
1973	985,351	96,614	1,081,965
1974	1,043,293	97,457	1,140,750
1975	1,113,873	106,234	1,220,107
1976	1,178,894	108,231	1,287,125
1977	1,209,763	113,010	1,322,773
1978	1,228,755	113,409	1,342,164
1979	1,230,252	111,909	1,342,161
1980	1,247,516	111,753	1,359,269
1981	1,248,502	111,754	1,360,256
1982	1,242,544	115,003	1,357,547
1983	1,280,468	120,550	1,401,018
1984	1,290,029	121,805	1,411,834
1985	1,305,702	129,753	1,435,455
1986	1,327,728	133,795	1,461,523
1987	1,332,056	133,647	1,465,703
1988	1,086,456	137,919	1,224,375
1989	1,027,581	125,062	1,152,643
1990	993,058	120,068	1,113,126
1991	951,112	120,833	1,071,945
1992	935,092	118,146	1,053,238
1993	920,311	132,927	1,053,238
1994	906,925	125,025	1,031,950
1995	878,506	121,722	1,000,228



In Fiscal Years 1973–87, the VA counted "one-day" dialysis patients as "inpatients." Beginning with Fiscal 1988, the VA has categorized them as "outpatients." This change in accounting has caused the steep decline in total patients since the end of Fiscal 1987.

Veterans of Principal US Wars

War	Number Served	Percent of Total
Revolutionary War (1775–83)	250,000	0.6
War of 1812 (1812–15)	286,730	0.7
Mexican War (1846–48)	78,718	0.2
Civil War (1861–66)	3,713,363	9.5
Spanish-American War (1898)	306,760	0.8
World War I (1917–18)	4,743,826	12.1
World War II (1941–45)	14,903,213	38.0
Korean War (1950–53)	5,764,143	14.7
Vietnam War (1964–73)	8,744,000	22.3
Persian Gulf War (1991)	467,539	1.2
Total (1775–1991)	**39,258,292**	**100.0**

During 216 years, nearly forty million Americans have worn the nation's uniform during war. Most served during four wars of the twentieth century—the two World Wars, Korea, and Vietnam. These four conflicts produced eighty-seven percent of all wartime veterans.

Casualties

Wartime Dead and Wounded, 1775–1991

War	Battle Deaths	Other Deaths	Wounds Not Mortal	Known Casualties
Revolutionary War (1775–83)	4,435	unknown	6,188	10,623
War of 1812 (1812–15)	2,260	unknown	4,505	6,765
Mexican War (1846–48)	1,733	11,550	4,152	17,435
Civil War (1861–66)	214,938	283,394	281,881	780,213
Spanish-American War (1898)	385	2,061	1,662	4,108
World War I (1917–18)	53,513	63,195	204,002	320,710
World War II (1941–45)	292,131	115,185	670,846	1,078,162
Korean War (1950–53)	33,651	unknown	103,284	136,935
Vietnam War (1964–73)	47,369	10,799	153,303	211,471
Persian Gulf War (1991)	148	145	467	760
Total Known Casualties (1775–1991)	**650,563**	**486,329**	**1,430,290**	**2,567,182**

More than a million US servicemen and -women did not survive to become "veterans." US government records show that at least 1,136,892 Americans died in wartime. Another 1,430,290 suffered "wounds not mortal." A significant number of the dead and wounded fell during the Civil War.

Where Veterans Live

Location	Number	Percent of State Population
Alabama	427,048	10.6
Alaska	64,923	11.8
Arizona	458,571	12.5
Arkansas	258,171	11.0
California	2,817,645	9.5
Colorado	385,445	11.7
Connecticut	339,079	10.3
Delaware	78,481	11.8
D. C.	50,219	8.3
Florida	1,709,066	13.2
Georgia	684,556	10.6
Hawaii	115,671	10.4
Idaho	112,151	11.1
Illinois	1,073,575	9.4
Indiana	592,672	10.7
Iowa	291,116	10.5
Kansas	262,790	10.6
Kentucky	367,205	10.0
Louisiana	378,146	9.0
Maine	153,462	12.5
Maryland	530,302	11.1
Massachusetts	593,992	9.9
Michigan	949,061	10.2
Minnesota	461,909	10.6
Mississippi	233,372	9.1
Missouri	585,862	11.4
Montana	95,401	11.9
Nebraska	167,564	10.6
Nevada	186,067	15.5
New Hampshire	135,340	12.2
New Jersey	740,665	9.6
New Mexico	171,925	11.3
New York	1,537,767	8.5
North Carolina	710,682	10.7
North Dakota	59,168	9.3
Ohio	1,188,166	11.0
Oklahoma	349,700	11.1
Oregon	370,803	13.0
Pennsylvania	1,363,207	11.5
Rhode Island	109,137	10.9
South Carolina	379,708	10.9
South Dakota	74,034	10.6
Tennessee	516,131	10.6
Texas	1,646,764	9.7
Utah	138,287	8.0
Vermont	62,257	11.1
Virginia	704,655	11.4
Washington	630,569	13.0
West Virginia	199,351	11.1
Wisconsin	507,386	10.4
Wyoming	47,935	10.6
Total US	**26,067,159**	**10.5**
US Possessions/ Foreign	130,841	
Total	**26,198,000**	

The number of female veterans has grown steadily over the past twenty-five years, surpassing the one million mark in 1976. Still, the female proportion of the veteran population increased by only about one percentage point during this period, rising from 3.5 percent in 1971 to 4.6 percent in 1995.

Male and Female Veterans

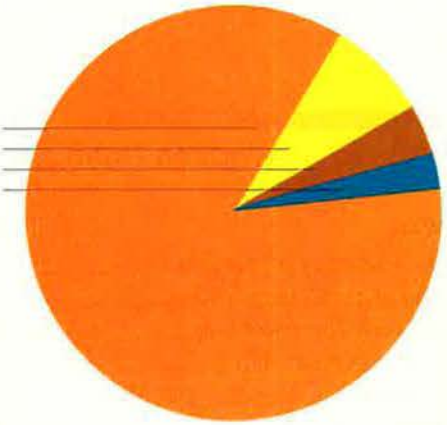
Fiscal Year	Male	Female
1971	26,558,800	964,200
1972	26,988,000	968,000
1973	27,154,000	971,000
1974	27,240,900	977,100
1975	27,295,100	985,900
1976	27,403,300	1,001,700
1977	27,495,600	1,030,400
1978	27,489,000	1,057,000
1979	27,517,000	1,088,000
1980	27,528,700	1,111,300
1981	27,515,800	1,003,200
1982	27,416,400	1,015,600
1983	27,290,500	1,025,500
1984	27,170,400	1,036,600
1985	27,027,600	1,047,400
1986	26,886,900	1,059,100
1987	26,733,600	1,069,400
1988	26,568,600	1,081,400
1989	26,402,600	1,094,400
1990	26,221,600	1,098,400
1991	26,011,700	1,140,300
1992	25,820,300	1,159,700
1993	25,608,900	1,180,100
1994	25,311,486	1,191,514
1995	24,993,691	1,204,309

Race and Ethnicity (percent)

Race and Ethnic Group	1979 Veteran	1986 Veteran	1992 Veteran	1992 US Adult
White	91.3	86.4	85.3	77.2
Black	7.5	8.0	8.2	10.9
Hispanic	—	4.1	3.9	8.3
Other	1.2	1.5	2.6	3.6

1992 Veterans

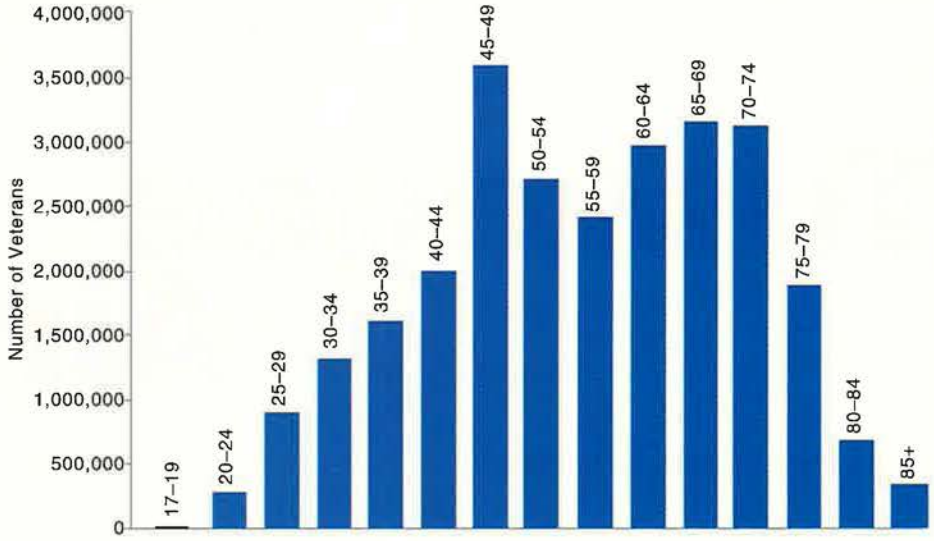
White 85.3%
Black 8.2%
Hispanic 3.9%
Other 2.6%



The year 1992 is the most recent for which federal data are available. Estimates are based on the 1990 US census. Projections show the white veteran population has declined in relative terms, while the minority veteran population has increased. However, the proportion of whites in the total veteran population still exceeds that found in the total US population.

Age of Veterans

Age Range	Number	Percent of Total
17–19	605	0.002
20–24	250,390	0.96
25–29	878,202	3.35
30–34	1,270,612	4.85
35–39	1,578,151	6.02
40–44	1,958,854	7.48
45–49	3,519,554	13.43
50–54	2,632,516	10.05
55–59	2,347,665	8.96
60–64	2,880,107	10.99
65–69	3,089,232	11.79
70–74	3,054,338	11.66
75–79	1,770,507	6.76
80–84	606,918	2.32
85+	229,509	0.88
Not in US	130,841	—



Fewer than four out of every ten national lawmakers have served in the armed forces. Overall, the 104th Congress, elected in 1994, has less military or combat experience than its predecessor, though members of the freshman class have more experience than their counterparts in the previous Congress.

Source: AFA's National Defense Issues Department

Veterans in Congress (percent)

Member Category	103d Congress	104th Congress
All members with combat experience	10.3	9.2
All members with military experience	44.3	39.3
Freshmen members with military experience	18.5	21.7

Educational Attainment of Veterans

Level	Percent of US Veterans	Percent of US Adults
Did not acquire a high school general education diploma	17.1	24.8
High school diploma, but no further formal education	29.6	30.0
High school diploma, some college training, no degree	32.2	24.9
College undergraduate degree, graduate degree, or higher	20.8	20.3

Employment for Veterans

Employment status	Percent of US Veterans	Percent of US Adults
Working—full-time employment	49.9	50.6
Working—part-time employment	4.9	10.7
Working—other type of employment	3.1	N/A
Not working—looking for employment	4.7	4.9
Not working—retired, disabled, other	37.4	33.7

Income Level of Veterans

Income level	Percent of US Veterans	Percent of US Adults
$10,000 or less	11.2	14.6
$10,001 to $20,000	20.9	18.3
$20,001 to $30,000	19.8	15.9
$30,001 to $40,000	15.9	13.5
$40,001 to $50,000	10.9	10.6
More than $50,000	21.3	27.1

Figures on these three charts are for 1992 and are drawn from the VA's most recent "National Survey of Veterans."

They did more than fight the enemy. They blew open the door to the Air Force for African-Americans.

Tuskegee Airmen

By Col. Alan L. Gropman, USAF (Ret.)

Col. Benjamin O. Davis (above) led the way. In an address to the Tuskegee Airmen Convention in 1995, Gen. Ronald R. Fogleman, USAF Chief of Staff, recalled one mission on which Colonel Davis led fifty-four aviators on the first Italian-based bomber-escort mission to Berlin: "You fought off waves of German fighters and . . . made history because you shot down three German jet fighters while losing only one friendly fighter. No bombers were lost."

THE Army Air Corps in January 1941 contained no African-Americans. One decade later, tens of thousands were serving in a racially integrated Air Force, working in every specialty. This revolutionary reform was inspired by the success of America's first black combat pilots, airmen who flew in World War II and in the immediate postwar era. The aviators were trained at Tuskegee AAF, Ala., and have always been known as the Tuskegee Airmen.

The Air Force was the first service to integrate its ranks fully. It began the process in 1949 because the Tuskegee Airmen, despite suffering terrible discrimination in World War II, had demonstrated that they could fly and fight against Hitler's best. This achievement undermined the foundation of segregation—the belief that blacks were inferior to whites. If blacks could arm, maintain, and fly airplanes as well as whites could, no one could assert a legitimate basis for segregation.

And on this last point, no question remained. During the last phase of World War II, the Tuskegee Airmen escort squadrons were employed as

frequently as any other fighter squadrons in their theater, and they were uniquely successful in defending AAF B-17s and B-24s against German attack. In the post–World War II period, the service's lone black flying wing continued to be a competent fighter organization, often winning major awards.

Many who have studied the subject of armed forces integration credit President Harry S. Truman with this reform. The fact is, however, that the Air Force's racial integration announcement came in April 1948, months before the presidential decree. Only in July 1948 did the President announce his Executive Order 9981. At that, the order called only for equal opportunity and never mentioned integration.

The magnitude of the Air Force's decision to integrate is increased by the record of US military studies in the 1920s and 1930s.

Ten Times Wrong

Shortly after the end of World War I, the War Department asked the Army War College to study the possible military role of blacks, with an eye to expanding their participation in the combat arms. Between 1924 and 1939, the Army War College investigated the underemployment of blacks on ten separate occasions. Each time, racism kept the students and faculty from reaching rational, fair-minded conclusions.

It seems inane now, but these studies asserted that blacks possessed brains significantly smaller than those of white troops and were predisposed to lack physical courage. The reports maintained that the Army should increase opportunities for blacks to help meet manpower requirements but claimed that they should always be commanded by whites and should always serve in segregated units.

The Air Corps at that time did not employ blacks in any role. However, President Franklin D. Roosevelt in 1940 directed the Air Corps to build an all-black flying unit. The presidential order propelled the air organization to create the 99th Pursuit Squadron. To develop the required pilot force, the Air Corps opened a new training base in central Alabama, near Tuskegee.

Central Alabama was a terrible place to train black pilots. The whites in the area were opposed to the very existence of a black flying training base and openly hostile to the trainees. Life off the post was often downright dangerous for the airmen.

Their first commander, Col. Frederick V. H. Kimble, was a poor choice for the job; he was at best indifferent and in all likelihood antagonistic to their success. Moreover, the flying instructors at the airfield during World War II, with the exception of Col. Noel F. Parrish, refused to socialize with the black pilots. All but Colonel Parrish refused to join the Tuskegee AAF Officers' Club. Once in the Mediterranean combat zone, Tuskegee Airmen were deliberately isolated in the 33d Fighter Group.

Because there was only one black fighting outfit, promotion in the organization was severely limited. There was only one colonel, and because he survived his combat missions, no others reached that rank. The same was true of squadron commanders in the four fighter units. If they managed to endure, nobody else could move up to their rank, and nobody did. A Tuskegee Airman could not fill a vacancy in any other fighter

Above is Col. Noel F. Parrish, the only instructor at Tuskegee AAF, Ala., who would socialize with the black pilots during World War II.

Brig. Gen. Idwal Edwards, a personnel specialist, saw segregation as an inefficient and defective policy and sought to eliminate it.

unit. Few Tuskegee Airmen rose above the rank of lieutenant from 1942 through the end of the war, despite the fact that many flew three times the number of combat missions required of fighter pilots before departing the combat zone.

Threat to Morale

All of these elements harmed morale, and the spirit of the 332d Fighter Group (which, by 1944, had united Tuskegee Airmen from the 99th, 100th, 301st, and 302d Fighter Squadrons) was somewhat damaged by segregation and the discrimination that accompanied it. However, the 332d's attitude and *esprit* were positive compared to that of the other Tuskegee Airmen flying unit, the 477th Bomb Group (Medium). The bomber group never got into combat as a result of its white commander's bigoted personnel policies. The commander was eventually fired because he had sabotaged his unit but not before he did great damage to the spirit of his troops.

Given the daily indignities faced by the Tuskegee Airmen, it is something of a miracle that they accomplished all they did.

In the spring of 1941, the first African-American enlisted men began training to become maintainers and the first thirteen pilot candidates entered training. From that time until the end of the war, Tuskegee AAF graduated 950 pilots and formed four fighter squadrons and four medium bomb squadrons. About half the pilot trainees flew in combat.

These men flew more than 10,000 sorties. During 200 escort missions to heavily defended targets in Germany and Romania, the Tuskegee Airmen never lost a friendly bomber to an enemy fighter. In 1944 and 1945, they shot down more than 100 enemy aircraft in air-to-air combat and destroyed many more on the ground. They also sank a destroyer with machine guns (another unique accomplishment) and destroyed many locomotives and other transportation assets.

Because of the success of the 332d Fighter Group and several other much smaller units, the War Department again reexamined the role of blacks in the armed forces. This massive study, "Participation of Negro Troops in the Post-War Military Establishment," concluded that blacks with the same training and aptitude as whites performed satisfactorily.

One of the general officers who supervised this study was USAAF Brig. Gen. Idwal H. Edwards, who was fully aware of the accomplishments (and trials) of the Tuskegee Airmen. General Edwards had investigated racial problems affecting the Army and the Army Air Forces between 1944 and 1947 and believed segregation was inefficient and, worse, incited racial disharmony and often provoked riots. He later became the Air Force's first deputy chief of staff for Personnel.

Dead-End Policies

General Edwards believed that segregation was a defective personnel practice. The services were forced to place educated and high-aptitude blacks in all-black units, and almost all of these were support units. Thus, blacks who had sufficient education and aptitude to rise in rank and contribute in combat areas were prevented from doing so.

After the war, the number of highly skilled black officers and enlisted men exceeded the needs of the 332d Fighter Wing (which had succeeded the 332d Fighter Group), then based at Lockbourne AAB, Ohio. Despite their skills, they could not fill shortages elsewhere because no other flying organization used skilled and trained blacks. Conversely, vacancies in the units of the 332d could not be filled by personnel in the rest of the Air Force because these units had to remain segregated.

General Edwards knew this practice was wasteful, but he could do nothing about it so long as the Air Force was segregated. When the Air Force became independent in 1947, General Edwards directed Lt. Col. Jack F. Marr, a subordinate staff officer, to study racial segregation to see if abandoning it was advisable.

At Lockbourne, the all-black fighter wing's aircraft were flown and successfully maintained by blacks. Colonel Marr also found that competent blacks worked alongside competent whites (though the two groups never messed or billeted together) in a friction-free atmosphere at other bases, despite official segregation. The Colonel concluded that USAF could desegregate safely and that sound management called for discontinuing the separation of the races.

Colonel Marr's study confirmed General Edwards's thinking. In the spring of 1948, the personnel chief convinced Gen. Carl A. Spaatz, the first Air Force Chief of Staff, and Gen. Hoyt S. Vandenberg, the vice chief, that sound personnel management practices demanded racial integration. These general officers had no trouble selling this idea to their civilian leaders, Secretary Stuart Symington and Assistant Secretary Eugene M. Zuckert, because both abhorred racial segregation. The Air

Force, furthermore, was in harmony with the thinking of Defense Secretary James V. Forrestal, who also favored integration.

Secretary Zuckert and General Spaatz announced in April 1948 that USAF would soon integrate because it accepted no doctrine of racial superiority or inferiority.

The Air Force was the first service to announce this dramatic change. At the time that the Air Force was declaring its intent to integrate, Secretary of the Army Kenneth C. Royall was asserting that the Army had no intention whatsoever of racially integrating. He also formally complained to the Secretary of Defense that the Air Force was breaking the united front and demanded that Secretary Forrestal stop Air Force integration.

With hindsight, it is easy to see how Secretary Royall and the Army acted as they did; they had no experience comparable to the Air Force's success with the Tuskegee Airmen. During World War II, all-black Army units, except the 92d and 93d Divisions, were tiny, and all of them, including the two infantry divisions, had white leaders at the top and in many other supervisory positions. In the postwar military, there were no Army (or Navy or Marine) units like Lockbourne's 332d Fighter Wing, an outfit with a complex and highly demanding mission that every day gave the lie to the basis for segregation.

Colonel Davis put to rest the myth that whites would not work for black officers. General Fogleman credited Davis's men with proving "to people with unbiased eyes that the Tuskegee Airmen could fly and fight with the best of them."

Selling the Policy

It took General Edwards about a year to carry out his policy because some senior officers had to be sold on integration. However, there was widespread support. In addition to the Chief and vice chief of staff, supporters included Gen. Nathan F. Twining, who commanded the World War II Tuskegee Airmen as Fifteenth Air Force commander, and Lt. Gen. Elwood R. "Pete" Quesada, who commanded the postwar Tactical Air Command, which included the 332d FW at Lockbourne.

Some senior Air Force officers claimed that the country was not ready for military integration, or that the military ought to wait for civilian integration, or that they and the troops would not cooperate.

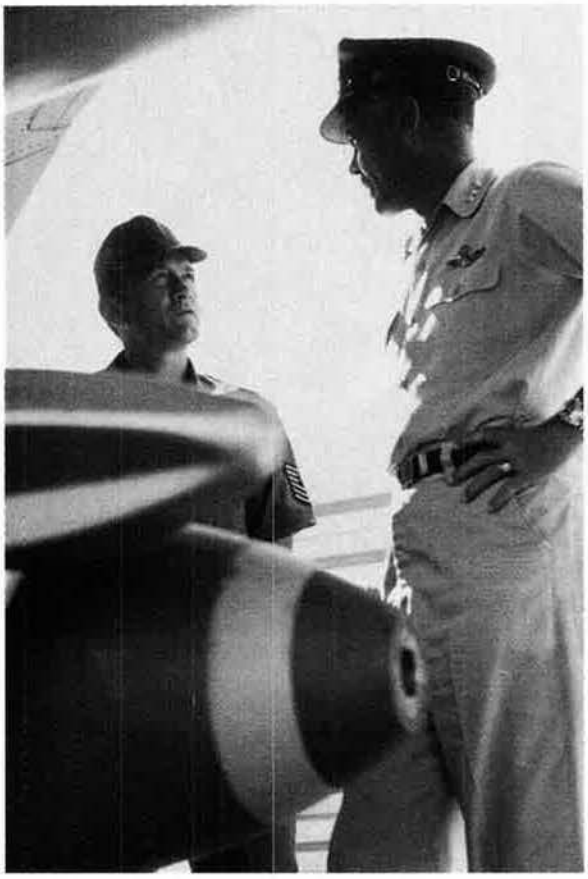
A persistent contention was that whites would never tolerate black supervision, but even that objection was buried by Col. Benjamin O. Davis, Jr., commander of the Tuskegee Airmen at Lockbourne from 1946 to 1949 and base commander.

It was Colonel Davis who led the 332d in combat in both ground-attack and escort roles, and it was he who demanded a level of professionalism and discipline that earned the praise of Gen. Ira C. Eaker himself. In the postwar period, therefore, Colonel Davis deliberately planned to overcome the old saw that whites would never work for blacks.

Although the 332d Fighter Wing at Lockbourne was all black, the tenant units at the base were white, and these outfits had to work with their black hosts for support. More significantly, the civilians employed by the 332d and Lockbourne were white and had black supervisors. Every inspector general inspection conducted by Tactical Air Command in this period determined that Colonel Davis and his post had smooth and harmonious personnel relations. Whites would indeed work for blacks.

Colonel Davis and his men thus had destroyed another myth.

Once in Europe, General Fogleman noted, the Tuskegee Airmen in "a series of 200 bomber-escort missions over Germany . . . became known as the Red Tail Devils" and compiled an enviable combat record, which would not have been possible without top-notch maintainers like these.



General Fogleman closed by summing up the combat record: "By war's end, the Tuskegee Airmen had shot down 111 enemy aircraft and destroyed another 150 on the ground. They disabled more than 600 boxcars, locomotives, and rolling stock and sank one German destroyer and forty other boats and barges . . . and never lost a bomber to enemy fighters." In the process, they paved the way for Lt. Gen. Benjamin Davis (right); the US military's first black four-star general, Gen. Daniel "Chappie" James; and thousands of others.

The Air Force pressed on with integration. General Edwards briefed the uniformed leadership in April 1949, telling the senior commanders that the "Air Force [had] adopted a policy of integration under which Negro officers and airmen may be assigned to any duty in any Air Force unit or activity in accordance with the qualifications of the individual [and the need] of the service." This was done, he said, out of a need for efficiency, economy, and effective airpower.

The 332d was to be broken up, and its pilots and mechanics were to be sent to formerly all-white units based on the needs of the Air Force. According to General Edwards, blacks entering the Air Force would be asked to meet the "same standards as anyone else and will be classified, assigned, promoted, or eliminated in accordance with standards that will apply equally to all personnel."

A Single Criterion

General Edwards put no limits on the number of blacks who could qualify for integrated positions, and he insisted that the only criterion for employment was ability. He directed that commanders give this new policy their wholehearted support and undivided attention, for without their backing and care it would not work. General Edwards then promulgated several documents—the regulation calling for integration and a classified supplement to the regulation that insisted the men be assigned according to their specialties (barring commanders from employing engine mechanics as janitors and so forth) and that told commanders that they were personally responsible for making the new policy work.

By the end of 1949, 7,402 African-Americans still were serving in all-black units. But 11,456 were serving in mixed-race units, and 7,033 were in transit to units that had formerly been all white. Blacks at that point made up seven percent of the enlisted force and twelve percent of the troops in Air Force basic training. By the end of 1951, the last all-black service unit was dissolved and the Air Force was officially integrated.

Colonel Davis departed Lockbourne for the Air War College and from there to the Pentagon and from there to command of a fighter wing in Korea, eventually reaching the rank of lieutenant general. After General Davis retired, another Tuskegee Airman, Daniel "Chappie" James, became a four-star general and commander in chief of North American Air Defense Command.

Unquestionably, the Air Force benefitted from employing people of all races based solely on ability, and so did the United States. This essential reform began with the Tuskegee Airmen and their demonstration of discipline, skill, and courage. This reality was made explicit by Air Force Chief of Staff Gen. Ronald R. Fogleman at the Tuskegee Airmen Convention last August in Atlanta, Ga.

"In the end," said General Fogleman, "the men and the women of the Tuskegee experience broke forever the myths that allowed segregation, inequity, and injustice to exist with a thin veil of legitimacy.

"You engaged one of the most formidable military establishments in the world—the Luftwaffe. . . . When you engaged this force in combat and came away victorious, you carried not only your own pride and your personal accomplishments but also the idea that never again would anybody deny a man or woman the opportunity to serve our country in any capacity because of the color of his or her skin."

General Fogleman concluded, "We look back with pride on your outstanding accomplishments—your skill in combat, your strength of character in the face of prejudice and racism. Despite the bigotry, you would not be denied the opportunity to serve your country in desperate times. 'Service before self' is a key concept of our modern-day Air Force. 'Service before self' was more than just a phrase to the Tuskegee Airmen. It was a way of life." ■

Col. Alan L. Gropman, USAF (Ret.), an instructor at National Defense University, has published widely on the topic of the Tuskegee Airmen. His most recent article for Air Force *Magazine, a book review of* Eagle Against the Sun: The American War with Japan, *by Ronald H. Spector, appeared in the June 1986 issue.*

THE UNIVERSITY DESIGNED FOR THE MILITARY PROFESSIONAL

AMERICAN MILITARY UNIVERSITY'S

MASTER of ARTS in MILITARY STUDIES

MAKES YOUR PME COUNT!

AN INFORMATION AGE MILITARY CAREER REQUIRES ADVANCED EDUCATION.

This graduate education program has been developed to meet the educational needs of tomorrow's officer. The curriculum and your Professional Military Education complement each other, allowing more rapid progress toward the degree.

OFFICER PME:
RECEIVE GRADUATE CREDIT FOR YOUR SERVICE SCHOOLING

SOS
ACSC
ISS
AWC
SSS

3 TO 15 CREDITS

TOTAL 36 CREDITS → **MA DEGREE**

(EXAMPLE)

AMU GRADUATE PROGRAM:
PURSUE ONE OF SIX ACADEMIC TRACKS

LAND WARFARE
AIR WARFARE
NAVAL WARFARE
DEFENSE MANAGEMENT
LOW INTENS. CONFLICT
INTELLIGENCE

MINIMUM OF 21 CREDITS

AMERICAN MILITARY UNIVERSITY
Established 1991
Nationally Accredited 1995
GI Bill & DANTES Tuition Assistance
Over 500 Officers Studying at AMU
Grad Ed Recognised by All Services

METHOD OF INSTRUCTION
Distance Education
Telephone/Computer/Internet/Correspondence
Directed Study and Research
One-On-One With Professor
Accomodates Military PCS-TDY-FTX-DEPLOY

COURSE REQUIREMENTS
Direct Telecommunications With Professor
15 Week Semester
1200-1500 Pages of Reading
Research Project/Paper
Proctored Final Essay Examination

SAMPLE COURSE OFFERINGS:

(SUBJECT TO PERIODIC REVISION)

LW501	*Great Military Leaders*	*AW503*	*The Air War in Korea*	*DM501*	*Communications in Warfare*
LW502	*Napoleon the General*	*AW504*	*The Air War in Southeast Asia*	*DM509*	*Program and Acquisition Mgmt in DoD*
LW508	*The Boer War*	*AW507*	*History of Rotary-Wing Aviation*	*IN505*	*Intelligence and the War on Drugs*
LW510	*The National Guard*	*MS607*	*Strategy, Tactics & Operational Art*	*IN506*	*Intelligence in the Combat Arms*
LW511	*History of the U.S. Army*	*MS612*	*AirLand Battle Doctrine*	*IN521*	*C4I*
LW512	*Amer Mil Experience Since 1900*	*MS613*	*Contemporary Tactical Thought*	*LC501*	*PSYOPS*
NW500	*History of Sea Power*	*MS622*	*Great Military Philosophers*	*LC502*	*UN Peacekeeping/Peacemaking Ops.*
NW503	*Amphibious Warfare*	*MS623*	*Japanese Military History*	*LC505*	*Future War*
NW505	*Submarines in War and Peace*	*MS698*	*Foreign Policy Great Decisions, 1996*	*LC509*	*Counterinsurgency: A Comparative Study*
NW507	*Post Cold War Sea Power/Mar Aff.*	*DM500*	*Logistics in Warfare*	*LC655*	*LIC and Special Operations Forces*

A COMPLETE LIST OF OVER 150 COURSES IS CONTAINED IN THE GRADUATE STUDIES CATALOG

TO RECEIVE A GRADUATE CATALOG WITH COMPLETE INFORMATION AND APPLICATION FOR ADMISSION SEND $7.00 TO:

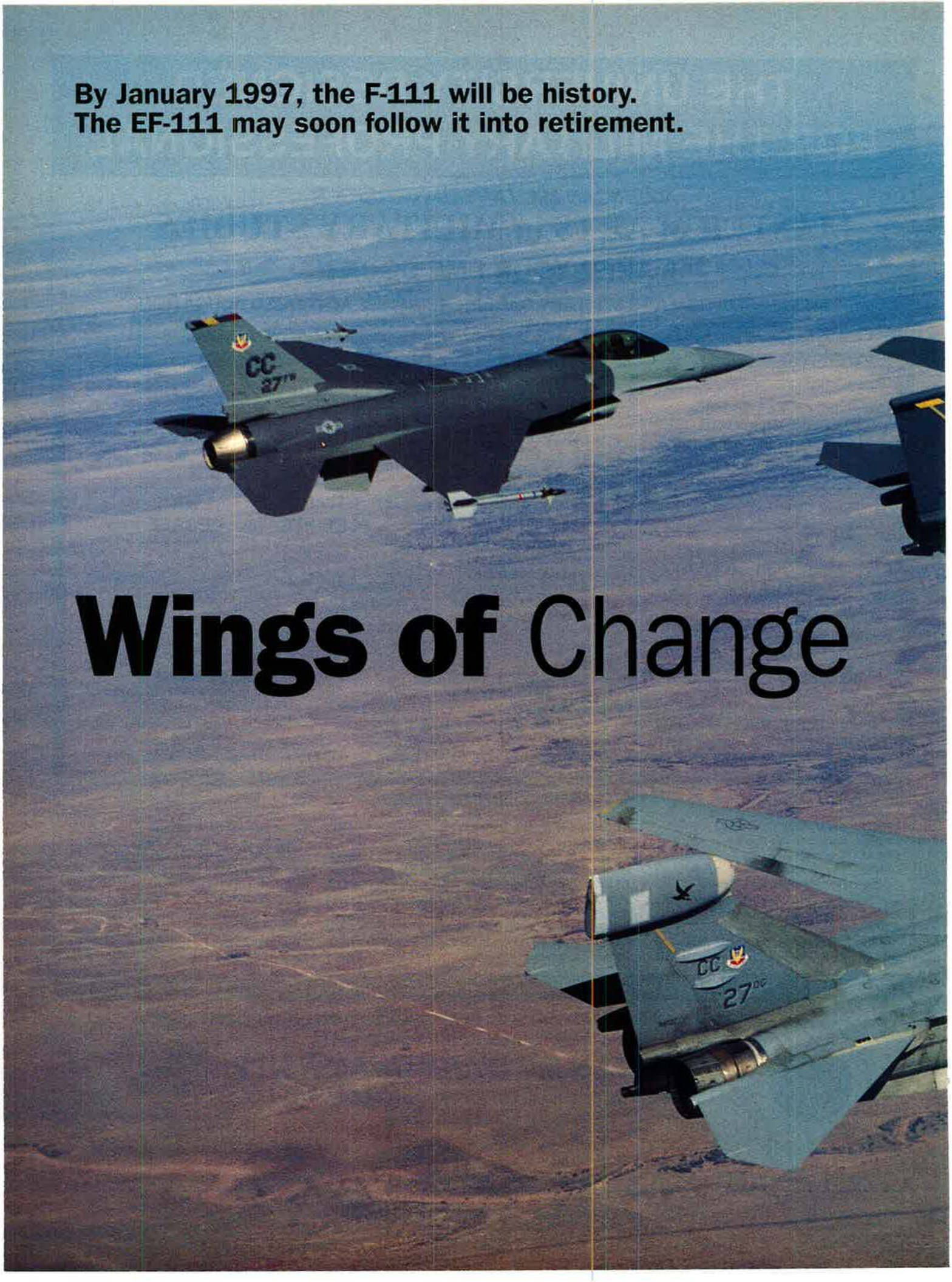
AMERICAN MILITARY UNIVERSITY

DIRECTOR OF GRADUATE ADMISSIONS (CODE AFM)
9104-P MANASSAS DRIVE
MANASSAS PARK, VA 22111

The Accrediting Commission of the Distance Education and Training Council is listed by the U.S. Dept. of Education as a nationally recognised accrediting agency.

