OCTOBER 1993/$3

AIR FORCE

PUBLISHED BY THE AIR FORCE ASSOCIATION

MAGAZINE

The Loadmasters

AMERICA HAS ALWAYS HAD THE ABILITY TO HELP IN A CRISIS.

America has always had the heart and the ability to reach out and help her friends in times of crisis. In the future, that ability will depend, in large part, on an aircraft called the C-17. This aircraft is the only one of its kind. The only wide-body, military aircraft that will operate into remote, short airfields. We don't have an alternative. We don't have a backup. And that's important to know.

WE SHOULD HAVE THAT ABILITY IN THE FUTURE.

Just as important as the fact that this aircraft has already flown hundreds of test missions and logged over 1900 flight hours. Add to that the fact that we've already started delivering C-17s to an operational Air Force unit, and you have an aircraft that's here proving it can do the job. Proving it can maintain America's ability to reach out and help in times of crisis.

MCDONNELL DOUGLAS
Performance Above and Beyond.

October 1993, Vol. 76, No. 10

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

About the cover: Loadmaster SSgt. Ted W. Herbert of the 22d Airlift Squadron, 60th Airlift Wing, Travis AFB, Calif., enjoys the view from his C-5B Galaxy. Photo by Ross Harrison Koty.

AIR FORCE Magazine (ISSN 0730-6784) October 1993 (Vol. 76, No. 10) 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:** $25 per year; $60 for three-year membership. **Life Membership:** $400 single payment, $420 extended payments. **Subscription Rate:** $25 per year; $25 per year additional for postage to foreign addresses (except Canada and Mexico, which are $8 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. Trademark registered by Air Force Association.

Editorial

By John T. Correll, Editor in Chief

Slipping in Space

THE SENATE, searching for cost savings last July, told the Pentagon to investigate using foreign launch vehicles to put national security payloads into space. That struck a discordant note for the armed forces, who have come to depend on space systems to an extent few commanders would have imagined as recently as five years ago.

Strike aircraft in the Persian Gulf War took advantage of weather satellite data to press the attack through gaps in cloud formations. Surveillance satellites provided information on the enemy and warning of Scud missile attacks. Eventually some 4,500 terminals in the war zone were keyed to Navstar navigation satellites. Meal trucks used signals from space to find and feed front-line units. Satellites carried eighty percent of the communications for land, sea, and air forces. And that, it seems, is just the beginning.

The new prophets of space are a couple of thirty-third-degree fighter pilots named McPeak and Horner. "If American military history ended today, airpower would be seen as our distinctive contribution, but I'm convinced that tomorrow we will judge a nation's power status by its relative position in space," says Gen. Merrill A. McPeak, Air Force Chief of Staff. "I believe that space is on the way to being the new centerpiece of our strategic leverage." Gen. Charles A. Horner says he knew almost nothing about space when be became air boss in the Gulf War. He was converted as well as instructed by that experience, and he now spreads the word with great credibility as commander in chief of US Space Command.

As the Senate's message indicated, though, the United States—and the US armed forces—have problems looming in space. "We are not the only nation learning lessons from Desert Storm," General Horner says. "Other countries are no longer content to stand on the sidelines and admire our military prowess in space."

Today, the United States launches only twenty-seven percent of the free world's satellites, down from eighty-five percent in the not-too-distant past. By the turn of the century, more than twenty nations will have spacebased intelligence and targeting capabilities. Earlier this year, a panel reporting to the National Science Foundation and NASA said the US lead has been lost in many critical satellite technologies and that other nations will soon begin moving ahead in the market.

Foreign launchers lift payloads for about half the cost of US launchers, which are obsolete and inefficient. In the 1970s, we committed ourselves almost exclusively to the space shuttle and did not resume work on modern launcher alternatives in earnest until after the *Challenger* disaster in 1986. The first big proposal, called the National Launch System, foundered. The next one, a modular family of "Spacelifter" vehicles, is stalled by lack of support.

Current military space launch is not operationally responsive. Given some luck and by pulling out all the stops, Space Command might get a high-priority satellite up on a month's notice, but the typical waiting time is closer to four months. Because of such delays and other factors, the Joint Military Net Assessment declares launch capability no better than "marginally sufficient." General Horner sees little relief until we stop treating every launch as a custom event. We do not assemble unique components and build a new aircraft each time we want to fly one, he says, and it's time to move away from one-of-a-kind satellites toward packages that can be launched with minimal modification on standard boosters.

In May, the Department of Defense declared "the end of the Star Wars era" and terminated the Strategic Defense Initiative. Residual elements continue as the Ballistic Missile Defense Organization, a scaled-down operation that focuses on the proliferating theater missile threat. That is a very hard job for existing satellite systems, which were not designed to detect dimmer, short-burning theater missiles. Nor do they have the capability to cue ground defenses. Replacement systems are a high priority for Space Command, but funding may not be available.

Almost two dozen nations have missile capabilities or are close to acquiring them. For the moment, most of these missiles are limited to theater range, but intercontinental weapons will not be far behind. It is starkly conceivable that a rising number of them could threaten North America in the next ten years. The Central Intelligence Agency predicts it will not be long before several Third World nations have ICBMs.

Ironically, just as the armed forces are recognizing the value of space to military operations, the nation's attention to space is scattered and unfocused. The direction, aside from economizing, is uncertain. The National Space Council has been downgraded. The Administration wants to shift space assets and funding from the military to civilian programs. There is no real sense of urgency about tackling the problems of space launch, missile defense, or reconnaissance capabilities.

By General McPeak's figuring, military space operations today are at about the same stage that airpower was at the end of World War I. We have just begun to discern the possibilities. It's understood that these are difficult times, but this is not a front on which we can back away. ■

THE BEST WAY TO OVERSEE PEACE BUILDING.

Regional conflicts have made Europe less stable, and management of security now ranges from Peace Keeping to Peace Building. NATO collectively aims to improve its ground surveillance capabilities for effective control and successful resolution of crises. Nothing can meet this need better than Joint STARS, which provides non-intrusive, deep-looking, wide-area surveillance of moving and stationary ground and maritime traffic as well as helicopters. By complementing the air-surveillance capabilities of NATO AWACS, Joint STARS will be indispensable to the future integrated and multinational Defense Structure. For more information, contact Grumman International, Inc., Brussels, Belgium, Tel: (02) 732 59 90 Telefax: (02) 732 64 47.

GRUMMAN

Letters

Schools for Leadership

"The Case for the Academies" *[July 1993, p. 60],* based on an interview with Air Force Academy Superintendent Hosmer, is worthy of further amplification for the benefit of your readers and the taxpayers of America.

The service academies provide uncompromised leadership for this nation, regardless of the task presented to its graduates. The nation was awed by the tactical brilliance of West Point graduate General Schwarzkopf, who commanded a decisive military victory in the Persian Gulf, but that victory could not have been achieved without the herculean multimodal transportation deployment commanded by Air Force Academy graduate General Johnson.

Since World War II, the academies have provided two Presidents (Eisenhower and Carter) and a Presidential contender (Perot) who shook the nation from its political apathy. In business, a Naval Academy graduate presided as the chief executive officer who rescued Texaco from a disastrous financial and legal precipice. A West Point graduate is the new chief financial officer overseeing the massive restructuring of IBM. An Air Force Academy graduate is chief legal counsel of General Motors.

The US must remember that during its most trying moments, the academies continued to graduate the highest-caliber junior officers to lead fellow Americans into combat. Witness the experience of the Vietnam era, when political activism forced the closing of many ROTC detachments, denying our field forces a source of educated and qualified leaders. The consequences were appalling and irrevocable.

The actions of Congress to alter the academic structure are unconscionable. What better role models could the cadets have than academically qualified professional officers balanced by distinguished visiting professors from nonmilitary institutions? What is the evidence of failure to warrant wholesale changes in faculty composition as legislated by Congress? Why should Congress deny incentives for achievement (*e.g.,* regular commissions) to academy and distinguished ROTC graduates?

This nation is foundering as scandal, divisiveness, and ineptitude have eroded the core institutions of finance, education, industry, government, and even religion. We need the service academies more than ever, and we need them devoid of debilitating political and social engineering.

John F. Flanagan, Jr.
Stamford, Conn.

The Academy's Product

I read "The Case for the Academies" with interest. I spent a very rewarding four years teaching military studies at the Air Force Academy from 1982 until 1986.

I have discovered you can get remarkable answers if you ask the right questions and ignore variables that do not support the answer you seek. For example, the cited retention rates of fifty-seven percent of Academy graduates reaching the twenty-year mark vs. the 30.6 percent of officers from other sources sounds pretty impressive. Consider that 100 percent of Academy graduates received regular commissions vs. the ten percent of officers receiving regular commissions from other sources and that Academy graduates will receive half of all available pilot training billets, and the Academy's retention rate becomes somewhat less impressive.

I went to flight school in 1975. At that time, Academy graduates who failed to complete pilot training were offered navigator training or some other career field. Officers commissioned from other sources were released from active duty. In recent years, with promotions being reduced, I have been told by nonselectees that the Military Personnel Center cited their late selection to "regular" as a factor in their failure to be promoted. I am sure many other factors drive the disparity between retention rates.

I believe in the Academy and believe it should be retained, but I support measures to make it more economical. I also support the requirement to keep active-duty officers as instructors. It is important for cadets to interact with people who will soon be their peers. An Academy graduate is much better informed when he comes on active duty than is someone commissioned from another source. . . .

I never met any officer who clearly stood head and shoulders above his peers because he had graduated from the Academy. I have met and served with some terrific officers who happened to be Academy grads. When I climbed in the cockpit of my aircraft, the commissioning source of the crew was never a consideration. Let's keep the Academies, but let us also keep their product in perspective.

Lt. Col. Patrick M. St. Romain, USAF (Ret.)
Owego, N. Y.

Asking Lt. Gen. Bradley C. Hosmer about the Academies is like asking a lawyer whether there are too many lawsuits. Is a current Superintendent and three-star USAFA graduate an impartial judge?

Academy graduates are not smarter, more loyal, better warriors or leaders, or more inclined toward service. Consider Gen. Colin Powell and many other citizen soldiers who have served this nation so well.

Without getting into the merits of a broader, more "real" education vs. the more sterile and forced Academy version, I believe we get the same product from all sources: an O-1. They just cost ten times more from an Academy. We all come in as the same "brown bar FNG"—nothing more, nothing less—and then develop leader-

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

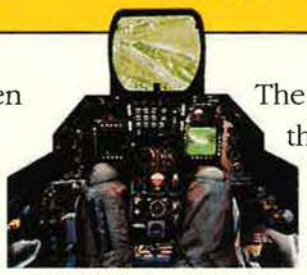
TIMES CHANGE. SO DO F-16S.

The world has seen some dramatic changes since the first F-16 was introduced. The Berlin Wall has come down. The Soviet Union and Warsaw Pact have been dissolved. And new potential trouble spots have emerged.

Dramatic changes in weapon technology have also taken place. Fighter aircraft have improved radar capabilities, faster computers and more advanced weapons.

Through the years the F-16 has proven it can truly stay ahead of the threat.

Its ability to continually adapt new avionics and weaponry has led to an incredible service record, including 65 aerial dogfight victories, with no losses.



F-16 (Night Attack) Cockpit

The F-16 was the workhorse of Desert Storm. It flew 13,500 missions and had the highest readiness rate of any fighter in theater.

With LANTIRN and GPS, F-16s were the premiere scud hunters.

The F-16 we're building today incorporates literally hundreds of new state-of-the-art technologies.

Pratt & Whitney F100-PW-229

The entire cockpit has been modernized. Engine thrust has been increased 25%, and there is a choice of the world's two best fighter engines manufactured by Pratt & Whitney and General Electric.

We've added beyond-visual-range firepower with Sparrow and AMRAAM radar missiles, night/all weather attack and autonomous precision attack with LANTIRN, IIR Mavericks, and laser guided bombs; anti-radar attack with HARM; and anti-ship with Penguin.

While the F-16's combat capability has been significantly enhanced, it was not done at the expense of operation and support costs. In terms of reliability, maintainability, readiness and lifecycle cost, the F-16 remains the best frontline fighter in the world.

And that's something we never intend to change.

General Electric F110

Lockheed
Fort Worth Company

AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

Publisher
Monroe W. Hatch, Jr.

Editorial

Editor in Chief
John T. Correll

Executive Editor
Robert S. Dudney

Senior Editor
James W. Canan

Associate Editors
Tamar A. Mehuron, Frank Oliveri

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

Managing Editor
Francine Krasowska

Assistant Managing Editor
Daniel M. Sheehan

Director of Production
Robert T. Shaughness

Art Director
Guy Aceto

Assistant Art Director
Sherryl Coombs

Research Librarian
Pearlie M. Draughn

Editorial Associates
Grace Lizzio, Doug Stucki

Administrative Assistant
Wendy L. Rivera

Advertising

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

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

US Sales Manager
By Nicholas • 203/357-7781
Stamford, CT

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

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

BPA Circulation audited by Business Publication Audit

Letters

ship in "real life" squadrons and offices.

The cost is extreme. The true cost of an Academy O-1 is really the annual budget of the Academy divided by the number of annual commissioned graduates. Graduates ought to sign on for twenty years minimum up front.

To say Academy graduates "stay better," measured by just sixteen percent more still serving after twenty years, is at best weak and at worst hurtful. "Zoomies" are more likely to serve full careers in a system that takes care of them.

A more telling stat is retention at end of first commitment. Not too long ago, Academy grads had the worst rates, with ROTC higher and OTS best—perhaps indicating the sorting of values that college students go through before seeking a commission.

The Academies are not economically justifiable and have not been since ROTC and OTS started. USAFA was started for reasons of pride, tradition, and "We deserve ours, too." To say otherwise is not living up to our commissions.

Close all of the Academies and turn the great USAFA physical plant into a consolidated professional military education center for all of DoD.

Maj. J. A. Clark,
USAF (Ret.)
Salt Lake City, Utah

And Credit for All

Could we please give credit to *all* who merit it, for once? Over the past several months, numerous articles and letters in AIR FORCE Magazine gave credit to those who made the F-117A Stealth fighter such a milestone in aviation. Yet the letter "Other Pilots at Tonopah" *[June 1993, p. 7]* falls far short of extending that congratulation to *all* the men and women who made the program the standard for aircraft builders and the military.

The contractor visionaries and a seasoned team of military and contractor pilots were key players in the program's success. Having been with the F-117A program since 1982 and currently assigned with the 410th Test Squadron—the F-117A flight test unit—I would like to see credit go to all the people who earned the program aviation awards and the respect of military personnel throughout the world.

Al Whitley did what any commander could have done—take a combat-ready unit that had honed its mission readiness with years of training, mostly in total darkness, into battle and execute with precision the taskings of headquarters. Group commanders from the early years of the 4450th Tactical Group spent years laying the groundwork, developing, acquiring, refining, and establishing capabilities for a unique weapon system. They also overcame a battery of hurdles, both from pilot and maintenance standpoints, while maintaining the veil of absolute secrecy.

NCOs who "hot-bunked" in the first years at Tonopah (two people assigned to one bed, each working a twelve-hour shift) were important contributors to the contractor's success. . . . Civilian and military pilots, contractor and military maintenance crews, engineers, designers, analysts, programmers, procurement specialists, and the entire network of contractor, civilian, and military security and support agencies—including the folks who saw that personnel were well fed and that their "off-duty" time was filled with activities and the comforts of home—made the F-117A program an unequaled success.

It's not the accomplishment or leadership of one person that made the word "stealth" a household term. No CEO or commander would have the laurels to enjoy from this program had it not been for the dedication, ingenuity, and team spirit of thousands of individuals cooperating to make the F-117 Stealth fighter a reality and giving birth to the evolution of future stealth technology. . . .

MSgt. Michel A. R. Marichal,
USAF
Rosamond, Calif.

Proper Medication

I thoroughly enjoyed "The Docs and the Jocks" *[August 1993, p. 38]*. However, I believe your statement on the number and kinds of self-medication aircrews may take is incorrect. You also neglected the role aerospace physiology plays in aircrew health and safety.

In May 1991, the Surgeon General of the Air Force issued a list of self-medications aircrews may take without seeing a flight surgeon. Five, not three, medications are allowed. Afrin is not one of them. The approved list consists of aspirin and Tylenol for occasional one-time use, topical medications (skin ointments, salves, etc.), antacids, Pepto Bismol or the chemical equivalent, and hemorrhoidal suppositories. Afrin was not approved because it may encourage flying with a cold. . . .