PHONE: 703-330-5398 FAX: 703-330-5109 E-MAIL: amugen@amunet.edu INTERNET: http://www.amunet.edu

By January 1997, the F-111 will be history. The EF-111 may soon follow it into retirement.



Wings of Change

Staff photo by Guy Aceto

Photographs by Paul Kennedy and Guy Aceto, Art Director

The three very different aircraft that currently represent the 27th Fighter Wing join up for the camera over eastern New Mexico. The Block 30 F-16C and the EF-111 are led by an F-111F.

Staff photo by Guy Aceto

The swing-wing F-111 has been a part of operations at Cannon since the first "Aardvark" arrived in 1969. A few years ago, the Air Force consolidated the fleet at the New Mexico base [see "The Aardvarks Gather at Cannon," April 1993, p. 36]. *More recently, budget considerations led to a decision to retire the aging but still potent system. In January, the 27th FW officially began its transition from the F-111 to the multirole F-16 Fighting Falcon, but it had laid the groundwork long before.*

The 27th FW was determined to move smoothly from one aircraft type to another, and senior wing officials decided that the first order of business should be to take care of the people who had worked so hard over the years to create the unit's enviable reputation. The wing put together a special assignment division to work directly with the Air Force Personnel Center at Randolph AFB, Tex. Its mission was to find everyone assignments quickly so they would know whether they would be cross-training to the new aircraft or transferring to a new base. Lt. Col. Dale Hanner, 524th Fighter Squadron commander, said, "It was flow-charted out to the very last guy."

Photo by Paul Kennedy

Photo by Paul Kennedy

Though they knew their aircraft were to be retired, F-111 crews still put in a great deal of time on temporary duty, participating in such exercises as Red Flag, Green Flag, and Gunsmoke 1995. Above, SSgt. Mark McConnell does a last-minute "tweak" of the jet under his care, while, at left, crew chiefs launch their jets for the day's missions. "Everybody has a critical part—a piece of the puzzle—to make a combat fighter wing work," said Col. Michael Koerner, 27th FW commander. "It requires a tremendous amount of support and effort by the entire team."

Staff photos by Guy Aceto

Cannon has been home to five versions of swing-wing aircraft—the F-111D/E/F/G and the EF-111A. The F model—with its Pave Tack infrared and laser-guided target designator system and the ability to deliver a wide range of smart munitions—and the sophisticated EF-111 Raven electronic countermeasures aircraft are survivors of the thinning of the wing's ranks that began in 1992. Above, the markings of the wing and the 27th Operations Group are shown on a newly arrived F-16C and an EF-111 being led past the flight line by an F-111F. At right, the much larger F-111 looms over its smaller cousin. Such disparity in size requires many changes. The dimensions of an aircraft affect how it is parked on the ramp and, consequently, taxiing and parking guides must be repainted.

Big changes may be taking place around them, but the EF-111s (bottom right) of the 429th Electronic Combat Squadron—the "World Famous Ravens"—are still assigned to deploy anywhere their electronic jamming expertise is needed. The World Famous Ravens will be the last F-111 squadron of any type in the Air Force. Current plans call for the EF-111 squadron to remain active at least until 1998.

Photos by Paul Kennedy

A new type of aircraft on the flight line means significant adjustments all around. Just ask anyone in supply. While a certain amount of equipment remains the same, there is not much overlap. Almost twenty years of technological advances separate the F-111 from the F-16. A lot of storage space is needed for F-111 equipment as the squadrons draw down. Aircraft are flown to the Aerospace Maintenance and Regeneration Center at Davis-Monthan AFB, Ariz., but the equipment must stay at Cannon for now. An estimated ninety-three percent of F-16 parts are already on hand, along with about seventy-one percent of new support equipment.

At top, a full warehouse on base is the first stop for new equipment arriving from throughout the Air Force. About $10 million will be spent on building or improving facilities at Cannon to accommodate its F-16 operations. Above right, cross-training takes place wherever space permits. Surrounded by a room full of F-16 pylons and equipment, (left to right) SSgt. Tim Hurst shows SrA. Jerry Shelton and former F-111 technician TSgt. James Lowe the finer points of an F-16 missile launcher.

Staff photo by Guy Aceto

The wing began training classes in July 1995 for maintenance personnel who would be converting from the F-111 to the F-16. At right, MSgt. Bernie Manfre (right) reviews a ten-hour throttle inspection in an F-16 cockpit with his student, Amn. Errson Martin. Sergeant Manfre is a former F-111 hydraulics technician and crew chief who has already cross-trained to the F-16 and is in charge of crew chief training for the 522d Fighter Squadron, the first of the three units to begin the transition. More than a few of his students will be just like him, with most of their Air Force experience in the F-111. What he teaches—and learns—will be invaluable to the other two squadrons down the line when it is time for them to make the change.

Photos by Paul Kennedy

Sgt. Michael Reeves (far left) oversees the removal of an F-16 canopy by his students, Amn. Ryan Sellers (center) and SrA. Rich Fisher. Sergeant Reeves came to the 27th FW from Osan AB, South Korea, to be part of a cadre of experienced F-16 maintainers and trainers. His eight years of experience with the Advanced-Concept Escape System II (ACES II) ejection seat has put him in charge of designing a new egress shop. The capsule ejection system for the F-111 is unique in the Air Force and is very different from the more common individual ejection seat.

Even with a busy schedule of training new pilots, qualifying the crews that will stay to fly the F-16, and disposing of a flight line of aircraft, F-111 crews take advantage of every opportunity to fly. In the past year, the Aardvark has been a regular on the ramp at Nellis AFB, Nev., for Red Flag, Green Flag, and Gunsmoke. They stand ready for any real-world commitments and expect to take part in several exercises this year. The 524th FS—"The Hounds of Heaven"—plans to attend this year's Maple Flag exercise at CFB Cold Lake, Canada. It will mark the last deployment of the bomber. At right, a crew from the 524th prepares for yet another sortie.

Staff photo by Guy Aceto

Some of the biggest changes stem from new weapons the 27th FW is adding to its inventory. The addition of AIM-120 AMRAAM and AGM-65 Maverick missiles means that weapons storage facilities need improvement and modification as crews test, assemble, and deliver the new missiles. A new maintenance building is planned for 1998. At right, munitions maintenance personnel move Mk. 84 training bombs to make a little extra room for the additional weapons.

Photos by Paul Kennedy

While the air-to-ground side of the mission is sure to change—with less time spent at medium altitude and on night, low-level missions—the air-to-air role is also new to the wing. At left, SrA. Michael L. Youngs checks part of an AIM-9M Sidewinder during a twenty-flight missile inspection. The advanced AIM-9, along with the AIM-120 AMRAAM, is at the heart of the F-16's air-to-air punch. The multimission capability of the "Viper" and its significantly lower operations and logistics costs made it an attractive choice to succeed the F-111.

The 522d FS, nicknamed the "Fireballs," was the first to begin the transition. (The 523d and 524th Fighter Squadrons will follow in order. The 524th will convert to Block 40 aircraft.) Most of the Block 30 F-16s for the 522d FS arrived from the 35th Fighter Wing at Misawa AB, Japan. Some come complete with pilots who have received regular assignments to Cannon. The Fireballs are the first stop for new F-16 pilots reporting to the wing, and a lot of desk sharing will go on until they move to the next squadron. About five percent of F-111 pilots and crews are expected to stay on to transition to the new system, said Lt. Col. Stephen Mueller, 522d FS commander.

Staff photo by Guy Aceto

Though the F-111 faces retirement, dedicated crews maintain a sense of style. The transition plan calls for three squadrons to be back to combat status by January 1997. The first F-16 sorties began in September 1995, said Lt. Col. Carl Armstrong, deputy chief of the transition team, and through the fall, the wing flew six to eight sorties a week. The wing looks ahead to other developments, too. It expects to field a "new" 522d FS at a Red Flag exercise in July. Also, the 429th ECS will continue to operate its advanced jamming platform at least until 1998. Crews who have been to war in and have been brought back safely by the F-111 might feel nostalgic walking out to the aircraft one last time. They nevertheless bring the highest standards of professionalism to their new aircraft and eagerly face the challenge of achieving new goals in it. By the beginning of 1997, the 27th FW will be represented by the EF-111 and the F-16C, shown above in formation over the New Mexico countryside. ■

Photo by Paul Kennedy

Staff photo by Guy Aceto

Gallery of Russian Aerospace Weapons

By John W. R. Taylor

Sukhoi Su-24MP ("Fencer-F") *(Yefim Gordon)*

Attack Aircraft

Sukhoi Su-24 (NATO "Fencer")

The Fencer-B initial operational version of the variable-geometry Su-24 entered service in 1976. About 365 of the improved Su-24M series now equip tactical strike components of Russian Air Forces, with 80 more for reconnaissance and ECM. Naval Aviation has 110 for attack and 20 for reconnaissance and electronic warfare. The ability of these aircraft to deliver a wide range of ASMs provides defense suppression and some hard-target kill potential, with the emphasis on low-level attack. There are three major operational versions:

Su-24M (Fencer-D). Theater attack aircraft, introduced in 1983, with terrain-avoidance radar. Longer nose (approx 2 ft 6 in) for new avionics bay. Added in-flight refueling capability, with centrally mounted retractable probe forward of windshield. Laser ranger/designator added aft of nosewheel bay. Overwing fences integral with extended wingroot glove pylons fitted when carrying Kh-29 (AS-14 "Kedge") ASMs.

Su-24MR (Fencer-E). Reconnaissance variant used by tactical and Naval Air Forces. Attack capability deleted. No overwing fences. Internal equipment includes Shtik side-looking airborne multimission radar in shorter radome. Zima IR reconnaissance system under center-fuselage, Aist-M TV reconnaissance system, with panoramic and oblique cameras in fuselage. A Shpil-2M laser pod can be carried on the centerline, with a Tangazh electronic intelligence (elint) pod or Efir-1M radiation detector pod on the starboard underwing swiveling pylon, and two R-60 AAMs under the port wing. Data can be transmitted to the ground by data link. Flight refueling capability is retained.

Su-24MP (Fencer-F). Electronic warfare/jamming/signals intelligence (sigint) version. Added small fairing under nose. Centerline EW pod. Gun and four R-60 AAMs retained. Only 12 built. *(Data for Su-24M.)*

Power Plant: two Saturn/Lyulka AL-21F-3A afterburning turbojets; each 24,690 lb thrust.

Dimensions: span 57 ft 10½ in spread, 34 ft 0 in swept, length 80 ft 8¼ in, height 20 ft 3¾ in.

Weights: empty, equipped 49,163 lb, gross 87,235 lb.

Performance: max speed at height Mach 1.35, at S/L (clean) Mach 1.08, ceiling 57,400 ft, T-O run 4,265 ft, landing run 3,120 ft, combat radius (lo-lo-lo) more than 200 miles, (hi-lo-hi, with 6,615 lb of weapons and two external tanks) 650 miles.

Accommodation: pilot and weapon systems officer, side by side.

Armament: one GSh-6-23M six-barrel 23-mm Gatling-type gun on starboard side of belly; nine pylons under fuselage, wingroot gloves, and outer wings for 17,857 lb of air-to-surface weapons, including TN-1000 and TN-1200 nuclear weapons, up to four TV- or laser-guided bombs, conventional bombs (typically 38 x 220-lb FAB-100), 57-mm to 330-mm rockets, 23-mm gun pods, and such ASMs as Kh-23 (AS-7 "Kerry"), Kh-25ML (AS-10 "Karen"), Kh-58 (AS-11 "Kilter"), Kh-25MP (AS-12 "Kegler"), Kh-59 (AS-13 "Kingbolt"), Kh-29 (AS-14 "Kedge"), and Kh-31A/P (AS-17 "Krypton"). Two R-60 (AA-8 "Aphid") AAMs can be carried for self-defense.

Sukhoi Su-25T *(Yefim Gordon)*

Sukhoi Su-25 (NATO "Frogfoot")

Following withdrawal from service of single-engine MiG-27s ("Flogger") and Su-17s ("Fitter"), the Su-25 is Russia's primary close-support aircraft. First flown February 22, 1975, its sole purpose is to battle through to ground targets at low level with a heavy weapon load. Survivability dominated its design philosophy. The pilot is protected by an all-welded cockpit of titanium armor, almost one inch thick. Pushrods rather than cables actuate the control surfaces, main load-bearing members are damage-resistant, the engines are widely separated in stainless steel bays, and the fuel tanks are filled with reticulated foam for explosion protection. A total of 256 flares can be packed into dispensers above the engine nacelles and tailcone for use during eight attack runs. Ten underwing pylons carry a wide range of ordnance, including self-protection AAMs. The engines will run on any fuel likely to be found in a combat area, including MT gasoline and diesel oil.

The most recent inventory showed 192 in Russian Air Forces service, plus 70 with Naval Aviation. Versions identified to date:

Su-25 (Frogfoot-A). Basic single-seat close-support aircraft.

Su-25UB (Frogfoot-B). Tandem two-seat operational conversion and weapons trainer. Raised rear cockpit. Taller tailfin. Gun and weapons pylons retained.

Su-25UT (Frogfoot-B). As Su-25UB but without weapons. Prototype first flew August 6, 1985. Few only.

Su-25UTG (G for *gak*, "hook") (Frogfoot-B). As Su-25UT, with arrester hook added under tail for deck landing training on dummy flight deck marked out on runway at Saki Naval Airfield, Ukraine, and for use on the carrier *Admiral Kuznetsov*. Ten built; four based at Severomorsk, Kola Peninsula, for service on *Admiral Kuznetsov*.

Su-25BM. Standard Su-25 with added underwing pylons for rocket-powered targets released for missile training by fighter pilots.

Su-25TM. See separate entry. *(Data for Frogfoot-A.)*

Power Plant: two Soyuz/Tumansky R-195 turbojets; each 9,921 lb thrust. To reduce infrared signature, a small pipe in the tailcone of each turbojet on later aircraft expels air to lower exhaust temperature.

Dimensions: span 47 ft 1½ in, length 50 ft 11½ in, height 15 ft 9 in.

Weights: empty 20,950 lb, gross 32,187–38,800 lb.

Performance: max level speed at S/L Mach 0.8, max attack speed, airbrakes open, 428 mph, ceiling 22,965 ft, T-O run 1,970–3,935 ft, landing run 1,312–1,970 ft, range with 9,700 lb of weapons at S/L 466 miles, at height 776 miles.

Accommodation: pilot only.

Armament: one twin-barrel AO-17A 30-mm gun in port side of nose, with 250 rds. Eight underwing pylons for 9,700 lb of air-to-surface weapons, including Kh-23 (AS-7 "Kerry"), Kh-25 (AS-10 "Karen"), and Kh-29 (AS-14 "Kedge") ASMs, SPPU-22 pods for 23-mm guns with twin barrels that pivot downward, 57-mm to 330-mm rockets, laser-guided rocket-boosted bombs, and 1,100-lb incendiary, antipersonnel, and other cluster bombs. Two small outboard pylons for R-3S (AA-2D "Atoll") or R-60 (AA-8 "Aphid") AAMs.

Su-25TM

This is a considerably upgraded "Frogfoot" derivative with improved navigation and attack systems and new missiles. The first development aircraft flew August 17, 1984. Eight **Su-25T** preseries aircraft were delivered to the Russian Air Forces from 1989.

Embodying lessons learned during action in Afghanistan, the three original development aircraft utilized converted Su-25UB airframes, with the humped rear cockpit faired over and the internal space used to house new avionics and an extra metric ton of fuel. The navigation system, with two digital computers and an inertial platform, permits flights to and from combat areas under largely automatic control. The widened nose houses a TV system, laser rangefinder, and target designator of improved capability. The TV can be activated some six miles from the target, after which target tracking, weapon selection, and release are automatic.

Chaff/flare dispensers are installed in the top of the fuselage tailcone and in a large cylindrical housing at the base of the rudder. This housing also contains an infrared jammer, optimized against Stinger and Redeye frequencies. A radar warning/emitter location system is standard. The Voskhod nav/attack system and Schkval electro-optical system are intended to ensure precision attacks on enemy armor. A Khod centerline IR pack enables a main battle tank to be identified at night over a distance of nearly two miles. This is replaced by a Kopyo-25 radar pod for full all-weather use on the intended operational **Su-25TM,** soon to begin flight tests. The gun is transferred to an underbelly position on the starboard side of a farther-offset nosewheel.

Power Plant: as for Su-25.

Dimensions: span 47 ft 7¾ in, length 50 ft 4½ in, height 17 ft 0¾ in.

Weight: gross 42,990 lb.

Performance: max speed at S/L Mach 0.78, ceiling 32,800 ft, T-O and landing run on unpaved runway 2,300 ft, combat radius with 4,410 lb of weapons at S/L 248 miles, at height 435 miles.

Armament: one twin-barrel NNPU-8M 30-mm gun, with 200 rds. Ten underwing pylons for 9,612 lb of weapons, including two eight-rd clusters of Vikhr M

(AT-X-16) tube-launched ASMs able to penetrate 35 in of reactive armor, KAB-500 laser-guided bombs, Kh-25ML (AS-10 "Karen"), Kh-58 (AS-11 "Kilter"), Kh-29L (AS-14 "Kedge"), and Kh-31A/P (AS-17 "Krypton") ASMs, Kh-35 (AS-20) antiship missiles, and R-77 (AA-12 "Adder") or R-60 (AA-8 "Aphid") AAMs.

Bombers and Maritime

Antonov An-72P/An-76 (NATO "Coaler")

Based on the airframe of the An-72 STOL transport, the An-72P/An-76 is intended for armed surveillance of coastal areas, within 230 miles of shore, in all-weather day/night conditions. Its avionics permit automated navigation at all stages of flight and precise fixing of the coordinates, speed, and heading of surface ships. Fixed cameras for photographing targets are supplemented by a TV scanning system, with flares for night use. Bombs can be carried in the roof of the hold, above the rear loading hatch, with the loading ramp slid forward under the cabin to make their release practicable. An upgraded version, equipped by Israel Aircraft Industries, is available with digital cockpit avionics, Elta EL/M 2022A maritime surveillance radar, El/Op day/night long-range observation system, and Elisra electronic warfare suite. Russia has ordered 20 An-76s. *(Data generally as for An-72.)*

Weights: mission load 1,433 lb, gross 82,670 lb.

Performance: patrol speed at 1,640–3,280 ft 186–217 mph, ceiling 33,135 ft, field requirement 4,600 ft, max endurance 7 hr 18 min.

Accommodation: crew of five; on secondary missions can carry and air-drop 22 fully equipped paratroops, or transport 40 passengers, 16 litter patients and attendant, or up to 11,020 lb of ammunition, vehicles, or equipment.

Armament: one GSh-23L 23-mm gun pod, with 250 rds, forward of starboard landing gear fairing; two UB-32M rocket packs underwing (Griffin laser-guided bombs on IAI upgraded aircraft); four 220-lb bombs.

Beriev A-40 Albatross and Be-42 (NATO "Mermaid")

Manufacture of the initial series of 20 of these amphibians, for Russian Naval Aviation, has been delayed by lack of funding. The basic **An-40** was designed to replace the Il-38 "May" and M-12 "Mail," though not on a one-for-one basis. Equipped for ASW/surveillance/minelaying duties, it carries weapons and other stores in a 21 ft 4 in bay in the bottom of the hull aft of the step. Features include booster turbojets in pods with eyelid nozzles at the rear of the pylon supports for the primary turbofans, a large nose radar, cylindrical containers for ESM above the wingtip floats, and an in-flight refueling probe on the nose.

Variants include the **Be-42** search-and-rescue amphibian, which has not yet flown. Its equipment includes extensive radio, radar, electro-optical sensors, and searchlights to detect shipwreck survivors by day or night. A rescue team with power boats, life rafts, and other specialized equipment can be carried, and there is room for up to 54 survivors, who enter the aircraft via hatches in the side of the hull with the aid of mechanized ramps. On-board equipment to combat hypothermia is available, together with resuscitation and surgical equipment and medicines. All ASW equipment, the booster turbojets, and ESM are deleted.

Further versions of the A-40 are projected as the **Be-40P** to carry up to 105 passengers and the **Be-40PT** transport for mixed cargo/passenger payloads. *(Data for basic A-40.)*

Power Plant: two Aviadvigatel D-30KPV turbofans, each 26,455 lb thrust, on pylons above rear of hull (33,070 lb thrust engines to be fitted later). Two RKBM RD-60K booster turbojets, each 5,510 lb thrust.

Dimensions: span 136 ft 6½ in, length 143 ft 10 in, height 36 ft 3¾ in.

Weights: max payload 14,330 lb, gross 189,595 lb.

Performance: max speed at 19,700 ft 472 mph, max cruising speed 447 mph, ceiling 31,825 ft, T-O run 3,280 ft, landing run 2,955 ft, range with max payload 2,547 miles, with max fuel 3,417 miles.

Accommodation: crew of eight.

Armament: not yet specified.

Beriev M-12/Be-12/Be-14 Tchaika (NATO "Mail")

About 55 **M-12/Be-12** twin-turboprop amphibians remain in Naval Aviation service. They were built for overwater surveillance and antisubmarine duties within a 230-mile radius of shore bases, but some have been converted into **Be-14** search-and-rescue amphibians. *(Data for M-12.)*

Beriev M-12 ("Mail") *(Piotr Butowski)*

Sukhoi Su-32FN *(Yefim Gordon)*

Tupolev Tu-22M-3 ("Backfire-C") *(Yefim Gordon)*

Power Plant: two ZMKB Progress/Ivchenko AI-20M turboprops; each 4,190 ehp.

Dimensions: span 97 ft 5¾ in, length 99 ft 0 in, height 22 ft 11½ in.

Weight: gross 68,345 lb.

Performance: max speed 378 mph, service ceiling 37,000 ft, max range 4,660 miles.

Accommodation: crew of five.

Armament and Operational Equipment: torpedoes, depth charges, mines, and other stores for maritime search and attack carried in internal bay aft of step in bottom of hull and on four pylons under outer wings. Radar in nose "thimble;" MAD (magnetic anomaly detection) tailsting.

Ilyushin Il-38 (NATO "May")

Thirty-six Il-38 intermediate-range, shore-based, antisubmarine/maritime patrol aircraft, derived from the Il-18 airliner, serve with Naval Aviation units at coastal bases. Standard equipment includes nav/weather radar in the nose, search radar in a large radome under the front fuselage, and an MAD tailsting, with two internal weapons/stores bays forward and aft of the wing carry-through structure.

Power Plant: four ZMKB Progress/Ivchenko AI-20M turboprops; each 4,190 ehp.

Dimensions: span 122 ft 9¼ in, length 129 ft 10 in, height 33 ft 4 in.

Weights: empty 79,367 lb, gross 140,000 lb.

Performance: max speed at 21,000 ft 448 mph, patrol speed at 2,000 ft 248 mph, T-O run 4,265 ft, landing run 2,790 ft, max range 4,473 miles, patrol endurance 12 hr.

Accommodation: crew of nine.

Armament and Operational Equipment: attack weapons and sonobuoys in weapons bays.

Sukhoi Su-32FN

This variant of the Su-34 is a coastal-based strike aircraft for defense against hostile submarines and surface ships by day and night in all weather. The example (with "45" painted on its fuselage) displayed at last year's Paris Air Show was fifth in a succession of side-by-side two-seat airframes developed from the Su-27 ("Flanker"). They include the Su-27IB prototype ("42"), preseries Su-34 ("43"), and two static test airframes ("41" and "44"). Two more were under assembly in mid-1995, when the Su-32FN was stated to be in production to replace Su-24s and Su-17s of Russian Naval Aviation.

Details are generally as for the Su-34. Probably common to both types are the Su-32FN's "active artificial intelligence system to support the pilot in critical situations," smooth-flight system to damp turbulence in low-level flight at high speeds, liquid-crystal EFIS, and Sorbtsya active ECM jamming pods on the wingtips.

Dimensions: span 48 ft 2¾ in, length 82 ft 8 in, height 20 ft 4 in.

Weight: gross 99,205 lb.

Armament: one 30-mm GSh-301 gun; total 17,635 lb stores on 10 pylons and wingtips can include six Kh-25M (AS-10 "Karen"), Kh-29 (AS-14 "Kedge"), or Kh-31P/A (AS-17 "Krypton"), three Kh-59M (AS-18 "Kazoo"), two Kh-35 (AS-20), or one Kh-41 Moskit ASMs; bombs ranging from 34 AB-100s to three KAB-1500s; rockets from 120 S-8s to six laser-guided S-25Ls; and six R-73 (AA-11 "Archer"), or eight R-27 (AA-10 "Alamo") or R-77 (AA-12 "Adder") AAMs.

Sukhoi Su-34

This side-by-side two-seat development of the Su-27 series is a theater bomber to replace MiG-27s, Su-17s, and some Su-24s. The first preseries Su-34, built at Novosibirsk, flew December 18, 1993, at Zhukovsky Flight Test Center. It has a dielectric nose, wider than that of the Su-27, to house nav/attack and terrain following/avoidance radar; foreplanes; a deep fairing behind the canopy, containing a toilet and galley; and wing extensions carried forward as chines to the tip of the nose. Additional fuel is carried in the tailfins. There are no ventral fins. The twin-wheel nosewheel leg has been moved forward and now retracts rearward into a large bay that contains the hatch for crew access to the cockpit. The main landing gear units are new, with smaller, tandem wheels. Titanium armor, 17 mm thick, protects the cockpit.

The longer, larger diameter tailsting has been raised and now extends as a spine above the rear-fuselage, blending into the cockpit fairing. It houses twin cruciform brake-chutes and, at its tip, a rearward-facing radar. A retractable flight refueling probe is fitted under the port windshield.

Power Plant: two Saturn/Lyulka AL-31F turbofans; each 27,557 lb thrust with afterburning. (Two 28,220–30,865 lb thrust AL-35F turbofans in later aircraft.)

Dimensions: similar to Su-32FN.

Weight: gross 97,800 lb.

Performance: max speed at height Mach 1.8, at S/L Mach 1.15, range 2,485 miles.

Accommodation: crew of two, on side-by-side zero/zero ejection seats.

Armament: one 30-mm GSh-301 gun in starboard wingroot extension; high-precision ASMs, KAB-500 laser-guided bombs; R-73 (AA-11 "Archer") and R-77 (AA-12) "Adder" AAMs.

Sukhoi T-60S

The Sukhoi OKB is reported to be developing a new intermediate-range bomber to replace the Tu-16, Tu-22, and some Su-24s, under the project designation T-60S. No details are available.

Tupolev Tu-22M (NATO "Backfire")

The Russian medium-range bomber force for attacking deep theater targets consists of about 100 variable-geometry Tu-22Ms; Naval Aviation units have 165. A high proportion of these forces are equipped with the Tu-22M-3, newer of the two bomber versions in service:

Tu-22M-2 (Backfire-B). Initial series production version, with 48,500 lb thrust NK-22 turbofans. Wingsweep variable from 20° to 65°. Slightly inclined lateral engine air intakes, with large splitter plates. Armament up to three Kh-22 (AS-4 "Kitchen") ASMs or 46,300 lb of conventional bombs or mines. Two GSh-23 twin-barrel 23-mm guns in radar-directed tail mounting. Above-nose fairing replaces formerly observed in-flight refueling probe. Production totaled 211.

Tu-22M-3 (Backfire-C). Advanced production version with more powerful engines and wedge-type air intakes, deployed from 1983. Upturned nosecone. No visible in-flight refueling probe. Max weapon load increased. Can carry Kh-15P (AS-16 "Kickback") SRAMs. Single GSh-23 gun, with barrels one above the other, in aerodynamically improved tail mounting. Production totalled 268.

Backfire is capable of performing nuclear strike, conventional attack, and antiship missions, its low-level penetration features making it more survivable than earlier Tupolev bombers. Deployment of SRAMs with Backfire-C improved deliverable warhead potential and increased flexibility for air force strategists. A further version is described in the "Reconnaissance, ECM, and Early Warning Aircraft" section. *(Data for Tu-22M-3.)*

Power Plant: two KKBM/Kuznetsov NK-25 turbofans; each 55,115 lb thrust with afterburning. Provision for JATO rockets.
Dimensions: span 112 ft 5¾ in spread, 76 ft 5½ in swept length 139 ft 3¾ in; height 36 ft 3 in.
Weight: gross 273,370 lb (278,660 lb with JATO).
Performance: max speed at high altitude Mach 1.88, at low altitude Mach 0.86, nominal cruising speed 560 mph, ceiling 43,635 ft, T-O run 6,560–6,890 ft, landing run 3,940–4,265 ft, max unrefueled combat radius with 26,455 lb weapons: supersonic hi-hi-hi 930–1,150 miles, subsonic lo-lo-lo 930–1,035 miles, subsonic hi-lo-hi 1,495 miles.
Accommodation: crew of four, in pairs on 200 ft/81–186 mph ejection seats.
Armament: max offensive weapon load comprises three Kh-22 (AS-4 Kitchen) ASMs, with one semi-recessed under the center-fuselage and one under the fixed center-section panel of each wing; or 52,910 lb of conventional bombs or mines, half of them carried internally and half on external racks under the wings and engine air intake trunks. Internal bombs can be replaced by a rotary launcher for six Kh-15P (AS-16 Kickback) SRAMs, with four more underwing as alternative to Kh-22s. The Tu-22M-3 can also carry Kh-31A/P (AS-17 "Krypton") and Kh-35 (AS-20) ASMs. Normal weapon load is a single Kh-22 or 26,455 lb of bombs. Typical loads are two FAB-3000, eight FAB-1500, 42 FAB-500, or 69 FAB-250 or -100 bombs (figures indicate weight in kg), or eight 3,300-lb or 18 x 1,100-lb mines. Single GSh-23 twin-barrel 23-mm gun in radar-directed tail mounting.

Tupolev Tu-95 and Tu-142 (NATO "Bear")

These remarkable turboprop aircraft continue to be spearheads of Russian airpower, 44 years after the prototype first flew. The Russian Air Forces have 24 Tu-95K-20/22 and 65 Tu-95MS missile carriers; Naval Aviation has 82 maritime reconnaissance/ASW/"TACAMO equivalent" versions. Major current versions:

Tu-95K-20 (Bear-B). Missile carrier, with NK-12 engines, and Kh-20 (AS-3 "Kangaroo") ASM under fuselage. Length 151 ft 5¾ in.

Tu-95RT (Bear-D). Maritime reconnaissance aircraft with surface search radar in a large blister fairing under the center-fuselage. Glazed nose with undernose radome and superimposed refueling probe. Elint blister fairing on each side of its rear-fuselage. Added ECM fairing at each tailplane tip. Tail-warning radar in large fairing at base of rudder. Defensive armament of six 23-mm NR-23 guns in pairs in remotely controlled rear dorsal and ventral turrets and manned tail turret. Carries no offensive weapons, but tasks include pinpointing of maritime targets for missile launch crews on board submarines, surface ships, and aircraft that are too distant to ensure precise missile aiming and guidance. A Bear-D was the first version seen with an SPS faired tailcone housing ECM in place of the normal tail turret and associated radome.

Tu-95MR (Bear-E). Reconnaissance version with rear-fuselage elint fairings and refueling probe. Seven camera windows in bomb bay doors. IR linescan added later. Armament initially as Tu-95RT, but dorsal turret often removed.

Tu-142 (Bear-F). Antisubmarine aircraft. Extensively redesigned, with improved wing airfoil, double-slotted flaps, and longer fuselage forward of the wings. Deployed initially by Naval Aviation in 1970. Reentered production in the mid-1980s. Originally, Bear-F had enlarged and lengthened fairings for 12-wheel main landing gear bogies aft of its inboard engine nacelles and undernose radar. The main underfuselage J-band radar housing is considerably further forward and smaller than on Bear-D. MAD fairings on tailplane tips. Two stores bays for sonobuoys, torpedoes, and nuclear or conventional depth charges in its rear-fuselage, one of them replacing the usual rear ventral gun turret and leaving the tail turret as the sole defensive gun position. Later variants of Bear-F are identified as follows:

Mod 1: Reverted to standard-size nacelles and four-wheel main landing gear bogies. Chin-mounted J-band radar deleted. Fewer protrusions.

Mod 2 (**Tu-142M-Z**): Entered service after Mod 3, with improved avionics and crew accommodation. Roof of flight deck raised. Angle of refueling probe lowered by 4°. INS standard.

Mod 3 (**Tu-142M**): MAD boom added to fintip. Fairings at tips of tailplane deleted. Observation blister each side of rear-fuselage deleted. Length over probe 174 ft 1½ in.

Mod 4 (**Tu-142M-Z**): ECM thimble radome on nose; FLIR, radar altimeter, and com antennas in undernose fairing; ESM receiver and antennas under rear-fuselage.

Most of 58 Bear-Fs in service are to Mod 3 or Mod 4 standard. All versions of the Tu-142M can carry eight Kh-35 (AS-20) active radar homing antiship missiles in underwing pairs.

Tu-95K-22 (Bear-G). Bomber and elint conversion of early Bear-B/C bombers, able to carry a single Kh-22 (AS-4 "Kitchen") ASM semirecessed under belly or one on a large pylon under each wingroot. New and larger undernose radar, an ECM thimble under the in-flight refueling probe, and an SPS tailcone, containing ECM. Defensive armament of two 23-mm guns, in ventral turret.

Tu-95MS (Bear-H). Late-production bomber based on Tu-142 airframe, but fuselage shortened. Improved NK-12MA engines, with longer TBO; rating unchanged. Initial **Tu-95MS16** version carried six Kh-55 (AS-15A "Kent") long-range cruise missiles on an internal rotary launcher, two more under each wingroot and a cluster of three between each pair of engines, for a total of 16. All were subsequently modified to **Tu-95MS6** final production standard, with the pylons for ten underwing missiles removed to conform with SALT/START treaty limitations. Bear-H attained IOC in 1984. Features include a larger and deeper radome ("Clam Pipe") built into the nose and a small fintip IR warning receiver fairing. There are no elint blister fairings on the sides of the rear-fuselage, and the ventral gun turret is deleted. Some aircraft have a single twin-barrel 23-mm gun, instead of the usual pair, in the tail turret. An active electronic jammer, RWR, missile warning receivers, and chaff/flare dispensers are standard.

Tu-142MR (Bear-J). Modified Tu-142M-Z airframe. Soviet equivalent of the US Navy's E-6A and EC-130Q TACAMO aircraft, with VLF communications avionics to maintain an on-station/all-ocean link between national command authorities and nuclear missile armed submarines under most operating conditions. Large ventral pod for VLF suspended-wire antenna, several kilometers long, under center-fuselage in weapons bay area. Undernose fairing as on Bear-F Mod 4. Fintip IR warning pod like that on Bear-Hs. Satcom dome aft of flight deck canopy. About 10 operational with the Northern and Pacific Fleets. *(Data for Tu-95MS.)*
Power Plant: four KKBM/Kuznetsov NK-12MA turboprops; each 14,795 ehp. Equipped for in-flight refueling.
Dimensions: span 164 ft 2 in, length 161 ft 2¼ in, height 43 ft 7¾ in.
Weights: empty 264,550 lb, gross 412,258 lb.
Performance: max speed at 25,000 ft 575 mph, at S/L 404 mph, nominal cruising speed 442 mph, ceiling 39,370 ft, combat radius with 25,000-lb payload 3,975 miles, with one in-flight refueling 5,155 miles.
Accommodation: crew of seven.
Armament: as described for individual versions.

Tupolev Tu-95MS6 ("Bear-H") *(Paul Jackson)*

Tupolev Tu-160 ("Blackjack") *(Piotr Butowski)*

MiG-29 ("Fulcrum-C") on Quick Reaction Alert *(F. G. Rozendaal)*

Tupolev Tu-160 (NATO "Blackjack")

The fly-by-wire Tu-160 is the heaviest and most powerful combat aircraft ever built, about 20 percent longer than USAF's B-1B, with greater unrefueled combat radius and maximum level speed comparable with that of the original B-1 prototypes. Its radar cross-section is smaller than that of the B-1B and its aerodynamic drag lower. It is in no way a scale-up of Tupolev's earlier Tu-22M. Common features include low-mounted variable-geometry (20°, 35°, and 65°, manually selected) wings and a massive dorsal fin, but the Tu-160's horizontal tail surfaces are mounted high, near the intersection of the dorsal fin and all-moving main fin. When the wings are fully swept, the inboard flap-ends hinge upward as large fences. The very long and sharply swept fixed root panel of each wing, and the engine installation, resemble those of the Tu-144 supersonic transport, retired by Aeroflot after little use in 1978. The flight deck has no head-up display (HUD) or CRTs.

The Russian Strategic Forces had only five Tu-160s in mid-1995, the remaining 19 operational Blackjacks being based in Ukraine. As well as being able to operate as a high-altitude standoff cruise missile carrier, the Tu-160 carries SRAMs for defense suppression during low-altitude penetration missions at transonic speed. An active jamming self-defense system is standard.
Power Plant: four Samara/Trud NK-321 turbofans; each 50,925 lb thrust with afterburning. Provision for in-flight refueling.
Dimensions: span 182 ft 9 in spread, 116 ft 9¾ in swept; length 177 ft 6 in; height 43 ft 0 in.
Weights: empty 260,140 lb, gross 606,260 lb.
Performance: max speed at high altitude Mach 2.05, nominal cruising speed 596 mph, ceiling 49,200 ft, T-O run 7,220 ft, landing run 5,250 ft, combat radius at Mach 1.5 1,240 miles, max unrefueled range 7,640 miles.
Accommodation: crew of four, in pairs, on zero/zero ejection seats.
Armament: no guns; internal stowage for up to 88,185 lb of free-fall bombs, SRAMs, or ALCMs. Rotary launcher for six Kh-55 (AS-15 "Kent") ALCMs in forward weapons bay; two rotary launchers for a total 24 Kh-15P (AS-16 "Kickback") SRAMS in rear bay.

Fighters

MiG 1-42

Like USAF's F-22, the 1-42 is a single-seat, twin-engine fighter, with twin fins, and will offer multirole air-to-air and air-to-surface capability. It is a tailless delta, with canards that improve on the agility of even the Su-27, and is designed to have thrust-vectoring engine nozzles. A degree of stealth can be assumed. As with other Russian designs, this is likely to result more from careful conventional airframe configuration, use of RAM (radar absorbent materials), and use of countermeasures than from such operationally restrictive features as internal weapons stowage. A new Phazotron-developed phased-array fire-control radar is fitted.

The 1-42 has a wingspan comparable with that of the Su-27 series. Its first flight was delayed initially by incomplete development of its Lyulka AL-41F afterburning turbofans, latterly by funding problems. Gross weight is reportedly in the 77,160-lb (35,000 kg) class. It will be able to cruise at supersonic speed without using afterburning.

MiG-29 (NATO "Fulcrum")

The basic MiG-29, operational since early 1985, is a twin-engine combat aircraft comparable in size to the US Navy's F/A-18 Hornet. Its N019 Sapfir-29 coherent pulse-Doppler look-down/shoot-down radar (search range 62 miles, tracking range 43 miles; ability to track 10 targets simultaneously) is supplemented by a laser rangefinder and infrared search/track sensor forward of the windscreen. Both systems operate in conjunction with the pilot's helmet-mounted target designator. Primary operational role is as a single-seat counterair fighter, but the MiG-29 has dual-role air combat/attack capability. About 345 are in service with Russian tactical air forces and 110 with naval forces. Current versions:

MiG-29 (Fulcrum-A). Landbased single-seater. During takeoff and landing, hinged doors shield the engine

air intakes against foreign-object ingestion; engine air is then taken in through louvers in the upper surface of the wingroot extensions. Flying controls actuated hydraulically. IRCM flare dispensers, each with 30 cartridges, in "fences" forward of dorsal tailfins. Airbrakes above and below rear fuselage. Max gross weight 40,785 lb, including 6,615 lb of weapons.

MiG-29UB (Fulcrum-B). Combat trainer. Second seat forward of the normal cockpit, under a continuous canopy, with periscope for rear occupant. No radar. Gun, IRST sensor, laser rangefinder, and underwing stores pylons retained.

MiG-29 (Fulcrum-C). Generally as Fulcrum-A, but with deeply curved top fuselage aft of cockpit housing additional avionics, including active jammers. Optional external fuel tanks under wings and belly.

MiG-29S (Fulcrum-C). Multistage upgrade of MiG-29 Fulcrum-C. Internal fuel increased by 20 gallons. Optional nonretractable flight refueling probe. Upgraded radar (N019M) can engage two targets simultaneously. Able to carry R-77 (AA-12 "Adder") AAMs or up to 8,820 lb of bombs, rockets, or antisubmarine, antiradiation, and TV- or laser-guided ASMs. Approx two squadrons only.

MiG-29M. Greatly redesigned, with quadruplex fly-by-wire controls and a "glass cockpit" with CRTs. First of six prototypes flown in 1986; first flight with definitive 19,400 lb thrust RD-33K engines in late 1989. Movable lower air intake lips to increase mass flow on takeoff. New N010 Zhuk terrain-following and ground-mapping radar (able to engage four targets simultaneously) in larger-diameter radome, new IRST, added TV, and laser designator/marked-target seeker. Nose lengthened by approximately 7½ in. Longer canopy. Wider, longer, and less curved dorsal spine, terminating in a "beaver-tail" structure that extends beyond the jet nozzles. Increased-span ailerons; bulged wingtips with fore and aft RWRs. Larger tailplane with dogtooth leading-edge. More rounded wingtip trailing-edge. New aluminum-lithium center-section, without engine air louvers, containing additional fuel; eight underwing hardpoints, single large airbrake above rear fuselage. Larger, sharp-edged, repositioned wingroot leading-edge extensions, generating stronger vortices, and modifications to extend aft center-of-gravity limit for relaxed stability make the MiG-29M more comfortable to fly, with increased permissible angle of attack, better maneuverability, and improved cruise efficiency. Max external stores load increased to 9,920 lb. Armament options include Kh-31P, Kh-29T, Kh-29L, and Kh-25ML ASMs and up to eight R-77 AAMs. Production started 1995; export designation **MiG-33.** Normal gross weight 37,037 lb. Performance as for MiG-29S, except range 1,242 miles on internal fuel, 1,988 miles with three external tanks. *(Data for MiG-29S.)*

Power Plant: two Klimov/Sarkisov RD-33 turbofans; each 18,300 lb thrust with afterburning.
Dimensions: span 37 ft 3¼ in, length 56 ft 10 in, height 15 ft 6¼ in.
Weights: normal T-O weight 33,730 lb, gross 43,430 lb.
Performance: max speed at height Mach 2.3, at S/L Mach 1.225, ceiling 59,055 ft, T-O run 820 ft, landing run 1,970 ft, range on internal fuel 932 miles, with external tanks 1,800 miles.
Accommodation: pilot only, on zero/zero ejection seat.
Armament: six close-range R-60T/MK (AA-8 "Aphid") AAMs, or four R-60T/MK and two medium-range R-27R-1 (AA-10A "Alamo-A"), on three pylons under each wing. Alternative AAMs include R-73A/E (AA-11 "Archer"). Able to carry bombs, submunitions dispensers, napalm, 80-mm, 130-mm, and 240-mm rockets, and other stores in attack role. One 30-mm GSh-301 gun in port wingroot leading-edge extension, with 150 rds.

MiG-31 (NATO "Foxhound")

The MiG-31 is similar in configuration to the MiG-25 but is a very different aircraft. The requirement was for an all-altitude, all-weather two-seat interceptor with advanced digital avionics. There was no need for higher redline speed than the MiG-25's Mach 2.83, but a longer range was specified, together with a redesigned airframe, to permit supersonic flight at low altitude. Mikoyan reduced the airframe's welded nickel steel content from 80 to 49 percent, with 16 percent titanium, 33 percent aluminum alloy, and two percent composites.

The first prototype flew September 16, 1975, and the fully developed **MiG-31** (Foxhound-A) began to replace Su-15s and MiG-23s in operational regiments seven years later. Its N007 Zaslon ("Flash Dance") fire control radar was the first electronically scanned phased-array type to enter service, with a search range of 124 miles in the forward clutter-free sector and the ability to track 10 targets and engage four simultaneously, including targets below and behind its own location. Foxhound can be guided automatically and can engage targets under ground control. Operational equipment includes a semiretractable IRST sensor, RWR, and active infrared and electronic countermeasures. Offset tandem twin-wheel main landing gear units facilitate operation from unprepared ground and gravel. A semiretractable flight refueling probe is mounted on the port side of the front fuselage. About 300 are deployed for home defense and 30 with tactical air forces.

MiG-31M ("Foxhound-B") *(Piotr Butowski)*

Sukhoi Su-30M *(Paul Jackson)*

Sukhoi Su-33s of Severomorsk Regiment *(Yefim Gordon)*

Developed by means of six prototypes, since 1984, the **MiG-31M** (Foxhound-B) has a new Phazotron radar, with a 55-in-diameter antenna, in a 3.5° downward-inclined nose. It is identified by a one-piece rounded windshield, small side windows for the rear cockpit, a wider and deeper dorsal spine containing additional fuel, more rounded wingtips (except when carrying ECM jammer pods), smaller wing fences, taller fins with larger curved root extensions, modified and extended wingroot leading-edge extensions, a nonretractable IRST, upgraded engines with modified nozzles, fully retractable flight refueling probe on starboard side, and four new-type underwing pylons for R-77 (AA-12 "Adder") active radar-guided AAMs. It has no gun, but the number of fuselage weapon stations is increased to six, with two centerline pylons carrying R-33S missiles and four R-37 AAMs on the side mounts. All systems are upgraded; digital flight controls and multifunction CRT cockpit displays are standard.

Some basic MiG-31s have been converted and others built as **MiG-31Ds**; these are compatible with R-37 missiles but retain basic radar. Under development is the **MiG-31BS,** a conversion of the basic MiG-31 with unchanged radar but provision for R-37 and R-77 AAMs. *(Data for MiG-31 Foxhound-A.)*

Power Plant: two Aviadvigatel D-30F6 turbofans; each 34,170 lb thrust with afterburning.
Dimensions: span 44 ft 2 in, length 74 ft 5¼ in, height 20 ft 2¼ in.
Weights: empty 48,105 lb, gross 90,390–101,850 lb (MiG-31M 114,640 lb).
Performance: max speed at height Mach 2.83, at S/L Mach 1.23, ceiling 67,600 ft, T-O run 3,940 ft, landing run 2,625 ft, combat radius at Mach 2.35 450 miles, at Mach 0.85 with external tanks 870 miles.
Accommodation: crew of two, on tandem zero/zero ejection seats.
Armament: basic armament of four R-33 (AA-9 "Amos") radar-homing, long-range AAMs, in pairs under fuselage; two R-40T (AA-6 "Acrid") medium-range, infrared-homing AAMs on inner underwing pylons; and four R-60 (AA-8 "Aphid") close-range, infrared-homing AAMs on two outer underwing pylons. One 23-mm GSh-6-23 six-barrel Gatling-type gun in fairing on starboard lower fuselage, with 260 rds.

Sukhoi Su-27 (NATO "Flanker")

More than 200 Su-27s equip Russian air defense units; 150 others serve with tactical air forces, their duties including escort of Su-24s on deep penetration missions. Current variants:

Su-27 (Flanker-B). Basic single-seat production version, first flown April 20, 1981; deliveries began in 1985. Square wingtips carry launchers for AAMs in Su-27P interceptor role, Sorbtsya ECM jammer pods in Su-27S ground-attack configuration. Four-channel analog fly-by-wire flight controls without mechanical backup. Inherently unstable. No ailerons; one-piece differential/collective tailerons operate in conjunction with flaperons and rudders for pitch and roll control. Wing leading-edge flaps and flaperons are controlled manually for takeoff and landing, computer-controlled in flight. Fine-grille hinged screens in the engine air intake ducts guard against foreign-object damage during takeoff and landing. No composites, but extensive use of aluminum-lithium alloys and titanium in the airframe. Integrated fire-control system enables the Phazotron N001 Zhuk track-while-scan coherent pulse-Doppler radar, IRST, and laser rangefinder to be slaved to the pilot's helmet-mounted target designator and displayed on the wide-angle HUD. Radar has search range of 62 miles. Provision for reconnaissance pack on centerline pylon. Three banks of chaff/flare dispensers in bottom of long tailcone.

Su-27UB (Flanker-C). Tandem two-seat trainer with full combat capability, based on Flanker-B. Instructor in raised rear seat. Taller fin; height 20 ft 10¼ in.

Su-27PU and Su-27IB: see Su-30 and Su-34, respectively. *(Data for Flanker-B.)*

Power Plant: two Saturn/Lyulka AL-31F turbofans; each 27,557 lb thrust with afterburning.
Dimensions: span 48 ft 2¾ in, length excl noseprobe 71 ft 11½ in, height 19 ft 5½ in.
Weight: gross 50,705–72,750 lb.
Performance: max speed at height Mach 2.35, at S/L Mach 1.1, ceiling 59,055 ft, T-O run 1,475 ft, landing run 2,035 ft, combat radius 930 miles, max range 2,285 miles.
Accommodation: pilot only, on zero/zero ejection seat.
Armament: one 30-mm GSh-301 gun, with 150 rds, in starboard wingroot extension. Up to 10 AAMs, including pairs of R-27 (AA-10 "Alamo-A/B/C/D"), or R-33 (AA-9 "Amos"), and four R-73A (AA-11 "Archer") or R-60 (AA-8 "Aphid"). Able to carry 8,818 lb of air-to-surface weapons, including 550-lb and 1,100-lb bombs, packs of 80-, 130-, and 250-mm rockets, cluster bombs, or a podded 30-mm gun with downward-deflecting barrel for air-to-ground and air-to-air use.

Sukhoi Su-30

This production development of two Su-27PU prototypes (first flown December 30, 1989) is available in two forms:

Su-30. Two-seat long-range interceptor for Russian home defense missions of 10 hours or more, with two in-flight refuelings, including group actions with four Su-27s. Only the Su-30 would operate its radar, so that it could assign targets to the other aircraft by radio data link, while the Su-27s maintained radar silence. Configuration similar to that of Su-27UB, with unstable aerodynamic characteristics and automatic control system. Able to carry bombs and rockets but not guided ASMs. New avionics: nav system based on Loran, Omega, and Mars; fire-control system able to engage two air-to-air targets simultaneously. Flight refueling probe and buddy refueling standard.

Su-30M. As Su-30 but equipped for multirole operations, with high-precision guided weapons. *(Data for Su-30M, except where indicated.)*

Dimensions: as Su-27, except height 20 ft 10¼ in.
Weights: empty 39,020 lb, normal gross 54,010 lb, max 72,750 lb.
Performance: max speed at height Mach 2.0, T-O run 1,805 ft, landing run 2,200 ft, combat range with internal fuel 1,865 miles, with one in-flight refueling 3,230 miles.
Accommodation: normal crew of two, on zero/zero ejection seats in tandem identical cockpits.
Armament (Su-30M): gun and AAMs as Su-27, plus R-77 (AA-12 "Adder") AAMs.
Armament (Su-30M): as Su-30 for air-to-air role. More than 17,635 lb of stores on 12 hardpoints for ground-attack role, including Kh-59M (AS-18 "Kazoo"), Kh-31 (AS-17 "Krypton"), and Kh-29 (AS-14 "Kedge") ASMs, ARMs, bombs, KAB-500Kr TV-guided bombs, rockets, and an APK-9 data link pod.

Sukhoi Su-33

Beginning in 1991, an initial series of 20 Su-33 single-seat fighters was delivered to an air base on the Kola Peninsula for eventual operation from *Admiral Kuznetsov*. Others have followed, and Su-33s are now operational on the carrier, which was deployed to the Adriatic in late 1995. Intended primarily for air defense, but with antiship capability, they were developed via Su-27K prototypes. Their airframe differs from that of the Su-27 (Flanker-B) in having collectively movable foreplanes, folding outer wings and tailerons, strengthened landing gear with twin-wheel nose unit, an added arrester hook, and navaids for maritime operations. The Su-27's flaperons are replaced by high-lift slotted flaps. The long tailcone of the landbased version is shortened to prevent tailscrapes during takeoff and landing. A retractable in-flight refueling probe is mounted on the port side of the nose, and there is provision for a centerline external fuel tank or buddy refueling pack. The IRST has a wider field of vision.

Power Plant: as Su-27.
Dimensions: span 48 ft 2¾ in, width wings folded 24 ft 3½ in, length 69 ft 6 in, height 19 ft 4¼ in.
Weights: not available.
Performance: max speed at height Mach 2.165, T-O run with 14° ramp 395 ft, range on internal fuel 1,865 miles.
Accommodation: pilot only, on zero/zero ejection seat.
Armament: as Su-27, plus Kh-31 (AS-17 "Krypton") ASMs.

Sukhoi Su-35

Known also as the Su-27M, this advanced single-seat development, with foreplanes, is designed to have quadruplex digital fly-by-wire controls and three-dimensional thrust-vectoring nozzles. The first prototype flew June 28, 1988; 10 more prototype and preseries Su-35s have followed, of which the last is being used to develop the vectored nozzles.

Compared with the Su-27, the airframe (with many carbonfiber components), power plant, and armament are all upgraded. The N011 primary radar is of an improved look-down/shoot-down type, with the ability to acquire airborne targets at ranges up to 250 miles and ground targets up to 125 miles. Fifteen targets can be tracked, and six engaged, simultaneously. An N014 rearward-facing radar (range 2.5 miles) is fitted in the tailcone. A small external TV pod, new-type IRST, enhanced ECM with wingtip jammer pods, and RWR are standard. All combat flight phases are computerized; cockpit displays include three-color CRTs. Entry into Russian Air Forces service will be in the second half of the 1990s.

Power Plant: two Saturn/Lyulka AL-35F turbofans; each 30,865 lb thrust with afterburning. In-flight refueling probe standard.
Dimensions: span over ECM pods 49 ft 9 in, length 72 ft 10 in, height 20 ft 10¼ in.
Weights: empty 37,480 lb, gross 57,320–74,955 lb.
Performance: max speed at height Mach 2.35, at S/L Mach 1.14, ceiling 59,055 ft, runway required 3,940 ft, max range on internal fuel more than 2,485 miles, with one in-flight refueling more than 4,040 miles.
Accommodation: pilot only, on zero/zero ejection seat.
Armament: one 30-mm GSh-30 gun. Fourteen weapon mounts for R-27 (AA-10 "Alamo-A/B/C/D"), R-40 (AA-6 "Acrid"), R-60 (AA-8 "Aphid"), R-73A (AA-11 "Archer"), and R-77 (AA-12 "Adder") AAMs. Optional air-to-surface weapons include Kh-25ML (AS-10 "Karen"), Kh-25MP (AS-12 "Kegler"), Kh-29T (AS-14 "Kedge"), Kh-31 (AS-17 "Krypton"), and Kh-59 (AS-18 "Kazoo") ASMs, KAB-500 bombs, and rocket packs. Max external stores 17,635 lb.

Helicopters

Kamov Ka-25 (NATO "Hormone")

About 88 Ka-25s remain in service with Russian Naval Aviation, in four versions:

Ka-25PL (Hormone-A). Ship-based ASW helicopter, with contrarotating three-blade rotors. Undernose search radar; racks for small stores, including sonobuoys, on the starboard side of the fuselage. Dipping sonar in compartment at rear of cabin.

Ka-25Ts (Hormone-B). Special electronics variant, to provide over-the-horizon target acquisition for cruise missiles carried by cruisers and destroyers on which Ka-25Ts helicopters are based. Larger undernose radome than that of Ka-25PL, with spherical undersurface. When radar is operating, all four wheels of landing gear can be retracted upward to offer minimal interference to emissions. Cylindrical fuel canister on each side of lower fuselage.

Ka-25BShZ. Equipped to tow minesweeping gear. No sonar.

Ka-25PS (Hormone-C). Search-and-rescue version with hoist and other role equipment. *(Data for Ka-25PL.)*
Power Plant: two Mars GTD-3F turboshafts; each 888 shp (later aircraft have 986 shp GTD-3Ms).
Dimensions: rotor diameter (each) 51 ft 7¾ in, length of fuselage 32 ft 0 in, height 17 ft 7½ in.
Weights: empty 10,505 lb, gross 15,873 lb.
Performance: max speed 130 mph, ceiling 11,000 ft, range 250–405 miles.
Accommodation: crew of two on flight deck; main cabin is large enough to contain 12 folding seats.
Armament: one 18-in ASW torpedo in underfuselage weapons bay.

Kamov Ka-27, Ka-29, Ka-31, and Ka-32 (NATO "Helix")

The prototype Ka-27 flew in 1973, retaining the Ka-25's proven contrarotating rotor configuration. The basic ASW version was first observed on the stern platform of the guided missile destroyer *Udaloy* in 1981. Other versions followed, and the military Helix now serves Russian Air Forces in the following forms:

Ka-27PL (Helix-A). ASW helicopter, with crew of three (pilot, tactical coordinator, ASW systems operator). Able to stow in much the same space as the Ka-25PL with the rotors folded, despite greater power and capability. Effective against submarines cruising at up to 40 knots, at a depth of 1,640 ft, out to 124 miles from its base, by day or night. Equipment includes undernose 360° search radar, ventral weapons bay for torpedoes, depth charges, and other stores, internally stowed sonobuoys, chaff/flare dispensers, IFF, RWRs on nose and above tailplane, ESM "flower pot" above rear of engine bay fairing, forward of IR jamming pod, flotation gear container on each side of fuselage, dipping sonar compartment in rear of fuselage, MAD, and Doppler box under tailboom. Retractable landing gear like Ka-25Ts. Normally operated in pairs; one aircraft tracks the hostile submarine, the other drops depth charges. About 88 operational with Naval Aviation.

Ka-29 (Helix-B). Assault transport version; entered service in 1985. Nonretractable landing gear. Heavy armor on wider flight deck and engine bay. Flexibly mounted four-barrel Gatling-type 7.62-mm machine gun behind downward-articulated door on starboard side of nose; primary radar and FLIR in port side. Four pylons on outriggers carry two four-rd clusters of 9M114 (AT-6 "Spiral") ASMs and two 57-mm or 80-mm rocket pods; alternative loads include four rocket pods, two ZB-500 incendiary tanks, or 23-mm gun pods. Provision for 30-mm Type 2A42 gun above port outrigger. Undernose pods for missile guidance/terrain-following radar and electro-optics. ESM "flower pot" above engine bay fairing, forward of IR jamming pod. Two-part upward/downward-opening cabin door for speedy exit of 16 assault troops from cabin. Casualty evacuation capability as Ka-27PL. About 25 in service.

Kamov Ka-31 *(Paul Jackson)*

Kamov Ka-32A7 *(Paul Jackson)*

Kamov Ka-50 ("Hokum") *(Yefim Gordon)*

Ka-27PS (Helix-D). Search-and-rescue and plane guard version. Basically similar to Ka-27PL but some operational equipment deleted. Winch beside cabin door on port side. External fuel tank above flotation gear on each side of cabin. Air-droppable dinghy packs in ventral stores bay; racks for marker floats.

Ka-31. Radar picket version, first flown in 1988 and shown on carrier *Admiral Kuznetsov* in August 1990. Crew of two. Large (64.5 sq ft) rotating radar antenna that stows flat against underfuselage and deploys downward, turning through 90° into vertical plane before starting to rotate. Landing gear retracts upward to prevent interference with emissions. Large pannier embodying fairing for retracted front wheel on each side, forward of main landing gear. Further large equipment pannier aft of main gear on starboard side. Two-piece airstair-type cabin door aft of flight deck on starboard side, divided into upward and downward opening sections. APU repositioned above rear of power plant fairing, with air intake at front. No ESM or IR jamming pods above fairing. Dielectric conical tailcone. No stores pylons, gun door, or armor. Endurance on station 2 hr 30 min at 11,500 ft; surveillance radius 62–93 miles for fighter-size targets, 155 miles for ships; up to 20 targets tracked simultaneously.

Ka-32A2. Version used by Moscow Militia. Seats for 11 passengers, two of whom can operate pintle-mounted guns in port rear doorway and starboard rear window. Hydraulic hoist; two sets of loudspeakers; searchlight under nose.

Ka-32A7. Armed version, first seen 1995. Pairs of Kh-35 (AS-20) antiship missiles, Kh-25 ASMs, 23-mm gun pods or 80-mm rocket pods under wings. Provision for 30-mm gun. Gross weight 24,250 lb. *(Data for Ka-29.)*
Power Plant: two Klimov TV3-117V turboshafts; each 2,190 shp.
Dimensions: rotor diameter (each) 52 ft 2 in, length of fuselage 37 ft 1 in, height 17 ft 8½ in.
Weights: empty 12,170 lb, gross 27,775 lb.
Performance: max speed at S/L 174 mph, ceiling 14,100 ft, range 285 miles.
Accommodation: flight crew of two, with seat for third person; up to 16 combat-ready troops, or four litters and six seated casualties, as alternative to mission equipment.
Armament: see above.

Kamov Ka-50 and Ka-52 (NATO "Hokum")

The basic **Ka-50** single-seat close-support helicopter was first flown in prototype form July 27, 1982. It has now been joined by a side-by-side two-seat combat and training version designated **Ka-52,** which differs in having a new and wider fuselage forward of the main rotor mast, and more extensive integral equipment for all-weather day/night missions, including a Schkval EO system for precision attacks on armor alongside the forward-looking infrared (FLIR) in the wider nose, and provision for night vision goggles for the crew. Both versions are reported to be in small-scale initial production for the Russian Army.

Retention of Kamov's familiar coaxial rotor configuration ensures compact dimensions, with no tail rotor to cause problems during nap-of-the-Earth operation. Composite materials constitute 35 percent by weight of the structure, including the three-blade rotors. Hokum is intended to attack targets fast and low, with great agility, at close range, aided by terrain-following radar and moving map display. Its avionics and missions require four computers to meet navigation, mission control, and display demands. Equipment in the basic Ka-50 includes a laser marked-target seeker and rangefinder, but the intention is to rely on another aircraft to locate and designate targets. It can, however, be given night attack capability by carrying a Saturn pod under the port stubwing, containing Khod FLIR, Kinzhal 8-mm radar, and a Schkval sight. The pilot has a MiG-29-type helmet sight and HUD.

In the Ka-50, all canopy and windscreen panels are of heavy bulletproof glass, and the double-wall steel armor surrounding the cockpit will resist hits by 20-mm and 23-mm gunfire over ranges as close as 330 ft. In an emergency, at any altitude, the rotor blades and cockpit roof are separated by explosive charges; the pilot is then extracted from the cockpit by a large rocket. Alternatively, he can jettison the cabin doors and stores before rolling out of the cockpit sideways. The two crew of the Ka-52 have similar escape provisions. Both

versions of Hokum can be air-ferried, partially disassembled, in an Il-76 freighter. All systems are configured to permit combat flying from an advanced base for at least two weeks without need for ground maintenance equipment. *(Data for Ka-50.)*

Power Plant: two Klimov TV3-117VK turboshafts; each 2,190 shp (2,465 shp in Ka-52).

Dimensions: rotor diameter (each) 47 ft 7 in, length (rotors turning) 52 ft 6 in, height 16 ft 2 in.

Weights: normal T-O weight 21,605 lb, max gross 23,810 lb.

Performance: max speed in shallow dive 217 mph, in level flight 193 mph (Ka-52 186 mph), vertical rate of climb at 8,200 ft 1,970 ft/min, hover ceiling out of ground effect 13,125 ft, estimated combat radius 155 miles (Ka-52 max range 285 miles), endurance 1 hr 40 min to 4 hr.

Accommodation: pilot only.