While aeromedical services primarily encompass flight medicine, bioenvironmental engineering, and military public health, an often neglected

partner is aerospace physiology. Aerospace physiology units often work very closely with, and sometimes for, the flight surgeon. It is easy to see why we are often overlooked. Few bases possess aerospace physiology units, and the only time most aircrews think of us is every three years when it's time for their chamber ride. . . .

While often mistaken for flight surgeons, aerospace physiologists are specialists not only in physiology but also in human factors, life support equipment, flight safety, and mishap investigation. We are often consulted by flight surgeons to help maintain aircrew health and safety. While physiologists are maligned by some, most aircrews would agree aerospace physiology is a valuable asset.

Todd S. Dart
Edwards, Calif.

Childish Criticisms

As a member of AFA for more than thirty years, I have been bothered more and more of late by the ridiculous, parochial, almost childish criticisms published in the "Letters" department.

Some are valid, and probably worthy of mention, but most—such as the letter from Captain Scharven *["May Issue Miscues," August 1993, p. 4]*—leave me exasperated and fuming.

Get a grip, Captain. No one cares if a somewhat obscure, but probably competent, aerial port squadron belongs to USAFE or Air Mobility Command.

While I'm sure the squadron does its job in fine fashion, as do the vast majority of Air Force units, it is simply not that critical to the hundreds of thousands of readers of AIR FORCE Magazine—particularly in the Almanac issue with its thousands of specific facts.

Captain, the Air Force does not revolve around your limited world—nor do most of us lose any sleep if the magazine errs occasionally. Your criticism was mean-spirited and petty.

Lt. Col. Jack Doub,
USAF (Ret.)
Lake San Marcos, Calif.

Willing to Take Less

I disagree with the thrust of "The Chosen Few" *[June 1993, p. 2]*. The pay of service personnel (including the tax-free allowances), vacation, sick leave, medical attention, and no-cost retirement pay are very expensive and generous. When you add the Social Security payment, the retired pay of officers ranked O-5 and above is actually more than it needs to be. If the reductions and adjustments are held to the group above O-5, nobody will be hurt.

Active-duty personnel below O-5 should be protected from pay cuts. Maybe there is room for compromise.

For a long time, as an O-7, I have expected to have my retired pay reduced. In fact, I don't see how the US government can afford to be so generous. I'm not going to refuse the current amount, but I will be a part of a concentrated effort to reduce the forty percent of the defense budget that goes to paying personnel costs. I'd be willing to take less.

In addressing such problems, why doesn't AFA take a less radical position and promote a compromise? Why not work hard at reducing Social Security payments to individuals with substantial outside income? Maybe this would help keep the COLAs of lower grades from being reduced. Along this line, most of the lower-graded personnel who retire do so at twenty years and shouldn't expect to live without working until they reach their sixties. Both twenty- and thirty-year retirees have ten to twenty years to find a second career with excellent financial benefits.

Brig. Gen. John W. Harrell,
USAF (Ret.)
McLean, Va.

The Chart Page

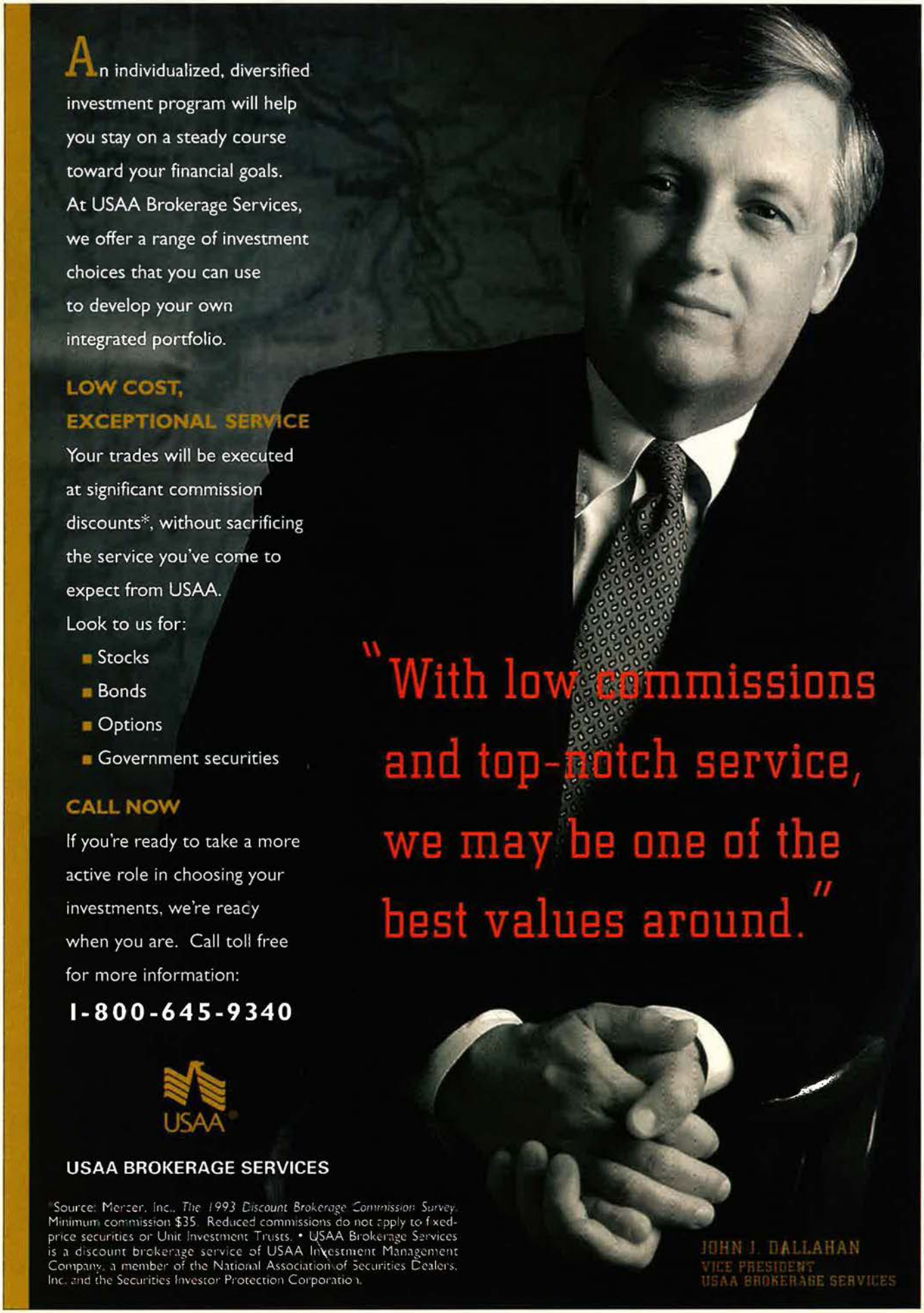
By Tamar A. Mehuron, Associate Editor

Geography of Major Armed Conflicts in 1992

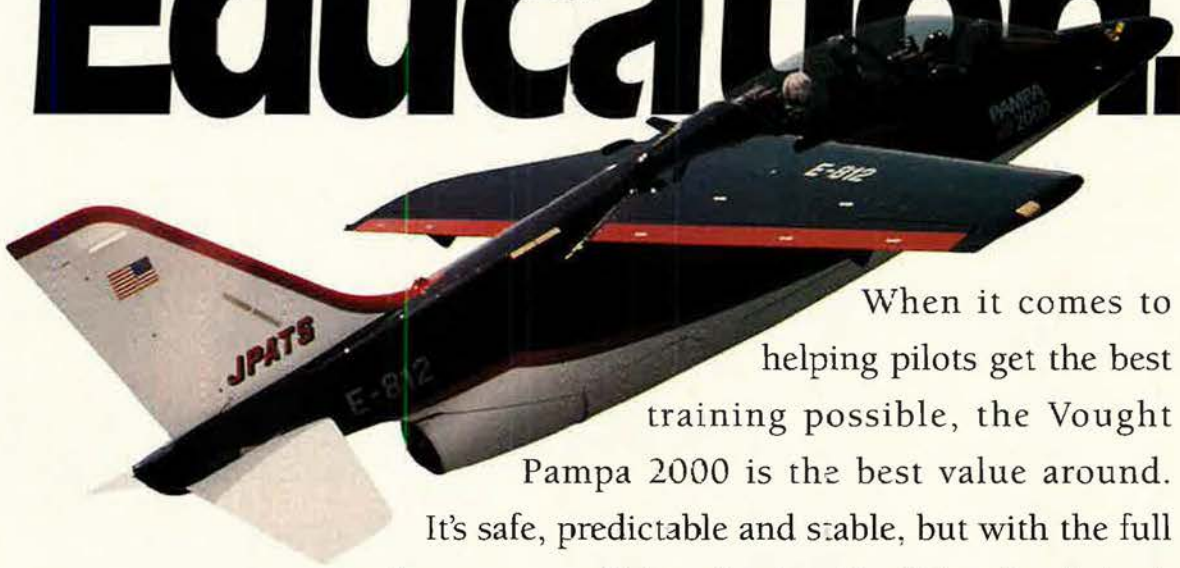
Major armed conflicts were waged in twenty-nine locations around the world in 1992. Wallensteen and Axell define a major armed conflict as having "more than 1,000 deaths during the course of the conflict." With the exception of India-Pakistan, all of the conflicts were intrastate.

In all, fifty-four armed conflicts (major and minor) were waged in forty-one locations during 1992. Minor armed conflicts are those with fewer than 1,000 battle-related deaths during the course of the conflict.

Source: Peter Wallensteen and Karin Axell, "Armed Conflict at the End of the Cold War, 1989–92," *Journal of Peace Research*, Vol. 30, No. 3, 1993, pp. 331–346. Department of Peace and Conflict Research, Uppsala University, Sweden.


An individualized, diversified investment program will help you stay on a steady course toward your financial goals. At USAA Brokerage Services, we offer a range of investment choices that you can use to develop your own integrated portfolio.
LOW COST, EXCEPTIONAL SERVICE
Your trades will be executed at significant commission discounts*, without sacrificing the service you've come to expect from USAA.
Look to us for:
Stocks
Bonds
Options
Government securities
CALL NOW
If you're ready to take a more active role in choosing your investments, we're reacy when you are. Call toll free for more information:
1-800-645-9340
USAA
USAA BROKERAGE SERVICES
"With low commissions and top-notch service, we may be one of the best values around."
JOHN J. DALLAHAN
VICE PRESIDENT
USAA BROKERAGE SERVICES
*Source: Mercer, Inc., The 1993 Discount Brokerage Commission Survey. Minimum commission $35. Reduced commissions do not apply to fixed-price securities or Unit Investment Trusts. • USAA Brokerage Services is a discount brokerage service of USAA Investment Management Company, a member of the National Association of Securities Dealers, Inc. and the Securities Investor Protection Corporation.

America's Best Value In Higher Education.



When it comes to helping pilots get the best training possible, the Vought Pampa 2000 is the best value around. It's safe, predictable and stable, but with the full performance qualities of a jet. Qualities that help it produce better-trained pilots at a lower cost.

The Pampa 2000 is also a crew chief's dream of easy access and maintainability. And its outstanding reliability means it spends less time in the hangar and more time in the air.

All of this makes the Pampa 2000 the best value for JPATS. Ready now to conquer the demanding training challenges of the 21st century.

Vought aircraft company

Pampa 2000 JPATS Team: Vought Aircraft • FMA • AlliedSignal • UNC

Capitol Hill

By Brian Green, Congressional Editor

Readiness at Risk

If present trends go unchecked, mission capable rates could drop six percent by next year, then get "rapidly worse."

IN NUMEROUS hearings and official presentations in recent months, Gen. Merrill A. McPeak, the Air Force Chief of Staff, has given Congress a blunt warning. He says that the service's readiness to go to war is at risk.

Today's force continues to be strong, said the General. However, he warned, if current trends go unchecked, USAF mission capable rates could fall six percent by next year. Soon after that, readiness would get "rapidly worse."

General McPeak's most detailed warnings could be found in his written answers to formal questions from Sen. John McCain, the Arizona Republican who serves on the Armed Services Committee. The General identified ten key readiness-related factors. Unless the US takes action, he said, problems here may create readiness woes on a scale unseen since the 1970s—a period widely remembered as the era of the "hollow force."

Topping the ten-point list was emergence of morale problems, stemming largely from erosion of service pay and benefits. Pay and compensation concerns are now the leading cause of growing dissatisfaction among enlisted troops, said General McPeak. As points of concern, these rate almost as high among officers.

Military pay fell twelve percent behind private-sector pay in the past decade. This erosion raises "significant risks," said General McPeak. Well-trained men and women form the centerpiece of readiness, he explained, adding, "We must be willing to pay our members in a manner commensurate with the quality we want."

Another key factor, said the General, is the loss of experience caused by the service's budget-driven rush to cut Air Force end strength. He noted that the problem is compounded by congressional tinkering with the military retirement system, which is the top incentive to make the military a career, and that attacks on this system are especially destructive to retention.

Proposals made earlier this year would have slashed the purchasing power of a master sergeant's retirement pay by forty percent by age sixty-one, according to the Chief of Staff. Recent legislation will delay cost-of-living adjustments for retirees by thirty-nine months over five years.

General McPeak said that to "maintain readiness over the long term we must . . . strike a balance between youth and experience in our force." Without that balance, the "drain of experience and leadership" becomes a serious problem.

Inadequate funding for exercises and flying hours already has had an impact on readiness, said the General. He noted that funds for such advanced training exercises as Red Flag, Green Flag, and Maple Flag were reduced by eighty percent as a result of Fiscal 1994 defense budget cuts.

Eighty percent of the Air Force's 1994 continuation training exercises were unfunded. Bomber exercises were cut by fifty percent. Major joint exercises have been chopped as well. The problem is expected to get worse through Fiscal 1997.

The congressional cap on procurement of spare parts, said General McPeak, threatens to devastate readiness. In order to reduce what they call "excess" inventories, the lawmakers have limited new procurement of spares to sixty-five percent of all sales by the Defense Business Operations Fund to service weapon users. This cap and other moves will "result in havoc on the logistics community," said the Air Force Chief of Staff.

In the long term, he said, capping the purchase of spares will reduce the availability of critical items, and recovering from this situation would not be easy. Stockpiling new spares would take months, and the "bow wave" of deferred repair work could well crash around the force.

General McPeak is also concerned about a "funding drain" stemming from maintenance of "too much infrastructure." The Air Force, he contended, has kept a balance between cuts in investment accounts and cuts in personnel and operating accounts during the drawdown but still has too much infrastructure, particularly in depot capacity.

While infrastructure has shrunk by only about fifteen percent, active-duty force structure has declined nearly fifty percent and end strength by thirty percent since peaking in the 1980s.

General McPeak noted the shortage of money for real property maintenance. He said that "active-duty troops are being diverted to self-help projects" and further shortfalls "will adversely impact mission readiness."

Five other factors cause General McPeak considerable concern:

- Changes in the active-duty/Air Reserve Component mix, brought about by the congressional desire to save money. The stronger emphasis on Guard and Reserve forces at the expense of active units, said the General, could "leave the force unable to meet short-notice requirements and needed [operations tempo] for service and joint training."
- The Air Force's absorption of "nontraditional missions," such as humanitarian and peacekeeping operations, which is causing a drain on training and maintenance resources. Operations in Somalia, northern and southern Iraq, and Bosnia have also drawn from readiness funding.
- Washington's tendency to make force reductions that are not based on a specific strategy and could leave the Air Force saddled with insufficient or inappropriate units, plans, and weapons.
- Congress's imposition of across-the-board, nonprogrammatic cuts, rather than targeted reductions, as the "method of choice" for achieving budget savings.
- The increasing number of congressionally mandated force structure decisions or modernization programs that are not based on actual military requirements. ■

Washington Watch

By James W. Canan, Senior Editor

The Painful Transition

Deputy Secretary Perry sees the defense market stabilizing around the level of the 1970s, leaving a much smaller but "perfectly viable" industrial base.

For the defense industry, things will get worse before they get better. Industry faces "a very painful transition" in adapting to a shrinking military market and to unfamiliar ways of doing business with the Pentagon. Companies will have to scale down and consolidate. Those that survive the shakedown will constitute a smaller but stable and healthy industry.

Deputy Secretary of Defense William J. Perry delivered this message in an interview not long ago. He made it clear that the defense procurement pinch and new Pentagon buying policies and practices will force major changes on the industry. He also emphasized that the Pentagon will take a hands-on approach to helping the industry through the tough times ahead.