Armament: one 30-mm 2A42 gun, with limited flexibility, (500 rds) on starboard side of fuselage; four wing pylons for two six-rd clusters of Vikhr M (AT-X-16) laser-guided ASMs, up to four packs of 20 x 80-mm S-8 rockets, 23-mm gun pods, Kh-25MP (AS-12 "Kegler") ARMs, R-60 or R-73 AAMs, or dispenser weapons.

Mil Mi-6 (NATO "Hook")

Basic task of the 350 Mi-6s in service with Russian armies is to haul guns, armor, vehicles, supplies, freight, or troops in combat areas in **Mi-6T** form; but some are equipped for command support roles (see Reconnaissance, ECM, and Early Warning Aircraft section). Replacement with Mi-26 Halos has been only partially acceptable, because of the hazards of operating helicopters as large as the Mi-26 in combat areas. Mil has proposed a 66,000-lb helicopter, designated Mi-46T, for service at the end of this century. Russian Naval Aviation has 10 Mi-6s

Power Plant: two Aviadvigatel/Soloviev D-25V turboshafts; each 5,425 shp.

Dimensions: rotor diameter 114 ft 10 in, length of fuselage 108 ft 10½ in, height 32 ft 4 in.

Weights: empty 60,055 lb, gross 93,700 lb.

Performance: max speed 186 mph, ceiling 14,750 ft, range with 17,637-lb payload 385 miles.

Accommodation: crew of five; normally, 70 combat-equipped troops, 26,450 lb of internal freight, or 41 litters and two medical attendants. Max slung cargo (usually with wings removed) 17,637 lb.

Armament: some aircraft have a 12.7-mm gun in the nose.

Mil Mi-8 (NATO "Hip")

Mi-8s and uprated Mi-17s (described separately) are the standard general-purpose helicopters of the Russian armies and air forces. One of their primary combat tasks is to put assault troops, equipment, and supplies behind enemy lines, which their crews are trained to do within 15–20 minutes of a nuclear or conventional bombardment/strike. Versions as follows:

Mi-8T (Hip-C). Assault transport used by army support forces, carrying 24 troops or freight, loaded via rear clamshell doors and hook-on ramps. Twin rack for stores on each side of cabin, able to carry 64 x 57-mm rockets in four packs or other weapons. Some uprated to Mi-17 standard, as **Mi-8MT** and **Mi-8MTV.** Estimated 1,520 in service with Russian armies, 70 with the Navy.

Mi-8PS (Hip-C). Military VIP transport.

Mi-8VZPU (Hip-D). Airborne reserve command post; see p. 73.

Mi-8TBK (Hip-E). Development of Hip-C, with emphasis on weapons for escort duties. One flexibly mounted 12.7-mm machine gun in nose. Triple stores rack on each side of cabin, able to carry up to 192 rockets in six suspended packs plus four 9M17P Skorpion (AT-2 "Swatter") antitank missiles on rails above racks. Some uprated to Mi-17 standard, as **Mi-8MTV.** About 250 in service.

Mi-9 (Hip-G). See Mi-9 entry on p. 73.

Mi-17 (Hip-H). See Mi-17 entry below.

Mi-8SMV (Hip-J) and **Mi-8PPA** (Hip-K). ECM versions; see p. 73.

Power Plant: two Klimov TV2-117A turboshafts; each 1,677 shp.

Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 59 ft 7¼ in, height 18 ft 6½ in.

Weights: empty 16,007 lb, gross 26,455 lb.

Performance: max speed at 3,280 ft 161 mph, ceiling 13,125 ft, range as personnel transport 264 miles.

Accommodation: crew of two or three; normal military configuration for 24 combat-equipped troops on tip-up seats along cabin side walls; 8,820 lb of freight internally, 6,614 lb externally; or 12 litter patients and attendant.

Armament: see individual model descriptions.

Mil Mi-14 (NATO "Haze")

Overall dimensions, power plant, and dynamic components of this shore-based amphibious helicopter are generally similar to those of the Mi-17. New features to suit the Mi-14 for its maritime roles include a boat hull, a small float attached to the tailskid, and a sponson on each side at the rear, carrying an inflatable flotation bag. The landing gear is fully retractable.

Mil Mi-14 ("Haze") *(Sebastian Zacharias)*

Mil Mi-24R ("Hind-G1") *(F. G. Rozendaal)*

Three Navy versions of the Mi-14 are in service:

Mi-14PL (Haze-A). ASW version, with crew of four. Equipment includes an undernose radome, a retractable sonar housed in the starboard rear of the planing bottom forward of two sonobuoy or signal flare chutes, and a towed MAD "bird" stowed against the rear of the fuselage pod. Torpedoes, bombs, and depth charges are carried in a weapons bay in the bottom of the hull.

Mi-14BT (Haze-B). Mine countermeasures version. Long duct for hydraulic tubing, and air-conditioning pod, on starboard side of cabin. No MAD. Searchlight to observe MCM gear during deployment and retrieval under tailboom, forward of Doppler box.

Mi-14PS (Haze-C). Search-and-rescue version. Double-width sliding door at front of cabin on port side, with retractable rescue hoist able to lift three persons in basket. Searchlight on each side of nose and under tailboom. Fuselage duct and air-conditioning pod as Mi-14BT. Room for 10 survivors in cabin, including two on litters; provision for towing many more in 10 20-place life rafts carried on board. Normal crew of three.

Russian Naval Aviation has 63 Mi-14PLs, plus around 25 other versions.

Power Plant: two Klimov TV3-117 turboshafts, each 1,923 shp.

Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 60 ft 3½ in, height 22 ft 9 in.

Weights: empty 25,900 lb, gross 30,865 lb.

Performance: max speed 143 mph, ceiling 11,500 ft, max range 705 miles.

Accommodation and Armament: as described above.

Mil Mi-17 (NATO "Hip-H")

The Mi-17 has an airframe basically identical to that of the Mi-8 but with more powerful TV3 engines in shorter nacelles, with the intakes positioned above the midpoint of the sliding cabin door. The tail rotor is repositioned on the port side of the vertical stabilizer, and the engine air intakes are fitted with deflectors to prevent the ingestion of sand, dust, or foreign particles at unprepared landing sites. Military versions have the same armament options as the Mi-8, supplemented by 23-mm GSh-23 gun packs, a VMR-2 fit for air-dropping such loads as mines, a chaff/flare dispenser, IRCM jammer, engine nozzle IR suppressors, and external armor plate on the cockpit sides.

Details of two special-duty versions can be found in the Reconnaissance, ECM, and Early Warning Aircraft section. Mi-8s can be uprated to Mi-17 standard (see Mi-8 entry). All Mi-17s in Russian military service retain Mi-8MT/MTV designations.

Power Plant: two Klimov TV3-117MT turboshafts; each 1,923 shp.

Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 60 ft 5¼ in, height 15 ft 7¼ in.

Weights: empty 15,653 lb, gross 28,660 lb.

Performance: max speed 155 mph, ceiling 11,800 ft (16,400 ft at normal gross weight), max range 289–307 miles.

Accommodation and Armament: as for Mi-8 Hip-E.

Mil Mi-24 (NATO "Hind")

The Russian Army has some 800 gunship and special-duty versions of the Mi-24, in six major forms:

Mi-24D (Hind-D). First observed 1977. Front fuselage completely redesigned by comparison with original Hind-A, B, and C armed assault transports. Transport capability retained and airframe armored. Tandem stations for weapon operator (in nose) and pilot have individual canopies, with rear seat raised to give pilot an unobstructed forward view. Under nose is a four-barrel Gatling-type 12.7-mm machine gun in a turret, slaved to adjacent electro-optical sight, and providing air-to-air as well as air-to-surface capability. Four hardpoints under stubwings for 32-rd packs of 57-mm rockets, 20-rd packs of 80-mm rockets, UPK-23 pods each containing a twin-barrel 23-mm gun, GUV pods each containing one four-barrel 12.7-mm gun and two four-barrel 7.62-mm guns or a 30-mm grenade launcher, up to 3,300 lb of bombs, mine dispensers, or other stores; four 9M17P Skorpion (AT-2 "Swatter") antitank missiles on wingtip launchers, with RF guidance pod under nose on port side. Provisions for firing AKMS guns from cabin windows. IFF and RWR. IR jammer in "flower pot" container above forward end of tailboom; three 32-rd ASO-2V chaff/flare dispensers initially under tailboom; later triple racks (total of 192 flares) on sides of center-fuselage. Engine exhaust IR suppressors standard. **Mi-24DU** dual-control training version has no gun turret.

Mi-24V (Hind-E). As Mi-24D but with modified wingtip launchers and four underwing pylons for up to eight 9M114 (AT-6 "Spiral") radio-guided, tube-launched antitank missiles in pairs, and enlarged undernose guidance pod on port side, with fixed searchlight to rear. R-60 (AA-8 "Aphid") AAMs can be carried on the underwing pylons. HUD replaces former reflector sight.

Mi-24VP. Variant of Mi-24V with twin-barrel 23-mm gun in place of four-barrel 12.7-mm gun in nose. Small series built.

Mi-24P (Hind-F). Generally similar to Mi-24V, but nose gun turret replaced by a twin-barrel 30-mm GSh-30-2 gun, with 750 rds, on starboard side of front fuselage. Bottom of nose smoothly faired above and forward of sensors.

Mi-24R (Hind-G1). No undernose electro-optical or RF guidance packs for antitank missiles. Instead of wingtip weapon attachments, it has "clutching hand" mechanisms for soil sampling, associated with nuclear, biological, and chemical (NBC) warfare, on lengthened pylons, with analysis equipment and data link console in the cabin. Other features include a bubble window on the starboard side and a small rearward-firing marker flare pack on the tailskid. The cockpits are hermetically sealed, and the crew of four wear NBC kits. The usual underwing pylons are retained for rocket pods, external fuel tanks, or unidentified containers. This version is deployed six per helicopter regiment throughout ground forces.

Mi-24K (Hind-G2). As Mi-24R but with a large camera in the cabin, with the lens on the starboard side, for reconnaissance and artillery spotting. No target designator pod under nose.

A few were modified for minesweeping duty in 1973, under the designation **Mi-24BMT.** An upgrade for current combat versions, designed to meet air mobility

requirements of the Russian Army, has been exhibited on an **Mi-35M** demonstrator. Features can include Mi-28 rotors and transmission, more powerful engines, new avionics, 23-mm twin-gun nose turret, and 9M114M1/2 Shturm 2 (AT-9) improved "Spiral" ASMs. Empty weight is reduced to 17,747 lb, gross 24,030 lb. Service ceiling is 18,860 ft. *(Data for Mi-24P.)*

Power Plant: two Klimov TV3-117 turboshafts; each 2,190 shp.

Dimensions: rotor diameter 56 ft 9¼ in, length excl rotors and gun 57 ft 5¼ in, height 21 ft 4 in.

Weights: empty 18,078 lb, gross 26,455 lb.

Performance: max speed 208 mph, ceiling 14,750 ft, range on internal fuel 310 miles, with auxiliary tanks 620 miles.

Accommodation: crew of two; flight mechanic, and provisions for eight troops or four litter patients in main cabin.

Armament: see individual model descriptions. Max external load 5,290 lb.

Mil Mi-26 (NATO "Halo")

First flown on December 14, 1977, the **Mi-26** is the heaviest production helicopter yet built anywhere in the world and the first to operate successfully with an eight-blade main rotor. Its features include a payload and cargo hold very similar in size to those of a C-130 Hercules, loading via clamshell doors and ramp at the rear of the cabin pod, and main landing gear legs that are adjustable individually in length to facilitate loading and permit landing on varying surfaces.

Mi-26s were fully operational by 1983. More than 300 have since been built at Rostov-on-Don for military and civil use by day and night, in all weather, of which some 21 are operated by the Russian Army. Infrared jammers, exhaust heat suppressors, and decoy dispensers can be fitted. Under development is the uprated **Mi-26M** with more powerful ZMKB Progress D-127 engines (each approx 14,000 shp), all-composites rotor blades, and max payload of 55,115 lb for crane operations. The **Mi-26TM** flying crane has a belly gondola for a pilot/sling supervisor, and an **Mi-26TZ** tanker version is projected.

Power Plant: two ZMKB Progress D-136 turboshafts; each 10,000 shp.

Dimensions: rotor diameter 105 ft 0 in, length of fuselage 110 ft 8 in, height to top of main rotor head 26 ft 8¾ in.

Weights: empty 62,170 lb, gross 123,450 lb.

Performance: max speed 183 mph, ceiling 15,100 ft, range with standard fuel 497 miles, with auxiliary tanks 1,190 miles.

Accommodation: crew of four; about 40 tip-up seats along side walls of hold; seats can be installed for total of 80 combat-equipped troops, plus four more passengers in compartment aft of flight deck, or litters for 60 casualties plus up to five attendants. Other loads include two airborne infantry combat vehicles or a standard 44,100-lb ISO container.

Armament: none.

Mil Mi-28 (NATO "Havoc")

The **Mi-28** two-seat attack helicopter is Russia's counterpart of the slightly smaller US Army AH-64A Apache but will enter service at least 12 years later. Its IFR instrumentation is conventional, with autostabilization, autohover, and hover/heading hold lock in the attack mode. The fuel tanks are protected by a thick second skin of composites. All vital units and parts are redundant and widely separated. The cockpits have armored glass transparencies and are protected by titanium and ceramic armor. Energy-absorbing seats and landing gear are designed to protect the crew in a 40 ft/sec vertical crash landing. Escape by parachute would be facilitated by a system that blasts away the doors and stubwings (but not the main rotor) in an emergency. A door aft of the port stubwing gives access to a compartment large enough to enable the crew to land and pick up two or three persons in a combat rescue situation.

The 30-mm 2A42 turret-mounted gun is identical to that on many CIS Army ground vehicles and uses the same ammunition. It is fired by the navigator/gunner in the front cockpit, together with the aircraft's guided and unguided weapons. The pilot normally fires only unguided weapons but can also fire the gun if it is fixed. Operational equipment includes a swiveling undernose turret for a daylight optical sight and laser ranger-designator, with provision for LLLTV and FLIR. A pod on each wingtip houses chaff/flare dispensers and sensors, probably RWR.

The first of four prototypes of the Mi-28 flew November 10, 1982. A small preseries is being built, but further development and manufacture are likely to concentrate on the **Mi-28N** variant with night/all-weather capability. This will have 360° scan mast-mounted millimeter wave radar, a FLIR ball, and LLLTV. Its armament will include Igla (SA-16 "Gimlet") AAMs. A prototype Mi-28N is expected to fly this year. *(Data for basic Mi-28.)*

Mil Mi-26TM ("Halo") flying crane
(John Fricker)

Ilyushin Il-20DSR ("Coot-A")
(F. G. Rozendaal)

Ilyushin Il-22 ("Coot-B")
(F. G. Rozendaal)

Power Plant: two Klimov TV3-117VM turboshafts; each 2,070 shp (2,465 shp in Mi-28N).

Dimensions: rotor diameter 56 ft 5 in, length excl rotors 55 ft 9¾ in, height overall 15 ft 5 in.

Weights: empty 17,846 lb, gross 25,705 lb.

Performance: max speed 186 mph, ceiling 19,025 ft, max range 285 miles.

Accommodation: crew of two, in tandem.

Armament: one 30-mm 2A42 gun, with 250 rds, in undernose turret. Four underwing pylons for 4,230 lb of stores, typically two UB-20 pods of 20 x 80-mm or 130-mm rockets and total of 16 9M114 Shturm (AT-6 "Spiral") antitank missiles. Missile guidance equipment in thimble radome on nose.

Reconnaissance, ECM, and Early Warning Aircraft

Antonov An-12 (NATO "Cub-A, B, C, and D")

The large hold of this four-turboprop transport can accommodate a wide variety of equipment for special duties. Variants:

Cub-A. Elint version. Generally similar to basic An-12BP transport but with blade antennas on front fuselage, aft of flight deck, and other changes.

An-12BK (Cub-B). Conversion of Cub transport for elint missions. Two additional radomes under the forward- and center-fuselage, plus other antennas.

An-12PP (Cub-C). ECM variant carrying several tons of electrical generation, distribution, and control gear in the cabin and palletized jammers for at least five wavebands faired into the belly, plus chaff/flare dispensers. Glazed nose and undernose radar of transport retained. An ogival "solid" fuselage tailcone, housing electronic equipment, is fitted in place of the usual gun position.

An-12PPS (Cub-D). Further ECM variant for active countermeasures, with pods on each side of front-fuselage and tailfin.

The Russian Air Forces have 125 reconnaissance/ECM Cubs; Naval Aviation has seven Cub-Cs and Ds.

Antonov An-26RTR (NATO "Curl-B")

The An-26RTR sigint version of the An-26 transport can be identified by many short blade antennas above and below the fuselage. About 100 serve with Russian Air Forces.

Beriev A-50 (NATO "Mainstay")

This AEW&C version of the Il-76 "Candid" transport is produced by the Beriev OKB. Sixteen **A-50s** operate with MiG-29, MiG-31, and Su-27 counterair fighters of the Russian home defense force and tactical air forces, mainly in the northwestern TVD centered on the Kola Peninsula. Mainstay's configuration is conventional, with a 29 ft 6 in diameter pylon-mounted rotating "saucer" radome, satellite nav/com, a new IFF system, RWR, comprehensive ECM, and flight refueling probe. A crew of 15 is carried. The Il-76's nose glazing around the navigator's station is replaced by nontransparent fairings, and there is no rear gun turret. The radar observers have color CRT displays.

The A-50 normally operates on a figure-eight course at 33,000 ft, with 62 miles between orbit centers, to detect and track aircraft and cruise missiles flying at high or low altitude over land and water.

An improved version, designated **A-50U,** was exhibited at the 1995 Moscow Air Show. Enhanced performance is provided by the Vega Schmel-M radar system that includes a passive mode to detect hostile ECM sources without transmission-induced vulnerability, a computer-based three-dimensional pulse-Doppler radar, and a digital subsystem that gives the altitude of all moving targets. Search radius is 143 miles for small aircraft, 248 miles for ships. Up to 50 targets can be tracked and interception of 10 guided simultaneously. The A-50U was said to be entering service with capabilities equivalent to those of USAF's E-3C Sentry.

Ilyushin Il-20DSR (NATO "Coot-A")

The Il-20DSR elint/sigint/reconnaissance aircraft is a conversion of the Il-18 four-turboprop transport, with flight crew of four or five and 20 mission specialists. An underfuselage container, about 33 ft 7½ in long and 3 ft 9 in deep, houses side-looking airborne radar (SLAR). Smaller containers on each side of the forward fuselage each contain a door over a camera or other sensor. About eight antennas and blisters can be counted on the undersurface of the center- and rear-fuselage, plus two large plates projecting above the forward fuselage. The Russian Navy has three Il-20s.

Ilyushin Il-22 (NATO "Coot-B")

In its best-known form, this airborne command post conversion of the Il-18 airframe has a bullet-shaped pod on the fintip, a long and shallow container under the front fuselage, and many small blade antennas above and below the fuselage. The electronics and their fairings vary from one aircraft to another. About 20 are in Russian Air Forces service.

MiG-25BM (NATO "Foxbat-F")

MiG-25 interceptors have been replaced by MiG-31s in the Russian Air Forces; but about 85 ECM and reconnaissance versions of Foxbat remain in service.

The MiG-25BM (Foxbat-F) is a "Wild Weasel" type of defense-suppression aircraft produced in 1982–85. Its airframe is generally similar to that of the MiG-25RB but with a dielectric panel for ECM aft of the radome on each side of a 2 ft 4½ in longer nose. There is a small blister on each side at the rear of the radome and a dielectric panel on the nose of each outboard weapon pylon. A 1,400-gallon underbelly fuel tank can be fitted. Armament consists of four Kh-58 (AS-11 "Kilter") antiradiation missiles to attack SAM sites over standoff ranges. *(Data generally as for MiG-25R.)*

MiG-25R (NATO "Foxbat-B and D")

Production of the basic MiG-25R single-seat, high-altitude, reconnaissance aircraft began in 1969; in the following year it was decided to add a bombing capability, and a modified version, the MiG-25RB, became standard. Its automatic bombing system made possible all-weather, day and night precision attacks at supersonic speed and from heights above 65,600 ft, against targets whose geographic coordinates were known. No gun or AAMs for self-defense were considered necessary because of the aircraft's high speed and ceiling, and ECM. Its navigation system was an inertial type, updated by Doppler. The following variants were produced:

MiG-25RB series (Foxbat-B). Carries any one of three interchangeable reconnaissance/elint packs in

its nose, offering combinations of cameras and SLAR. Later subtypes were **MiG-25RBV** and **MiG-25RBT**, with different SLAR or navigation equipment. Foxbat-B can be identified by its five camera windows. All reconnaissance Foxbats also have large dielectric panels for the SLAR on the sides of the nose.

MiG-25RU (Foxbat-C). Training version of the MiG-25R, with separate cockpit for instructor, under individual canopy, forward of standard cockpit and at lower level. No reconnaissance sensors or combat capability. Limited to Mach 2.65.

MiG-25RBK series (Foxbat-D). Produced simultaneously with RB series in 1971–80. Modules contain different elint systems and no cameras, requiring no camera windows. **MiG-25RBS** had different sensors, and all RBSs were upgraded to **MiG-25RBSh** standard, with more sophisticated equipment, from 1981. The **MiG-25RBF** is an updated RB, to RBK standard but retaining cameras and with different active/passive countermeasures.

All versions have a generally similar specification, two 24,675 lb thrust R-15BD-300 engines, 4,850 gallons of internal fuel, and provision for a 1,400-gallon underbelly tank.

Dimensions: span 44 ft 0¼ in, length 70 ft 8½ in, height 21 ft 4 in.
Weights: gross 81,570–90,830 lb.
Performance: max speed at height Mach 2.83, at S/L Mach 0.98, ceiling 68,900 ft, range at supersonic speed on internal fuel 1,015 miles, subsonic with underbelly tank 1,490 miles.
Armament: provision for four 1,100-lb bombs under wings and two under fuselage.

Mil Mi-6 and Mi-22 (NATO "Hook-B and C")

There are two special-duty versions of the Mi-6 helicopter:

Mi-6VKP (Hook-B). Airborne command post helicopter, with flat-bottom, U-shaped antenna under tailboom, X-configuration blade antennas forward of horizontal stabilizers, large heat exchanger on starboard side of cabin, and small cylindrical container aft of starboard rear cabin door.

Mi-6AYa/Mi-22 (Hook-C). Developed command support version with sweptback plate antenna above forward part of tailboom instead of Hook-B's U-shaped antenna. Small antennas under fuselage. Pole antenna attached to starboard main landing gear of some aircraft.

Mil Mi-8 (NATO "Hip-D, J, and K")

Special-mission versions of this helicopter have the following NATO reporting names:

Mi-8VZPU (Hip-D). Airborne reserve command post. Generally similar to Hip-C transport but with canisters of rectangular section on outer stores racks and two large antennas above forward part of tailboom. No armament.

Mi-8SMV (Hip-J). ECM version, with additional small boxes on sides of fuselage, fore and aft of main landing gear legs. Used mainly for border surveillance.

Mi-8PPA (Hip-K). Active communications jammer and communications intelligence (comint) helicopter; rectangular container and array of six cruciform dipole antennas on each side of cabin. Heat exchangers under front fuselage. No Doppler box under tailboom. Some uprated to Mi-17 standard, with port-side tail rotor.

Mil Mi-9 (NATO "Hip-G")

The designation Mi-9 applies to the command relay platform variant of the Mi-8 known to NATO as Hip-G. Rearward-inclined "hockey stick" antennas project from rear of cabin and from undersurface of tailboom, aft of box for Doppler radar. Short rearward-inclined whip antenna above forward end of tailboom. Strakes on fuselage undersurface. Crew of three to six. About 50 in Russian Army service.

Mil Mi-17 (NATO "Hip-K derivative")

The **Mi-17P** ECM communications jamming and comint helicopter, designated Hip-K derivative by NATO, has an airframe and power plant of Mi-17 standard. Behind the main landing gear on each side is a large, panel-like, 32-element array, with a separate four-element array to the rear, on the tailboom. A large radome is mounted on each side of the cabin, below the jet exhaust, with a further triangular container in place of the rear cabin window each side. There are six heat exchangers under the front fuselage.

Two examples of a **further military variant** of the Mi-17 were seen in Czech Air Force service at Dobrany-Line AB, near Plzen, in 1991. Each had a tandem pair of large cylindrical containers mounted on each side of the cabin. It is assumed that the containers are made of dielectric material and contain receivers able to locate, analyze, and jam hostile electronic emissions. Each of two operator's stations in the main cabin has large screens, computer-type keyboards, and an oscilloscope. Several blade antennas project from the tailboom.

Mil Mi-24 (NATO "Hind-G1 and G2")

See main Mi-24 entry for details of these special-duty versions.

Sukhoi Su-24 (NATO "Fencer-E and F")

Reconnaissance and electronic warfare versions of the Su-24 are listed under the main entry for this aircraft in the Attack Aircraft section.

Tupolev Tu-95 (NATO "Bear")

See main Tu-95 entry in the Bombers and Maritime section.

Tupolev Tu-22M (NATO "Backfire")

An electronic warfare version of Backfire was observed at Akhtubinsk Test Center in mid-1995. One of a small number of Tu-22M-3 airframes converted for the Russian Air Forces since 1989, it had a semirecessed pod in the weapons bay and dielectric fairings on the side of each engine duct and forward of the root of the dorsal tailfin. Its precise role, for reconnaissance, ECM, or other EW missions, is not yet clear.

Transports and Tankers

Antonov An-12BP (NATO "Cub")

About 350 of these 1950s-vintage four-turboprop transports remain available to the Russian Military Transport Aviation force (VTA). Their usefulness is limited by lack of an integral rear-loading ramp/door. Instead, the bottom of the rear fuselage is made up of two longitudinal doors that hinge upward inside the cabin to permit direct loading from trucks on the ground or air-dropping supplies and equipment. A full complement of 60 paratroops can be dispatched via this exit in less than one minute.

The Cub-A, B, C, and D elint and ECM versions are described separately on p. 72.

Power Plant: four ZMKB Progress/Ivchenko AI-20K turboprops; each 3,945 ehp.

Mil Mi-8VZPU ("Hip-D")
(F. G. Rozendaal)

Antonov An-26 ("Curl-A")
(F. G. Rozendaal)

Antonov An-32 ("Cline")
(Piotr Butowski)

Dimensions: span 124 ft 8 in, length 108 ft 7¼ in, height 34 ft 6½ in.
Weights: empty 61,730 lb, gross 134,480 lb.
Performance: max speed 482 mph, ceiling 33,500 ft, range 2,236 miles with max payload.
Accommodation: crew of six; 44,090 lb of freight, 90 troops or 60 parachute troops. Built-in freight-handling gantry with capacity of 5,070 lb.
Armament: two 23-mm NR-23 guns in manned tail turret. Provision for carrying bombs on landing gear fairings.

Antonov An-22 (NATO "Cock")

The An-22 was the only Soviet transport aircraft capable of lifting the Soviet Army's main battle tanks and theater missile systems until the An-124 entered service. About 40 are available to VTA, often operating in civil markings. Each has a max payload of 176,350 lb, loaded via a rear ramp.

Power Plant: four KKBM/Kuznetsov NK-12MA turboprops; each 14,795 shp.
Dimensions: span 211 ft 4 in, length 190 ft 0 in, height 41 ft 1½ in.
Weights: empty 251,325 lb, gross 551,160 lb.
Performance: max speed 460 mph, range with 99,200 lb payload 6,800 miles.
Accommodation: crew of five or six, 28–29 passengers in cabin forward of main freight hold. Four traveling gantries and two winches to speed freight handling.
Armament: none.

Antonov An-26 (NATO "Curl")

The An-26 freighter (**Curl-A**) was the first aircraft to embody Oleg Antonov's unique rear-loading ramp. This forms the underside of the rear fuselage when retracted but can be slid forward under the rear of the cabin to facilitate direct loading onto the floor of the hold or when the cargo is to be air-dropped. Max payload is 12,125 lb; conversion of the standard freighter to carry troops or litters takes 20 to 30 minutes in the field. About 150 are in Russian Air Forces service. The **Curl-B** sigint version is described in the Reconnaissance, ECM, and Early Warning Aircraft section.

Power Plant: two ZMKB Progress AI-24VT turboprops; each 2,780 ehp. One 1,765 lb thrust RU 19A-300 auxiliary turbojet in starboard nacelle for turboprop starting and to provide additional power for takeoff, climb, and cruising flight, as required.
Dimensions: span 95 ft 9½ in, length 78 ft 1 in, height 28 ft 1½ in.
Weights: empty 32,518 lb, gross 52,911 lb.
Performance: cruising speed at 19,675 ft 270 mph, ceiling 24,600 ft, T-O run 2,855 ft, landing run 2,135 ft, range with max payload 770 miles, with max fuel 1,652 miles.
Accommodation: crew of five, plus station for load supervisor or dispatcher. Electrically powered mobile hoist, capacity 4,409 lb, and conveyor to facilitate loading and air-dropping. Provision for carrying 40 paratroops or 24 litters. Improved An-26B (Curl-A) version has improved handling system, enabling two men to load and unload three eight-ft-long freight pallets in 30 min.
Armament: none.

Antonov An-32 (NATO "Cline")

To provide much improved performance under "hot and high" conditions, this development of the basic An-26 airframe, has almost doubled engine power, triple-slotted trailing-edge flaps, automatic leading-edge slats, enlarged ventral fins, a full-span slotted tailplane, and improved systems. The basic **An-32** is able to operate from airfields 13,000 to 14,750 ft above sea level in an ambient temperature of ISA + 25°C. Turboprop uprating, to give an extra 200 shp from each engine, gives the **An-32B** a 1,100-lb increase in payload. Russian Air Forces have 50. *(Data for basic An-32.)*

Power Plant: two ZMKB Progress AI-20D Series 5 turboprops; each 5,042 ehp.
Dimensions: span 95 ft 9½ in, length 78 ft 0¼ in, height 28 ft 8½ in.
Weights: empty, equipped 38,158 lb, max payload 14,770 lb, gross 59,525 lb.
Performance: max cruising speed 329 mph, ceiling 30,840 ft, T-O run 2,495 ft, landing run 1,542 ft, range with max payload 745 miles, with max fuel 1,565 miles.
Accommodation: crew of three or four; freight, or 42 paratroops and a jumpmaster, or 24 litter patients and up to three medical attendants.
Armament: none.

Antonov An-70

First aircraft to fly powered only by propfans, the An-70 is a wide-body transport that was announced in 1988 as an An-12 replacement. It is intended primarily as a freight carrier, with few cabin windows; but its pressurized and air-conditioned hold would permit the carriage of troops. Approx 28 percent of the airframe, by

weight, is made of composites. The freight hold is 61 ft long (73 ft 6 in with ramp, which can be loaded), 13 ft 1½ in wide, and 13 ft 5½ in high. Loading is via rear fuselage ramp/doors, with adjustable sill height and built-in cargo-handling system. Normal payload is 66,135 lb, with a maximum 77,160 lb. Control is fly-by-wire, with backup by a unique fly-by-hydraulics system, immune to electromagnetic interference. Design life is 20,000 cycles and 45,000 flying hours in 25 years. Eight to 10 man-hours of maintenance per flying hour is estimated, and the An-70 is expected to be cost-effective with a minimum 200 flying hours per month.

The first prototype was lost in February 1995 in an in-flight collision with an An-72. A replacement will fly this year.

Power Plant: four ZMKB Progress D-27 propfans; each 13,800 shp.

Dimensions: span 144 ft 6¾ in, length 132 ft 0¾ in, height 52 ft 10 in.

Weight: gross 286,600 lb.

Performance (estimated): nominal cruising speed at 30,000 ft 466–497 mph, T-O run 4,920–5,905 ft, landing run 6,235 ft, max range with normal payload 3,435 miles.

Accommodation: crew of three, plus loadmaster; freight in containers, on pallets, or unpackaged, including perishables or vehicles. Seats for 170 troops optional.

Armament: none specified.

Antonov An-72 and An-74 (NATO "Coaler")

Developed as a STOL replacement for the An-26, with an emphasis on freight carrying, the An-72 can operate from unprepared airfields or from surfaces covered with ice or snow. The high location of the engines was adopted to avoid foreign-object ingestion. Their efflux is ejected over the wing upper surface and then down over large multislotted flaps to provide a considerable increase in lift for short-field operation. The first of two prototypes (NATO Coaler-A) flew December 22, 1977. Features included a Doppler-based automatic navigation system. The second prototype introduced a "slide-forward" loading ramp of the kind fitted to the An-26. Only 20 were operational with Russian Air Forces in 1994, but production is maintained at the rate of 20 aircraft a year, in the following forms:

An-72 (Coaler-C). Light STOL transport. Extended wings and lengthened fuselage by comparison with prototypes. Conventional landing gear, with twin-wheel nose unit and two wheels in tandem on each main unit.

An-72P/An-76. See Bombers and Maritime section.