Will such an approach have the earmarks of a so-called "industrial policy," one of direct government intervention in corporate affairs?

"Not in the sense that we'll be trying to direct or influence how the companies run their businesses," Mr. Perry replied. "We will not try to do that. Market forces will continue to drive that. But we do have a responsibility to give the companies full information on those markets, so that they'll understand [them] and have a realistic basis for planning."

Pentagon fudging of such information through the years has often resulted in ill-advised strategies and misguided marketing on the part of defense contractors, he claimed.

Mr. Perry also underscored the following points:

- The Pentagon will buy increasing quantities and types of commercially available hardware. It will dispense with military specifications wherever possible in moving to integrate the US defense and commercial industrial bases for its purposes.
- The Pentagon puts a premium on combat readiness of military forces and, thus, will maintain its operations and maintenance (O&M) and personnel budgets "at whatever level is necessary to sustain whatever force size we have."
- Research and development funding "will take the heat" as defense budgets diminish. Funding for the technology base will hold its own, but systems development funding will fall off.
- The next generation of military systems will feature "important technological improvements," but none so dramatic as those that gave rise to the present generation of precision guided munitions, stealthy aircraft, and digital computers and communications, for example.

In the Beginning

Mr. Perry had a lot to do with the birth and upbringing of those technologies. As Under Secretary of Defense for Research and Engineering throughout the Carter Administration, he supervised the development of PGMs, stealthy aircraft, and very-high-speed integrated circuits, among other technological triumphs. The F-117 Stealth fighter came into being and the B-2 bomber had its beginnings during his term as USDR&E. He was the principal advisor to Secretary of Defense Harold Brown on all matters of technology, communications, intelligence, and atomic energy.

Mr. Perry came to the Pentagon in 1977 from ESL, Inc., a California company specializing in electromagnetic systems development that he had cofounded in 1964. He left the Pentagon in 1981 for academic and business pursuits, including a professorship at Stanford University and directorships of FMC Corp. and United Technologies Corp. He served on such influential advisory panels as the Packard Commission, wellspring of many important defense acquisition and management reforms, the President's Foreign Intelligence Advisory Board, and the Senate Intelligence Committee's Technical Review Panel.

With such hard-to-beat credentials, Mr. Perry seems superbly prepared to tackle the broader set of problems he faces this time around, as the Defense Department's second-in-command and chief operating officer. It won't be easy. Making sure that the Pentagon spends its money wisely and well is a major part of his job, and that money is harder to come by all the time.

Mr. Perry's outlook for the defense industry gives him a strong sense of *déjà vu*. He expects the defense procurement budget will have shrunk "sixty to sixty-five percent" from 1986 to 1996, causing "a very substantial market compression . . . to the level of the mid- to late 1970s." This will result in a defense industry "about the same size" as the industry of those days, one that was, in his experience, "perfectly viable."

"The difficulty for the industry," Mr. Perry continued, "will be in getting from here to there. Going through the transition will be very painful. The Defense Department cares a lot about the outcome. We want to minimize turbulence and disruption while the transition is going on."

Act, Don't React

He said the Pentagon "will try to influence [the course of] the transition so that, when we arrive at a steady state, we will have a healthy, effective defense industry." His advice to the industry: "Smaller is better."

"Nearly all of the defense companies will have to come down in size," the Deputy Defense Secretary declared. "They know it, and they're moving in various ways to do that, some more effectively than others. The key to doing it effectively is to do it proactively and not reactively."

Companies that wait too long to cut back "always find themselves in a loss position or in an excessively high overhead position," he said, whereas those that don't "can hold down their overhead rates and maintain a viable business while downsizing."

The Defense Department must help the companies downsize in a timely manner, Mr. Perry contended. How? By providing them with "realistic and honest FYDPs" (Future Year Defense Programs), instead of the "grossly over-optimistic FYDPs" of previous years.

"The problem with those FYDPs," he continued, "is that they were taken seriously. Program managers based their planning on them. That influenced people in industry who were doing the marketing, sizing the staffs, and so on. They were overly optimistic, based on the unrealistic FYDPs, and this caused the industry to be too slow in downsizing."

He continued, "The downsizing, the mergers, the consolidations—all activity in the industry—will be driven by market forces, and the proper role of the Defense Department is to provide the industry with data that allows it to do intelligent planning on the market. We have a responsibility to help industry with honest and carefully prepared FYDPs."

Will the Pentagon be tempted to throw its weight around a little too much in industrial circles?

"I don't think so," Mr. Perry replied. "I think it will become clear, on a step-by-step basis, that we will not interpose ourselves in mergers and acquisitions, or in trying to bail out a company that's failing. That's what I would call an industrial policy. There will be pressures on us to do that, and we will resist those pressures."

On the other hand, he said, the Defense Department has "a responsibility to clearly state our position that we support the consolidation of the industry," and he acknowledged that this may bring the Pentagon into conflict with the Justice Department.

"There will be tension between the government's concern for antitrust in the consolidation of the industry, and the Defense Department's concern for an efficient industry through consolidation and merger of its companies. We are prepared to take the position that mergers and consolidations are in the interests of the government, even though they reduce, theoretically at least, the number of companies that can compete on given programs."

In Mr. Perry's view, the US defense industrial base will become too small to accommodate more than one manufacturer for most major weapon systems, such as battle tanks and submarines. Aircraft companies are another story. He indicated that there should be enough aircraft programs to keep several airplane-makers going, in teaming arrangements, through the lean years ahead.

Sufficient Horsepower

Will the Pentagon be able to sustain the momentum of high-leverage military technologies, such as PGMs and stealth?

"Yes," Mr. Perry replied. "We came forward with those technologies and others at a time, in the 1970s, when the defense R&D budget was smaller than the R&D budgets we're anticipating. We managed to carry them forward to full-scale development in some cases and all the way through FSD in many cases. We took the [sea-launched] cruise missile program all the way to IOC [initial operational capability] by the early 1980s. The F-117 and ALCM [air-launched cruise missile] both achieved IOC in 1981. . . . The B-2 and the Advanced Cruise Missile were stealth technology programs, just starting to ramp up.

"It is important to note, though, that [the Pentagon] could not have produced and deployed all those systems and others if the defense budget had not gone up in the 1980s, and that the military developed the tactics and the doctrine to use them properly. Military leaders had to invent a new way of fighting with those systems, and they got it right—and right the first time."

Technology-base programs of the late 1970s brought forth many major systems that scored high in the Persian Gulf War. Likewise, such programs currently in progress "will determine the effectiveness of US military forces during the first decade of the next century," Mr. Perry predicted. "We have a responsibility to sustain the technology base for important programs, so we will keep technology-base funding constant."

Information technology ranks high among Pentagon priorities. "It will be important," said Mr. Perry, "for us to apply modern information technology—computers and software—to manufacturing and design processes, to war-gaming, to military planning and management processes, to a whole big sweep of things."

Does this mean less emphasis on things that shoot?

"No," he replied, "we'll be looking ahead in our technology programs to the next generation of weapon systems, but I don't think we'll have the dramatic increase in effectiveness that we had in going to this generation."

He noted, for example, that many past-generation military systems employed vacuum-tube electronics, whereas those of the present generation incorporate solid-state, digital electronics, with integrated circuits and software, and are far more capable and reliable as a result. Current systems represent "the first serious application of modern information technology," he said.

No Great Leaps Forward

Progressing to the next generation of systems "won't be like going from vacuum tubes to VLSI [very-large-scale integration] circuits in one swoop," he said, "but we can make some important improvements nevertheless."

The Persian Gulf War showed the way. "We patted ourselves on the back about how well our technology worked in Desert Storm, but we also made critical assessments of where it didn't work, and where it could have worked a lot better," Mr. Perry said. "In our next generation of systems, we have to be prepared to deal with a more sophisticated adversary."

In Desert Storm, "there were some things that could have hurt us and a few that did," he said. "One [problem area] was the use of deception and decoys, and not just with Scuds. They were just the most prominent examples.

"Our PGMs work great if they know where they're going. If they don't know, or if they go to a decoy, then they're just a wasted shot. So the next generation of our PGMs and the intelligence systems behind them have to have some way of dealing with deception and decoys."

How? "By improving on existing technologies—[those of] JSTARS, for example."

Mr. Perry called the E-8A Joint Surveillance and Target Attack Radar System development program a "giant leap forward—putting sensors in an airplane with a real-time link to a [target] assessment center and a real-time link to strike aircraft." Noting that two Joint STARS developmental aircraft did great work in Desert Storm, he said they can do even better.

The idea is to augment their imaging-radar and moving-target-indicator (MTI) capabilities with sensors that can distinguish between fake missile launchers and the real thing. "The decoy problem in general is very difficult, complex," he said. "Generically, the way to attack it is with multispectral sensors that look at targets in different ways. The decoy that fools one spectral band won't fool another spectral band."

The Gulf War also demonstrated a crying need for autonomously guided, all-weather, "fire-and-forget" PGMs, Mr. Perry said.

"Most of the PGMs we used in Desert Storm were laser-guided bombs, slightly improved but conceptually the same [as those used in the Vietnam War]." He said they "worked very well"

but might not have done so "in an environment where the [aircraft] doing the sensing and launching was under attack or harassment."

In such circumstances, using laser-guided bombs is "a tough job," Mr. Perry said, "because you must keep the laser beam on the target while the bomb is on the way there and after you've signaled that you're attacking the target."

"What we really need," he continued, "is the next generation of those systems—fire-and-forget missiles with automatic ability to stay on the target all the way in, enabling the launching airplane to turn around and get out of there."

Fast Track for Fire-and-Forget

He noted that there are "a few fire-and-forget missiles actually deployed" in the ground-attack mode, notably "the imaging infrared Maverick" that came into play in Desert Storm. In general, though, the development of such weapons "languished in the last ten years," he said.

"I want to pick that up again and get the fire-and-forget weapons back on the fast track," Mr. Perry declared.

There will be relatively few fast tracks for new weapons. "The biggest chunk of the R&D budget goes for full-scale development of weapon systems, and that is going to go down," Mr. Perry said. "It's quite clear that we're not going to have enough money to continue FSD of all the next-generation weapon systems that we might be interested in having."

He anticipates that the defense budget will drop "by forty percent in real terms" from 1986 to 1996 ("that's the best handle I can get on the numbers"). The procurement and R&D parts of the budget will continue to drop the most and the personnel and readiness parts the least, he said.

Why? He explained that the active force structure and, thus, the personnel budget are programmed to go down by about one-third, which means that "our O&M budget will probably go down by about the same percentage, because we will maintain readiness at whatever level is necessary to sustain whatever size force we have.

"This leaves the modernization parts of the budget to take the heat. The only ways of beating that problem are to stint readiness, which we've resolved not to do, or take a deeper cut in force structure—and we have decided that we won't cut deeper than thirty-three percent."

To make the most of its modernization money, the Pentagon will concentrate on upgrading current systems, on the "rollover" of new technologies into development programs that advance to the point of, but not into, production, and on selective, low-rate production of high-leverage "silver-bullet" systems.

The silver-bullet concept is "the reason for sustaining the technology-base part of the budget and for nurturing some of the full-scale development part," Mr. Perry explained. "We don't want the compression of the budget to uniformly wreck everything. We want to be able to pick out the ideas that are really important to our future—the silver-bullet ideas, the ones that move technology into the next generation—and keep those funded."

International systems development programs are gaining favor in the Defense Department. "We need to look at the international aspect of the defense industrial base, focusing on the development of the next generation of equipment," said the Deputy Defense Secretary. Cross-national cooperation "makes more sense as everyone's defense budget decreases," he contends. "Put another way, it makes no sense at all for the United States and Germany and France and Britain each to develop a battle tank for the twenty-first century. If there is to be a tank development program at all, it ought to be cooperative."

Mr. Perry made it clear that the Pentagon will not go out of its way to buy European-made systems or to promote sales of American-made systems to NATO Allies. "To the extent that the [NATO] two-way street means buying and selling each other's equipment and trying to work out balances of trade and so forth, we're not going to put any emphasis on that part of it," he explained.

Minimizing Overhead

"We have a big challenge," the Deputy Defense Secretary asserted, "but the resources are there for us to meet it, if we manage them right." Requisite to this is a streamlined defense industry "operating efficiently and not carrying a lot of unnecessary overhead," he claimed, and "we have a responsibility to get our acquisition system reformed so that we're not requiring the industry to carry a lot of overhead." Thus the Defense Department is heading for "a major change in the way we do business—shifting to commercially available products" whenever possible.

"If we succeed, the efficiencies and the savings will be enormous, because we will be able to tie into the production runs of subsystems and components that are being developed and produced for commercial and industrial uses," the Deputy Defense Secretary declared. "We're talking here about cutting the cost of buying such things to a half or a third or a fourth of what they now cost—huge savings."

The buy-commercial practice will not apply to "defense-unique systems and subsystems, such as radiation-hardened semiconductors, for which there's no counterpart in industry," he explained. Defense-unique systems will continue to draw "the lion's share of our development and production resources." But DoD has its sights on "commercially available products for the big bulk of what we buy," much of it computers and related electronic gear.

"To make the shift," Mr. Perry continued, "we'll need to conform to commercial buying practices and to industrial specifications, rather than maintaining our own unique military specifications. That will require an enormous shift of our system."

He admitted that "it will be difficult" to implement the buy-commercial policy in military and industrial circles where military specifications have long been law. "Some segments of the industry will lose their competitive advantage if we pull away from military specifications," he said. "For example, some companies set up to produce milspec semiconductors cannot compete in the commercial field. Their semiconductors cost two to five times more than comparable non-milspec semiconductors. If we withdraw the requirement for milspecs, they're going to go out of business."

On the other hand, he said, putting the policy into effect "should now be possible, for a number of reasons"—the end of the Cold War, the glaring need to save money, the rearranging of acquisition bureaucracies, and, not least, "because it has wide acceptance in the military today."

"In Desert Storm," he continued, "a good many of our senior military leaders saw commercial equipment being put to good use, equipment like GPS [Global Positioning System] receivers and PCs. Commercial laptop computers proliferated all over the desert. The troops found all sorts of ways of using them very effectively."

As a result of such experiences, "a lot of the senior military leadership has come to believe that there's an important application to be made of commercial components and commercial subsystems," Mr. Perry said. ■

Aerospace World

By Frank Oliveri, Associate Editor

"A Handful of Bullies"

When Secretary of Defense Les Aspin unveiled the results of his "Bottom-Up Review" of defense needs, the Air Force learned it was marked for a painful new cut in force structure. It also heard that it would be able to go forward with its highest-priority modernization programs in Fiscal 1995–99.

The decisions, made public in September, swept away the remnant of the "Base Force" plan—President Bush's blueprint for a 1.6-million-strong military. The new plan envisions 1.4 million troops in a "lean, mobile, high-tech" force.

Such a defense force, observed Mr. Aspin, will be sufficient to deal with "a handful of bullies" abroad.

The Base Force called for USAF to drop from thirty-six fighter wing equivalents in 1990 to twenty-six in 1997. In March, the Clinton Pentagon chopped off two more FWEs. In the latest force sizing, Mr. Aspin cut four more wings, leaving twenty in 1999. Thirteen would be active-duty, and seven would be in the Guard and Reserve.

The review said the Air Force could operate up to 184 long-range B-1, B-2, and B-52 bombers, generally tracking with Base Force plans.

A senior Air Force official said USAF end strength would be slightly higher than 400,000 in Fiscal 1999, down from 430,000 in the Base Force plan.

Modernization Kept on Track

In his package of September decisions, Mr. Aspin cut the number of major aircraft development programs but seemed bent on maintaining a decisive high-tech edge in those that survived.

The Pentagon chief noted that the US armed forces had been moving forward with five tactical aircraft programs—USAF's F-22 fighter, F-16 fighter, and Multirole Fighter (MRF) and the Navy's F/A-18E/F jet and A/F-X system.

Mr. Aspin canceled the MRF and the A/F-X, effective immediately, and ordered an end to F-16 purchases after the 1994 buy.

However, his review concluded that the Air Force should press on with the stealthy F-22 air-superiority fighter and even build into the jet a ground-attack capability. One top Air Force officer claimed the F-22's initial ground capability would approximate that found in the stealthy F-117.

The Navy got approval to go ahead with the beefed-up variant of its current F/A-18 strike fighter.

The Air Force and Navy would supplant the A/F-X attack aircraft with a Joint Advanced Strike Technology program. A senior DoD official claimed that the program would produce a number of flying prototypes.

The review affirmed the Air Force's move to strengthen the conventional capabilities of the bomber force. Specifically approved were plans to develop smart and brilliant munitions, such as the Joint Direct Attack Munition, the Joint Standoff Weapon, and the Sensor-Fuzed Weapon.

The C-17 transport was not considered in this review, but the need for robust airlift capability was validated. The report also strongly supported the E-8 Joint Surveillance and Target Attack Radar System and Milstar satellite program.

New Air Force Secretary Steps In

The Senate confirmed Dr. Sheila Widnall in August to be the twenty-second Secretary of the Air Force.

USAF photo by Sgt. Tina Richards

Brig. Gen. James C. Wilson, Jr. (second from right), commander of the 28th Bomb Wing, Ellsworth AFB, S. D., greets one of the two B-1 crews returning from the first around-the-world flights of B-1Bs. Crew members are (left to right) Capt. Pat Hobday, Capt. Vic Wade, Capt. Marty Case, and Capt. Chuck Petty.

Ms. Widnall, an aeronautical engineer, was confirmed by voice vote. The action made her the first woman in US history to serve as the civilian leader of a branch of the armed forces. Ms. Widnall succeeds Donald Rice, who was Air Force Secretary from May 1989 through January 1993. Michael Donley served as interim acting secretary.

Ms. Widnall was formerly an associate provost at the Massachusetts Institute of Technology.

General Shalikashvili Steps Up

President Clinton nominated Army Gen. John M. Shalikashvili to be the next chairman of the Joint Chiefs of Staff.

The move put General Shalikashvili in line to replace Gen. Colin L. Powell, who had set his retirement date for September 30. General Shalikashvili, the Supreme Allied Commander, Europe, and commander in chief, US European Command, climbed through the enlisted and officer ranks after emigrating from Poland to this country at age sixteen.

General Shalikashvili, fifty-seven, entered the Army in 1958 as a private and was selected to attend Officer Candidate School one year later. Much of his career has been spent in Europe, but he also served tours in Vietnam and Korea. Most recently, he commanded the US humanitarian mission, aiding Kurds in northern hinterlands of Iraq.

General Shalikashvili served as an assistant to General Powell from August 1991 to June 1992. Unlike his predecessor, General Shalikashvili has served as a division commander and a theater commander. General Powell had spent considerably more time in Washington in sensitive military and political posts.

USAF Restricts C-141Bs

The Air Force said in August that Air Mobility Command had grounded forty-five C-141 transports and banned another 116 from in-flight refueling.

The action will remain in effect while USAF conducts tests to determine the extent of newfound weep hole cracks. Weep holes are quarter-inch holes that allow fuel to flow between strengthening risers along the interior of the aircraft's inboard lower wing. If not fixed, the cracks could extend to underwing panels, causing fuel leaks and weakening the wings.

Because of earlier wing-cracking problems, USAF restricted all C-141s last May to no more than seventy-four percent of their normal load capacity. The Air Force said it will take about three months to inspect its inventory of 249 C-141Bs, which includes active-duty and Guard and Reserve aircraft.

The Air Force and Lockheed have determined that aircraft with more than 40,000 equivalent flying hours are at risk for weep hole cracks. Equivalent flying hours are computed using a formula involving actual flying time and stress incurred from low-level flight and maneuvering. Aircraft with 35,000 to 40,000 equivalent flying hours are also at risk but to a lesser degree. The aircraft banned from in-flight refueling fall into this latter category.

F-4G Attacks Iraqi Missile Site

In mid-July, an F-4G "Wild Weasel" aircraft patrolling the southern no-fly zone in Iraq fired a missile at an Iraqi surface-to-air missile site after being illuminated by tracking radar.

A flight of F-15s later observed what appeared to be a single SAM launch in the same vicinity, according to US Central Command spokesmen.

After the attack, all aircraft returned safely to base. Damage assessment was not possible. It was the second time in a month that Iraqi antiaircraft artillery radars had locked on to US fighter aircraft.

McPeak Targets Smokers

The Air Force has begun taking steps to eliminate smoking from its ranks, starting with a new policy that bans smoking in all Air Force facilities except designated recreation areas and government housing.

The new policy began in August following an official notification to commanders in July by Air Force Chief of Staff Gen. Merrill A. McPeak. "Tobacco use is inconsistent with a healthy, fit force," General McPeak said. "Health and fitness are force-multipliers. The Air Force will lead the way by fostering lifestyles that enhance overall readiness."

The Air Force also seeks to impose a similar ban for civilian workers.

The new initiative offers nonsmoking areas at morale, welfare, recreation, and services indoor activities where smoking is permitted; prohibits cigarette vending machines in the workplace; prohibits smoking by those attending formal Air Force schools; provides instruction for new USAF recruits about the danger of tobacco; makes nicotine gum and nicotine patches available at local medical treatment facilities; and increases stop-smoking programs at medical facilities.

F-16 Pilot Wins Jabara Award

Maj. Ali C. Frohlich, an F-16 instructor pilot based at Ramstein AB, Germany, won the 1993 Jabara Award for his assistance in saving a downed French pilot while enforcing the no-fly zone over Iraq.

The award is presented annually to an Air Force Academy graduate—active-duty or civilian—who makes a significant contribution to airmanship.

Major Frohlich, a 1980 Academy graduate, flies with the 86th Operations Group. He worked as a special assistant to the commanding general, focusing on air operations in northern Iraq and rescue of allied aviators.

When a French reconnaissance aircraft crashed in northern Iraq, Major Frohlich contacted French forces for information and took over as on-scene search-and-rescue commander. The Major brought combat aircraft into the area to provide cover for the downed pilot and the unarmed helicopter that rescued him.

The award is named for Capt. James Jabara, the first USAF ace of the Korean War.

US Fortifies Bosnia Support

The US Air Force strengthened NATO's support for the UN peacekeeping mission in Bosnia by sending forty aircraft to provide additional protection for peacekeeping troops.

The order authorized a phased deployment of thirty ground-attack aircraft, ten support aircraft, and about 1,500 personnel. The deployment includes twelve A-10 and OA-10 aircraft from Spangdahlem AB, Germany, and four AC-130 gunships from Hurlburt Field, Fla. The aircraft were deployed to Aviano AB, Italy.

The service also deployed five KC-135 tankers from Fairchild AFB, Wash., and five EC-130 airborne command, control, and communications support aircraft from Keesler AFB, Miss. The AC-130s were to operate from a base at Brindisi, Italy, and the KC-135s from Sigonella and Malpensa, Italy.

The Navy supports the mission from the aircraft carrier *Theodore Roosevelt* in the Mediterranean.

Operation Provide Promise aircrews have dropped more than 7,210 tons of food into Bosnia since February and have flown some 19,000 tons of food and medical supplies to Sarajevo in more than 1,600 missions.

In Operation Able Sentry, sixteen C-141 and C-5 transports delivered more than 500 tons of equipment to Macedonia. The US Army's Berlin Brigade deployed to contribute to the UN peacekeeping mission.

Russian Aircraft Intercepted

Two Air Force F-15C fighters from Elmendorf AFB, Alaska, intercepted a Russian Il-20 military reconnaissance aircraft off the western coast of Alaska in late July, the Air Force said.

The binational North American Aerospace Defense Command ordered the intercept after the Russian aircraft entered the US air defense identification zone. The four-engine turboprop aircraft remained over international waters and did not cross into US airspace. The aircraft made its closest pass by land at seventy miles off the coast of Cape Romanzof. This was the third intercept of Russian aircraft near Alaska this year.

AMC Helps Flooded Areas

Air Mobility Command aircraft and troops delivered sandbags and water-purification systems to flood-ravaged areas throughout the midwestern US.

At the request of the Federal Emergency Management Agency and US Forces Command, C-141s and C-5s flew more than thirty missions to Illinois and Iowa, delivering more than one million empty sandbags, which were subsequently filled to help stanch the flow of water from flooded rivers. C-5 aircraft delivered fourteen Army National Guard water-purification systems to Des Moines, Iowa, to relieve the danger and hardship caused by contamination of the city's water supply.

Air Force personnel throughout the Midwest helped fill sandbags to shore up threatened levees.

Mishaps Afflict Fighter Force

On July 27, a pilot was killed and another injured when their F-16s collided on the runway at Kunsan AB, South Korea. Lt. Col. Ralph E. Gardner, of Milton, Pa., died in the collision. He was taking off while another pilot, whose name was not disclosed, was landing, and their jets crashed. The second pilot ejected. He was treated at the base hospital and released.

On August 2, two F-16s from the 2d Air Delivery Group at Langley AFB, Va., were involved in a midair incident while en route to Europe. Both aircraft were damaged but were able to land safely at Plattsburgh AFB, N. Y., the Air Force said. Neither pilot was hurt.

On August 11, an F-16 pilot died when his jet crashed on the Nellis AFB, Nev., range complex. Capt. James H. Reynolds, Jr., an instructor pilot with the 414th Composite Wing at Nellis, was on a training mission when the accident occurred.

On the same day, an F-16 pilot safely ejected before his aircraft crashed into the Adriatic Sea off Croatia. The pilot, whose name was not released, was participating in Operation Deny Flight. He was returning from a flight over Bosnia when his aircraft malfunctioned. He was rescued by a UN helicopter and was returned to Italy by a C-130.

Focus on Long-Range Bombers

The force the US is building to contend with multiple regional contingencies must be stiffened with the striking power of long-range Air Force bombers.

So said Gen. John Michael Loh, commander of USAF's Air Combat Command, Langley AFB, Va. General Loh told a Senate Armed Services subcommittee that the US needs twenty B-2 Stealth bombers and production of precision guided munitions for the B-1B and B-52 bombers.

"Bombers have an agility that other assets cannot match," he said. "They can swing quickly from one target set to another hundreds and even thousands of miles away. They can demonstrate resolve without employing heavy-handed tactics, and they can bring significant firepower to bear without risking many lives."

General Loh said the US needs about 180 to 200 operational bombers but that to have that number available and ready for action, about 210 to 230 bombers must be kept in the active inventory.

The Air Force anticipates having Primary Aircraft Authorized totaling 184 bombers—sixteen B-2s, eighty-four B-1Bs, and eighty-four B-52s. This force would be drawn from a total force of twenty B-2s, ninety-five B-1Bs, and ninety-five B-52Hs left after the drawdown.

USAF Demographics

An Air Force paper released in July states that the service now comprises 445,000 active-duty personnel: 360,000 enlisted men and women and 85,000 officers. Among its other findings:

- USAF has 17,200 pilots, 7,500 navigators, and 38,600 nonrated line officers.
- The average age is thirty-five years for officers and twenty-nine for enlisted personnel. Of the total active-duty force, thirty-three percent are younger than twenty-six.
- Twenty-three percent of USAF members are assigned overseas. Average service is eleven years for officers and nine for enlisted.
- Women make up fifteen percent of the active-duty Air Force; they are fourteen percent of the officer corps and fifteen percent of enlisted ranks. In 1975, there were 33,000 women in the Air Force, a figure that has more than doubled to some 67,000 in 1993.
- When it comes to race and ethnicity, the force breaks down this way: seventy-eight percent Caucasian, fifteen percent African-American, two percent Hispanic, and three percent "Other." Eighty-nine percent of the officers are Caucasian, six percent African-American, two percent Hispanic, and three percent "Other." Seventy-six percent of enlisted personnel are Caucasian, seventeen percent African-American, four percent Hispanic, and three percent "Other."
- Sixty-six percent of current personnel are married. Active-duty members support 720,000 dependents.

C-17 Testing Continues

The fifth production C-17 returned to California in late July after completing simulated lightning-strike testing two weeks ahead of schedule, McDonnell Douglas said.

Electromagnetic radiation testing began in March at the Patuxent River, Md., Naval Air Warfare Center. After completion of those tests in April, the aircraft began lightning-strike testing, in which electrical pulses were sent along the surface of the aircraft. Data were collected on the current's effect. Later, electric currents were pulsed through specific wire bundles.

In late July, the seventh C-17, the second scheduled to be delivered to the Air Force, made its maiden flight. The aircraft took off from Long Beach Municipal Airport and landed there after a 7.2-hour flight. The aircraft was delivered in August to the 437th Airlift Wing at Charleston AFB, S. C., its operational unit.

POW/MIA Efforts Consolidated

The Defense Department has consolidated its own agencies and service agencies involved with POW/MIA issues, Defense Secretary Les Aspin said in July.

Four separate offices will be combined to form the Defense Prisoner of War/Missing in Action Office: the Deputy Assistant Secretary of Defense for POW/MIA Matters; the Assistant Secretary of Defense Command, Control, and Communications Central Documentation Officer; the Defense Intelligence Agency Special Office for POW/MIA; and the Army's Task Force Russia.

Mr. Aspin said that the new office will provide a better organizational structure for pursuit of a full accounting of all missing Americans.

Pentagon Aids Transition

In an effort to help communities hard hit by base closings, the Pentagon has created the Base Closure Transition Office and named transi-

tion coordinators to work with the communities to speed the cleanup and turnover of closed facilities.

The July action is part of a five-part program announced by the President to bring economic relief to affected areas. He also proposed a job-producing property disposal plan, a fast-track cleanup for bases, procedures for easy access to transition and redevelopment help for workers and communities, and larger economic development planning grants to communities.

Transition coordinators will serve as advocates for the affected communities, use their training in environmental cleanup and property disposal, and work with the base commander and federal and state agencies to keep environmental cleanup on the fast track and to push for priority treatment of parcels of land that have the potential for rapid redevelopment and job creation.

USAF Pushes "Goals 2000"

The Air Force has begun working with states and communities to improve schools.

This effort is part of a program known as "Goals 2000: Educate America." All the military services are taking part in the program.

Air Force personnel are repairing damaged equipment, improving school grounds, and assisting teachers. Some service members read to young students for twenty to thirty minutes at a time.

Air Force Announces Awards

The Air Force announced in July the winners of the Gen. Curtis E. LeMay Award and Maj. Gen. Eugene L. Eubank Award for 1992. The 18th Wing, Kadena AB, Japan, won the LeMay Award, and the 30th Space Wing, Vandenberg AFB, Calif., won the Eubank Award.

The Daedalian Foundation established both awards to recognize the best USAF programs in morale, welfare, recreation, and services. The awards go to a large and a small base, respectively.

The Air Force also announced the winners of its awards for meritorious MWRS achievement, recognizing individuals and programs making significant contributions.

Individual winners were Lt. Col. Joseph Komisarz, Kadena; Capt. Mark Tharp, Incirlik AB, Turkey; MSgt. William C. Garner II, RAF Chicksands, England; Janet A. Edwards, Air Force Academy, Colo.; and Christine L. Murray, K. I. Sawyer AFB, Mich.

Gerrity, Sharp, Maintenance Awards

The Air Force recognized the 52d Fighter Wing Logistics Group, Spangdahlem AB, Germany, in July with the Gen. Thomas P. Gerrity Unit Award.

The award recognizes superior organizational performance in support of the Air Force mission. The logistics group planned and participated in Operation Desert Calm, Operation Southern Watch, and combined Task Force Provide Comfort. The combined efforts of transportation, maintenance, supply, and logistics support won the group a superior Inspector General effectiveness rating.

SSgt. John R. Watters was recognized in July as the winner of the 1993 Dudley C. Sharp Award, given for outstanding logistics achievement resulting in long-term impact or significant cost savings to the government. Sergeant Watters is assigned to the 319th Maintenance Squadron at Grand Forks AFB, N. D.

Two organizations won 1993 Secretary of Defense Maintenance Awards. The 3d Wing, Elmendorf AFB, Alaska, won the award for superior maintenance while undergoing a reorganization, upgrade of its F-15Cs, and addition of two new types. The 224th Joint Communications Support Squadron, Georgia ANG, Brunswick, was recognized for superior communications and electronics maintenance while providing communications to the Joint Chiefs of Staff during deployments to Saudi Arabia, Kuwait, and Turkey.

Training Changes Announced

The Air Force announced major policy changes in July, drawing down field training detachments, standardizing enlisted skill level training requirements, and changing requirements for enlisted professional military education.