An-74-200 (Coaler-B). For all-weather operation, including Arctic missions; flight crew of five and full deicing system. D-36 Series 3A turbofans. More advanced navigation aids include inertial navigation system; provision for wheel/ski landing gear and greatly increased fuel capacity. Payload 16,535 lb. Airframe identical with that of An-72 except for two blister windows at rear of flight deck and front of cabin on port side and larger nose radome. Gross weight 80,465 lb.

An-74T-200 (Coaler-B). Cargo transport with 22,045-lb payload. Loading winch and roller conveyors in floor. Crew of two.

An-74TK-200 (Coaler-B). Convertible passenger/freighter with 52 folding seats, combi or all-cargo layouts. Built-in loading equipment. Crew of two.

An-74T-100 (Coaler-B). As T-200, with added navigator station. Crew of four.

An-74TK-100 (Coaler-B). As TK-200, with added navigator station. Crew of four. *(Data for An-72.)*

Power Plant: two ZMKB Progress D-36 turbofans; each 14,330 lb thrust.

Dimensions: span 104 ft 7½ in, length 92 ft 1¼ in, height 28 ft 4½ in.

Weights: empty 42,000 lb, max payload 22,045 lb, gross 60,625–76,060 lb.

Performance (at T-O weight of 72,750 lb): max speed 438 mph, normal cruising speed at 32,800 ft 342–373 mph, ceiling 35,100 ft, T-O run 3,050 ft, landing run 1,525 ft, range with max payload 497 miles, with max fuel 2,980 miles.

Accommodation: crew of three or four; main cabin designed primarily for freight but with provision for 68 passengers or 57 paratroops on folding seats along side walls and removable central seats; or for 24 litter patients, 12 seated casualties, and attendant.

Armament: none.

Antonov An-124 (NATO "Condor")

The world's largest production aircraft, the An-124 has a greater wingspan and higher gross weight than USAF's C-5 Galaxy. An upward-hinged, visor-type nose and rear fuselage ramp/door allow simultaneous front and rear loading/unloading. Advanced features include a fly-by-wire control system, "mobilely attached" titanium floor throughout the main hold, and 12,125 lb of composites, making up more than 16,150 sq ft of the airframe surface area. The 24-wheel landing gear enables the An-124 to operate from unprepared fields, hard-packed snow, and ice-covered swampland. The nosewheels can be retracted so that the aircraft "kneels" to facilitate front loading. Payloads range from the largest battle tanks to complete missile systems.

The first of two prototypes flew December 26,1982. On July 26, 1985, an An-124 set 21 official records by lifting a payload of 377,473 lb to a height of 35,269 ft. On May 6–7, 1987, it set a closed-circuit distance record by flying 12,521.2 miles nonstop. Deliveries to the VTA began in the same year. More than 50 have been built, of which 26 are available to VTA.

Power Plant: four ZMKB Progress D-18T turbofans; each 51,590 lb thrust.

Dimensions: span 240 ft 5¾ in, length 226 ft 8½ in, height 69 ft 2 in.

Weights: empty 385,800 lb, max payload 330,693 lb, gross 892,872 lb.

Performance: max cruising speed 537 mph, T-O balanced field length 9,850 ft, landing run 2,955 ft, range with max payload 2,795 miles, with max fuel 10,250 miles.

Accommodation: crew of six, plus loadmaster and relief crew; up to 88 passengers on fully pressurized upper deck; freight on lightly pressurized lower deck, positioned by two electric traveling cranes with total lifting capability of 44,100 lb.

Armament: none.

Antonov An-124 ("Condor")
(Piotr Butowski)

Prototype stretched Ilyushin Il-76MF
(Piotr Butowski)

Ilyushin Il-76 (NATO "Candid-B")

This is the standard medium/long-range workhorse of the Russian VTA, which has about 375 military Il-76M/MDs (Candid-B), with rear guns and small ECM blisters on each side of the front and rear fuselage. When operating into combat areas, they can be fitted with packs of 96 x 50-mm IRCM flares, on the landing gear fairings and/or on the sides of the rear fuselage.

The basic **Il-76M** is comparable to USAF's C-141 Starlifters. Design features include rear-loading ramp/doors, full-span leading-edge slats and triple-slotted flaps for good field performance, a glazed navigator's station and weather radar in the nose, navigation and ground-mapping radar in a large undernose fairing, and a unique and complex 20-wheel landing gear. The entire accommodation can be pressurized, making it possible to carry 140 troops or 125 paratroops as an alternative to freight. Advanced mechanical freight handling systems are fitted. Equipment for all-weather operation includes a computer for automatic flight control and automatic landing approach.

The improved **Il-76MD** has an increased gross weight of 418,875 lb, max payload of 110,230 lb, and additional fuel to extend max range by 745 miles. A stretched version, with the freight hold lengthened by 21 ft 8 in and payload increased to 114,640 lb, was flown for the first time on August 1, 1995. Designated **Il-76MF,** it has 35,275 lb thrust Aviadvigatel PS-90AN turbofans. *(Data for basic Il-76M.)*

Power Plant: four Aviadvigatel D-30KP turbofans; each 26,455 lb thrust.

Dimensions: span 165 ft 8 in, length 152 ft 10¼ in, height 48 ft 5 in.

Weights: max payload 88,185 lb, gross 374,785 lb.

Performance: cruising speed at 29,500–39,350 ft 466–497 mph, T-O run 2,790 ft, landing run 1,475 ft, nominal range with max payload 3,100 miles, max range 4,163 miles.

Accommodation: crew of seven, incl two freight handlers.

Armament: two 23-mm twin-barrel GSh-23L guns in tail turret.

Ilyushin Il-76VPK Command Post

Two examples of this airborne command post version of the Il-76MD were first seen at Zhukovsky Flight Test Center in 1992. Each has a large fairing above the fuselage forward of the wing over satcom/IR equipment; a ventral canoe-shaped radome and strakes; five small antennas above the center-section; other small antennas and air intake scoops under the front fuselage and at the rear of the main landing gear fairings; a long, shallow fairing forward of the dorsal fin on each side at the top of the fuselage; a large, downward-inclined, flat-plate antenna on each side of the tail-cone; and a long, pod-mounted probe on a pylon under each outer wing. The usual nose glazing around the navigator's compartment has been deleted, and the flight deck rear side windows are covered. The basket-drogue of what appears to be a VLF trailing-wire antenna can be seen under the rear fuselage.

Ilyushin Il-78 (NATO "Midas")

The basic **Il-78** in-flight refueling tanker derivative of the Il-76MD entered service during 1987, in support of both strategic and tactical aircraft. Using the probe-and-drogue technique, it is able to refuel up to three aircraft simultaneously. Two refueling pods are mounted conventionally under the outer wings. The third drogue is streamed from a similar pod on the port side of the rear fuselage. Fuel can be transferred from the standard 198,412-lb tanks in the wing torsion box as well as from two cylindrical tanks, containing 61,728 lb of fuel, in the hold. These two tanks are removable, enabling the aircraft to be used as a transport. The rear turret is retained as a flight refueling observation station, without guns. Special navigation systems allow all-weather day/night mutual detection and approach by receiver aircraft from distances up to 185 miles. Convergence is controlled automatically, but refueling is permitted only in direct visibility.

The current-standard **Il-78M** has three fixed tanks in the hold, containing an additional 44,090 lb of fuel, and is not convertible. Twenty are operational with Russian Air Forces.

Power Plant: four Aviadvigatel D-30KP-2 turbofans; each 26,455 lb thrust.

Weights (Il-78): empty 216,050 lb, gross 346,120–418,875 lb (Il-78M 462,965 lb).

Performance (Il-78): nominal cruising speed 466 mph, refueling speed at 6,500–29,500 ft 267–366 mph, refueling radius with 143,300 lb transfer fuel 620 miles, with 79,365 lb transfer fuel 1,553 miles.

Accommodation: crew of seven.

Ilyushin Il-87 (NATO "Maxdome")

Four Il-86 transports were observed at Zhukovsky Flight Test Center in 1992 with modifications similar to those seen on Il-76VPK airborne command posts. Each has a large boat-shaped fairing above the front-fuselage, as well as a shallow dished fairing forward of the fin root, strake antenna under the rear-fuselage, large blade antennas above the center- and rear-fuselage and under the front-fuselage, and large turbine-powered electric generator pods with a ram air intake under the wings inboard of the inner engines. A drogue for a VLF trailing-wire antenna is mounted on the lower fuselage on the port side. The Russian designation is reported to be Il-87 Aimak.

Power Plant: four KKBM NK-86 turbofans; each 28,660 lb thrust.

Dimensions: span 157 ft 8¼ in, length 195 ft 4 in, height 51 ft 10½ in.

Performance (as transport): normal cruising speed at 30,000–36,000 ft 559–590 mph, nominal range with max fuel 2,858 miles.

Airborne Nuclear Attack and Cruise Missiles

AS-4 (Kh-22 Burya; NATO "Kitchen")

This large ASM is primary armament of two of the three major types of Russian strategic bomber. The original **Kh-22,** which entered service in 1964, had

inertial guidance and a 350-kiloton nuclear warhead, needing no terminal homing. The **Kh-22N** with active radar terminal homing and alternative nuclear or 2,200-lb high-explosive (HE) warhead was developed in the early 1970s. The **Kh-22MP** defense-suppression version, with passive radar homing and HE warhead, is also in service.
Type: medium-range ASM.
Power Plant: liquid-propellant rocket.
Guidance: inertial, or inertial plus active or passive radar homing.
Warhead: alternative nuclear (350 kilotons) or HE (2,200 lb).
Dimensions: span 9 ft 10 in, length 37 ft 1 in, body diameter 3 ft 3½ in.
Launch Weight: 14,990 lb.
Performance: max speed Mach 4.6, range 185 miles at low altitude, 285 miles at 50,000 ft.
Carried by: Tu-22M "Backfire" (up to three), Tu-95 "Bear-G" (two).

AS-6 (Kh-26/KSR-5; NATO "Kingfish")

The AS-6 Kingfish has a similar configuration to that of the AS-4 "Kitchen" but is powered by a solid-propellant rocket motor. It was carried primarily by the now-retired Tu-16K for antiship missions but has been seen also on Tu-22Ms. Its three versions paralleled those of the AS-4, but some of the estimated 100 that remain have been converted into targets.
Type: medium-range ASM.
Power Plant: solid-propellant rocket.
Guidance: inertial, or inertial plus active or passive radar homing.
Warhead: alternative nuclear (350 kilotons) or HE (2,200 lb).
Dimensions: span 8 ft 2 in, length 35 ft 9 in, body diameter 3 ft 0¼ in.
Launch Weight: 13,120 lb.
Performance: max speed Mach 3, range 185 miles.

AS-15 (Kh-55; NATO "Kent")

Three-fourths of Russia's long-range bomber force of 95 aircraft consists of Tu-95MS "Bear-Hs" and Tu-160 "Blackjacks" armed with AS-15 ALCMs. AS-15 appears to be similar in configuration and size to the US BGM-109 Tomahawk. Both missiles are turbofan-powered, with flip-out wings, and the AS-15 has a terrain-comparison/inertial guidance system like Tomahawk's Tercom.

Deployment on the Tu-95MS16 began in 1984, with six **AS-15A**s on an internal rotary launcher in each aircraft and 10 more in four underwing clusters. The Tu-95MS6, now the standard operational Bear-H, has only the rotary launcher. The Tu-160 has a rotary launcher for six **AS-15B**s, which appear to have slender external fuel tanks scabbed onto their sides, giving a triangular cross section, with rounded corners. *(Data for AS-15A.)*
Type: long-range ALCM.
Power Plant: podded turbofan, extended down from rear of body after launch.
Guidance: inertial with terrain comparison.
Warhead: nuclear (200 kilotons).
Dimensions: span 10 ft 8 in, length 26 ft 6½ in, body diameter 1 ft 8 in (AS-15B 2 ft 6¼ in).
Launch Weight: 3,750 lb.
Performance: speed subsonic, range 1,490 miles at height. CEP 500 ft.
Carried by: Tu-95MS Bear-H, Tu-160 Blackjack.

AS-16 (Kh-15; NATO "Kickback")

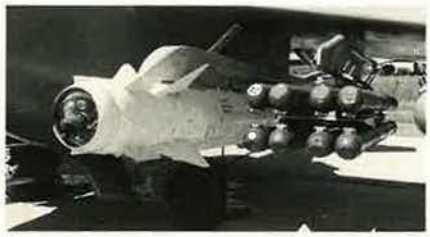
A Tu-22M-3 "Backfire-C" bomber has been displayed with a rotary launcher carrying six **AS-16** Kickbacks in its weapons bay, in addition to two underwing AS-4s. DoD believes that four more AS-16s could be carried underwing, instead of the AS-4s. Designated Kh-15 in Russia, the AS-16 is in the same class as USAF's now-withdrawn AGM-69 SRAM. An alternative nuclear or conventional warhead can be fitted, plus an active radar seeker in the **Kh-15A** antiship version and a passive radar seeker in the antiradiation **Kh-15P.** Twelve can be carried as an alternative to six AS-15B ALCMs on each of the Tu-160 "Blackjack's" rotary launchers. A version with conventional warhead and active seeker has been offered for export as the **Kh-15S,** for antiship use.
Type: medium-range ASM.
Power Plant: solid-propellant rocket.
Guidance: inertial plus active or passive radar homing.
Warhead: nuclear (350 kilotons) or HE (330 lb).
Dimensions: span 3 ft 0¼ in, length 15 ft 8 in, body diameter 1 ft 5¾ in.
Launch Weight: 2,650 lb.
Performance: max speed Mach 5, range 62 miles at low altitude, 95 miles at height.
Carried by: Tu-22M-3 Backfire-C, Tu-160 Blackjack.

AS-? (Kh-65SE)

Possibly a conventional-warhead version of the AS-15, this ALCM has a basically cylindrical body, changing to a flat-bottom triangular section with rounded corners forward of the wings to reduce radar signature. The wings and three tail control surfaces fold for stowage on the missile launcher. After launch, these surfaces deploy, and the power plant pod extends through hinged doors in the weapon's undersurface. The Kh-65SE is about 19 ft 8 in long, with an estimated launch weight of 2,750 lb and range of 155 miles.

AS-4 (Kh-22MP "Kitchen") *(Yefim Gordon)*

GELA test vehicle for AS-X-19 (BL-10 "Koala") ALCM *(Piotr Butowski)*



AS-14 (Kh-29T "Kedge") and eight Vikhr ATMs *(Piotr Butowski)*

AS-X-19 (BL-10; NATO "Koala")

Existence of this supersonic ALCM was confirmed in 1988, when US Defense Secretary Frank Carlucci was invited to inspect a Tu-160 bomber at Kubinka AB, near Moscow. Russia announced termination of the program, said to be designated BL-10, in 1992. By then, flight tests had begun under the wing of a Tu-95MS, and what is assumed to be one of the test vehicles was exhibited at the 1995 Moscow Air Show. Approximately 30 ft long, and known as GELA (hypersonic experimental flying testbed), this is powered by a ramjet engine, with a shock-cone inlet under a flat-blade nose section. Earlier reports had suggested that Koala would cruise at Mach 2.5 to 3 at a height of 70,000 ft, and might carry two independently targeted warheads able to impact up to 60 miles apart.

Airborne Tactical Missiles

AS-7 (Kh-23; NATO "Kerry")

This first-generation tactical ASM has a solid-propellant rocket motor, radio command guidance by joystick control from the launch aircraft, and a 242-lb, hollow-charge, high-explosive warhead. It is carried by the Su-24.
Dimensions: span 2 ft 7¼ in, length 11 ft 7 in, body diameter 10⅞ in.
Weight: 633 lb.
Performance: max speed transonic, range 3 miles.

AS-9 (Kh-28; NATO "Kyle")

The liquid-propellant AS-9 antiradiation missile has a passive radar homing system and 342-lb warhead with which to attack landbased and shipborne radars. Launch aircraft are reported to be the MiG-25, Su-24, and Tu-22M. It is said to cruise to the target at high altitude and to complete its terminal homing in a steep dive.
Dimensions: span 4 ft 7¼ in, length 19 ft 8¼ in, body diameter 1 ft 5 in.
Weight: 1,576 lb.
Performance: max speed supersonic, range 56 miles.

AS-10 (Kh-25ML/MR; NATO "Karen")

Each of the two basic operational versions of Karen has a solid-propellant motor and 198-lb warhead. The **Kh-25MR** uses the same kind of radio command guidance system as the Kh-23 (AS-7 "Kerry"), to which it is similar. The **Kh-25ML** is laser-guided, with target designation by the launch aircraft. These include the Su-24, Su-25, and Su-25TM. *(Data for Kh-25ML.)*
Dimensions: span 2 ft 7½ in, length 12 ft 2 in, body diameter 10⅞ in.
Weight: 660 lb.
Performance: launch height 330–33,000 ft, max speed Mach 2.35, range 1.25–12.5 miles.

AS-11 (Kh-58; NATO "Kilter")

Complementing the larger AS-9, the AS-11 is a third-generation antiradiation missile of cruciform clipped-delta wing/tailfin configuration, with inertial guidance, a passive radar homing head and a dual-thrust solid-propellant rocket motor. A nuclear warhead is reported to be optional in place of the usual 330-lb or 440-lb HE blast/fragmentation type. Kilter forms the primary armament of the MiG-25BM and is compatible with the Su-24 and the Su-25TM. A new version for use against ship radars has a range of 112 miles after high-altitude launch.
Dimensions: span 3 ft 10 in, length 16 ft 4⅞ in, body diameter 1 ft 3 in.
Weight: 1,433 lb.
Performance: max speed Mach 4, range from low altitude 6–43 miles, from high altitude 6–93 miles.

AS-12 (Kh-25MP; NATO "Kegler")

Kegler differs from the AS-10 "Karen" ASM in having a passive radar homing head. Much smaller and lighter than the AS-9, it can be carried by the Su-24, Su-25, and Tu-22M. It has a 198-lb warhead.
Dimensions: as AS-10, except length 14 ft 3½ in.
Weight: 685 lb.
Performance: launch height 330–49,200 ft, max speed Mach 2.5, range from low altitude 1.5–15.5 miles, from high altitude 1.5–37 miles.

AS-13 (Kh-59; NATO "Kingbolt")

The medium-range, TV-guided AS-13 has a two-stage solid-propellant power plant. Although first displayed in 1991, it was probably developed in the 1970s to supplement the short-range AS-10. It is reported to have a 695-lb warhead and is carried by the Su-24 and Su-25, together with an ARK-9 data link pod.
Dimensions: span 4 ft 1¼ in, length 16 ft 9 in, body diameter 1 ft 3 in.
Weight: 1,875 lb.
Performance: range from low altitude 56 miles, from high altitude 100 miles.

AS-14 (Kh-29; NATO "Kedge")

Basic versions of this tactical ASM are the TV-guided **Kh-29T** and the semiactive, laser-guided **Kh-29L.** Except for the interchangeable seeker heads, they are identical. In the class of USAF's Maverick, they are carried on the extended wingroot glove pylons of the Su-24M and by the MiG-29, Su-25, and Su-25TM. Each version has a 705-lb HE warhead. A **Kh-29MP** version, with passive antiradiation seeker, has been reported. *(Data for Kh-29T.)*
Dimensions: span 3 ft 7¼ in, length 12 ft 8½ in, body diameter 1 ft 3¾ in.
Weight: 1,477 lb. (Kh-29L 1,448 lb.)
Performance: launch height 650–16,400 ft, range 1.85–7.5 miles.

AS-17 (Kh-31A/P; NATO "Krypton")

This impressive medium-range inertially guided ASM was developed initially to attack US Patriot and AEGIS phased-array missile radars. First exhibited at Dubai in 1991, it is powered by an integral rocket/ramjet, with four intakes for the ramjet disposed around the body, each carrying a wing and a control surface. Warhead weight is 198 lb. Four versions of the AS-17 have been identified:

Kh-31A Mod 1. Antiship missile with active radar

seeker and blast/penetration warhead. Length 15 ft 5 in, range 3–31 miles.

Kh-31A Mod 2. As Mod 1, but length 17 ft 2 in, range 3–43 miles.

Kh-31P Mod 1. Antiradiation missile with passive radar seeker and blast/fragmentation warhead. Length 15 ft 5 in, range 6–93 miles.

Kh-31P Mod 2. As Mod 1, but length 17 ft 2 in, range 6–125 miles.

An air-to-air version for use against AWACS aircraft also exists. All versions are designed for effectiveness in ECM environments. The Kh-31 has been seen mounted in inert form, or has been reported, on Su-24, Su-25TM, Su-32FN, Su-34, and Su-35 aircraft.

Dimensions: span 3 ft 9¼ in, length see above, body diameter 1 ft 2¼ in.
Weight: 1,323 lb.
Performance: launch height 165–49,200 ft, max speed Mach 3, range see above.

AS-18 (Kh-59M; NATO "Kazoo")

First seen under the wing of an Su-30 demonstrator at the 1993 Paris Air Show, this conventionally armed short-range cruise missile has a cylindrical body with sweptback cruciform flip-out nose surfaces and a cruciform tail unit carrying inset control surfaces. Guidance is command-updated midcourse inertial, with terminal homing via a Granit 7TM1 TV camera behind a glass nose, and the AS-18 is powered by a podded turbofan pylon-mounted under the rear of the body. A 705-lb HE or 617-lb cluster submunitions warhead can be fitted. The Russian designation Kh-59M implies that it is a development of the Kh-59 "Kingbolt," which has the same body diameter.

Dimensions: span 4 ft 3 in, length 17 ft 7½ in, body diameter 1 ft 3 in.
Weight: 2,050 lb.
Performance: speed at 330–660 ft Mach 0.85, range 25 miles with prelaunch lock-on, 71 miles with command update.

AS-20 (Kh-35)

Dubbed "Harpoonski" because of its similarity to the US AGM-84 Harpoon, the turbofan-powered Kh-35 is an active radar homing antiship ASM to arm combat aircraft and helicopters. As the 3M60 Uran (SS-N-25), it forms surface-to-surface armament for ships and is available for use on shore-based combat vehicles. First deployment of the Kh-35 was intended to be on the Tu-142M, with the Su-33 as another major carrier. Other aircraft cleared for carrying this weapon include the Su-24. With an added tandem booster, it can be launched from Ka-27 and Ka-50 helicopters. Warhead weight is 320 lb. Midcourse guidance is inertial, with a sea-skimming approach to the target at 16–33 ft altitude.

Dimensions: span 4 ft 3¼ in, length 12 ft 3½ in, body diameter 1 ft 4½ in.
Weight: 1,060 lb.
Performance: launch height 650–16,400 ft, max speed 670 mph, range 3–80 miles.

AS-? (Kh-41 Moskit)

This large rocket/ramjet antiship missile has been identified as an air-launched development of the SS-N-22 "Sunburn" carried in launchtubes by Russian naval craft. The configuration resembles that of the much smaller Kh-31 but with the cruciform wings located toward the front of the wraparound ramjet air intakes. The wing and tail surfaces all fold to fit between the engine ducts of the Su-33, on which the Kh-41 has been exhibited. It has a 705-lb HE blast/fragmentation warhead and makes an inertially guided sea-skimming approach to its target. Terminal guidance is by a dual-mode active/passive radar seeker, with ECCM capability. Moskit has been described as a primary weapon for the Su-32FN coastal-based attack aircraft but too heavy for use from aircraft carriers at sea.

Dimensions: span (spread) 6 ft 10¾ in, length 31 ft 11½ in, body diameter 2 ft 6 in.
Weight: 9,920 lb.
Performance: max speed Mach 2.1–3, range sea-skimming 93 miles, at high altitude 155 miles.

AFM-L

A mockup of this new antiship ASM was exhibited at the 1993 Moscow Air Show. No details were given, but the AFM-L has a very long cylindrical body, with slightly reduced diameter on a short section behind the ogival nosecone. The only visible aerodynamic surfaces comprised small cruciform fins at the extreme tail, but there are long slots for retracted wings in the upper part of the center-body.

Dimensions: length 24 ft 11¼ in, body diameter 1 ft 7¾ in.

ALFA

Under development without state funding, ALFA is a supersonic antiship missile for launch from ships or such aircraft as the Su-32FN. It has inertial midcourse guidance, with active radar terminal homing. The cylindrical body has a diameter of about 1 ft 9¾ in, with an ogival nose, small delta wings under the mid-body, and cruciform tail surfaces. A rectangular air intake for the turbofan engine is located aft of the wings. The missile's length is estimated as 19 ft 8 in, with a weight of 2,645 lb, and ability to carry an 880-lb warhead 375 miles.

AT-2 (9M17 Skorpion; NATO "Swatter")

This solid-propellant antitank missile (ATM) forms the missile armament of the Mi-24D helicopter gunship and is carried by the Mi-8TBK. The **Swatter-A/B** employs radio command guidance and requires the helicopter's weapons operator to keep crosswires on his sight centered on the target. **Swatter-C** is similar but has semiautomatic command to line-of-sight and a range of 2.5 miles. *(Data for Swatter-A/B.)*

Dimensions: span 2 ft 2 in, length 3 ft 9¾ in, body diameter 5¼ in.
Weight: 65 lb.
Performance: cruising speed 335 mph, range 1.85 miles.

AT-6 (9M114 Shturm; NATO "Spiral")

The AT-6 is a solid-propellant, tube-launched missile with a radio command guidance system. It has two small flip-out control fins on the nose and four wraparound stabilizing fins at the rear. The 16.3-lb HE warhead fitted to the basic antitank version can penetrate 37 in of armor plate. A variant with an HE fragmentation warhead for attacking other battlefield targets has been reported. The antitank version entered service in 1978 and is standard armament on the Mi-24V/P, Mi-28, and Ka-29.

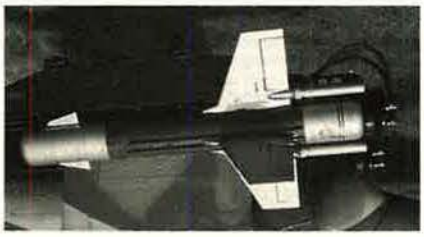
Dimensions: span 1 ft 0 in, length 6 ft 0 in, body diameter 5¼ in.
Weight: 74 lb.
Performance: cruising speed 895 mph, range 3.75 miles.

AT-9 (9M114M1/2 Shturm 2)

Seen in two eight-rd clusters on the outer underwing weapon pylons of an Mi-35M ("Hind") helicopter, at the 1995 Paris Air Show, the AT-9 has an improved radio command link, greater armor penetration, and an increased range compared with the AT-6. It can be used in both air-to-surface and air-to-air modes. IOC is reported to have been achieved in 1988.

Weight: 88 lb.
Performance: range 5 miles.

AS-18 (Kh-59M "Kazoo") *(Paul Jackson)*



AT-2 (9M17 "Swatter") *(Paul Jackson)*

AA-7 (R-23R "Apex") *(Piotr Butowski)*

AT-12 (9M120 Vikhr)

This tube-launched, solid-propellant ATM was seen for the first time in 1991 in the form of two eight-rd clusters under the wings of an Su-25TM attack aircraft. The configuration of the missile is believed to be similar to that of the AT-6/9, but its nose projects from the launchtube. Guidance is by laser beam riding. The warhead weight is estimated at 16.5 lb. The AT-12 is cleared for use on Mi-24, Mi-28, and Ka-50 helicopters. An air-to-air version, with proximity fuze and rod warhead, is reported.

Dimensions: span 1 ft 0¾ in, length 5 ft 7 in, body diameter 5¼ in.
Weight: 95 lb.
Performance: range 5 miles.

AT-X-16 (9M120M Vikhr M)

This version of the Vikhr ATM appears to be a lengthened and improved AT-9. Its launchtube is 9 ft 8 in long, suggesting the estimated missile data that follow. The AT-12 was first seen in 1992 on the Ka-50 combat helicopter, in the form of six-rd underwing clusters. Other possible carriers include the Mi-24, Mi-28, and Su-25TM. The motor is believed to be two-stage solid-propellant. Semiactive laser guidance is standard, with a 17-lb shaped-charge warhead reportedly capable of penetrating 39 in of reactive protected armor.

Dimensions: length 9 ft 6 in, body diameter 5¼ in.
Weight: 99 lb.
Performance: cruising speed supersonic, range 6.2 miles.

AA-6 (R-40/46; NATO "Acrid")

This two-stage, solid-propellant AAM, with a 154-lb fragmentation warhead, is one of the weapons that can be carried by MiG-31 interceptors. The **R-40T** and updated **R-46TD** have command-updated inertial guidance and an infrared homing head. The **R-40R** and **R-46RD** are semiactive radar homing versions, no longer marketed.

Dimensions: length 20 ft 4 in, body diameter 1 ft 2 in, wingspan 5 ft 11 in.
Weight: 1,047 lb.
Performance: cruising speed Mach 2.2, range (R-40) 18.5 miles, (R-46) 31 miles.

AA-7 (R-23/24; NATO "Apex")

This AAM, designed for the now-retired MiG-23, is reported to be an alternative weapon for the MiG-29. Apex has a solid-propellant rocket motor and exists in command-guided infrared and semiactive radar homing versions. Russian designations of the basic weapons were **R-23T** and **R-23R**, respectively; the improved **R-24R** may use CW monopulse radar for better performance against low-level targets. Warhead weight is 66 lb. *(Data for R-24R.)*

Dimensions: length 14 ft 7¾ in, body diameter 8 in, wingspan 3 ft 5 in.
Weight: 518 lb.
Performance: range 12.5 miles.

AA-8 (R-60; NATO "Aphid")

This close-range AAM can be carried by most Russian fighters and attack aircraft. It is intended for both interception and self-defense and has been reported in the latter role on Mi-24D/24V helicopters. It is a highly maneuverable, solid-propellant weapon with infrared homing guidance. In addition to the basic **R-60T** with active radar fuze, there is an **R-60M** version with new electro-optical fuze to match all-aspect engagement capability and range of three miles. The **R-60MK** carried by MiG-29s is adapted for designation by the pilot's helmet-mounted sight. A 13.2-lb fragmentation warhead is standard. *(Data for R-60T.)*

Dimensions: length 6 ft 10 in, body diameter 5⅛ in, wingspan 1 ft 5 in.
Weight: 143 lb.
Performance: range under 1,650 ft min, 1.85 miles max.

AA-9 (R-33; NATO "Amos")

Standard armament on the MiG-31, the AA-9 is claimed to be capable of destroying targets, including ALCMs, flying at up to Mach 3.5 at all altitudes from 80 ft to 92,000 ft, in all weather. It has folding upper tailfins to facilitate stowage on the MiG's recessed launchers, a solid-propellant motor, and a 104-lb blast/fragmentation warhead, and combines inertial autopilot guidance with semiactive radar terminal homing. The AA-9 is an alternative weapon for the Su-27. The basic **R-33** version has been followed by the **R-33S** with small cruciform front fins.

Dimensions: length 13 ft 7½ in, body diameter 1 ft 3 in, wingspan 2 ft 11½ in.

Weight: 1,080 lb.
Performance: range 62 miles.

AA-10 (R-27; NATO "Alamo")

The AA-10 has a complex configuration, with long-span, reverse-tapered, cruciform control surfaces to the rear of small foreplanes. An 86-lb expanding-rod warhead is standard. Six versions have been identified:

R-27R (Alamo-A). Short-burn version, with radio-corrected inertial guidance and semiactive radar terminal homing. Standard medium-range armament of MiG-29 and Su-27.

R-27T (Alamo-B). Short-burn, all-aspect, infrared homing version with inertial midcourse guidance and fire-and-forget capability. Carried by MiG-29 and Su-27.

R-27RE (Alamo-C). Long-burn version for longer ranges. Guidance as R-27R. Carried by Su-27.

R-27AE (Alamo-C). As R-27RE but active radar guidance, better able to deal with active maneuvering counterattacks and countermeasures.

R-27EM (Alamo-C). As R-27RE, with added capability against sea-skimming ASMs down to 10 ft above water.

R-27TE (Alamo-D). Long-burn, all-aspect, infrared counterpart of R-27RE, with fire-and-forget capability. Carried by Su-27.

Dimensions: length 13 ft 1½ in (27R), 12 ft 1¾ in (27T), 15 ft 5 in (27RE), 15 ft 8¼ in (27AE/EM), 14 ft 9 in (27TE), body diameter 9 in (27R/T), 10¼ in (all others), finspan 3 ft 2¼ in.
Weights: 558 lb (27R), 560 lb (27T), 772 lb (27RE/AE/EM), 756 lb (27TE).
Performance: range 31 miles (27R), 25 miles (27T), 46 miles (27RE), 50 miles (27AE), 68 miles (27EM), 43 miles (27TE), min launching range (tail-chase) 1,640 ft.

AA-11 (R-73; NATO "Archer")

This close-range missile is standard armament on the MiG-29, MiG-31/31M, Su-27, Su-32FN/34, Su-33, and Su-35. Its controls are complex, with movable sets of vanes and fins fore and aft of fixed cruciform surfaces at the nose, control surfaces at the trailing-edge of each of the cruciform tailfins, and four thrust-vectoring control vanes in the efflux of the two-phase solid-propellant rocket motor. They ensure 12*g* maneuverability, particularly when the missile is launched at large off-boresight target angles via the pilot's helmet-mounted sight. Guidance is inertial, with terminal all-aspect infrared and ability to discriminate against decoy flares; a 16-lb fragmentation warhead is fitted. There are two versions:

R-73M1. Basic version; off-boresight capability ±45°.

R-73M2. Off-boresight capability ±60°; increased weight and range; digital control electronics and IRCCM; reported capability against low-flying missiles.

Dimensions: length 9 ft 6¼ in, body diameter 6¾ in, finspan 1 ft 8 in.
Weights: R-73M1 232 lb, R-73M2 243 lb.
Performance: range 12.4 miles (R-73M1), 18.6 miles (R-73M2), min launching range (tail-chase) 985 ft.

AA-12 (R-77; NATO "Adder")

The capability of the **R-77** solid-propellant AAM earned it the Western nickname "AMRAAMski" before it received its official designation AA-12 Adder. First seen in February 1992, it was designed to destroy highly maneuverable (12*g*) aircraft, helicopters, cruise missiles, SAMs, and AAMs at all aspects, by day and night, in all weather and intense ECM, over ground and sea, in fire-and-forget mode. It has inertial control, with midcourse radar updates and active radar home-on-jam terminal lock-on, and a planned future version will be able to attack AWACS aircraft at a range of 100 miles or more. Designated **R-77M-PD**, this will have a rocket/ramjet motor, IR homing, and a weight of 496 lb. The basic R-77 will gradually become standard armament on late-model Russian aircraft. It is easily distinguished by its lattice tailfins, which fold for possible future internal stowage. Warhead weight is 66 lb.
Dimensions: length 11 ft 9¾ in, body diameter 7⅞ in, wingspan 1 ft 1¾ in.
Weight: 385 lb.
Performance: max speed Mach 3, range 31 miles, min launching range 985 ft.

AA-? (Kh-31 derivative)

Derived from the Kh-31A/P (AS-17 "Krypton"), this AAM is identical to the ASM in dimensions, weight, warhead, and max speed. It is intended to be launched at all altitudes from 330 to 49,200 ft, to attack targets over a range of 6.2 to 125 miles, and will have a combined active/passive radar seeker for the specific task of destroying AWACS and other nonagile aircraft.

AA-? (R-37)

A MiG-31M has been depicted with four R-37 AAMs on the fuselage-side conformal weapon attachments and with two R-33S versions of the AA-9 "Amos" on centerline mounts. The R-37 is a greatly enhanced derivative of the R-33, with all four tailfins able to fold for internal stowage on future stealthy aircraft. Its cruciform wings are positioned further forward than those of the R-33, and it has active radar terminal homing. A 132-lb fragmentation warhead is fitted.
Dimensions: length 13 ft 9½ in, body diameter 1 ft 3 in, wingspan 2 ft 3½ in.
Weight: 992 lb.
Performance: range 93 miles.

AA-? (AAM-L; KS-172)

This long-range AAM was shown in mockup form at the 1993 Moscow Air Show. It is a slim cylindrical missile with small cruciform tail control surfaces. Propulsion is by two-stage solid rocket. Guidance is inertial with midcourse update and active radar terminal homing. A range of 250 miles is claimed, against targets flying up to Mach 3.75 at heights from 10 ft to 98,000 ft. The HE fragmentation warhead has an estimated weight of 110 lb.
Dimensions: length 24 ft 3 in, body diameter 1 ft 7¾ in, finspan 2 ft 11½ in.
Weight: 1,650 lb.

SA-7, SA-14, SA-16, and SA-18

All of these man-portable SAMs have been adapted for air-to-air use on Mi-24 and other helicopters. Details in Surface-to-Air Missiles section.

AA-11 (R-73 "Archer") *(Paul Beaver)*

SA-3 (S-125 Neva, "Goa") *(Piotr Butowski)*

Intercontinental Ballistic Missiles

The totals of operational ICBMs given in this section refer to the number deployed in Russia, Belarus, and Kazakhstan in 1994, the latest available strengths.

SS-11 (RS-10; NATO "Sego")

In 1994, there were 20 of these "light" ICBMs at sites in Russia. The version in service is known to NATO as the SS-11 Mod 2, carrying a single one-megaton reentry vehicle plus penetration aids. These remaining SS-11s were expected to be deactivated during the mid-1990s.
Launch Mode: silo-based (not upgraded in hardness); hot-launched.
Power Plant: two-stage storable liquid-propellant.
Guidance: inertial.
Warhead: single nuclear (one megaton).
Dimensions: length 62 ft 4 in, body diameter 6 ft 6¾ in.
Launch Weight: 110,450 lb.
Performance: max range 8,075 miles. Throw weight 2,645 lb. CEP 1.1 km (0.7 miles).

SS-13 (RS-12; NATO "Savage")

Only 20 of these solid-propellant ICBMs, in Mod 2 configuration, remain in silos in Russia, with deactivation imminent.
Launch Mode: silo-based; hot-launched.
Power Plant: three-stage solid-propellant, each with four nozzles and separated by truss structures.
Guidance: inertial.
Warhead: single nuclear (750 kilotons).
Dimensions: length 71 ft 2½ in, body diameter 6 ft 0½ in (first stage).
Launch Weight: 112,435 lb.
Performance: range 5,840 miles. Throw weight 1,323 lb. CEP 1.8 km (1.1 miles).

SS-18 (RS-20; NATO "Satan")

The SS-18 is the only Russian missile classified as a "heavy" ICBM in START terms. Under START I, the total of 308 deployed in converted SS-9 silos had to be reduced to 154 by 1998. This was to be achieved by removing the 104 SS-18s that constituted Kazakhstan's entire ICBM force, plus 50 of those based in Russian Siberia. The total was down to 188 by 1994, most with MIRV payloads of 10 reentry vehicles each. All SS-18s are intended to be eliminated by 2000–03 under START II.
Launch Mode: silo-based; cold-launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: single nuclear (25 megatons in Mod 1, 20 megatons in Mod 3 and 6). Ten MIRVs (each 500 kilotons in Mod 2 and 4; 750 kilotons in Mod 5).
Dimensions: length 119 ft 9 in, body diameter 9 ft 10 in.
Launch Weight: 465,390 lb.
Performance: max range 6,200 miles (Mod 1), 6,835 miles (Mod 2 and 4), 8,075 miles (Mod 3). Throw weight 19,400 lb. CEP 820 ft.

SS-19 (RS-18; NATO "Stiletto")

The hot-launched SS-19 Mod 3 is a light ICBM, comparable in size to USAF's Peacekeeper. Although less accurate than the SS-18, it is reckoned to have significant capability against all but hardened silos. The total of 170 currently emplaced in Russia was expected to be deactivated under START II, but 105 of the missiles may now be kept, probably converted to single warheads. A further 130 were based in Ukraine in 1994 but were to be deactivated.
Launch Mode: silo-based; hot-launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: six MIRVs (each 500 kilotons).
Dimensions: length 88 ft 7 in, max diameter 8 ft 2½ in.
Launch Weight: 232,805 lb.
Performance: range 6,200 miles. Throw weight 9,590 lb. CEP 985 ft.

SS-24 (RS-22; NATO "Scalpel")

The SS-24 is a highly accurate, Peacekeeper-sized, solid-propellant system intended for use against soft or

semihardened targets. The Mod 1 version, regarded in the US as the first Russian fifth-generation ICBM, reflected the 1970s emphasis on survivability through weapon system mobility. The three rail-mobile garrisons for this system have the capability to roam more than 90,100 miles of track.

Thirty-six SS-24 Mod 1s were operational in 1994. The other 56 SS-24s were Mod 2s: 10 in Russia at Tatishchevo, the remainder in Ukraine, all in converted SS-17 silos. The Ukrainian SS-24s were being deactivated; those in Russia should go by the end of the decade.

Launch Mode: rail-mobile (Mod 1) or silo-based (Mod 2); cold-launched.
Power Plant: three-stage solid-propellant.
Guidance: inertial.
Warhead: up to 10 MIRVs (each 300–500 kilotons).
Dimensions: length 78 ft 1 in, body diameter 7 ft 10½ in.
Launch Weight: 230,380 lb.
Performance: max range 6,200 miles. Throw weight 8,930 lb. CEP 660 ft.

SS-25 (RS-12M Topol; NATO "Sickle")

A total of 318 road-mobile SS-25s were operational in 1994. All but 54 (in Belarus) were based in seven regions of Russia, each with 27 to 45 missiles: Irkutsk, Kansk, Nizhniy Tagil, Novosibirsk, Teykovo, Yoshkar Ola, and Yuryu. The total deployed could increase to 588 under START I, 690 under START II. Ninety redundant SS-18 silos could be made available for nonmobile SS-25s under START II.

As the designation RS-12M implies, Moscow regards this Minuteman-sized ICBM as a direct modernization of the SS-13 (RS-12). This enables it to conform with restraints embodied in the SALT Treaty terms. Most operational SS-25 deployments are to former SS-20 IRBM bases eliminated under the INF Treaty. At each base, a number of garages with sliding roofs house the system's massive off-road, wheeled transporter-erector-launchers (TELs); other buildings shelter the mobile support equipment. The SS-25 is claimed to have a greater throw weight and nine times the accuracy of the SS-13, as well as greater survivability (because it is mobile in its basic form) and an inherent refire capability.

The Topol-M upgraded version will complete development this year and will replace the current version at the heart of Russia's strategic missile force.

Launch Mode: basically road-mobile, with operational launch from inside garage, or from silo; cold-launched.
Power Plant: three-stage solid-propellant.
Guidance: inertial.
Warhead: single RV (550 kilotons).
Dimensions: length 70 ft 6½ in, body diameter 5 ft 11 in.
Launch Weight: 99,425 lb.
Performance: range 6,525 miles. Throw weight 2,205 lb. CEP 660 ft.

Submarine-Launched Ballistic Missiles

SS-N-8 (RSM-48 Vysota; NATO "Sawfly")

Increased size and the addition of stellar sensing techniques to the guidance system gave this SLBM intercontinental range and greatly improved accuracy compared with the now-withdrawn SS-N-6. It was deployed from 1971 on 18 (now eight) "Delta I" submarines, which are being paid off progressively. The number of missiles in each ship was restricted to 12 but was restored to 16 in the four Delta IIs, which have a lengthened hull at the expense of a small speed reduction to 24 knots. *(Data for Mod 1.)*

Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: one RV (1.2 megatons).
Dimensions: length 46 ft 7 in, body diameter 5 ft 10⅞ in.
Launch Weight: 73,410 lb.
Performance: max range 4,850 miles. CEP 1,315 ft.

SS-N-18 (RSM-50 Volna; NATO "Stingray")

The SS-N-18 introduced the first MIRVed warheads on a Russian SLBM. It was deployed on 14 (now 13) "Delta III" SSBNs, assigned to the Pacific and Northern Fleets, in 1976–82. Each ship carries 16 missiles, in two rows. Some are being replaced with SS-N-23 "Skiffs." *(Data for Mod 1.)*

Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: three MIRVs (each 200 kilotons).
Dimensions: length 51 ft 2¼ in, body diameter 5 ft 10⅞ in.
Launch Weight: 77,820 lb.
Performance: max range 4,040 miles. CEP 2,950 ft.

SS-N-20 (RSM-52; NATO "Sturgeon")

Largest and heaviest of Russian SLBMs, the SS-N-20 is carried by "Typhoon" SSBNs. These are by far the biggest submarines ever put into service, with a length of 562 ft and displacement of 26,500 tons submerged. Six entered service in 1981–89; they are intended to launch their missiles from protected waters near Russia.

The SS-N-20 was the first Russian series-production solid-propellant SLBM. Twenty are loaded in each Typhoon in a unique configuration with the launchtubes forward of the sail. The submarines are being modified to take SS-N-24/26 improved versions of "Sturgeon," with greater accuracy.

Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage solid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: nine MIRVs (each 200 kilotons). May be downloaded to six or four MIRVs under START II.
Dimensions: length 59 ft 0½ in, body diameter 7 ft 10½ in.
Launch Weight: 185,185 lb.
Performance: max range 5,150 miles. Throw weight 5,620 lb. CEP 1,640 ft.

SS-N-23 (RSM-54 Shetal; NATO "Skiff")

The SS-N-23 has liquid propulsion, suggesting that this is still preferred by Russia's submariners. To carry it, seven *Delphin*-class (NATO "Delta IV") submarines have been constructed at Severodvinsk, with a follow-on class planned. Each carries 16 SS-N-23s inside the conventional type of raised housing aft of the sail. They are based with the "Typhoon" class in the Kola Peninsula as part of the Northern Fleet. SS-N-23s are also replacing SS-N-18s in some "Delta III" SSBNs.

Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: four MIRVs (each 100 kilotons).
Dimensions: length 55 ft 1½ in, body diameter 6 ft 2¾ in.
Launch Weight: 88,845 lb.
Performance: max range 5,150 miles. Throw weight 6,175 lb. CEP 1,640 ft.

Surface-to-Air Missiles

SH-11 (UR-96; NATO "Gorgon")

The world's only operational antiballistic missile (ABM) system is emplaced at eight sites around Moscow. Comprising the full 100 launchers permitted by the 1972 ABM Treaty, it is considered capable of engaging small numbers of reentry vehicles approaching from any direction during an accidental or unauthorized launch against the city. In its current ABM-3 form, it offers a dual-layered defense against ballistic missiles and some use against satellites in low-Earth orbit. A multifunctional "Pill Box" radar located at Pushkino, north of Moscow, has the task of identifying and tracking incoming reentry vehicles. These would then be intercepted at high altitude and over long ranges by Gorgon ABMs. Any that penetrated this layer of defense would be engaged by "Gazelle" ABMs within the atmosphere.

Thirty-six silo-based Gorgons have replaced the original SH-01 "Galosh" exoatmospheric intercept missiles, which were launched from above ground. Little is known about them, but they were identified initially as Modified Galosh, and the following details of the original SH-01 provide an indication of their likely characteristics:

Type: silo-launched, exoatmospheric, antiballistic missile.
Power Plant: three-stage liquid-propellant.
Guidance: command.
Warhead: nuclear (one megaton).
Dimensions: length 65 ft, base diameter 8 ft 5 in.
Launch Weight: 72,750 lb.
Performance: range more than 200 miles.

SH-08 (NATO "Gazelle")

This quick-reaction, high-acceleration interceptor missile is designed to destroy in the atmosphere reentry vehicles that penetrate the outer layer of ABM defense. Up to 64 are thought to be silo-based around Moscow, as the second stage of the capital's ABM defenses. Gazelle is described as being similar in general configuration to the long-abandoned US Sprint, with a low-yield nuclear warhead. Like the exoatmospheric "Gorgons," it is command-guided from the ground via the "Pill Box" phased-array radar. The following data are estimated:

Type: silo-launched, endoatmospheric, antiballistic missile.
Power Plant: solid-propellant.
Guidance: command.
Warhead: nuclear (10 kilotons or less).
Dimensions: length 32 ft 10 in, max diameter 3 ft 3 in.
Launch Weight: 22,000 lb.
Performance: range 50 miles.

SA-2 (S-75 Dvina/Volkhov; NATO "Guideline")

This veteran SAM is land-transportable on a semitrailer and can be transferred to the standard single-rd launcher in 12 minutes. Of six versions (**SA-2A/B Dvina, SA-2C to F Volkhov**), only the **SA-2E** has alternative high-explosive (650 lb) or command-detonated nuclear (15 kiloton) warheads, in a more bulbous nose. Improved guidance on the **SA-2F** (S-75M) offers a home-on-jam capability. About 300 SA-2s are in service in Russia; replacement by SA-10s is expected to be complete by the end of this decade. **Volga-M** upgrade packages, now being delivered, introduce digital subsystems for improved accuracy, 60 percent less maintenance requirement, fully automatic launch operation, and range increase to 41 miles.

The SA-2's effectiveness was reduced dramatically by modern airborne countermeasures. Its "Fan Song" radar, with a crew of four to six, operates in target-acquisition and automatic-tracking modes. It can track up to six targets simultaneously before switching to automatic tracking and missile guidance against the selected target. Unless the SA-2 picks up its narrow UHF line-of-sight guidance beam within six seconds of launch, it will go ballistic and self-destruct. It reaches its maximum velocity at 25,000 ft and has only limited maneuverability against modern tactical aircraft. Launcher reload takes 12 minutes.

Type: low/high-altitude, transportable SAM.
Power Plant: storable liquid-propellant sustainer; solid-propellant booster.
Guidance: UHF radio command.
Warhead: HE fragmentation (430 lb, except on SA-2E), with proximity and/or command fuzing.
Dimensions (SA-2F): length 35 ft 5¼ in, body diameter (second stage) 1 ft 8 in, wingspan (second stage) 5 ft 7 in.
Launch Weight (SA-2F): 5,040 lb.
Performance (SA-2F): max speed Mach 3.5, slant range 3.7–18.6 miles, effective ceiling 300–98,425 ft.

SA-3 (S-125 Neva; NATO "Goa")

Only some 200 SA-3 launchers remain operational in Russia, each carrying two or four SAMs. Current versions are the **SA-3A** and **SA-3B**, the latter with improved command guidance. Reload time on four rails is 50 minutes.

The system's P-15M "Squat Eye" early warning and target acquisition radar has a range of 130 miles and is supplemented by PRV-11 height-finding radar. "Low Blow" radar used for target monitoring and missile control has an acquisition range of 68 miles and a tracking range of 25–52 miles. Six targets can be tracked simultaneously and one or two missiles guided. During operations in a dense ECM environment, 15-mile-range TV cameras on the later Low Blow systems provide the fire-control team with the same information as that from the radar without affecting the command guidance function. *(Data for SA-3B.)*

Type: low/medium-altitude, transportable SAM.
Power Plant: two-stage solid-propellant.
Guidance: command.
Warhead: HE fragmentation (132 lb), with Doppler radar proximity and contact fuzing. Lethal burst radius 41 ft.
Dimensions: length 22 ft 0 in, body diameter (second stage, max) 1 ft 2½ in, wingspan (second stage) 4 ft 0 in.
Launch Weight: 2,095 lb.
Performance: max speed Mach 3.5, slant range 1.5–15.5 miles, effective ceiling 165–59,050 ft.

SA-5 (S-200 Angara; NATO "Gammon")

About 600 SA-5s are operational in Russia. They exist in three versions:

S-200. Initial production version with HE fragmentation warhead. Length 34 ft 5½ in. Ceiling 65,600 ft. Operational from 1966.

S-200V. As S-200 but with 25-kiloton nuclear warhead. Length 35 ft 5¼ in. Ceiling 95,150 ft. Entered service 1969–70.

S-200D. HE warhead. Length as S-200V. Improved

ceiling and terminal guidance. Standard version from 1975.

The Russian missiles are deployed in Air Defense Rocket Brigades, made up of battalions of SA-3 and SA-5 launchers, plus 23-mm or 57-mm antiaircraft guns. Each SA-5 battalion has a 200-mile-range P-35M "Bar Lock B" target search and acquisition radar with integral IFF, a 165-mile-range "Square Pair" missile guidance radar, and six single-rail missile launchers. *(Data for S-200D.)*

Type: low/high-altitude SAM.
Power Plant: dual-thrust solid-propellant sustainer; four wraparound solid-propellant boosters.
Guidance: radar command, with active radar terminal homing.
Warhead: HE fragmentation, with proximity and command fuzing.
Dimensions: length 35 ft 5¼ in, body diameter 2 ft 9½ in, wingspan 9 ft 4 in.
Launch Weight: 6,173 lb.
Performance: max speed above Mach 4, slant range 4.35–150 miles, effective ceiling 165–114,800 ft, max target engagement speed Mach 3.7.

SA-6 (3M9 Kub; NATO "Gainful")

This self-propelled tactical weapon system consists of a tracked TEL carrying three missiles with integral solid rocket/ramjet propulsion. Many hundred TELs are deployed in Russian antiaircraft regiments, each of which consists of a headquarters with EW, IFF, and height-finding radars, and five SA-6 batteries. Each battery has a 1S91 "Straight Flush" fire-control radar, mounted on the same kind of tracked chassis as the TEL; four SA-6 TELs; and four ZIL 131 TZM reload vehicles, each carrying three missiles. Straight Flush has a surveillance range of 34–46 miles and engagement range of 18 miles. It performs IFF interrogation, target tracking and illumination, and missile radar command guidance functions. Up to three missiles can be guided toward the same target, with a TV tracker available to assist operation in a dense ECM environment. Reloading of the TEL takes 10 minutes. All elements of the SA-6 system are air-transportable in An-22, An-124, and Il-76 freighters.

Pending availability of the SA-11 "Gadfly" weapon system, one of the original **SA-6A** TELs in some batteries was replaced with a TELAR (transporter-erector-launcher and radar) with added SA-11 "Fire Dome" engagement radar. The TELAR carries modified **SA-6B** (9M336) missiles.

Type: low/medium-altitude, mobile SAM.
Power Plant: solid-propellant booster; after burnout, its empty casing becomes a ramjet combustion chamber for ram air mixed with the exhaust from a solid-propellant gas generator.
Guidance: radar command; semiactive radar terminal homing.
Warhead: HE fragmentation (123 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.
Dimensions: length 18 ft 8½ in, body diameter 1 ft 1¼ in, wingspan 4 ft 1 in.
Launch Weight: 1,320 lb.
Performance: max speed Mach 2.8, slant range 1.8–15 miles, effective ceiling 330–36,000 ft.

SA-7 (9M32 Strela-2; NATO "Grail")

The initial **SA-7A** version of the shoulder-fired, tube-launched, passive IR homing Grail could be fired only from behind a target at a very hot exhaust area, over a narrow field of fire. From 1971, the **SA-7B** Grail Mod 1 (Russian **9M32M Strela-2M**) offered an extended field of fire of 30° each side of the target's tail, a seeker able to filter out spurious heat sources, including early IR decoys and flares, and an improved warhead. The operator could also have a small passive RF antenna fixed to his helmet, to provide audible warning of an approaching aircraft by picking up emissions from its radar and radar altimeter. Major version from the mid-1970s has been the **SA-7C** Grail Mod 2, with improved launcher and more effective RF detector, mounted forward of the gripstock. The second member of an SA-7 team carries a reload missile. Reload time is six seconds. *(Data for SA-7B.)*

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.5 lb) with contact and graze fuzing.
Dimensions: length 4 ft 8¾ in, body diameter 2⅞ in.
Launch Weight: 21.7 lb. Launcher: 10.9 lb.
Performance: max speed Mach 1.70, slant range 0.5–2.6 miles, effective ceiling 165–7,550 ft.

SA-8 (9M33 Romb; NATO "Gecko")

This all-weather, low-altitude SAM was the first tactical air defense weapon system of the former USSR in which all components necessary to conduct a target engagement are carried by a single vehicle. In the original **SA-8A** Gecko Mod 0 (**9M33**), two pairs of exposed single-stage missiles were carried, ready to fire.

SA-11 (9M38 Buk, "Gadfly")
(Linda Jackson)

SA-6 (3M9 Kub, "Gainful")
(Piotr Butowski)

The **SA-8B** Gecko Mod 1 (typically **9M33M3**) system has six dual-thrust, increased-performance missiles in launcher/containers. Fire-control equipment and launcher are mounted on a rotating turret, carried by a BAZ-5937 six-wheel, fully amphibious, all-terrain vehicle. The "Land Role" fire-control radar, to the rear of the one-man gunner/radar operator's position, has a 360° scan over a 22-mile range. It folds down behind the launcher, enabling the weapon system to be airlifted in An-22, An-124, and Il-76 transport aircraft. Range of the monopulse tracking radar is 15.5 miles. An LLLTV/optical system assists target tracking in low visibility and dense ECM. Reload time is five minutes.

Together with the SA-6, the SA-8A largely replaced S-60 57-mm towed antiaircraft guns in Russian service and has itself replaced some SA-6s. In Iraqi service, SA-8s destroyed a number of Tomahawk cruise missiles during the Persian Gulf War. *(Data for SA-8A.)*

Type: low-altitude, self-contained, mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: radar command, permitting two missiles to be guided simultaneously against a single target, on different frequencies to complicate ECM.
Warhead: HE fragmentation (42 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.
Dimensions: length 10 ft 4 in, body diameter 8¼ in, finspan 2 ft 1¼ in.
Launch Weight: 286 lb (SA-8B 375 lb).
Performance: max speed Mach 2.4, slant range SA-8A 0.9–7.5 miles, SA-8B 0.9–9.3 miles, effective ceiling 82–16,400 ft.

SA-10 (S-300P; NATO "Grumble")

Russia's counterpart to the US Army's MIM-104 Patriot, the all-altitude SA-10 replaces SA-2s, SA-3s, and SA-5s. About 2,075 were in service in 1994, and production is continuing. The SA-10 is effective against targets at heights up to 88,500 ft, including low-flying aircraft, cruise missiles, and reentry vehicles from ballistic missiles in the class of the Scuds used by Iraq in the Gulf War. Deployment of the initial **SA-10A** (Grumble Mod 0) began in 1980. In its **S-300PT** towed form, a regiment comprises three batteries and an F-band 3-D surveillance and tracking radar ("Big Bird") at the command post for long-range target detection. Each battery has an engagement control center, a 3-D CW pulse-Doppler target acquisition radar ("Clam Shell"), an I-band phased-array engagement radar ("Flap Lid A"), and up to 12 four-rail container erector/launchers on semitrailers. These are positioned on concrete pads, and the 5V55K missiles are launched vertically, with ignition after launch. The track-via-missile system guidance, like that of Patriot, enables up to six targets to be engaged simultaneously, with two missiles per target. A launcher can fire missiles at three-second intervals, against targets traveling at up to 2,610 mph. Max range of the SA-10A missile is 29 miles.

For improved mobility, the land-mobile **S-300PS** version was developed, with the same missiles carried by a four-axle, four-rd 5P85S TEL vehicle. Reload missiles and a "Flap Lid B" planar-array target-tracking and fire-control radar are carried on similar trucks. Readiness to fire is five minutes after the vehicles come to a halt.

Subsequent improvements increased the range of the missiles first to 56 miles with 5V55R missiles, in the **S-300PM/PMU** (**SA-10B** Grumble Mod 1) and then to 93 miles with 48N6 missiles, in the **S-300PMU1** (**SA-10C**), which can engage targets traveling at 6,200 mph. *(Data for SA-10B.)*

Type: all-altitude, fixed-site and mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: radar command and midcourse inertial, with semiactive radar terminal homing and proximity fuzing.
Warhead: HE fragmentation (285 lb).
Dimensions: length 23 ft 4 in, body diameter 1 ft 5¾ in, wingspan 3 ft 3½ in.
Launch Weight: 3,300 lb.
Performance: max speed Mach 6, range 3–56 miles, effective ceiling 80–88,500 ft.

SA-11 (9M38 Buk; NATO "Gadfly")

From 1980, this weapon system progressively replaced SA-4s in army-level missile brigades, and some SA-6As at divisional level, for defense against high-performance aircraft and cruise missiles at low to high altitudes. The SA-11 system is self-contained on a GM-569 tracked vehicle, which carries a 360° traversing four-rail launcher and "Fire Dome" monopulse guidance and tracking radar. The missile, which resembles the US Navy's RIM-66 Standard MR-1, can sustain 23*g* maneuvers.

An SA-11 regiment is made up of four batteries, each with six TELs, and similar GM-569 vehicles carrying the two 62-mile range radars of the regimental target acquisition battery, and reload missiles. The same chassis carries the regiment's long-range early warning radar ("Snow Drift"). If this is not available, the SA-11 TELs can be integrated into an SA-6 battery, using the latter's "Straight Flush" fire-control radar.

Type: low/high-altitude, mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: semiactive monopulse radar command.
Warhead: HE fragmentation (154 lb), with proximity and contact fuzing.
Dimensions: length 18 ft 2½ in, body diameter 1 ft 3¾ in, wingspan 2 ft 9⅞ in.
Launch Weight: 1,520 lb.
Performance: max speed Mach 2.8, slant range 1.85–20 miles, effective ceiling 50–72,000 ft, max target engagement speed Mach 2.8 (approaching), Mach 1 (receding).

SA-12A (S-300V/9M83; NATO "Gladiator")

The land-mobile tactical SA-12A has been fully operational since 1986, primarily for use against aircraft and ASMs. All components of the system are based on the tracked MT-T chassis, a derivative of the T-64 main battle tank. The four batteries of a typical SA-12 brigade each have up to six TELARs, a "Grill Pan" fire-control vehicle, and three reload transporters. The original intention was to deploy mixed batteries of four SA-12A TELARS and two SA-12B TELARS. More usual is to have six of the same type. The main "Bill Board" long-range target search and acquisition radar and sector-scanning radar ("High Screen") vehicles are held at battalion headquarters level. Each SA-12A TELAR carries four recyclable missile container/launchers that can be raised independently to a vertical position for launch and a missile guidance radar. The latter controls the missile in flight after its target has been tracked and handed on by Grill Pan.

The conical SA-12A missile can be readied for launch in 15 seconds. It ignites at a height of about 165 ft after ejection from its launcher. One missile can be fired every 1.5 seconds by each TELAR, with either two missiles from one launcher or four missiles from two launchers directed at each target.

Type: all-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: radar command and midcourse inertial, with semiactive radar terminal homing.
Warhead: HE focused fragmentation (330 lb), with selectable in-flight proximity fuzing.
Dimensions: length 26 ft 11 in, body diameter 2 ft 3½ in.
Launch Weight: 5,300 lb.
Performance: max speed Mach 5.75, slant range 3.7–47 miles, effective ceiling 820-82,000 ft, max target engagement speed Mach 10.

SA-12B (S-300V/9M82; NATO "Giant")

This derivative of the SA-12A appears to have the

same 21-ft-long, 1,800-lb second stage mated to a much longer first stage. It was intended to be deployed to defend road-mobile SS-25s and as part of the rail-mobile SS-24 Mod 1 ICBM system with its MT-T two-rd tracked TELs carried on low-loader railcars. After an SS-24 train emerged from its tunnel concealment to move to its launch area, the SA-12Bs were to disperse into the surrounding area to defend the Scalpel launchers from attacking and standoff jamming enemy aircraft, short-range ballistic missiles, and near-strategic missile reentry vehicles.

Type: all-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: as SA-12A.
Warhead: as SA-12A.
Dimensions: length 34 ft 5½ in, body diameter 3 ft 3½ in.
Launch Weight: 10,140 lb.
Performance: max speed Mach 8, slant range 8–62 miles, effective ceiling 3,300–98,400 ft, max target engagement speed Mach 10.

SA-13 (9M37 Strela-10; NATO "Gopher")

At its peak, production of SA-13 four-missile tracked launchers for the Russian Army and Naval Infantry, and for export to at least 16 nations, was at the rate of around 2,800 a year. Replacing the wheeled SA-9 (Gaskin), the basic **9M37** missile was followed by the **9M37M Strela-10M2,** with infrared homing seeker, and all-aspect and IRCCM capabilities. The missiles are carried in two twin-box launchers on TELAR vehicles, some with four "Flat Box B" passive radar detection antennas on their upper surface. Four reload missiles are normally carried by each of the vehicles, which are fully amphibious. The associated "Dog Ear" acquisition/tracking radar vehicle of the SA-9 is retained, with range-only radar ("Snap Shot") on each TELAR.

The latest known version of the missile is the **9M333 Strela-10M3,** intended for use in the mobile battle and to defend troops in movement from attack by low-level aircraft, helicopters, and precision guided weapons, as well as from observation by UAVs. It has a dual-mode optical photocontrast/IR seeker to improve adverse weather operation. *(Data for 9M37M; 9M333 in parentheses.)*

Type: low-altitude, mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: infrared passive homing in two frequency bands (optical photocontrast/IR).
Warhead: HE fragmentation rod; 6 lb and 100 rods. Lethal burst radius 16 ft. Contact and active xenon lamp proximity fuzing (contact and active laser proximity fuzing).
Dimensions: length 7 ft 2½ in, body diameter 4¾ in, wingspan 1 ft 3¾ in.
Launch Weight: 87 lb (93 lb).
Performance: max speed Mach 2, slant range 0.3–6.2 miles, effective ceiling 33–16,400 ft, max target engagement speed Mach 1.25 (Mach 1.6).

SA-14 (Strela-3; NATO "Gremlin")

This successor to the SA-7 shoulder-fired SAM, with much-improved capability, began to replace the earlier weapon one for one in 1978. Compared with the SA-7, it has an uprated rocket motor, a more powerful warhead, and a cryogenically cooled IR seeker with proportional guidance that is effective in head-on as well as tail-chase firings and against targets maneuvering at up to 8*g*. Effectiveness against targets equipped with flare dispensers and IR jammers is claimed to be much enhanced. A passive RF direction-finder antenna system is optional. A second target can be engaged within 35 seconds of the first.