The policy changes stem from an initiative to review Air Force education and training processes, programs, and structure. A USAF task force had studied trends and made recommendations to help raise train-

ing standards. They call for the Air Force to:

- Transfer field training detachments to Air Education and Training Command training wings and regional training sites.
- Standardize enlisted skill-level training requirements.
- Provide structured on-the-job training, with candidates being formally appointed, trained, and certified.
- Change active-duty requirements for enlisted professional military education.
- Increase officer skills training.
- Increase officer PME.
- Revise the advanced academic degree graduate education management system to validate requirements.
- Revise the professional continuing education management process.
- Enhance civilian training and education to allow civilians to participate in the same programs as their military co-workers.
- Standardize civilian orientation to provide the same information to all newly hired personnel.

Civilians Earn Safety Awards

The Air Force named David L. Luttrell as the winner of the 1992 Chief of Safety Special Achievement Award and Randolph E. Guennel as the winner of the Safety Career Professional of the Year Award.

The special achievement award is presented to an individual or organization for outstanding safety contributions or achievements. The professional of the year award goes to an individual in the safety career field for outstanding contributions to the Air Force safety program.

Mr. Luttrell, the 437th Airlift Wing weapons safety manager at Charleston AFB, S. C., developed ground and operational procedures for C-141 aircraft modifications to employ flares for airlift defense.

Mr. Guennel, the 380th Air Refueling Wing ground and explosive safety office chief at Plattsburgh AFB, N. Y., was cited for aggressive action resulting in a fifty to 100 percent reduction in injuries and fatalities in all reportable categories during the past year.

Dental Plan for Reserve Officers

Reserve officers on extended active duty and within twenty-four months of their separation date may enroll in the Dependents Dental Plan if they intend to remain on active duty beyond their projected separation date, the Air Force Military Personnel Center said in August.

The member must express an intent to remain on active duty, and no quality force indicators can exist to prevent his or her continuation of service. The effective date of the dental plan will be the first day of the month following completion of Pentagon forms 2494 or 2492-1, Standard Processing Procedures for New Enrollees.

Pentagon Schools Upgraded

The Pentagon plans to improve its dependent schools by investing in new computer-assisted education technologies, such as computer graphing in mathematics, which allows students to compare graphs to equations.

Department of Defense Dependent Schools Director John Stremple told the Senate Armed Services Committee in June that, with the roughly $35 million authorized for DoDDS, the organization can expand its courses in math, science, and engineering.

The new technologies will particularly benefit advanced students, he said. By using telecommunications technology, students can share data and conclusions with other students, teachers, or even scientists in remote locations.

DoDDS currently serves more than 108,000 military and civilian dependents in 224 schools.

Pentagon Consolidates Accounting Systems

DoD is consolidating eleven payroll and debt accounting systems to improve customer service while saving $13 million.

The eleven systems will be merged into two: one for military retiree pay and the other to handle debts to the Pentagon. The savings are to be realized over the next ten years and are expected to be achieved through standardization and consolidation.

"Under the defense retiree and annuitant pay system, all military retiree records and accounts will be processed and maintained at the current Defense Finance and Accounting Service Center in Cleveland," said a Pen-

Index to Advertisers

tagon press release. "The Center in Denver will process and maintain accounts for military annuitants—survivors of military retirees." The system will be fully operational by December 1994.

The Defense Debt Management System will combine Air Force, Army, Navy, Marine Corps, and Defense Logistics Agency debt collection systems into one operation.

New Radar Tracking System Tested

Loral Corp. demonstrated its precision radar frequency targeting system, the Targeting Avionics Sensor (TAS), on a Navy F/A-18 aircraft at the Naval Air Warfare Center in Maryland in July.

The goal of the test was to demonstrate that a very accurate radar frequency locating system can be mounted in an aircraft pylon, providing "Wild Weasel" capabilities without major modifications and greatly reducing overall costs, the firm said.

The TAS can point precisely to groundbased or airborne radar emitters at extreme ranges.

NASA Adapts X-Ray Techniques

The National Aeronautics and Space Administration is adapting an X-ray system to improve inspection of aging aircraft by combining TV scanning by X-ray beams with digital data acquisition, the agency said in late July.

The technology was originally intended for medical, dental, and industrial purposes, but NASA researchers at Langley Research Center in Virginia have devised several unique applications for aeronautics and aerospace. The system is being adapted to inspect aircraft wings, turbines, and propeller blades for corrosion, cracks, and "disbonding."

"Because the system yields depth information, this X-ray technique also may be used by NASA to view how fibers mesh in three-dimensional composites and to monitor them for internal damage," NASA said.

Before the system can be of practical value, its sensors must be miniaturized, which would allow them to be inserted into structures that need inspection.

News Notes

■ In July, the Air Force graduated its first group of pilots from the specialized undergraduate pilot training program. The dual-track program—comprising the fighter-bomber and tanker-transport tracks—is designed to produce better-prepared pilots for follow-on training in a major weapon system.

■ The Air Force Doctrine Center began business as a field operating agency in July, joining other military doctrine centers in southeast Virginia. AFDC will work with other services to develop joint doctrine and will put all Air Force doctrine writers in one location. Until now, these individuals worked at a number of command locations.

■ The Air Force said in August that 3,723 service members have applied for the new fifteen-year retirement program. Staff sergeants and technical sergeants submitted 2,389 of the applications.

■ The only operational WB-57F Canberra aircraft in existence got a $46,000 facelift at the San Antonio Air Logistics Center at Kelly AFB, Tex. The atmospheric-research aircraft is operated by NASA for various space-related projects. This is the first coat of paint the aircraft has received in thirty years of service. It will sport a blue-tone white.

■ Exercise Northern Viking '93, an Iceland Defense Force land and air, command post, and field training exercise, took place in late July and early August. More than 675 persons from all branches of the military took part.

■ Army Lt. Col. James M. Colvin, Jr., was named Joint Staff Officer of the Year in July. Colonel Colvin is an International Logistics Staff Officer assigned to the Logistics Plans, Exercises, and International Logistics Division within the Joint Staff. He was

Senior Staff Changes

RETIREMENTS: B/G Benard W. **Gann;** B/G Timothy D. **Gill;** B/G Paul D. **Gleason;** B/G C. Jerome **Jones;** B/G Bobbie L. **Mitchell.**

PROMOTION: To be **Lieutenant General:** Charles E. **Franklin.**

CHANGES: M/G Patrick P. Caruana, from Dir., Long-Range Power Projection, Special Ops. Forces, PEO Airlift and Training Prgms., Ass't Sec'y of the Air Force for Acquisition, Hq. USAF, Washington, D. C., to Cmdr., 14th AF, AFSPACECOM, Vandenberg AFB, Calif. . . . **M/G James E. Chambers,** from Cmdr., Combined Air Ops. Cen., NATO, and Cmdr., 17th AF, USAFE, Sembach AB, Germany, to Dir., Contingency Ops., Hq. USAFE, Ramstein AB, Germany . . . **M/G (L/G selectee) Charles E. Franklin,** from PEO, Tactical/Airlift Sys., AFPEO, Hq. USAF, Washington, D. C., to Cmdr., ESC, AFMC, Hanscom AFB, Mass., replacing retiring L/G Gordon E. Fornell . . . **B/G William R. Hodges,** from Cmdr., 5th BW, ACC, Minot AFB, N. D., to IG, Hq. ACC, Langley AFB, Va., replacing B/G John L. Welde . . . **B/G Raymond P. Huot,** from Dep. Dir., Operational Requirements, DCS/P&O, Hq. USAF, Washington, D. C., to Dep. Cmdr., Canadian NORAD Region, CFB North Bay, Canada, replacing retired B/G Benard W. Gann . . . **B/G James M. Richards III,** from Cmdr., 92d BW, ACC, Fairchild AFB, Wash., to Dir., Long-Range Power Projection, Special Ops. Forces, PEO Airlift and Training Prgms., Ass't Sec'y of the Air Force for Acquisition, Hq. USAF, Washington, D. C., replacing M/G Patrick P. Caruana.

M/G Eugene D. Santarelli, from Cmdr., 355th Wing, ACC, Davis-Monthan AFB, Ariz., to Cmdr., Combined Air Ops. Cen., NATO, and Cmdr, 17th AF, USAFE, Sembach AB, Germany, replacing M/G James E. Chambers . . . **B/G Anthony J. Tolin,** from Cmdr., 57th Wing, ACC, Nellis AFB, Nev., to Dep. Dir., Strategy and Policy, J-5, Joint Staff, Washington, D. C. . . . **B/G Lansford E. Trapp, Jr.,** from Mil. Ass't to the Sec'y of the Air Force, Hq. USAF, Washington, D. C., to Cmdr., 355th Wing, ACC, Davis-Monthan AFB, Ariz., replacing M/G Eugene D. Santarelli . . . **B/G John L. Welde,** from IG, Hq. ACC, Langley AFB, Va., to Cmdr., 57th Wing, ACC, Nellis AFB, Nev., replacing B/G Anthony J. Tolin . . . **B/G William L. Worthington, Jr.,** from Dir., Log., Hq. AETC, Randolph AFB, Tex., to Cmdr., 82d Training Wing, AETC, Sheppard AFB, Tex., replacing retiring M/G Dale C. Tabor.

SENIOR EXECUTIVE SERVICE (SES) RETIREMENT: Earl W. **Briesch.**

SES CHANGES: Roger M. Blanchard, from Dep. Dir., P&R, Hq. USAF, Washington, D. C., to Chief, Resources, and Dir., Personnel Prgms., Education, and Training, Hq. USAF, Washington, D. C. . . . **Roy C. Gay,** from Dep. Dir., Personnel Mgmt., Hq. USAF, Washington, D. C., to Chief, AFCPMC, Randolph AFB, Tex. . . . **John R. Graham,** from Dir., Civilian Personnel, Hq. USAF, Washington, D. C., to Dir., Civilian Personnel Policy and Personnel Plans, Hq. USAF, Washington, D. C. . . . **Steve N. Smith,** from Dep. Dir., Work Force Effectiveness, Hq. USAF, Washington, D. C., to Chief, AFPOA, Hq. USAF, Washington, D. C. ■

recognized for his efforts in support of Operation Restore Hope and his help in reorganizing the Department of Defense's logistics structure.

■ The Pentagon announced the appointment of Kathleen M. deLaski as assistant to the Secretary of Defense for Public Affairs in July. Ms. deLaski had been an ABC News correspondent since 1988 and served as the White House correspondent for the past year. She becomes the first woman to serve as the official Pentagon spokesperson.

■ Beech flew its second Joint Primary Aircraft Training System prototype aircraft in late July. The firm said the first flight of the Beech PC-9 Mk. II was successfully completed.

■ The first four production Sensor-Fuzed Weapons (SFWs) exceeded the criteria for single munition performance and combined average performance in tests conducted at Eglin AFB, Fla., Textron said in August. The SFWs were delivered by F-16s against a target array representing a mixture of tanks, light armor, and trucks.

■ In July, a newly developed communications technology, the Transportable Communications Central system, was pressed into service to assist civil defense efforts in the flood-stricken Mississippi River valley, according to Rome Laboratory, Griffiss AFB, N. Y. The flooding had created a communications breakdown in the area. The TCCs were designed to assist the Coast Guard in such activities as drug interdiction and search and rescue.

■ Two B-1Bs assigned to the 28th Bomb Wing at Ellsworth AFB, S. D., circumnavigated the globe in August as part of exercise Global Enterprise. The mission took the aircraft east to Europe, across the Mediterranean Sea, and down the Red Sea; they landed at a forward base in southwest Asia. After crew changes, the B-1Bs flew over southeast Asia, up to Japan, and over the Aleutian Islands before landing at Ellsworth. These are the longest two flights a B-1B has ever taken. The first lasted twenty-four hours and the second twenty-two hours.

■ The US and Ukraine signed a Memorandum of Understanding in July to create a formal structure of defense contacts and cooperation between their defense and military establishments. The goal of the agreement is to promote confidence and enhance understanding between the two nations' defense and military establishments.

■ The 71st Security Police Squadron at Vance AFB, Okla., was named the Air Force Outstanding Small Security Police Unit of 1992, according to the service.

Purchases

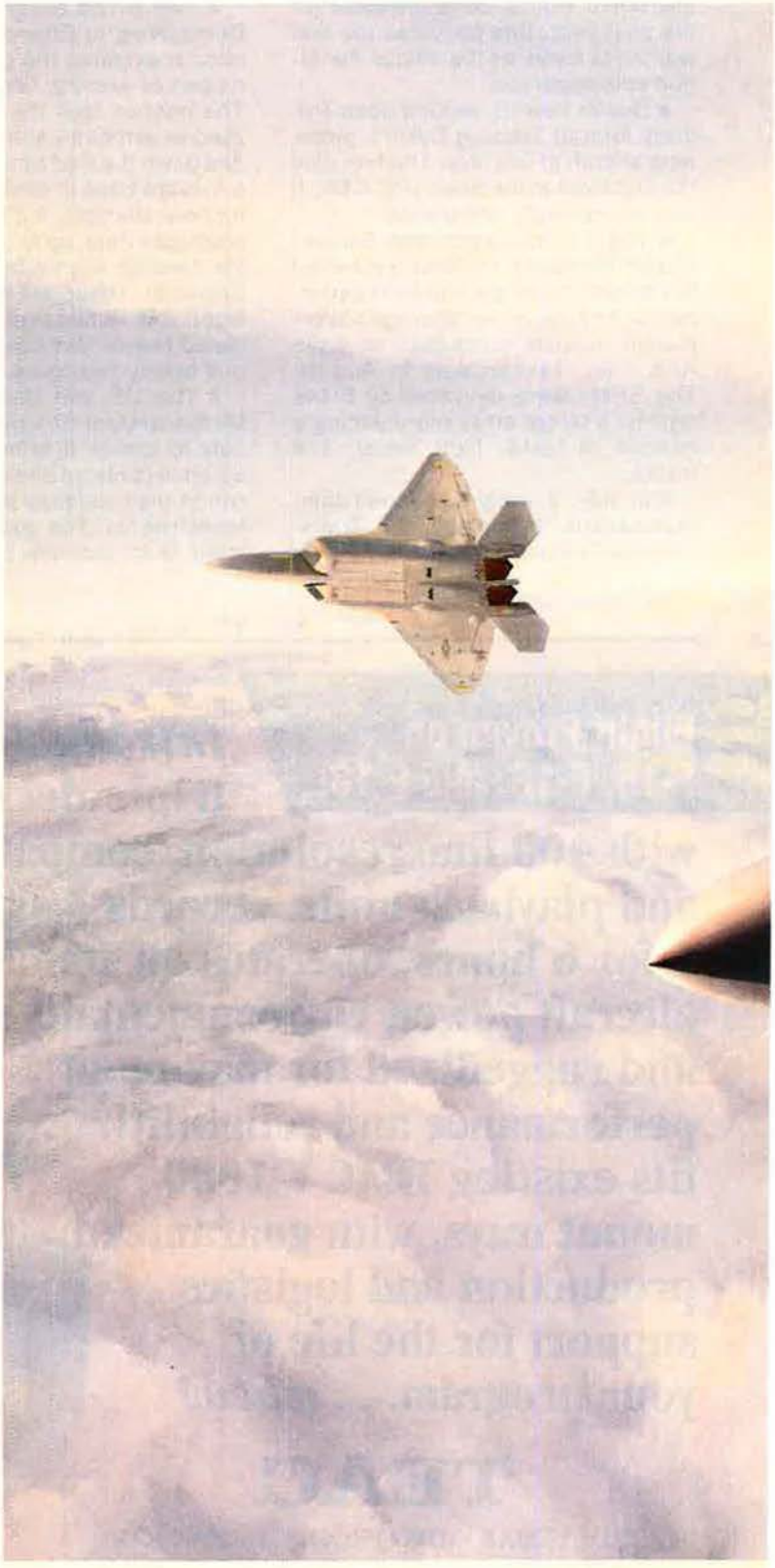
The Air Force awarded Motorola Inc. an $8 million cost plus award fee contract for the Joint Programmable Fuze Program, which will develop, test, and procure a multifunction fuze for the Joint Direct Attack Munition employing the Mk. 84, BLU-109/B, and Mk. 83 bombs. Expected completion: June 1996.

The Air Force awarded Lockheed a $15 million face-value increase to a fixed-price incentive firm contract for Fiscal 1994 long-lead funding for twenty-four F-16C aircraft. Expected completion: November 1993.

The Air Force also awarded Lockheed a $6 million face-value increase to a cost plus fixed-fee contract for integration of the Air Force Mission Support System into the F-16 aircraft. Expected completion: September 1995. ■

Air-Land Options

By James W. Canan, Senior Editor



"The Edge" © 1993 Keith Ferris

AN AIR FORCE F-22 fighter streaks across the sky over enemy territory. It is on the hunt, not for hostile fighters, but for prime targets on terra firma. From under its wings it launches two long, sleek standoff missiles. They set a course through the clouds for vital command-and-control facilities more than 100 miles away, strike them dead center, and blow them up.

The F-22 keeps coming, closing in. From its weapons bay falls a pair of 1,000-pound bombs. Using Global Positioning System (GPS) satellite signals and inertial navigation to correct for windage, they glide through the overcast to a surface-to-air missile (SAM) site more than ten miles downrange, hit the mark, and demolish it.

This scenario may seem odd at first. The F-22 is doing all the wrong things. It is supposed to be a hot, stealthy, air-combat fighter, not an attack fighter.

In fact, it is both. It was born for counterair combat, but it has always had the inherent makings of a stealthy, standoff strike fighter as well. Now the Air Force is showing the other side of the F-22 and laying plans to put it to use in future air-land operations.

The Air Force is also considering a supplementary air-to-ground role for

Nearly all the fighters will be multirole, including the F-22 with bombs in the weapons bay.

the F-15C once the F-22 supersedes the F-15C as its top-of-the-line air-combat fighter. Now used exclusively in the air-to-air role, the F-15C may be assigned to the defense suppression mission as well.

"To some extent, all our fighters will be multirole fighters," predicts Maj. Gen. Larry L. Henry, director of operational requirements in the office of the Air Force deputy chief of staff for Plans and Operations. "They'll be flexible. The F-22 will have great flexibility. It will be able to do a lot of things."

The Air Force is fashioning its operational requirements to make its weapons and forces as flexible as possible. It pegs those requirements to its global airpower strategy and to its partnership with the Army in air-land operations, a post–Cold War warfighting concept that the two services jointly introduced two years ago.

"The Edge" © 1993 Keith Ferris

With precision guided munitions carried internally, the F-22 will be a formidable air-to-ground weapon. Requirements chief Maj. Gen. Larry L. Henry praised the fighter's flexibility: "It will be able to do a lot of things."

Defense in Depth

Projecting power around the world with smaller, US-based, rapid-reaction air and ground forces is what the air-land operations concept is all about. It is a far cry from its forerunner, the AirLand Battle Doctrine for waging defensive warfare in depth against massed armored and mechanized forces in Europe, but its Air Force missions are basically the same. They include air superiority, air interdiction, close air support (CAS), airborne tactical reconnaissance and surveillance, Suppression of Enemy Air Defenses (SEAD), and even theater defense against ballistic missiles now spreading around the globe.

Biservice teamwork in air-land operations has given rise to a new Air Force composite wing—the 23d Wing at Pope AFB, N. C.—in direct support of the Army's 82d Airborne Division at nearby Fort Bragg, N. C., and it may lead to other such wings as well. It has tightened the biservice air-mobility arrangements.

Army and Air Force requirements and preparations for air-land operations increasingly interweave with those of the Navy and Marine Corps for maritime power projection. All the services are in it together as the US pulls back from overseas and concentrates on fashioning a thoroughly joint expeditionary force.

More and more, "our operational requirements are joint requirements" and are formulated "to make sure we can fight as a [joint] expeditionary force," explained Lt. Gen. Stephen B. Croker while vice commander of Air Combat Command, headquartered at Langley AFB, Va.

He noted, for example, that "we're into joint acquisition in a big way" and that "all our new PGMs [precision guided munitions] are not just Air Force munitions; they're Air Force–Navy munitions or Air Force–Navy–Army munitions."

Autonomously guided, through-the-weather PGMs rank high among Air Force requirements. Right up there too are GPS receivers for installation in all combat aircraft, upgraded E-8 Joint STARS (Surveillance and Target Attack Radar System) and E-3 AWACS (Airborne Warning and Control System) surveillance and warning aircraft, and the means of swiftly conveying situational awareness images from spy satellites and airplanes to cockpits of fighters and bombers.

Topping the requirements list are the big three. "For air-land operations, the new weapons I think we need the most are the F-22 for air superiority and ground attack, the JDAM [Joint Direct Attack Munition], and the B-2 bomber," General Henry explains. "From day one, there has been an inherent air-to-ground capability in the F-22, and we intend to take full advantage of it."

The Air Force provided for air-to-ground capability in designing the configuration and the integrated avionics of its Advanced Tactical Fighter more than a decade ago. The ATF program produced two prototypes, one of which was chosen to go into full-scale development three years ago as the sophisticated Lockheed F-22 air-combat fighter.

No Place

Through the years, Air Force leaders occasionally noted that the fighter had a built-in ground-attack capability, consistent with its original requirements, but never made much of it. There was no place for an air-to-ground F-22 in any number of on-again, off-again Pentagon plans for new Air Force and Navy combat aircraft. One such plan called for the Navy to acquire a carrier-based variant of the F-22 to be used as a fleet interceptor and for the Air Force to sign up for a Navy-developed attack aircraft, first the A-12 and then the A-X, which the Navy later called the A/F-X to accentuate its dual-role nature.

None of this has panned out. Congress is putting pressure on the Navy to buy the F-22 for air combat, but the Navy seems reluctant while in the midst of upgrading some of its F-14 interceptors and modifying others for air-to-surface capability. The A-12 program fell through a few years ago. The A/F-X program never got off the ground, rejected by Congress and in the Pentagon's Bottom-Up Review (BUR) of multiservice aircraft requirements.

Air Combat Command's "combat forces roadmap," unveiled at a meeting of top Air Force generals last June, came out strongly for a ground-attack version of the F-22. With such backing, now that the F-22 production program seems securely on track, the Air Force has found a place for the strike-fighter F-22 high among its air-land operational requirements.

Last July, at an AFA symposium in Dayton, Ohio, Lt. Gen. John E. Jaquish, then a top Air Force acquisition official, linked the BUR with the attack F-22. He predicted that the BUR "will support the F-22, to include an air-to-ground capability, as a key component of the resulting force structure. . . . Once air superiority is achieved, this capability would enable us to employ the F-22 force in ground-attack roles as required."

Air Combat Command reportedly sees ground attack as the first order of business for F-22s under some circumstances. There is a school of thought that some F-22s could be used in the attack role at the very beginning of a conflict, to take out high-value targets, such as antiaircraft radar sites and command-and-control centers, even before air superiority is fully established. The attack F-22s would do what the stealthy F-117s did in Operation Desert Storm: elude radars and penetrate undetected deep into enemy territory to strike nerve centers with precision guided weapons.

The F-22 would undoubtedly do more and do it better. "What we'll have with the F-22," says General Henry, "is an F-117 capability in an air-superiority airplane—a stealthy and much faster airplane."

He continues, "The F-22's modern avionics provide a flexibility we've never had before. When we set out to make the F-15 air-superiority fighter into an [interdiction] F-15E, we had to modify it quite a lot. To make the F-22 capable of delivering a JDAM, for example, we require only some very modest changes, and none at all to the external airframe. The F-22 will carry JDAM internally."

Swinging Back to Stealth

In the attack mode, each F-22 would carry under its wings two stealthy, hundred-mile-plus AGM-137 Tri-service Standoff Attack Missiles. Their exposed profiles would enlarge the F-22's radar signature, but the fighter would launch them from well beyond the ranges of enemy SAM radars and would then revert, with cleaned-up configuration, to its old stealthy self. Thus, carrying TSSAMs externally would not degrade the stealth capability of the F-22, Air Force officials claim.

General Henry notes that the Air Force "didn't fly F-15Cs over Baghdad" because those air-superiority fighters are decidedly unstealthy, "but we could have flown the F-22 there" in both air-to-air and air-to-ground sorties.

The requirements chief makes the point that the Air Force can use the F-22 like an F-117, but not the other way around. "If we wanted to modify the F-117 to make it into an air-to-air fighter, we'd have to do some pretty drastic things to it," he says.

In the Persian Gulf War, the F-117 struck command-and-control centers with upgraded 2,000-pound, laser-guided bombs. They performed well but had their limits. Clear weather was a prerequisite for lasing targets from the air using a technique and weapons not terribly advanced from those used in the Vietnam War.

USAF will rig all combat aircraft to carry and launch one or more types of the new PGMs now in development. "We want to get precision capability through the weather and with autonomous weapons," General Henry explains. "The new PGMs will make a lot of good things happen for us."

The blue-ribbon PGMs in the Air Force's future are the JDAM, a glide bomb with either a 2,000-pound warhead or a 1,000-pound warhead; the Joint Standoff Weapon (JSOW), a glide bomb with cluster-type antiarmor submunitions; and the TSSAM, a stealthy cruise missile with a range of more than 100 nautical miles. The TSSAM's technology and capabilities are classified, but the others are fairly open books.

The first-generation JDAM will incorporate inertial navigation and GPS guidance technology to strike within forty-five feet of targets, regardless of weather, at ranges beyond ten miles. An advanced JDAM variant now in the works will combine GPS with an on-board seeker to achieve bull's-eye accuracy.

Sharp Navigation

The JSOW combines the Navy's Advanced Interdiction Weapon System with the Air Force's Skeet sensor-fuzed submunitions. Strike aircraft will use inertial navigation to fly to JSOW launchpoints. Once in free flight, JSOW dispensers will employ inertial navigation to correct for windage en route to targets and will release submunitions with self-contained target-homing autonomous guidance systems. The dispensers are built for other kinds of munitions, too.

"JSOW will enable us to attack armor in various formations, spread out or in single file," General Henry

Unlike the F-117, the F-22 can swing from air-to-air to air-to-ground missions with only minor modifications. In order to configure an F-117 for air-to-air missions, General Henry observed, "we'd have to do some pretty drastic things to it."

SEAD and close air support are integral parts of air-land operations. With F-4Gs, F-16s, and A-10s, the 52d Fighter Wing, Spangdahlem AB, Germany, a veteran of the Gulf War, stands ready to perform either mission.

explains. "We'll get multiple kills per dispenser." This, he says, is much different from "tank plinking," which involves "dropping a laser-guided 500-pound bomb on a single tank."

The new PGMs are designed to attack a wide variety of targets, and all may be launched against SAM sites at the outbreak of war—TSSAMs against the sites with the longest-range missiles, JSOWs against those with lesser range, and JDAMs against short-range SAMs.

They are designed for "hard kills"—destroying the missiles, their launchers, their radars, and their crews—in preference to the "soft kills of the HARM [high-speed antiradiation missile] shots, which take out the [SAM radar] antennas," General Henry explains. "We want the SAM crews to fear for their lives, not for their antennas."

Once the new-generation PGMs have done their job, "we'll be able to use our defense suppression forces much more effectively and efficiently, because we'll only have to target the SAM sites that we've missed with our hard-kill weapons or that we hadn't known about," says General Henry.

At the outset of future air-land operations, the Air Force will use F-16s for "some air-to-ground, a little air-to-air, and some SEAD with HARMs," he explains. F-15Cs will perform their specialty—air-superiority missions. After they gain air superiority, "some could pick up the SEAD mission with HARMs on board. They'd be configured full-up for air-to-air, but they'd be able to take a couple of HARM shots first." The F-15Cs could jettison the HARMs if they're attacked by fighters early on.

SEAD is not likely for F-15Es. "They'll be heavily tasked for the longer-range, night interdiction mission," General Henry says. "We don't have a lot of aircraft that are capable of doing that mission, and we may not be able to pull them off to do SEAD."

Air Combat Command is pushing hard for additional F-15Es to compensate for attrition and to make its interdiction force more flexible in performing air-land operations. ACC proposes low-rate production of Air Force F-15Es (now nearing an end) through the next several years, but there were no signs at midyear that the Air Force planned to do so.

Reaching Out

Bombers with nonnuclear weapons are cast as big sluggers in expeditionary operations, spearheading "forcible entry" of US combat troops and air units into hostile territory. They can be employed "in concert with a deployed force or to support carrier battle groups," General Henry notes. "They can reach out from CONUS anytime, anywhere, and they are important to theater operations in the interdiction role. They offer great range and flexibility."

ACC is said to be campaigning within the Air Force for more than the twenty B-2s that the Defense Department and Congress agreed on last year. Increasing that number would suit the Air Force just fine, but "we are not overtly campaigning for more B-2s," one official says. ACC's combat forces roadmap also makes a strong case for the C-17 airlifter as the *sine qua non* of future air-land operations.

Modifying the B-1 to make it more survivable and able to carry assorted nonnuclear weapons is "the most important upgrade program of all," said General Croker. "No system has

USAF has more than 200 F-15Es, and ACC is pushing for more. The flexible, but decidedly unstealthy, fighter (seen here with AGM-88 HARMs underwing) has been proposed as a successor to the F-4G for the "Wild Weasel" mission.

greater potential to alter the outcome of a conventional scenario than the B-1. Its tremendous payload and standoff and penetration capabilities make it the ideal weapon for the expeditionary force we're creating."

The Air Force intends to arm its B-2s and B-1s with a variety of standoff PGMs, most extensively JDAM 2,000-pound general-purpose Mk. 84 glide bombs and the folding-wing JSOW projectile. For those weapons, it has developed a guidance kit that combines inertial navigation with GPS navigation. This enables the system to do without both an on-board seeker and target illumination and, as a result, reduces its cost and makes it difficult to detect and oblivious to weather.

Making better use of the spacebased GPS is a top-drawer Air Force operational requirement. The position-fixing precision afforded by the GPS makes a huge difference in the employment of forces and firepower in all sorts of air-land operations.

Among other things, the GPS puts a new face on the close air support mission, making it possible for fast fighters like the F-16 to carry out CAS, notwithstanding their speed.

"Ground commanders will have a lot more confidence in what we can do for them [in CAS] with any kind of airframe when they know that the weapons we're dropping are precise," says General Henry.

When aircrews, forward air controllers, and tank crews, for example, can pinpoint their positions in relation to one another, they will gain confidence in assigning and attacking targets, he contends. "So CAS is not going to be limited to slow-speed A-10s and helicopters," the General asserts.

He claims that CAS, with precision weapons, navigation, and targeting now available or in store, is "more of a training issue than an airframe issue. We can take an F-16 with LANTIRN [Low-Altitude Navigation and Targeting Infrared for Night pods] on it for interdiction and train the pilot in CAS procedures for delivering his ordnance close in."

He continues, "GPS and precision weapons are blurring the traditional lines around CAS and other air-land missions. GPS brings a situational awareness to the battlefield that gives everyone in the air and on the ground reference points for everything they do, and in tandem with one another."

Army and Air Force requirements for air-land operations are increasingly interwoven with those of the Navy and Marine Corps. The services are cooperating to achieve the quantum improvement provided by the latest in PGMs.

This, he points out, should also greatly reduce fratricide.

Early Knockout

The Air Force does not anticipate many large-scale CAS operations against massed armor and mechanized forces in future air-land combat. The reason for this, says General Henry, is that attack aircraft should be able to strike and check those forces before they come head-to-head with friendly ground troops.

The key to this, and a prime Air Force operational requirement, is the means of swiftly disseminating surveillance and reconnaissance information to the crews of attack squadrons, greatly enhancing their situational awareness. U-2 and Joint STARS aircraft are big contributors, as they demonstrated in Operation Desert Storm, and the Air Force is busily upgrading both. It is outfitting U-2s with new engines and enhancing Joint STARS sensor and signal processing systems.

Joint STARS, a classic air-land system for the Air Force and Army, was designed for ground surveillance, targeting, and battle management. Two Joint STARS development planes lacking full powers did all those things on short notice and much better than expected in Operation Desert Storm. Now, having decided to acquire nineteen full-up Joint STARS production aircraft, the Air Force is expanding their missions to include bomb-damage assessment, SEAD, and theater missile defense, with an accent on detection of mobile missile launchers and their decoys *[see "Washington Watch," p. 12]*.

The Air Force is testing—and has big plans for—a new, highly sophisticated data modem for relaying surveillance and targeting data from satellites and U-2, Joint STARS, and E-3 AWACS planes directly to attack aircraft. In its Talon Sword program, the Air Force has begun testing such a setup, conveying data "in near real time" to F-15E interdiction fighters and to F-4G, F-16C, and Navy EA-6B SEAD aircraft armed with HARMs, "with very impressive results," General Henry says.

"All requirements involving C^4I [command, control, communications, computers, and intelligence] are extremely important to us," he adds. "We're looking ahead to lightweight, off-the-shelf, wireless communications equipment that doesn't require a lot of airlift for us to get it to theaters [of operation]."