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.2 lb), with contact and graze fuzing.
Dimensions: length 4 ft 8 in, body diameter 2⅞ in.
Launch Weight: 22.7 lb. Launcher: 12.6 lb.
Performance: average speed Mach 1.38, slant range 0.31–2.8 miles, effective ceiling 50–9,840 ft, max target engagement speed Mach 0.9 (approaching), Mach 0.75 (receding).

SA-15 (9M330 Tor; NATO "Gauntlet")

In service since 1991, the large, highly automated, Tor-M1 mobile SAM system is immensely more formidable than the SA-8 it was designed to replace. Its modified GM-569 tracked vehicle is air-transportable but not amphibious. A box-like turret on top of the hull houses eight vertically mounted missiles in two rows and carries the engagement radars. Above the rear of the box is a three-dimensional pulse-Doppler H-band surveillance radar able to detect up to 48 targets over a range of 15 miles. The radar then assesses in order of priority, and tracks, the 10 most threatening targets. The pulse-Doppler phased-array K-band target tracking and missile guidance radar at the front can simultaneously track and engage two targets traveling at 22–1,565 mph, by day or night, in all weather, and in dense ECM environments. It is supplemented by an autonomous automatic TV tracking system, with a range of 12.4 miles, that enhances the SA-15's capability in battlefield clutter and dense ECM. Reaction time is five to eight seconds from target detection. The missiles are cold-launched, at minimum three-second intervals, and able to maneuver at 23*g* to 30*g* against fixed-wing aircraft, helicopters UAVs, precision guided weapons, and some types of guided missiles. The SA-15 vehicle carries a crew of three and is supported by a wheeled loader/transporter with two four-rd reload packs that can be installed in less than 20 minutes. There are normally four launch vehicles in each battery.

Type: low/medium-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: radar command.
Warhead: HE fragmentation (33 lb), with proximity fuzing.
Dimensions: length 9 ft 4¼ in, body diameter 1 ft 1¾ in, wingspan 2 ft 0 in.
Launch Weight: 368 lb.
Performance: max speed Mach 2.5, slant range 0.9–7.5 miles, effective ceiling 33–19,700 ft, max target engagement speed Mach 2.2.

SA-16 (9M313 Igla-1; NATO "Gimlet")

The configuration of the third-generation SA-16 is similar to that of the SA-7 and SA-14, but it is an entirely new weapon, with a conical nose. Deployment time is 13 seconds, and launch time from target acquisition is five seconds. The cooled IR seeker improves resistance to countermeasures. Maximum target bearing angle for launch is ±40°. During the Persian Gulf War, the SA-16 proved the most effective Iraqi man-portable SAM.

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.2 lb), with contact and graze fuzing.
Dimensions: length 5 ft 5⅞ in, body diameter 2⅞ in.
Launch Weight: 23.8 lb. Launcher 12.9 lb.
Performance: average speed Mach 1.68, slant range 0.37–1.86 miles, effective ceiling 33–11,500 ft.

SA-12B (S-300V/9M82, "Giant") *(Paul Jackson)*

Pantzyr-S1 *(Paul Jackson)*

SA-17 (9M38M2 Buk-2M; NATO "Grizzly")

This new low/medium-altitude SAM entered service with the Russian Army in 1995 and will eventually supersede the SA-11 ("Gadfly"). It has a similar configuration to the SA-11 and is based on a similar tracked vehicle. A major innovation is a new jam-resistant electronically scanned phased-array engagement radar known to NATO as "Chair Back," which has a range of 75 miles and enables four targets to be engaged simultaneously. Other vehicles in the SA-17 system, basically similar to the four-missile TEL, include a mount for the 100-mile range target acquisition radar and a loader/launcher carrying eight missiles but no radar.

Type: low/medium-altitude, mobile SAM.
Power Plant: two-phase solid-propellant.
Guidance: radar command, midcourse inertial, and semiactive radar homing.
Warhead: HE fragmentation (110–155 lb), with proximity and contact fuzing.
Dimensions: length 18 ft 0½ in, body diameter 1 ft 3¾ in.
Launch Weight: 1,587 lb.
Performance: max speed Mach 4, slant range 1.85–31 miles, effective ceiling 33–82,000 ft, max target engagement speed Mach 4 (approaching), Mach 1.35 (receding).

SA-18 (9K38 Igla; NATO "Grouse")

This fourth-generation shoulder-fired SAM has been operational since 1983. The basic **9K38 Igla** is designed to engage low-flying maneuverable and non-maneuverable targets and hovering helicopters. Deployment time is 10 seconds and launch time from target acquisition five seconds. Developed **Igla-2** versions are the **Igla-D** with improved operational features and the **Igla-N** with improved lethality. *(Data for 9K38 Igla.)*

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: two-channel infrared passive homing.
Warhead: HE fragmentation (2.2 lb), with contact and graze fuzing.
Dimensions: length 5 ft 7 in, body diameter 2⅞ in.
Launch Weight: 24.2 lb. Launcher 16.4 lb.
Performance: slant range 0.31–3.2 miles, effective ceiling 33–11,500 ft, max target engagement speed Mach 1.18 (approaching), Mach 0.94 (receding).

SA-19 (9M311; NATO "Grison")

This tube-launched missile was developed as one element of the 2S6 Tunguska gun/missile tracked regimental air defense vehicle, which entered service in 1986 as a replacement for 23-mm ZSU-23-4 self-propelled antiaircraft guns and SA-9/SA-13 missile systems. In the improved 2S6M version, eight SA-19s are mounted in clusters of four on each side of a turret that also carries four 30-mm guns, and fire-control and "Hot Shot" surveillance and target acquisition radars. A crew of four is standard. Support vehicles include a resupply truck that can load eight missiles and 1,904 rds of 30-mm ammunition in 16 minutes.

Type: tube-launched, low/medium-altitude SAM.
Power Plant: two-stage solid-propellant.
Guidance: semiautomatic command to line-of-sight (SACLOS), supplemented by thermal imaging sight, TV, and laser rangefinder/designator.
Warhead: HE fragmentation (19.8 lb).
Dimensions: length 8 ft 4¾ in, body diameter 6¾ in.
Launch Weight: 93 lb.
Performance: speed Mach 2.65, slant range 1.5–5 miles, effective ceiling 50–11,500 ft.

Pantzyr-S1

This new air defense system, mounted on a Ural 53234 (8x8) cross-country truck chassis, is reported to be ready for production. The truck bed supports a box-like shelter, above which is a 360° rotating turret. On each side of the turret is a cluster of six tube-launched missiles, developed from the SA-19 ("Grison"), and a Type 2A72 30-mm gun. Surveillance radar is carried on top of the turret, with tracking radar and an LLLTV/IR sensor package between the missile clusters. Slant range of the missiles is said to be 7.5 miles, with an effective ceiling of 10–19,700 ft. Engagement can be fully automatic, against two or three targets simultaneously. ■

A life-size bronze statue, presented by AFA's Montgomery Chapter, honors the late Chief Master Sergeant of the Air Force.

The Kisling Memorial

Roy A. Boudreaux, former Senior Enlisted Advisor to Air University and current member of AFA's Finance Committee, James M. McCoy, former AFA national president and current chairman of the board, Alene Kisling, and Gene Smith, current national president, gather around the statue of Chief Kisling in Kisling Hall at the Senior NCO Academy at Maxwell AFB's Gunter Annex, Ala.

A LIFE-SIZE bronze statue of CMSAF Richard D. Kisling now stands in the lobby of Kisling Hall at the Air Force Senior Noncommissioned Officer Academy at the Gunter Annex of Maxwell AFB, Ala. Chief Kisling died in 1985 of Lou Gehrig's disease. Kisling Hall, the central building at the Academy, was named in his honor in 1986. The statue was donated to the Air Force by the Montgomery (Ala.) Chapter of the Air Force Association, which conducted a fifteen-month fund-raising campaign to make the memorial possible.

The Chief's wife, Alene Kisling, and his daughters, Kathy Durant and Karen Apple, were present for the dedication ceremony December 13, as were all ten of the other NCOs who have worn the special stripes of Chief Master Sergeant of the Air Force since the position was created in 1967. Also present were AFA Chairman of the Board James M. McCoy—himself a former Chief Master Sergeant of the Air Force—and AFA National President Gene Smith.

The statue was sculpted by John Lajba of Omaha, Neb., who also did the statue of Gen. James H. Doolittle in the AFA headquarters building in Arlington, Va. Gen. Billy J. Boles, commander of Air Education and Training Command, accepted the statue on behalf of the Air Force from AFA officials.

Chief Kisling was the third Chief Master Sergeant of the Air Force, serving from 1971 to 1973. Before coming to that post, he had spent most of his career in personnel. He had also been a recruiter, a first sergeant, and a sergeant major. He is credited as being the driving force behind the creation, in 1973, of the Air Force Senior NCO Academy.

He always demonstrated a special feeling for people and their problems, perhaps partly because he grew up during the Depression as one of ten children in a farm family in western Iowa. Their mother died at the peak of the Depression.

In a feature article in 1972, *Air Force* Magazine called Chief Kisling "The GI's Man in Washington." That designation stuck and was recalled in press reports when the statue was dedicated. Alene Kisling added a line that described the Chief even better. "He was the nicest man I ever met," she said. ■

Pinball

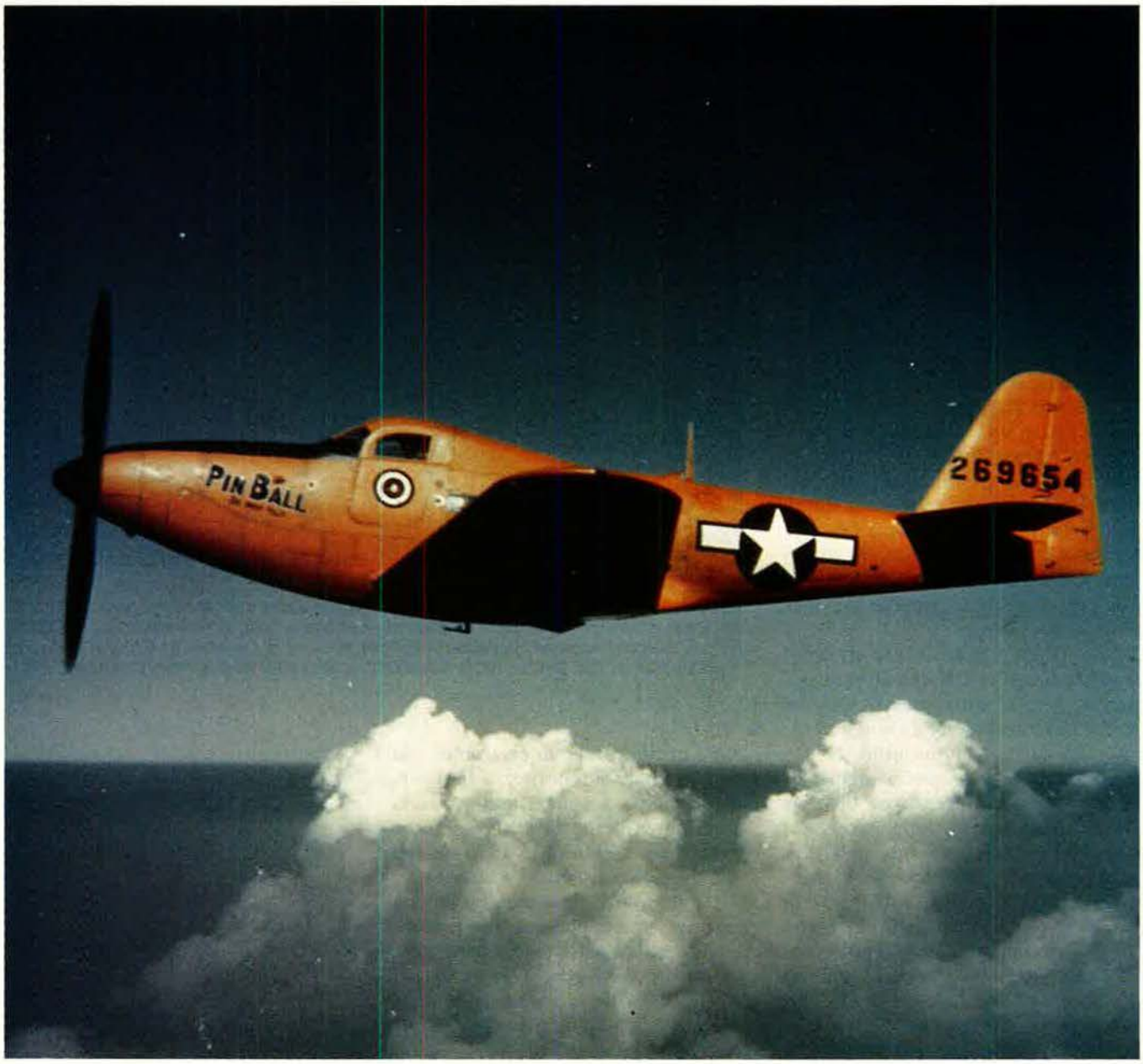


Photo courtesy Jeffrey Ethell via Dana Bell

In 1943, Bell extensively modified a P-63 Kingcobra to serve as a target for bomber gunner training. All weapons and interior armor were removed, thicker metal sheet replaced the skin, the canopy was armored to protect the pilot, and more than 100 microphones were buried in the skin. A light in the propeller hub—and, later, additional lights around the rear fuselage—flashed each time the lead and plastic frangible training bullets hit the plane. A counter on the instrument panel recorded each hit. These aircraft became known as "Pinballs," and Bell built more than 300 of them. The end of World War II and the advent of the jet age brought the program to a halt.

Verbatim

Did Saddam Slip the Punch?

"I think it might have been wise after the war to insist Saddam Hussein come to the tent in Safwan and sign the cease-fire. I don't know whether that would have worked or not. . . . If he refused to, what could we do about it? . . . Basically, he was able to avoid responsibility for losing the war. He stayed back and made the generals sign the surrender."

Lt. Gen. Brent Scowcroft, USAF (Ret.), quoted in a January 16, 1996, Washington* Times *story on the fifth anniversary of the start of Operation Desert Storm.

The Aerospace Nation

"The United States of America is an aerospace nation. Commercial travel is largely by air. More and more goods are shipped by air these days. The vast majority of our communications are routed through satellites, and the largest segment of US exports comes from the aerospace industry. The United States Air Force is the most respected air and space force in the world. Throughout history, great nations have been defined by the nature of their military forces. Certainly, the strength of Rome lay in its legions. . . . England became a world power as a result of the Royal Navy and its ability to control the seas and project power around the globe for that island nation. I think as we move into the twenty-first century, the United States of America will be defined by the fact that it is an aerospace nation."

Gen. Ronald R. Fogleman, USAF Chief of Staff, in a December 11, 1995, speech to Business Executives for National Security.

Ask Questions Later

"We've got some jerk up there [in a building] pulling a trigger, and he's got a nightscope. That makes it tough, but boy, let me tell you, if we do see him, he had better be fast and be clad in bulletproof stuff because we will attack without warning. . . . People who snipe at our forces are a great risk to themselves. If we see somebody pointing a weapon at our forces, he will be attacked without warning. No warning shots. No 'Drop your weapon.' He will be attacked."

Adm. Leighton W. Smith, Jr., USN, commander of NATO forces in Bosnia-Hercegovina, in February 1, 1996, remarks to the Defense Writers Group in Washington, D. C. Admiral Smith spoke following several sniper incidents in Sarajevo.

More in Sorrow than Anger, Of Course

"We have consistently encouraged the peaceful reunification of the motherland, but, in the final analysis, we cannot promise to give up the use of force."

Chinese Premier Li Peng, in a January 30, 1996, speech in which he renewed Beijing's insistence on reclaiming Taiwan.

There's a Name for It

"There is absolutely no indication that the Russian legislature will even ratify START II, let alone comply [with its terms]. . . . The Russians are trying to manipulate the START II ratification issue to coerce financial and military concessions from the United States. Specifically, the Russians have stated that, unless we suspend NATO expansion, unless we continue to adhere unconditionally to the ABM Treaty, and unless we increase financial aid to Russia, they will not ratify START II. Where I come from, that is called extortion."

Sen. Robert C. Smith (R–N. H.), in a January 26, 1996, floor speech opposing Senate ratification of the second Strategic Arms Reduction Talks (START) Treaty signed by Washington and Moscow in 1993.

Great Expectations

"I don't expect either the Bosnian Federal Army or the Bosnian Serb Army to be coming out and fighting anybody next spring. I am persuaded that both of those governments and both of those armies really want peace and really are committed to trying to make this work. I do expect that there are individuals and gangs within Bosnia who will not agree with the judgment of their leaders and will, therefore, try to undermine the peace agreement in various ways. One way of undermining it is by harassing or attacking the peace implementation force. That's what we're prepared for. We don't expect, as has happened in previous springs, the two armies to come out and start fighting each other. I don't expect that to happen. None of our military leaders are looking for that to happen."

Defense Secretary William J. Perry, in a December 20, 1995, session with Pentagon reporters.

Why US Should Privatize

"When I was in Alaska, we had three remote bases. . . . We had 300 uniformed personnel at Galena. . . . Their mission was to keep the runway clean, keep the barrier up in operation, keep the command post alive, keep the dining hall up, and [keep] the billeting operations up. . . . Today, instead of having 300 uniformed personnel at Galena, we have forty-seven contract employees. That is a tremendous savings for the taxpayer.

"Now, you might ask the question: How could the Air Force [need] 300 people to do what forty-seven contractors do? Well, as we send the magnificent young Americans to Galena, one of the things that you expect us to do is provide them three meals a day when they're there. You expect us to provide them a place to sleep and live. . . . You would expect me to have some kind of morale, welfare, and recreation activity for them there. And every time I add MWR people, I've got to add more cooks, I've got to add more billeting personnel. Pretty soon I'm at 300 people. . . .

"So I'm a personal believer that there are functions you can do more economically by contracting out."

Gen. Joseph W. Ralston, commander of Air Combat Command, in January 26, 1996, Senate testimony on his nomination to become vice chairman of the Joint Chiefs of Staff. ■

DoD SENIOR LEADERSHIP

(As of February 1, 1996)

Secretary of Defense
William J. Perry

Deputy Secretary of Defense
John P. White

Asst. to the Secretary of Defense for Public Affairs
Kenneth H. Bacon

Inspector General
Eleanor Hill

Deputy Inspector General
Derek J. Vander Schaaf

Director, Operational Test & Evaluation
Philip E. Coyle III

General Counsel
Judith A. Miller

Principal Deputy General Counsel
Steven W. Preston

ASD for Legislative Affairs
Sandra K. Stuart

DASD for Legislative Affairs
Rear Adm. Richard Kirkland, USN

Principal Dep. Asst. to the Secretary of Defense for Public Affairs
Clifford H. Bernath

Dep. Asst. to the Secretary of Defense for Public Affairs (Information)
Capt. Michael W. Doubleday, USN

Dep. Asst. to the Secretary of Defense for Public Affairs (Communication)
William B. Blacklow

Command, Control, Communications, & Intelligence

ASD for C^{3}I
Emmett Paige, Jr.

PDASD for C^{3}I
Barry Horton

DASD for C^{3}I
James E. Soos

DASD for C^{3}I Acquisition
Tony Valletta

DASD for Information Management
Cynthia Kendall

DASD for Intelligence & Security
Joan Dempsey

Director, Counterintelligence & Security Programs (acting)
Margaret R. Munson

DASD for Plans & Resources
Bel Leong-Hong

Finance

USD Comptroller & Chief Financial Officer
John J. Hamre

Deputy Chief Financial Officer
Alvin Tucker

Deputy Comptroller (Program/Budget)
Ronald A. Davidson

Principal Deputy Under Secretary Comptroller
Alice C. Maroni

Director, Program Analysis & Evaluation
William J. Lynn III

KEY

USD	Under Secretary of Defense
PDUSD	Principal Deputy Under Secretary of Defense
DUSD	Deputy Under Secretary of Defense
ASD	Assistant Secretary of Defense
PDASD	Principal Deputy Assistant Secretary of Defense
DASD	Deputy Assistant Secretary Defense

Personnel & Readiness

USD for Personnel & Readiness
Edwin Dorn

PDUSD for Personnel & Readiness
Frederick F. Y. Pang

DUSD for Readiness
Louis Finch

DASD for Military Manpower & Personnel Policy
Lt. Gen. Samuel E. Ebbesen, USA

DUSD for Requirements & Resources
Jeanne B. Fites

DASD for Personnel Support, Families, & Education
Carolyn H. Becraft

DASD for Civilian Personnel Policy
Diane M. Disney

DASD for Equal Opportunity
William E. Leftwich III

ASD for Force Management Policy
Frederick F. Y. Pang

PDASD for Force Management Policy
Frank Rush

ASD for Health Affairs
Stephen C. Joseph

PDASD for Health Affairs
Edward D. Martin

ASD for Reserve Affairs
Deborah R. Lee

PDASD for Reserve Affairs
Maj. Gen. John T. Coyne, USMCR

DASD for Strategic Plans & Analysis
Joel B. Resnick

DASD for Manpower & Personnel
Al Bemis

DASD for Materiel & Facilities
John Rosamond

DASD for Program, Budget, & Systems
Jennifer Buck

Acquisition & Technology

USD for Acquisition & Technology
Paul G. Kaminski

PDUSD for Acquisition & Technology
R. Noel Longuemare

Director of Defense Research & Engineering
Anita K. Jones

DASD for Installations
Robert E. Bayer

DASD for Industrial Affairs (Acting ASD for Economic Security)
John B. Goodman

DUSD for Acquisition Reform
Colleen A. Preston

DUSD for Advanced Technology
John M. Bachkosky

DUSD for Environmental Security
Sherri Wasserman Goodman

DUSD for Logistics
John Phillips

Asst. to the Secretary of Defense for Atomic Energy
Harold P. Smith, Jr.

Military Departments

Secretary of the Air Force
Sheila E. Widnall

Under Secretary of the Air Force
Rudy F. de Leon

Secretary of the Army
Togo D. West, Jr.

Under Secretary of the Army
Joe R. Reeder

Secretary of the Navy
John H. Dalton

Under Secretary of the Navy
Richard Danzig

Policy

USD for Policy
Walter B. Slocombe

PDUSD for Policy
Jan M. Lodal

ASD for Strategy & Requirements
Edward L. Warner III

PDASD Strategy & Requirements
Thomas K. Longstreth

DASD for Strategy
Michelle A. Flournoy

DASD for Requirements & Plans
Fred Frostic

DASD for Peacekeeping & Peace Enforcement Policy
Sarah B. Sewall

ASD for International Security Policy
Ashton B. Carter

DASD for Counterproliferation Policy
Mitchel B. Wallerstein

DASD (Special Coordinator, Cooperative Threat Reduction)
Laura S. H. Holgate

DASD for Threat Reduction Policy
Susan J. Koch

DASD for Russia, Ukraine, & Eurasia
Elizabeth Sherwood

DASD for Forces Policy
John R. Harvey

PDASD for International Security Affairs
(Acting ASD for International Security Affairs)
Frederick C. Smith

DASD for Inter-American Affairs
Maria C. Fernandez

DASD for European & NATO Policy
Frank D. Kramer

DASD for Asian & Pacific Affairs
Kurt M. Campbell

DASD for Near Eastern & South Asian Affairs
Bruce O. Riedel

DASD for Africa Affairs
Vincent D. Kern

DASD for POW-MIA Affairs
James W. Wold

ASD for Special Operations & Low-Intensity Conflict
H. Allen Holmes

PDASD for Special Operations & Low-Intensity Conflict
Timothy G. Connolly

DASD for Forces & Resources
Raymond Dominguez

DASD for Policy & Missions
Brig. Gen. Thomas E. Swain, USA

DASD for Humanitarian & Refugee Affairs
Patricia Irvin

DASD for Drug Enforcement Policy & Support
Brian Sheridan

Director of Net Assessment
Andrew W. Marshall

Directors of Defense Agencies

Advanced Research Projects Agency
V. Larry Lynn

Ballistic Missile Defense Organization
Lt. Gen. Malcolm R. O'Neill, USA

Defense Commissary Agency
Maj. Gen. Richard E. Beale, Jr., USA

Defense Contract Audit Agency
William H. Reed

Defense Finance & Accounting Service
Richard F. Keevey

Defense Information Systems Agency
Lt. Gen. Albert J. Edmonds, USAF

Defense Intelligence Agency
Maj. Gen. (Lt. Gen. selectee) Patrick M. Hughes, USA
effective Feb. 17, 1996

Defense Investigative Service
John F. Donnelly

Defense Legal Services Agency
Judith A. Miller

Defense Logistics Agency
Vice Adm. Edward M. Straw, USN

Defense Mapping Agency
Maj. Gen. Philip W. Nuber, USAF

Defense Nuclear Agency
Maj. Gen. Gary L. Curtin, USAF

Defense Security Assistance Agency
Lt. Gen. Thomas G. Rhame, USA

National Security Agency
Vice Adm. John M. McConnell, USN

On-Site Inspection Agency
Brig. Gen. Thomas E. Kuenning, Jr., USAF

Office of the Joint Chiefs of Staff

Chairman
Gen. John M. Shalikashvili, USA

Air Force Chief of Staff
Gen. Ronald R. Fogleman, USAF

Army Chief of Staff
Gen. Dennis J. Reimer, USA

Chief of Naval Operations
Adm. J. M. Boorda, USN

Commandant of the Marine Corps
Gen. Charles C. Krulak, USMC

Vice Chairman
Gen. Joseph W. Ralston, USAF
(effective Mar. 1, 1996)

The Joint Staff

Chairman
Gen. John M. Shalikashvili, USA

Vice Chairman
Gen. Joseph W. Ralston, USAF
effective March 1, 1996

Assistant to the CJCS
Lt. Gen. Daniel W. Christman, USA

Director, Joint Staff
Lt. Gen. Walter Kross, USAF

J-1 Manpower & Personnel
Rear Adm. Veronica Z. Froman, USN

J-2 Joint Staff Intelligence
Maj. Gen. James C. King, USA
(effective Feb. 17, 1996)

J-3 Operations
Lt. Gen. Howell M. Estes III, USAF

J-4 Logistics
Vice Adm. John B. LaPlante, USN

J-5 Strategic Plans & Policy
Lt. Gen. Wesley K. Clark, USA

J-6 Command, Control, Communications, & Computer Systems
Vice Adm. Arthur K. Cebrowski, USN

J-7 Operational Plans & Interoperability
Maj. Gen. Stephen Silvasy, Jr., USA

J-8 Force Structure, Resources, & Assessment
Rear Adm. Francis W. Lacroix, USN

Commanders in Chief, Unified Commands

US Atlantic Command
Gen. John J. Sheehan, USMC

US Central Command
Gen. J. H. Binford Peay III, USA

US European Command
Gen. George A. Joulwan, USA

US Pacific Command
Adm. Joseph Prueher, USN

US Southern Command
Lt. Gen. Barry R. McCaffrey, USA

US Space Command and North American Aerospace Defense Command
Gen. Joseph W. Ashy, USAF

US Special Operations Command
Lt. Gen. (Gen. selectee) H. Hugh Shelton, USA
(effective Feb. 29, 1996)

US Strategic Command
Lt. Gen. (Gen. selectee) Eugene E. Habiger, USAF
(effective Feb. 21, 1996)

US Transportation Command
Gen. Robert L. Rutherford, USAF

Air Force Association - Working for its National Membership. March 1996

National Report

Photo by Paul Kennedy

From Out of the Past. *At a reception in observance of the Air Force Association's fiftieth anniversary in February, Secretary of the Air Force Sheila E. Widnall and Gen. Ronald R. Fogleman, USAF Chief of Staff, get a close look at the 225 detailed elements in a restrospective collage commemorating AFA's first half-century. The collage, done by artist Lawrence M. Romorini, will hang permanently in the reception area of the Association's headquarters building.*

A Hit in Cyberspace

The Air Force Association's World Wide Web site on the Internet is now averaging more than 560 hits a day, with the total reaching as high as 1,100 some days. The site, which has been operational since the AFA National Convention last September, had drawn well in excess of 50,000 hits by January.

Analysis of these contacts finds that the site is being used heavily by commercial establishments, individuals, educational institutions, military organizations, and other government agencies. The site has also achieved considerable popularity abroad, receiving hits from Japan, Finland, Switzerland, Italy, Australia, Canada, Norway, Germany, South Africa, Singapore, Portugal, Poland, Costa Rica, Sweden, the Netherlands, South Korea, Israel, Hong Kong, the United Kingdom, and the Slovak Republic.

Address of the site is http://www.afa.org. It provides quick access to information about AFA and its policies and positions, news releases, issue summaries, selections from *Air Force* Magazine, links to the Aerospace Education Foundation site and AFA's *Enola Gay* site, and much more. More than 2.5 megabytes of data are downloaded daily from the site, with the hits spread across the range of the material offered.

AFA has gained its first few new members via cyberspace. The membership application is available on the Web site and can be returned directly to the Membership Department by e-mail. (Applicants are then billed. In time, when security issues are resolved, credit card transactions will be possible.)

In the near future, the site will include the *Air Force* Magazine Space Almanac, which appears annually in the August issue of the magazine and which has been incredibly popular with educators around the country.

AFA Keeps Pressing on Medicare Subvention

The Air Force Association is working with Congress to gain support for Medicare Subvention, the reimbursement from Medicare for treatment and services provided to Medicare-eligible military retirees and beneficiaries through defense and VA medical facilities. Currently, Medicare-eligible retirees are precluded from participating fully in Tricare, the new managed-care military health system. Medicare Subvention would allow the Defense Department to enroll these retirees in Tricare and receive reimbursement from Medicare—at lower cost for care, both to the retirees and to the taxpayers.

In the House of Representatives, the necessary legislation has been introduced by Rep. Joel Hefley (R-Colo.). He has 232 cosponsors for his bill. In the Senate, a measure to achieve similar results is sponsored by Sen. Phil Gramm (R-Tex.).

The Air Force Association recommends that members write or call their senators and representatives and urge them to cosponsor Medicare Subvention legislation. For a copy of AFA's white paper, "Medicare Subvention: The Facts and Figures," contact the National Defense Issues Department at (800) 727-3337, extension 4844.

AFA/AEF Report

By Frances McKenney, Assistant Managing Editor

Appreciation for Barry Goldwater

Former US Sen. Barry M. Goldwater was the focus of the **Frank Luke (Ariz.) Chapter's** "Barry Goldwater Appreciation Dinner," held in December as part of the chapter's fifteenth-anniversary celebration.

Mr. Goldwater, eighty-seven years old, was a US senator from Arizona, 1953–65 and 1969–87. He was an AAF pilot during World War II and retired from military service in 1967 as a major general in the Air Force Reserve. He is also the Aerospace Education Foundation's chairman emeritus. In his remarks to a large audience of chapter members, active-duty military personnel, and local civic leaders, Mr. Goldwater recalled his first days at Luke AFB during World War II.

Gen. Henry Viccellio, Jr., commander of Air Force Materiel Command, Wright-Patterson AFB, Ohio, also attended the dinner. He spoke about national defense issues and noted the importance of the US Air Force Academy and ROTC units, saying the future of the nation's smaller military rests with these leaders now in training.

At a Frank Luke (Ariz.) Chapter dinner honoring his achievements, Barry Goldwater (center) presented Aerospace Education Foundation Eagle Grant scholarships to SSgt. Gary Fetters (left) and TSgt. Nathan Stephens. Mr. Goldwater, a former US senator, is chairman emeritus of AEF.

General Viccellio also presented AEF Eagle Grant Scholarships to TSgt. Nathan Stephens of the 56th Logistics Support Squadron and SSgt. Gary E. Fetters of the 56th Equipment Maintenance Squadron, Luke AFB, Ariz. They will be using the grants, awarded to outstanding graduates of the Community College of the Air Force, to pursue bachelor's degrees. A third Eagle Grant Scholarship winner, SrA. Paul B. Hoff of the 56th Services Squadron, was unable to attend the ceremony.

Ten Chief Master Sergeants of the Air Force gathered at Gunter Annex, Maxwell AFB, Ala., in December 1995 to dedicate a statue of the late CMSAF Richard D. Kisling. In the front row (l–r) are Robert D. Gaylor, Thomas N. Barnes, Donald L. Harlow, and Paul W. Airey. In the back row (l–r) are CMSAF David J. Campanale, Gary R. Pfingston, James C. Binnicker, Sam E. Parish, Arthur L. Andrews, and James M. McCoy, also currently AFA Chairman of the Board. AFA's Montgomery (Ala.) Chapter raised funds for the statue .

Also in the Grand Canyon State

In October, the Frank Luke Chapter joined the **Phoenix Sky Harbor (Ariz.) Chapter** in presenting an employee recognition and appreciation award to the Carl T. Hayden Veterans Affairs Medical Center in Phoenix, Ariz. The center's director, John R. Fears, accepted the plaque.