USAF's 366th Wing, a composite, air-intervention wing based at Mountain Home AFB, Idaho, has just such equipment. In a recent deployment exercise, it was able to set up, on arrival, "a wireless LAN [local area network] to do everything they needed to do. They laid no wires at all. That's a big part of our vision of the future in air-land operations," General Henry says. ■

Cockpit videotapes from Operation Night Camel in 1990 suggested a bold new tactic for the Persian Gulf War.

Tank Plinking

By Maj. Michael J. Bodner and Maj. William W. Bruner III

Maj. Michael J. "Boone" Bodner gives the high sign from his F-111F after a successful tank-plinking mission, one of more than 650 flown by F-111 crews during the Persian Gulf War. Opposite is the F-111 flown by Col. Tom Lennon of the 48th Tactical Fighter Wing (Provisional), one of the first tank plinkers. The aircraft is armed with the plinker's weapon of choice, the GBU-12 bomb.

WHEN US fighters began picking off individual Iraqi tanks with precision weapons in the Persian Gulf War, Gen. H. Norman Schwarzkopf, the commander in chief of US Central Command, is said to have groused to his air boss, Lt. Gen. Charles Horner, about the nomenclature.

Schwarzkopf: "Tell them not to call it 'tank plinking'!"

Horner: "That's the surest way to get them to call it 'tank plinking.' "

In postmission debriefs, aircrews would watch tape after tape of these attacks. They observed the ease with which tanks and other revetted objects were blasted to pieces. This reminded them of "plinking" tin cans with a BB gun. Thus "tank plinking" was born.

Much has been written about the tank-plinking mission, usually from the perspective of those who flew the missions. Not much is known about the origin of the mission or how airplanes ordinarily thought of as "interdiction" or "deep strike" fighters ended up bombing tanks, in revetted positions, one by one, with laser-guided bombs from medium altitude at night.

As Saddam Hussein consolidated his grip on Kuwait in the summer and fall of 1990 and US leaders began to develop plans for dealing with Iraq's aggression, a concept for an offensive air campaign emerged. This led to a devastating air campaign and an Air Tasking Order used by General Horner.

In the early days in Riyadh, before much ground power had arrived in the theater, General Horner's director of campaign plans, Brig. Gen. Buster Glosson, worked closely with the ground planners to integrate the emerging ground plan into the existing air

plan. In September, his planning staff worked with an analytical team at the Pentagon to help determine how quickly airpower could destroy the enemy's armor, artillery, logistics, and personnel to make the enemy combat-ineffective.

The Fifty Percent Solution

Most armies use an attrition figure of thirty percent as the threshold at which a unit should be "pulled off the line" because it has become combat-ineffective. The Pentagon analysis team, the Air Staff's "Checkmate" division, ran its analysis to fifty percent and ninety-five percent attrition of enemy ground forces. General Glosson checked his analysis with General Schwarzkopf's lead planner, Lt. Col. Joe Purvis, asking, "At what attrition level is an army considered combat-ineffective?" Colonel Purvis answered, "Thirty to sixty percent, depending on whom in the Army you ask." General Glosson then asked Colonel Purvis if he could live with fifty percent, and he answered, "Yes."

With the CINC's approval, air planners and commanders paid more attention in the planning process and during the prosecution of the war to destroying the combat effectiveness of the Iraqi Army, especially the Republican Guards, through the independent use of land- and seabased airpower. To do this, they needed to execute precision bombing and around-the-clock attacks on enemy forces in the field similar to the attacks carried out against Iraq's military-industrial complex.

In the early stages of the planning process, attacks against the enemy army were to be carried out primarily by F-16C, F/A-18C, A-10, AV-8B, and other aircraft using Maverick missiles, guns, and cluster and general-purpose bombs.

By December 1990, General Horner, General Glosson, and Maj. Gen. John Corder, General Horner's deputy for operations, had concluded that fighter aircraft equipped with new infrared (IR) targeting pods would be able to find and destroy armored vehicles from medium altitude at night. This seemingly simple idea was a radical departure from the tactics manuals, which advocated the traditional concept of low-altitude ingress against a single fixed target deep in enemy territory. This concept was advanced primarily in response to the assumed deadliness of radar surface-to-air missiles (SAMs).

The generals believed instead that an effective attack on enemy air defenses would allow sophisticated aircraft carrying precision guided munitions (PGMs) to loiter over enemy ground deployments. Once air superiority was achieved, airmen could exploit their freedom of action to dismantle the enemy's ground defenses in the same way that strategic attack could dismantle enemy telecommunications, infrastructure, leadership, and weapons of mass destruction following the suppression of enemy air defenses and the air-superiority campaigns.

Operation Night Camel

In December 1990, a month before the beginning of the air campaign, Air Force wings equipped with infrared navigation and targeting pods began flying night training missions against VII Corps armored forces. These training missions, known collectively as Operation Night Camel, were intended to determine whether IR-equipped aircraft could carry out night interdiction against supply lines and cluster-bomb attacks against armor.

Night Camel had an unintended consequence, however. On cockpit

videotapes from the training missions, armored vehicles showed up clearly on IR screens between sunset and midnight. This key piece of information led directly to the tank-plinking idea. The videotapes also demonstrated that IR-equipped aircraft could be used for nighttime, medium-altitude attacks.

For most of the F-15E, F-16C, and F-111F crews who flew in these tests, medium-altitude attack on field armies was a new mission. The majority of Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) and Pave Tack peacetime training was oriented toward low-altitude, first-look strikes against fixed, high-value targets. Crews did not fly medium-altitude night missions in search of armor and armored personnel carriers (APCs) routinely in peacetime.

In the 1970s and 1980s, as radar-directed SAMs became too sophisticated, numerous, and deadly for medium-altitude ingress, it made sense for strike tactics to move toward lower altitudes. Attack aircraft, avionics, weapons, fuzes, tactics, and training were optimized for use at low level. After Vietnam, in operations such as Peace in Galilee in 1982 and El Dorado Canyon against Libya in 1986, these tactics (and increasingly sophisticated electronic countermeasures) caused a dramatic decline in losses to radar-guided SAMs. Although the number of aircraft lost to antiaircraft artillery and handheld SAMs increased, aircraft ingressing and egressing at low altitude minimized their exposure to enemy radar and therefore suffered fewer overall losses.

Given this background, it is understandable that A-6, F-111, F-15E, and F-16 crews, who had trained for years at low altitude, considered it "unnatural"—even "suicidal"—to loiter over an enemy army at medium altitude. F-111 wing planners wanted their crews to spend as little time as possible on medium-altitude sorties during Night Camel. They preferred instead to train at low level, preparing for the low-level war they expected to fight against the dangerous and sophisticated Iraqi Integrated Air Defense System.

Despite the skepticism, the results of Night Camel were far better than expected. Pave Tack and LANTIRN pods could pick out ground targets at night from medium altitude. Reviewing the tapes of these missions built up the confidence of senior commanders that airpower could carry out effective night deliveries against an enemy army.

From the first night of the war, the strategic air campaign had been brought to bear on one of the regime's centers of gravity—the Republican Guards. By January 29, most combat shooter sorties were flown against enemy military forces in the Kuwait Theater of Operations, carrying out direct attacks on air defenses, artillery, armor, personnel, logistics, and command and control, eroding the will of the Iraqi Army to fight.

Above is a ground scene transmitted to a Weapon System Officer's console by the Pave Tack infrared targeting pod. Pave Tack can acquire and track ground targets, such as tanks (the white patches here), for laser- or IR-guided weapons.

Faster Work Needed

However, there was a problem. Intelligence sources could not report the destruction of enemy forces in the field quickly enough to fit General Schwarzkopf's timetable for executing his theater campaign to eject the Iraqis from Kuwait. Coalition air planners knew they had to concentrate around-the-clock precision firepower on the Iraqi Army's huge array of dug-in equipment. By day, air planners could achieve high kill rates with tactics recycled from earlier conflicts. In order to wreak the same amount of destruction at night, the planners had to come up with totally new tactics.

General Glosson, as 14th Air Division Commander, laid out his plan to Col. Tom Lennon, the F-111F wing commander at the 48th Tactical Fighter Wing (Provisional), based at Taif, Saudi Arabia. Colonel Lennon's initial response to General Glosson's idea was negative, to put it mildly. Nevertheless, the Colonel did all he could to make it work, even scheduling himself in the lead airplane.

Colonel Lennon and Maj. Steve Williams, flying in Charger 07, with Lt. Col. Tommy Crawford and Capt. Scott Gillespie on the wing in Charger 08, became the first combat tank plinkers. The two F-111Fs proceeded to their station above a sixty-by-thirty-mile area comprising two "kill boxes," grids overlaid over Iraqi-held territory for purposes of scheduling and deconfliction.

Each aircraft was loaded with four GBU-12 500-pound, laser-guided bombs. Each bomb was to be dropped on any tank, APC, truck, artillery piece, command-and-control bunker, or supply dump that crews could find in their box. The two initial sorties were so successful that planners scheduled forty-four more sorties for the next night. They sent two-ship and four-ship formations into kill boxes to fly medium-altitude attacks against the enemy's field army. This mission was a radical departure for F-111 crews, but it proved so effective that F-111Fs flew 664 successful sorties over twenty-three days.

Precision made the use of smaller warheads possible. Weapons experts, both civilian and military, had said that 500-pound precision bombs would not be accurate enough to kill tanks, but the GBU-12 had great success. The Pave Tack targeting pod was optimized for large targets at short slant

Above, two F-111s prepare to take off on a tank-plinking mission; two EF-111s rest in the background. Modified for defense suppression, the EF-111 was crucial to allied air supremacy during the Gulf War, rendering Iraqi radar useless.

ranges. The resort to medium-altitude attacks forced Weapon System Officers to learn how to discriminate among tanks, trucks, artillery pieces, and other battlefield objects from miles away.

Mission videotapes showed that the first missions were much more effective than had been thought possible—and much more survivable. The F-111Fs had returned with no losses and no battle damage. Picking off enemy armor from medium altitude at night suddenly seemed a wise use of the aircraft's lethal PGMs, infrared targeting pod, heavy payload, and ability to loiter for long periods.

Generals Schwarzkopf, Horner, and Glosson were impressed by the results, if not by the nickname the crews had given the mission. They had to learn to live with "tank plinking."

Sixteen at a Time

For operational security reasons, videotapes of tank plinking never made CINCCENT's evening press briefings, so the extent of the devastation was not known to the public in the days leading up to the ground operation. In the nineteen days preceding the start of the ground operation, F-111Fs, F-15Es, and A-6s flew hundreds of tank-plinking missions. On several occasions, two F-15Es carrying a total of eight GBU-12s destroyed sixteen armored vehicles on a single sortie.

The new tactic seemed strange to the aircrews but even stranger to the ground intelligence and operations staffs charged with estimating enemy strength. The existing bomb-damage assessment system was not designed to accept videotape-derived BDA from F-111Fs, F-15Es, or A-6s. It took some convincing for Central Command to accept reporting from PGM-equipped units as accurate. When it did, the assessed rate of Iraqi attrition rose dramatically.

The Iraqis, as well as most other armies and military thinkers up to February 1991, believed that digging into the ground and dispersing forces or massing only at night would make them nearly invulnerable to air attack. This was an effective defense for ground forces forty years ago, but its time has passed. Today, if armies dig in, they die. If they come out of their holes, they die sooner.

In the future, an air force that gains and exploits air superiority with precision weapons and persistent attacks will gain tremendous economies and efficiencies of scale. Each GBU-12 dropped on the Iraqi Army cost about $10,000. The export model of Iraq's T-72 tank goes for about $1.5 million on the open market. Since airplanes like the F-111F or stealthy air-to-ground airplanes such as the F-117 can destroy $6 million worth of tanks with $40,000 worth of bombs, it soon becomes costly and nearly impossible for armies to deploy massed armor or artillery against a US Air Force with command of the airspace over the battlefield. ■

Maj. Michael J. "Boone" Bodner is an F-111F pilot and Fighter Weapons School graduate who flew tank-plinking missions during the Persian Gulf War and is now assigned to Air Combat Command. Maj. William W. Bruner III is an F-111 Weapon System Officer and Fighter Weapons School graduate who worked for CENTAF's Director of Campaign Plans in Riyadh, Saudi Arabia, during the war. He is now at the Air Command and Staff College.

As budgets go down, there is less room for mistakes—but confusion and uncertainty are setting the stage for errors.

The Fog of Procurement

By Peter Grier

THE AIR FORCE'S acquisition professionals do not have an easy job. Day in and day out, they are buffeted by conflicting advice. Goals change. In some cases, even program direction remains uncertain. They must cope for years with unstable budgets while satisfying not only their service superiors but also Congress and Pentagon auditors.

The continuing decline in the defense budget narrows the margin for error. Clausewitz examined the fog of war. Perhaps he should also have investigated the fog of procurement.

"The acquisition professional of the United States Air Force today is at war every day, while, generally speaking, the rest of the force is at peace," said Lt. Gen. John E. Jaquish, the Principal Deputy Assistant Secretary of the Air Force for Acquisition, at an Air Force Association symposium held July 15–16, 1993, in Dayton, Ohio.

The stress of this environment may be taking its toll. General Jaquish worries about the proliferation of a "no-risk attitude" among procurement officials. Afraid of having decisions questioned after the fact, some refuse responsibility for anything but by-the-book action, backed by paperwork in triplicate.

If Air Force acquisition is to remain the envy of the other services, said General Jaquish, USAF will have to spread this message: "Above all, never, ever, ever cower in fear of failure."

For procurement officials to succeed, they will have to adapt to an era of great change in military weapons development and acquisition. The need for flexibility and open minds at all levels of the procurement chain came through loud and clear at the two-day AFA conference, "Opportunities and Change: Technology, Acquisition, and Logistics in the Nineties and Beyond."

Speaker after speaker emphasized the need to save money through acquisition reform so that the dollars could be reapplied to shrinking procurement accounts. Many also hailed the benefits of "dual use" technologies—those having beneficial military and civilian applications. The promotion of dual-use items could bolster the domestic economy and broaden the funding base for military research and development, they said.

Seeking a Balance

The new budget era will require a reevaluation of the proper balance

between private and government investment in some technology areas, said a number of speakers. In particular, that may mean commercializing more of the maintenance and modification work now done by the Air Force's five depots, or Air Logistics Centers: Ogden ALC, Hill AFB, Utah; Oklahoma City ALC, Tinker AFB, Okla.; Sacramento ALC, McClellan AFB, Calif.; San Antonio ALC, Kelly AFB, Tex; and Warner Robins ALC, Robins AFB, Ga.

None of these tasks will be simple. In the future, procurement success will probably be equal to "being successful in self–brain surgery while juggling on a unicycle on a high wire in a gusty wind," said conference participant K. C. Overman, general manager of the Systems Development and Engineering Division of Westinghouse.

It seems clear that a major procurement change is on the way. From Secretary of Defense Les Aspin on down, Clinton Administration defense officials are more actively addressing issues ranging from how to preserve the health of the defense industrial base to whether to eliminate restrictive military specification requirements.

There are a number of reasons action may finally be taken on the perennial challenge of acquisition reform, according to several speakers. Primary among them is growing dissatisfaction with the current system.

"I do believe it may work this time, because I think it is well understood that the time is right and there is a compelling need to change," said General Jaquish.

This developing consensus of discontent has at least two causes, said General Jaquish. The first is that many provisions of current laws and policies are, in fact, barriers to acquisition. A recent congressionally mandated study found 889 federal laws related to procurement. The study identified 300 of these laws as impediments to innovation and recommended they be changed.

The second reason is that within the procurement system there are many constituencies, each with an equal say but not an equal stake in weapons development outcome. Thus the Air Force E-8 Joint Surveillance and Target Attack Radar System (Joint STARS) program now includes a directed infrared countermeasures system not called for in the plane's requirements documents.

Joint STARS "was merely the most available vehicle on which to hang the system, which was championed by a special-interest group," said General Jaquish.

More rational purchase practices could save money, giving the Defense Department more purchase bang for its procurement buck. Why, for example, should a jet engine manufacturer employ fifty-two people solely to answer government requests for reports?

The Limits of Reform

The Air Force wants to test a number of model procurement programs. Key aspects of these programs would be waivers to existing laws, lower overhead costs, and greater use of commercial standards. A prime candidate is the Joint Primary Aircraft Training System, which includes an aircraft and simulator equipment.