David C. Noerr, 1937–1996

It's a near certainty that Dave Noerr knew—and was known by—more Air Force Association volunteers than anybody else in AFA. He took about thirty telephone calls a day, sometimes more, from members in chapters and throughout AFA's field organizations. That was when he was in the office. As director of Volunteer and Regional Activities, he traveled constantly, especially from late spring through the summer when AFA state organizations hold their conventions. Between April and July, Mr. Noerr spent three weekends out of four at Association events somewhere in the field.

For the past year, however, many a telephone call from the field to AFA headquarters has concluded with the question, "How's Dave?" As almost everyone active in AFA affairs knew, Mr. Noerr was in a northern Virginia care center fighting a long battle with cancer. It ended with his death on January 13.

Dave Noerr and AFA were a perfect match. He grew up in Wisconsin and joined the Air Force at age eighteen. His first duty was as a tactical and academic instructor, but most of his career was in the morale, welfare, and recreation field. When he retired as a chief master sergeant in 1976, he was an inspector for Morale, Welfare, and Recreation in the Office of the Air Force Inspector General at Norton AFB, Calif. Following retirement, he was general chairman and vice president of the Arrowhead United Way of Southern California.

He was already an active participant in AFA and had served as chairman of the Enlisted Council from 1975 to 1976. His first national AFA award was a Medal of Merit in 1976. That was soon followed by a string of other awards, culminating in one of the top honors the Association can bestow on a member when he was named Air Force Association Man of the Year in 1980.

Dave Noerr joined the AFA national staff in January 1981. The job fit him like a glove. He understood AFA, and he understood volunteers. For the next fifteen years, his combination of commitment, enthusiasm, and personality gained him (and AFA) high regard wherever he went.

He is survived by his wife, Margaret "Sue" Noerr, whose speech to delegates about Dave was an emotional high point of the 1995 AFA National Convention. He is also survived by seven children, twelve grandchildren, his mother, two sisters, and a brother.

— John T. Correll

J. Ward Boyce, representing the two AFA chapters, and Arizona State AFA Vice President for Government Relations Glenn O. Plaumann made the presentation.

The next month, on behalf of the **Barry Goldwater (Ariz.) Chapter** and the **Prescott (Ariz.) Chapter,** Mr. Plaumann presented an employee recognition and appreciation award to Patricia A. McKlem, director of the Department of Veterans Affairs Medical Center in Prescott, Ariz., during a reception for the facility's workers. The center is located on the site of historic Fort Whipple, established in the mid-1800s during Abraham Lincoln's administration.

Last fall, the **Richard S. Reid (Ariz.) Chapter** sponsored the Sahuarita/Green Valley 49ers, a Pop Warner football team and cheerleading squad. Chapter President Angelo Di Giovanni pointed out that the team's uniforms prominently advertised AFA and the chapter name. As one of its activities, the chapter took the team to visit the Green Valley's Titan Missile Museum.

The chapter's home base, Green Valley, held its annual country fair parade in October, this year honoring World War II veterans. The chapter took part in the festival with a red Ford Mustang convertible carrying four special chapter members: Lt. Col. Orville Doughty, USAF (Ret.), and MSgt. Herman R. Meyer, USAF (Ret.), who spent seventeen months and thirty-six days, respectively, as POWs at Stalag Luft I in northern Germany; Lt. Col. Jack C. West, USAF (Ret.), who was shot down over Africa and spent twenty-five months as a POW at Stalag Luft III; and Charles A. Ulery, who escaped from a Japanese POW camp in south China in 1944.

In November, Mr. Di Giovanni and a contingent of chapter members took part in the Veterans Day memorial service held at the Green Valley Cemetery, placing a wreath at a memorial of six flags—one flag for each service and a POW flag.

A Trip to the Moon

With the help of an AEF grant secured by the **Florida Highlands Chapter,** Sun 'n Lake Elementary School teacher Frances G. Beers took her fifth-grade students to the Moon.

It was only a 100-mile trip, however. The students traveled by bus from their school in Sebring, Fla., to Tampa's Museum of Science and Industry and from there rocketed to the moon in the GTE *Challenger* Learning Center. Under the center's "Return to the Moon" scenario, the students used a space station and a mission control simulator. They also learned teamwork as they performed duties of the space control center personnel and used robots and stellar navigation techniques.

"Being able to help take these students to such a wonderful learning experience is just another one of the Air Force Association's programs to help create interest in science and math in this generation of young Americans," said Chapter President C. B. Shirey, Jr.

The *Challenger* Learning Center is one of twenty-five nationwide, established by the families of the space shuttle crew who died after the liquid fuel booster on *Challenger* STS-51L exploded just after liftoff in January 1986.

Word From the Academy

Winter storms in December left ice on parts of the runway at Stewart IAP, N. Y., but that didn't keep Lt. Gen. Paul E. Stein from his speaking engagement with the **Westchester Falcon (N. Y.) Chapter.**

Fifty-five people braved the icy roads and turned out for the US Air Force Academy superintendent's appearance, some from as far away as Albany and Long Island, reported Chapter President Herbert S. Leo-

pold. At this quarterly Sunday brunch meeting at the West Point Officers' Club, General Stein gave a presentation on training at the Academy. Several in the audience—chapter member John F. Flanagan, Jr., among them—were particularly interested in the General's remarks because they have family members attending the school.

A year ago, Mr. Leopold and Mr. Flanagan, an Academy graduate, attended a luncheon for New York–area graduates of the Air Force Academy. There, Mr. Leopold, a retired dentist and a former B-24 bombardier with the 466th Bomb Group, Eighth Air Force, met General Stein and asked him to be a guest speaker.

"There was not a minute's hesitation" from the General, Mr. Leopold recalled. The superintendent said he was going to be in the New York area at the time of the chapter's quarterly meeting and was happy to work in a visit.

The Florida Highlands Chapter sponsored a visit to the* Challenger *Learning Center in Tampa, Fla., for fifth grader Altus Lee and his fellow students. Teacher Frances Beers (left) and the Center's program director, Gene Nibbelink, guided the students through a trip-to-the-Moon scenario.

Blue-Water Sailor on Deck

The **Dale O. Smith (Nev.) Chapter's** new president comes from a sister service. Lt. Cmdr. Paul B. Kincade, USN (Ret.), began his twenty-seven-year Navy career as a signalman in World War II. He later retired from the San Diego, Calif., police department.

He met Donald L. Schwartz, who was the chapter's previous president, while working with him on a Chamber of Commerce committee. Mr. Schwartz, a Civil Air Patrol colonel, talked Mr. Kincade into joining AFA in August 1994 to help with the chapter's many World War II commemorative activities. A year later, the chapter elected Mr. Kincade president.

Most recently, the chapter held a Christmas gathering, where it raised $3,000 for its scholarship fund through several means. The guests brought wrapped white-elephant gifts that were auctioned off at the party. There was also a silent auction for other goods and services. Chapter members Victor R. and Beatrice M. Hollandsworth donated handmade, tabletop ceramic Christmas trees. And Mr. Schwartz collected donations.

The chapter awards two $1,200 scholarships each year to high school– and college-age children of Air National Guard members.

On behalf of the area's veterans, Glenn Plaumann (right) of Arizona State AFA and J. Ward Boyce (left), representing the Phoenix Sky Harbor and Frank Luke Chapters, presented John Fears with a plaque for the "Honors Wall" of the VA Medical Center in Phoenix. Mr. Fears is the center's director.

Hooligans at the Hooligans'

In January, North Dakota Adjutant General Brig. Gen. Keith D. Bjerke, ANG, spoke at a joint meeting of the **Happy Hooligan (N. D.) Chapter** and a local chapter of the Reserve Officers Association.

The 119th Fighter Wing (ANG) hosted the luncheon gathering at the unit's operations briefing room. General Bjerke spoke about the Air National Guard's operations in 1996, as did ANG Maj. Terrance Sando, the chapter's new vice president. Chapter members also toured the 119th FW's facilities at Hector IAP, getting a close-up look at the wing's F-16s and Hughes and William Tell Trophies. The 119th FW's 178th Fighter Squadron—nicknamed the "Happy Hooligans"—took home the Hughes Trophy in 1994 as the outstanding air-to-air unit in USAF and also won the William Tell competition that year.

The chapter's new president, Gary H. Olson, reported that the other newly elected officers include Secretary SSgt. Bradley J. Jernberg, ANG, and Treasurer SSgt. Troy C. Krabbenhoft, USAF. Mr. Olson served in the Air National Guard and Air Force Reserve for thirty-seven years, retiring as a colonel. He owns an insurance agency.

Darleen Druyun (at left), then acting assistant secretary of the Air Force for Acquisition, congratulates Bert Melnick, 1st Lt. Renee Carter, and Maj. John Raham, USMC, who were part of the JDAM program acquisition team honored at a reception for the USAF acquisition community.

Rewarding Acquisition Reform

To acknowledge the improvements in procuring USAF warfighting systems, the **Donald W. Steele, Sr., Memorial (Va.) Chapter** honored the Air Force acquisition community with a reception in November.

More than 100 active-duty service members from the Office of the Assistant Secretary of the Air Force for Acquisition joined more than 200 industry representatives from forty-three companies at the event, held at the Fort Myer, Va., Officers' Club.

Darleen Druyun, then acting assistant secretary of the Air Force for Acquisition, presented the Acquisition Reform award to the Air Force–McDonnell Douglas Joint Direct Attack Munition program acquisition team. JDAM System Program Office members Lt. Col. Jim McClendon, Maj. John Raham, USMC, 1st Lt. Renee Carter, Bert Melnick, and David O. Swain, vice president and general manager for the company's Advanced Systems and Technology–Phantom Works accepted the award. Ms. Druyun had told AFA's Los Angeles Symposium last October that JDAM tops her list of acquisition success stories.

Maj. Robert Barry from the mission area director's staff, Lt. Col. Donald Vazquez, then of the Air Force's Tactical and Airlift Program Executive Office, and Karen-Sue Dunn from the functional directors' staff received awards as outstanding USAF acquisition action officers. Lt. Gen. George K. Muellner, principal deputy assistant secretary of the Air Force for Acquisition, was among the special guests.

In the Interest of Science

"Kids with brains didn't seem to get the attention," said William B. Gemmill, **On Wings of Eagles (Fla.) Chapter** president. For that reason, he pushed the chapter to become a regular sponsor of the Hernando County Science and Engineering Fair.

It has only 156 members, but the chapter recently raised $2,200 to be used for the science fair's awards and its scholarship fund. AEF donated $1,000, and Mr. Gemmill said the chapter raised the rest through a donation from the local Veterans of Foreign Wars chapter and through a white-elephant sale.

He noted that, because of the chapter's active involvement in the science fair, aerospace has been added to the categories judged in the annual February contest, which last year attracted 2,000 entries from students in six schools, from grades six through twelve. Students who win this science fair and go on to statewide competition receive T-shirts that bear not only the name of the fair but also the AFA logo and the chapter's name.

Craig Gates, the science fair's director, teaches ninth-grade science at Springstead High School West, in Spring Hill, Fla., and is a member of On Wings of Eagles. His classroom provides the National Weather Service with weather reports from its central Florida location on the Gulf of Mexico and earlier received an AEF grant for a weather satellite monitoring system. It allows them to keep track of weather satellites from around the world.

On Wings of Eagles also plans to fund a science project on wind tunnels, conducted by another area school.

An Indoor Air Fair

December seems like an awkward time of year to hold an air fair in Oregon, but **Portland (Ore.) Chapter** President Lavern A. Willie explained that the event took place indoors, in the Oregon Convention Center in downtown Portland. The fifth annual celebration, sponsored by the Northwest Aviation Association, featured several aircraft, including a 1929 Bellanca seaplane, a Coast Guard helicopter and a BO

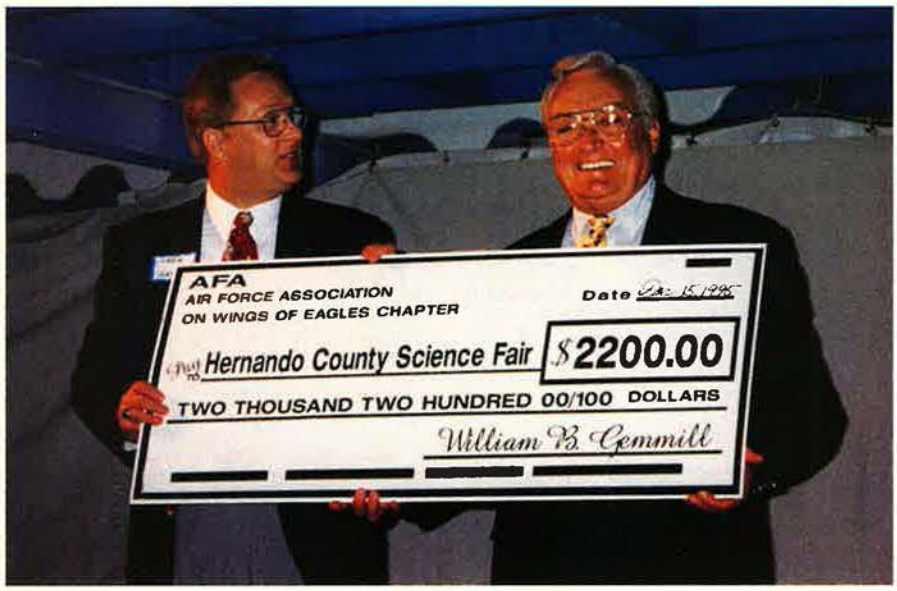
Coming Events

April 19–21, **New Mexico State Convention,** Windrock, N. M.; April 26–27, **Louisiana State Convention,** Baton Rouge, La.; May 3–4, **Tennessee State Convention,** Memphis, Tenn.; May 10–11, **South Carolina State Convention,** Charleston, S. C.; May 17, **Maryland State Convention,** Andrews AFB, Md.; May 17–19, **New Jersey State Convention,** Absecon, N. J.; June 7–9, **New York State Convention,** Lake Placid, N. Y.; June 7–9, **Texas State Convention,** San Antonio, Tex.; June 14–15, **Arkansas State Convention,** Jacksonville, Ark.; June 14–16, **Arizona/Nevada State Convention,** Las Vegas, Nev.; June 21–22, **Alabama State Convention,** Mobile, Ala.; June 21–22, **Ohio State Convention,** Youngstown, Ohio; July 13, **Georgia State Convention,** Robins AFB, Ga.; July 18–21, **California State Convention,** Fresno, Calif.; July 20, **Virginia State Convention,** Charlottesvile, Va.; July 26–27, **Florida State Convention,** Daytona Beach, Fla.; July 26–28, **Pennsylvania State Convention,** Trevose, Pa.; August 2–3, **Missouri State Convention,** Kansas City, Mo.; August 9–10, **North Carolina State Convention,** Seymour Johnson AFB, N. C.; August 9–11, **Iowa State Convention,** Cedar Rapids, Iowa; September 16–18, **AFA National Convention and Aerospace Technology Exhibition,** Washington, D. C.

105 helicopter, sailplanes, and a section of ultralights, displayed on the 160,000-square-foot exhibit area of the convention center.

Sixty technical seminars were conducted during the fair, spotlighting such keynote speakers as Lt. Col. Richard G. Rutan, USAF (Ret.), who in 1986, with Jeana Yeager, flew around the world without refueling; SR-71 test pilot Robert Gilliland; and Deanna Brassuer, the first Canadian Forces female fighter pilot for CF-18s.

Portland Chapter members staffed a booth during the three-day fair, drawing crowds of youngsters with a space shuttle display provided by AEF. Chapter members also promoted the *USA Today*/AEF "Visions of Exploration" program with a video, and representatives from that newspaper were on hand to explain how the program encourages an interest in science and technology.



On Wings of Eagles (Fla.) Chapter President William Gemmill (right) presented a generous donation to Craig Gates, a chapter member and also the Hernando County Science Fair director. The gift will be used for the annual science fair's awards and scholarship fund.

More Chapter News

The **Fort Wayne (Ind.) Chapter** welcomed ANG Lt. Col. Perry M. Collins, chief of staff for the 122d Fighter Wing (ANG), Fort Wayne IAP, to its Christmas awards banquet, where he discussed the wing's future operations. Among the ten awards presented at the dinner was the Service Award given to the chapter's Vice President for Communications Gene Royer.

At Maxwell AFB, Ala., in September, National Director O. R. Crawford administered the commissioning oath to a member of the third generation of Crawfords to serve in the US Air Force, 2d Lt. Oliver C. Bonney. Lieutenant Bonney, the son of Mr. Crawford's daughter Lynda, started undergraduate pilot training in November at Columbus AFB, Miss. As his proud grandfather noted, "He follows my son, Alan R. Crawford, who received his Air Force wings at Williams AFB, Ariz., in 1975."

Have AFA/AEF News?

Contributions to "AFA/AEF Report" should be sent to *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Phone: (703) 247-5828. Fax: (703) 247-5855. ■

Unit Reunions

Augusta Military Academy. May 16–19, 1996, at the Holiday Inn in Staunton, Va. **Contacts:** Ed Click, R. R. 1, Box 12, Fort Defiance, VA 24437-9703. Phone (703) 248-0507. James W. Councill, 103 Alanwood Dr., Ormond Beach, FL 32174. Phone: (904) 672-2217.

RF-101 Voodoo. May 23–26, 1996, in Hot Springs, Ark. **Contacts:** Richard J. Corbett, Rte. 1, Box 15, Salado, TX 76571. Phone: (817) 947-5877. Pete Swanson (214) 418-7315.

Scouting Force Ass'n. April 25–28, 1996, at the Hilton De Soto Hotel in Savannah, Ga. **Contact:** E. Richard Atkins, 1304 Cochise Dr., Suite 222A, Arlington, TX 76012. Phone: (817) 261-3007.

W & B Army Air Forces Flying School, Chickasha, Okla. (1941–45). Cadets, instructors, and staff. April 26–28, 1996, in Chickasha, Okla. **Contact:** Ron Baker, 23 Walnut Dr., Ninnekah, OK 73067. Phone: (405) 224-5343.

7th Tactical Depot Squadron or 400th Munitions Maintenance Squadron (Kadena AB, Japan). August 7–11, 1996, in Albuquerque, N. M. **Contact:** Bruce R. Cubbison, 5051 W. Portland Dr., Littleton CO 80123.

Mail unit reunion notices well in advance of the event to "Unit Reunions," *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

11th Bomb Group Ass'n. May 15–18, 1996, in Orlando, Fla. **Contact:** Robert E. May, P. O. Box 637, Seffner, FL 33584-0637. Phone: (813) 681-3544.

40th Air Refueling Squadron (Salina, Kan.). September 1996, in Lake Tahoe, Nev. **Contacts:** Ray Ruana, 206 Saddle Ct., Folsom, CA 95630. Phone: (916) 985-7298. Charlie West, 3506 Gulf Shore Blvd. N., Apt. #107, Naples, FL 33940. Phone: (941) 261-8562.

Pilot Class 59-A. April 17–21, 1996, at the Windmill Hotel in Tucson, Ariz. **Contact:** Leslie A. Morris, P. O. Box 1295, Green Valley, AZ 85622-1295. Phone: (520) 625-4745.

Pilot Class 67-D. June 20–23, 1996, in Phoenix, Ariz. **Contact:** Gerald T. Horiuchi, 1223 E. Mesa Ave., Fresno, CA 93710-5613. Phone: (209) 435-4312.

71st Tactical Reconnaissance Group, 17th Reconnaissance Squadron, 25th Liaison Squadron, and 82d and 110th Tactical Reconnaissance Squadrons (World War II). August 22–24, 1996, at the Marriott Hotel in Colorado Springs, Colo. **Contact:** Earlan L. Seawards, 23 W. Concord St., Dover, NH 03820-3636. Phone: (603) 749-3685.

315th Fighter Squadron, 324th Fighter Group (World War II). May 1–5, 1996, at the Regency Plaza Hotel in San Diego, Calif. **Contact:** Eugene J. Orlandi, 311 Third St., East Northport, NY 11731. Phone: (516) 368-9193.

351st Bomb Group Ass'n, Polebrook, England (World War II). May 27–June 1, 1996, at the Holiday Inn in Chattanooga, Tenn. **Contact:** Clinton W. Hammond, P. O. Box 281, Mechanicsburg, PA 17055. Phone: (717) 766-1489.

Unit Reunions

353d Fighter Group, including the 350th, 351st, and 352d Fighter Squadrons, 8th Air Force. May 15–19, 1996, at the Country Hearth Inn in Orlando, Fla. **Contact:** Charles J. Graham, 1800 Old Meadow Rd., Apt. #814, McLean, VA 22102. Phone or fax: (703) 734-0138.

376th Bomb Group Ass'n (World War II). September 26–30, 1996, in Charleston, S. C. **Contact:** Tom Brown, 104 Lake Fairfield Dr., Greenville, SC 29615-1506. Phone: (864) 244-8420.

410th Bomb Group Ass'n (World War II). May 22–25, 1996, at the Holiday Inn Crowne Plaza in Nashville, Tenn. **Contacts:** Howard B. Aines, 516 Rolling Hills Lane, Danville, CA 94526. Phone: (510) 820-8433. John P. McDonagh, 6013 Rembert Dr., Hanahan, SC 29406. (803) 747-2404.

416th Bomb Group (World War II). April 19–21, 1996, in Tucson, Ariz. **Contact:** Dolphus Whitten, P. O. Box 792, Arkadelphia, AR 71923. Phone: (501) 246–2223.

447th Bomb Group. July 24–28, 1996, in Valley Forge, Pa. **Contact:** Pete Petrillo, 955 N. Pasadena Ave., Elyria, OH 44035. Phone: (216) 365-2561.

451st Bomb Group, 60th Air Service Squadron (North Africa and Italy). September 18–22, 1996, in Minneapolis, Minn. **Contact:** Robert Karstensen, 1032 S. State St., Marengo, IL 60152. Phone: (815) 568-7766. Fax: (815) 568-0451.

548th Reconnaissance Technical Squadron, 6th Photo Technical Squadron, Yokota AB, Japan (1948–60). June 13–15, 1996, in Carlisle, Pa. **Contact:** Ben Kessler, 311 Mt. Allen Dr., Mechanicsburg, PA 17055. Phone: (717) 766-8808.

Pilot Class 42-G, Brooks Field, Tex. Seeking contact with members who are interested in a reunion. **Contact:** John R. Hed, 5141 Glenwood St., Duluth, MN 55804-1625.

Class 51-A (USAF Officer Candidate School). Seeking contact with members for a future reunion. **Contact:** George A. Erswell, Jr., R. R. 1, Box 668-F, South Harpswell, ME 04079. Phone: (207) 833-6260.

Pilot Class 53-B. Seeking contact with former members to update roster. **Contact:** Erroll L. Williams, 1716 Greenbriar Rd., Glendale, CA 91207. ■

Bulletin Board

Seeking the whereabouts of **John Choy,** a World War II fighter pilot who attended Porterville High School, Calif., and the University of Nevada. **Contact:** Gene Demler, 693 Glorietta Blvd., Lafayette, CA 94549-3404.

Seeking contact with former members of 5th Air Force's **370th Service Squadron,** March–April 1943, who knew **Lt. Tom J. Miller. Contact:** Robert Sherrard, 715 Cranbrook Dr., St. Louis, MO 63122.

Seeking the whereabouts of **John Seaman,** an 8th Air Force navigator stationed near Norwich, UK, 1944–45. **Contact:** Patricia Chester-Kadwell, 166 Manor Gardens, Cambridge St., St. Neots, Cambridgeshire PE19 1PU, UK.

Seeking aviator wings and **badges,** and their histories, from World War II and earlier. **Contact:** Maj. Jack Else, USAF (Ret.), 1307 Main St., Bastrop, TX 78602.

Seeking the whereabouts of **Sgt. Jim Broach,** who flew a P-51 during World War II at Cox's Bazar, India, in the 1st Fighter Squadron, 2d Air Commando Group, 1944–45. **Contact:** Hadley M. Dixon, 18 Cool Brook, Irvine, CA 92715-3412.

Seeking the whereabouts of **SSgt. Richard Adolph Barthelemess,** who worked in communications at High Wycombe AS, UK, 1966. **Contact:** Richard Robertson, 30 Gardner Dr., Kincorth, Aberdeen AB1 5SQ, UK.

Seeking information on **Amn. Jack Amacker,** based in London in the summer of 1943. **Contact:** June Mockridge Brereton, 116 Stocks Lane, Stalybridge, Cheshire SK15 2TQ, UK.

Seeking **patches** from the 3301st Pilot Training Group, Moore Field, Tex., 1955; the 3505th Pilot Training Wing, Greenville AFB, Miss., 1956; and the 3525th Combat Crew Training Wing, Williams AFB, Nev., 1956. **Contact:** Sidney J. Wright, 6392 Lincolnia Rd., Alexandria, VA 22312.

Seeking contact with instructors and graduates from the University of Northern Colorado's **AFROTC Det. 100,** 1985–90. **Contact:** Capt. Charles K. Grossart, USAF, 3160 Altamonte Dr., Beale AFB, CA 95903.

Seeking information on **military disposal of surplus aircraft** or aircraft parts by burial during World War II and after. **Contact:** David A. Beulke, 347 Eastern Ave., Brookings, SD 57006.

Seeking World War II–era brown **leather photo albums. Contact:** William A. Barner, P. O. Box 978, Allyn, WA 98524.

Seeking contact with former **USAF or ANG fighter-interceptor squadron** personnel. **Contact:** Alec Fushi, 20 E. Cedar St., Apt. #11D, Chicago, IL 60611.

Seeking **444th Fighter-Interceptor Squadron** patches and memorabilia. **Contact:** MSgt. Joe McDowell, USAF (Ret.), 5716 Remington Lake, Apt. #2110, Fort Worth, TX 76132-3235.

Seeking contact with the family of **Maj. Moss Kirby Fletcher,** of Paris, Ill., last assigned to Bitburg AB, Germany, 1965–66. **Contact:** Brig. Gen. Victor N. Cabas, USAF (Ret.), 31021 Marne Dr., Rancho Palos Verdes, CA 90275-5613.

Seeking contact with **514th Troop Carrier Group** personnel stationed at Marietta AAF, Ga., 1947–49. **Contact:** TSgt. David G. Stroebel, USAFR, 2217 W. Arnold Ave., McGuire AFB, NJ 08641-5218.

Seeking contact with former **13th Bomb Squadron,** 3d Bomb Group, personnel (Korea). **Con-**

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

tact: Alvin Adams, 3398 N. Studebaker Ct., Terre Haute, IN 47803-9403.

Seeking contact with B-29 navigator **John G. Davis** and radar operator **Billy D. Dobbs. Contact:** Frank E. Vogelle, 4 Garden Ave., Miller Place, NY 11764.

Seeking contact with graduates of **Luke Field Class 45-C. Contact:** F. H. Smith, Jr., 5852 E. Jasmine St., Mesa, AZ 85205.

Seeking contact with **Brig. Gen. Richard B. Posey,** of Camp Hill, Pa., who may have been based at Field 9, Eglin AFB, Fla., 1943–46. **Contact:** Richard Zenker, 19694 E. Kings Ct., Grosse Pointe Woods, MI 48236.

Seeking photographs of the **119th Observation Squadron's** O-52s and O-47s. **Contact:** Lt. Col. Joel A. Harper, AFRES (Ret.), 7744 Northcross Dr., Apt. #N 113, Austin, TX 78757-1718.

Seeking information on **Capt. John H. Carter,** stationed at Big Spring, Tex., in 1944, who flew B-26s and B-17s. **Contact:** Letha Farmer Shelton, 1303 Alpine St., Odessa, TX 79762.

Seeking information on a **P-38** that lost its tailplane May 31, 1944, and crashed in Sutton, UK. **Contact:** Dorien Clifford, 20 rue Gimelli, 83000 Toulon, France.

Seeking the whereabouts of **Christina Wiggins,** from Raytown, Mo., who joined the Air Force in 1986. **Contact:** Mike Smalley, 8304 E. 87th St., Raytown, MO 64138.

Seeking information on **USAF locomotives** and rolling stock. Also seeking contact with anyone involved in USAF railroad operations. **Contact:** MSgt. John H. Grier, USAF (Ret.), 3257 Squaw Valley Dr., Colorado Springs, CO 80918.

Seeking contact with **Boomer Flight pilots,** Class 62-B, Williams AFB, Ariz., 1961. **Contact:** Ingomar R. Lindner, 3417 Loch Stone Ct., Charlotte, NC 28210.

Seeking contact with Air Transport Command personnel who flew into **Yerevan, Russia,** during World War II. **Contact:** Jim Fletcher, P. O. Box 311, Green Forest, AR 72638.

Seeking information on **Control Box BC-1156-A,** which controlled the Azon, G. B., and Razon radio-controlled bombs in World War II. **Contact:** John W. Swancara, 5 Honeysuckle Ridge Rd., Pisgah Forest, NC 28768-9525.

Seeking contact with and information about **49th Fighter-Bomber Group and 7th, 8th, and 9th Fighter-Bomber Squadron** personnel, Taegu, Korea, in the early 1950s. **Contact:** R. C. Roark, 2216 S. 132d East Ave., Tulsa, OK 74134.

Seeking USAF **patches,** badges, rank insignias, and photographs of F-4 Phantom IIs. **Contact:** Michel Labrosse, Cite J. M. Chalot A/20, 71230 Saint Vallier, France.

Seeking ***The Flying Years,*** by Lt. Col. Louis T. Reichers, USAF. **Contact:** Lt. Col. Paul H. Knox, USAF (Ret.), Rte. 2, Box 1957, Dickerson Ct., Connellys Springs, NC 28612-9802.

Seeking contact with former 3626th Training Squadron and 3625th Training Wing personnel based at Tyndall AFB, Fla., who knew **Flight Lt. Peter S. Q. Anderson,** RAF, World War II. **Contact:** Santiago A. Flores, P. O. Box 430910, San Ysidro, CA 92143-0910.

Seeking AAF leather **flight jackets,** uniforms, flight equipment, and photo albums. **Contact:** Jon Cerar, 425 John St., Carlinville, IL 62626.

Seeking information on and photos of **RORO** personnel assigned to Rockville, Iceland, 1950–93. **Contact:** 2d Lt. Eric M. Moody, USAF, PSC 1013, Box 23, APO AE 09725-0023.

Seeking contact with **492d, 801st, and 885th Bomb Squadron** and Bomb Group members who flew B-24s or A/B-26s supporting OSS missions. Also seeking information on **B-29 #44-61975. Contact:** Bryan G. Phillips, P. O. Box 73, Norfolk, MA 02056-0073.

Seeking a **Dash-1** rescue training manual and in-country check-out procedures for the 37th and 40th Aerospace Rescue and Recovery Squadrons HH-53B/C Jolly Green Giants (Vietnam or Thailand). **Contact:** Mike McCorkle, 58 Woodbridge Dr., Colorado Springs, CO 80906. ■

Pieces of History

Photography by Paul Kennedy

Locate and Liquidate

Memorabilia courtesy Warren Thompson, Memphis, Tenn.

One of the most important technological advances to receive widespread use during World War II was radar. It could not only warn of an approaching enemy, but it gave operators the ability to "see" at night. Some aircraft were hastily adapted to a night-fighting role. The P-61 Black Widow, however, was built for the task. Using British-designed radar, the huge three-man fighter saw action in Europe and the Pacific from early 1944 through the end of the war. A variant of the aircraft, the F-15 Reporter (later redesignated RF-61C), saw service until 1952. "Locate and Liquidate" was the motto of the 325th Fighter Group, one of the largest units to fly the aircraft, and is a succinct description of the P-61's mission.

Raytheon's AIM-9X gives U.S. fighter pilots an incredibly unfair technological advantage. Raytheon is ready to produce the AIM-9X missile that changes the rules of air-to-air combat. We have flown and successfully validated

our AIM-9X technology on six separate flights. We know this missile system, from its high off-boresight seeker, to its advanced imaging focal plane array detector, to its thrust vector control. We have demonstrated the focal plane array that guarantees our

pilots the first shot opportunity in all encounters using our AIM-9X technology. Today, U.S. fighter pilots face superior missiles. They deserve the best. They deserve the Raytheon AIM-9X.

Raytheon Electronic Systems

IT'S PROVEN ITSELF IN THE MOST CRITICAL TEST OF ALL.

KEEPING THE PEACE.

In December, twelve C-17s were enlisted to fly troops and supplies into Bosnia as part of Operation Joint Endeavor. By being the only airlifter capable of carrying large equipment and landing on restricted runways in severe weather, it gave our peacekeeping forces an immediate presence. With its unrivaled ability to quickly unload cargo and personnel under the most demanding conditions, the C-17 Globemaster III will continue to do the heavy lifting in the most vital military mission of all: peace.

MCDONNELL DOUGLAS

C-17 unloading, Tuzla, Bosnia, 1/13/96