Not everyone is optimistic that reform will go far or will address the real problems. This is certainly not the first time that industry has heard defense officials pledge to make changes in the name of efficiency. Often, nothing much happens.

Laws that are now considered impediments usually began as responses to something Congress perceived as a problem. Getting Congress to change its mind about such matters is a difficult task.

"Once those laws get on the books, it's like a fish hook to pull them out," said industry keynote speaker William A. Anders, chairman of the board of General Dynamics.

Mr. Anders, resorting to fighter pilot terminology, said he is not a pessimist but an optimist who keeps an eye on his six. He warned that there are some "bogies pulling in" that both the Air Force and industry officials need to consider when planning future acquisition.

For one thing, it is not clear what kind of world role the US public will support for its military. Operation Restore Hope in Somalia is already showing the limitations of working within the UN peacekeeping structure. Yet for the US to remain a superpower in tactical weaponry on its own is very expensive—especially when the nation's unwritten policy is to keep its own casualties as low as possible.

"With costs up, bucks down, maybe a 'no-body-bag' policy, something's got to give," said Mr. Anders.

The new team at the Defense Department faced up to these issues through such actions as the "Bottom-Up Review" of US defense programs and requirements, said the General Dynamics chairman. However, the budget outlook is still cloudy, and the future force structure remains uncertain, which makes it difficult to plan a national security strategy.

Mr. Anders was also less than upbeat about the future of the defense industrial base. Only one submarine manufacturer will survive, he predicted; he felt there are still too many aircraft makers in the US, even after the sale of GD's fighter division to Lockheed.

With so much overcapacity around, he remarked, it will be hard to keep unit costs of new weapons from skyrocketing due to high overhead. Mr. Anders said "the only adjustment" possible is to move some work currently done in-house by the military out to manufacturers.

Despite this, complained Mr. Anders, the Air Force and Navy continue to make major investments in their maintenance and modification capacity. Industry, for its part, has been faster in cutting people and cost structure. In the military-industrial balance between the public and private sectors, he said, the movement is toward the public. Meanwhile, the big original equipment manufacturers (OEMs) are floundering.

Creeping Nationalization

"It's amazing that we have Russia with emerging privatization and the USA with what I consider creeping nationalization," said Mr. Anders.

Some Air Force officials think industry perceptions of their actions are clouded by misunderstanding. That is particularly true for the subject Mr. Anders was obliquely referring to: depot maintenance competition.

According to Gen. Ronald W. Yates, commander of Air Force Materiel Command and therefore the ultimate boss of the ALCs, depot maintenance is one of the procurement areas where "change meets opportunity most clearly."

Unlike other senior Air Force officials—most notably, Gen. Michael P. C. Carns, the Vice Chief of Staff—General Yates is not in favor of turning over the bulk of the work at the five ALCs to private contractors.

"I'm not going to turn over any-

thing that they're not more competitive at than we are," he said. General Yates favors putting depot work up for grabs rather than arbitrarily handing over work to the private sector. By that, he means fostering not only USAF-vs.-industry competition but interservice competition as well.

Current law caps the amount of depot maintenance competition at forty percent of work load. General Yates said he is working to get that lifted. "I believe 100 percent of our work load should be competed, either with industry or with the other services," he said.

The AFMC head agreed that the Air Force should retain "core work" in depots. However, he said that he believed the true amount of core Air Force work has been overstated. Other Air Force conference participants suggested that heavy repair of aircraft should not necessarily be deemed a core capability since, given the rapid pace of today's combat, it is unlikely that a damaged aircraft could go through the repair cycle fast enough to get back into action before a war ended.

General Yates said he is doing everything he can to make current depot maintenance competitions fair. It is true that the government does not have to make a profit, he said, and that it does not have to pay income taxes. But, he pointed out, government depots are far more constrained in (among other things) the use of part-time employees; they have to buy materials from designated Defense Department sources; and their overhead includes such extraneous factors as the cost of base fire protection.

Level the Field

The goal, said General Yates, is not to make sure that the competition has been perfectly evened out, but to "adequately level the playing field."

Maintenance and modification specialty houses are already competitive with the depots, said General Yates. OEMs are not, mainly because of the research and development and engineering costs that they carry.

At a press conference, General Yates suggested that OEMs will have to create modification companies separate from central research. A core firm with development capacity would remain, though General Yates admitted he had not planned to keep important R&D teams together.

"Competition is the first step, and later on you probably have to have a broader plan," he said. "The broader plan might include how you keep these core companies."

As to interservice competition, General Yates denied that he is looking to steal Navy business. If Navy depots are cheaper than those of the Air Force, they will get all the work, he said.

Right now they are not. Last year's Air Force depot work done at Navy rates "would have cost me another $800 million," said General Yates.

The Defense Department remains concerned about the state of US military R&D. It is a harsh fact that the defense budget will have declined by forty percent during the decade ending in 1996; for industry, the drop will be even greater: Revenues from the Pentagon will drop by sixty percent over the same period.

The Department of Defense wants defense and commercial industry to form a single, coordinated industrial base, competing strongly overseas as well as at home. Whether that happens is to a large extent in the hands of industry, argued Anita Jones, the Pentagon's director of Defense Research and Engineering.

One action industry must take is consolidation, she said. That is happening, and the Defense Department can help it along with more accurate predictions about the fate of future programs. In the past, Future Year Defense Programs have been not just unrealistic but also misleading and therefore counterproductive. US industry would make investment decisions based on such plans, but "when reality came to pass, it was quite clear that a particular program really had no chance of being funded," said the new DDR&E.

A second industry task is diversification. Airplane manufacturers are not about to switch their production lines to banging out washing machines, but it is possible to harness defense technologies for commercial use.

"Because that hasn't been looked at too hard in the past, . . . there are some nuggets of opportunity there," said Dr. Jones.

The use of independent research and development funds will be less constrained in the future now that the Pentagon has ruled that contractor diversification is in the interest of national security. The rule of thumb has been that three percent of defense industry revenue was reinvested in R&D. With profits under pressure, that figure may decline. Dr. Jones said she does not believe firms will take the shortsighted step of zeroing their R&D budgets.

Several defense-related technologies show particular promise as dual-use items, according to the Pentagon research director. One is modeling and simulation. Another is information technology to support manufacturing. Proper use of this so-called "agile manufacturing" technique would enable contractors to build civil and military products at the same time.

"You can build a few defense items by rapidly changing the parameters on-line and then reverting to another class of product," said Dr. Jones.

Westinghouse is one firm that has successfully adapted some of its expertise to the civilian world. Back in the mid-1980s, the firm targeted three business segments in which it thought it could compete: transportation, information, and security systems.

In transportation, Westinghouse radar and air defense research was translated into air traffic control expertise. In information, the company is working on ground mobile communications terminals. In security, Westinghouse has developed a monitoring system now installed in more than 200,000 homes.

"Those who quickly downsize and consolidate and those who push hardest and fastest at diversification based on their market positions are more likely to be correct than those who are indecisive," said Westinghouse's Mr. Overman.

Diversification is not enough. If the United States is to maintain its world-class defense capability, some tough challenges must be met, argued Mr. Overman. First is a broadening of the funding base for technology development. Second is a quantum improvement in the acquisition process. Third is to somehow halt the precipitous decline in the procurement budget. ■

Peter Grier is the Washington, D. C., defense correspondent for the Christian Science Monitor *and a regular contributor to* Air Force *Magazine. His most recent article, "Leaner Links and Tighter Squeezes," appeared in the September 1993 issue.*

People who know countermeasures count on Sanders.

We're on board the best aircraft in the world because we offer the best protection.

Combat proven in every military branch and with allies around the world, our countermeasures systems lead the industry in innovation and effectiveness. That's why people who know countermeasures systems choose Sanders.

Today, we're guiding electronic warfare into a new age with the electronic combat suite for the F-22 and the Advanced Threat Infrared Countermeasures System, two of the most sophisticated avionics architectures ever designed.

Backed by 40 years of experience, Sanders delivers innovative, affordable and effective countermeasures, including missile warning systems, expendables and ESM. That's how we became the industry's preferred supplier; that's how we intend to stay that way.

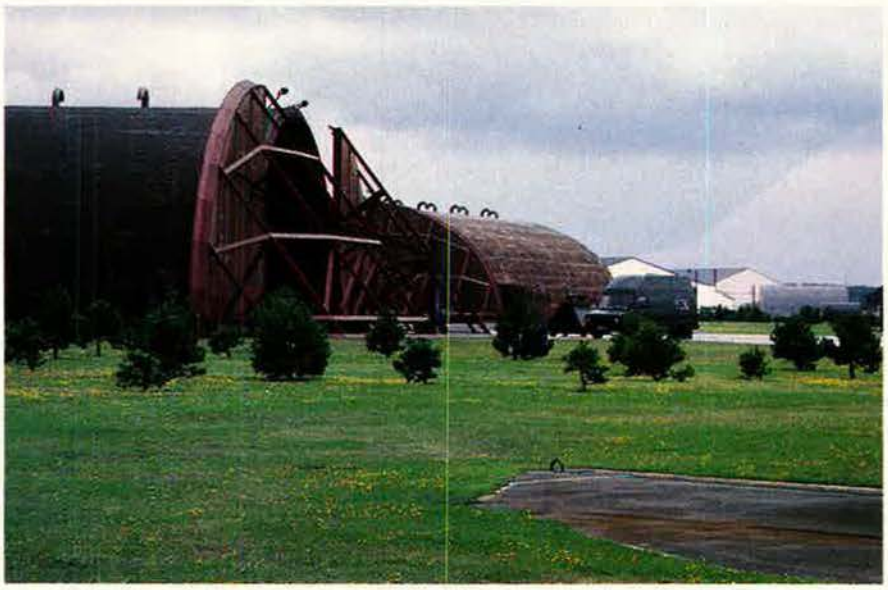
Lockheed leads.

Lockheed Sanders

The USAFE mission has shifted. F-15Es had barely settled in before preparing to deploy for regional operations.

New Drill at Lakenheath

By James Kitfield



Above, nestled amid the shrubbery at RAF Lakenheath, UK, are the hardened shelters characteristic of air bases in Europe. Formerly the home of F-111s, they now house F-15Es. Opposite, F-15Es of the 48th Fighter Wing cruise above the English countryside.

EVEN AS NATO pondered air strikes into Bosnia, Air Force F-15E units in Britain faced another tough challenge.

The 48th Fighter Wing at RAF Lakenheath had not been committed to Balkan operations. It was up against the start of a major deployment to Turkey, where F-15Es would bed down at Incirlik AB and patrol the dangerous airspace over northern Iraq in support of Operation Provide Comfort.

Though unrelated, the two occurrences—contemplation of combat in the Balkans and deployment to Turkey—pointed up a dramatic shift in the mission of US Air Forces in Europe.

USAFE was once a collection of fixed, in-place fighting forces focused on discrete parts of the Soviet war machine. Now all signs are that USAFE is becoming a true expeditionary force, its squadrons ready to go virtually anywhere within the NATO treaty area with little notice and fight on arrival.

Nowhere were the pressures of this change felt more acutely than within the 48th Fighter Wing. The outfit was already coping with problems caused by a transition from the potent but aging F-111 aircraft to the state-of-the-art F-15E. Because spare parts bins at Lakenheath were not yet filled with enough materiel to support a massive fighter deployment, maintenance personnel had to borrow parts from some fighters so that others could function.

At the same time, Air Force officers at Lakenheath understood that, if NATO decided to launch air strikes into what once was Yugoslavia, their F-15E crews would be top contenders for the mission. The fighter's precision-strike capability marked it for such a mission.

Doing Business Differently

The realization that the wing could be tasked with such an operation on a moment's notice changed how it does business, said officers.

"As NATO redefines its role in the world," noted Brig. Gen. Kurt B. Anderson, commander of the 48th FW, "and increasingly takes on mobility missions for which it is totally unaccustomed, we will find ourselves potentially committed [to fight] wherever the NATO umbrella falls."

USAFE officers pointed out that, of the forty-eight nations that fall within the sphere of interest of the Western Alliance, eighteen are now engaged in armed conflict. "That changes things significantly for a wing that just a few years ago was completely oriented to fighting in northern Germany from its home base," said General Anderson. "We're still in the process of defining what it means to become a deploying wing."

USAFE's deployment statistics certainly support the claim that its mission has shifted decisively toward mobilization and deployment. By the end of 1993, half the 42,000 airmen assigned to the command will have deployed for such contingencies as Operation Provide Comfort in Iraq and Operation Deny Flight in the former Yugoslavia. Two years ago, only one in five airmen in the command received temporary orders to take part in a deployment.

That shift in mission affected operations at Lakenheath in ways large and small. Deployment must be an integral part of a wing's mindset, officers said, because even the smallest mobilization problem can be a potential war-stopper.

"Something as routine as pallets for loading equipment becomes a significant roadblock if you don't have them," said General Anderson, who noted that the 48th FW has begun to acquire a host of support equipment essential for fighting on the road. "Not only has this wing not had to think about or develop mobility plans in the past, but we don't have all the equipment necessary for deployment, and it will be some time before we're at that point."

In an effort to develop procedures to ease the wing's transformation, officers at the 48th have been in close contact with their counterparts at the 4th Wing, Seymour Johnson AFB, N. C., the first operational wing to field the F-15E. General Anderson said he has closely studied the experiences of the 4th Wing during its deployment to Saudi Arabia in 1990–91 for Operations Desert Shield and Desert Storm. "We're using their memory of the deployment to the desert to shorten our learning curve," said the General, who added that he hoped to be able to reduce the amount of time required for the UK-based wing to acquire the same capability.

Helping to smooth the transition is the high level of experience found among the 48th Wing's pilots, most of whom flew F-111s during the war after the 48th deployed to Saudi Arabia. Most have switched from the F-111 to the newer fighter.

Making the transition to the F-15E required four months of retraining at Luke AFB, Ariz. The training has produced a group of pilots with experience deploying to and fighting in the Persian Gulf region and with intimate knowledge about flying on the Continent and in the United Kingdom.

A Shorter Fuse

Wing officers said that, in an effort to hammer home the importance of rapid response to crises, the 48th FW

has been put on the same short fuse as Stateside fighter wings, which historically are more accustomed to deployments away from home bases. These officers say that the 48th FW now must be ready to ship out its first combat-ready squadron within twenty-four hours of an emergency deployment notification.

The shift toward a rapid mobilization mission and more frequent deployments puts yet another strain on a command already reeling from the tumultuous changes buffeting US forces in Europe. Personnel wondering about their future in a dramatically downsized Air Force are now having to contemplate longer separations from their families.

In a recent interview carried in the service newspaper *Stars & Stripes*, USAFE's commander in chief openly acknowledged a problem in the making. "It puts stress on marriages," reported Gen. Robert C. Oaks. "It puts stress on family relationships. When people feel stressed, their morale goes down. That kind of deployment figure is a significant morale problem."

Those stresses come on top of the natural uncertainty created by the Air Force's rapid withdrawal from Europe and the closing of major bases such as RAF Upper Heyford in England, formerly the home of three F-111 squadrons.

Europe has been at the epicenter of the pullback of US forces from abroad. According to Defense Department statistics, the total number of military sites overseas has been reduced by fifty percent since January 1990. Of the 840 sites overseas where operations have ended or been reduced in the last three years, 773 are in Europe.

Meanwhile, the force structure of USAFE has been cut from its 1990 level of 8.8 fighter wing equivalents with approximately 650 aircraft to a 1993 level of 3.5 fighter wing equivalents with 258 aircraft. USAFE officers say that, by the end of 1994, the force structure will have fallen to a mere 2.33 fighter wing equivalents with 168 aircraft.

The total number of USAFE personnel (military and civilian) has shown a corresponding drop—from 70,839 in 1990 to 47,759 in 1993. That number is expected to drop further, to roughly 30,000 by 1995.

"The entire Air Force is getting smaller, and certainly we're not insulated from that," said General Anderson. "In fact, you don't really feel overseas you have the safety net if things go badly. The ready option of walking out the gates and applying for a job in the local community is just not there."

General Anderson thus believes that the greatest challenge for all USAFE commanders is to assuage fears so that personnel remain focused on the mission. At Lakenheath, that effort is bolstered by the recent growth of the base. Later this year, for instance, the 48th Fighter Wing will welcome a squadron of F-15C aircraft, adding significantly to the wing's ability to deploy and establish air superiority.

It is encouraging to Air Force troops "to be stationed at a base that's growing as opposed to closing," said General Anderson. He added that "the aircraft we own make us a preeminent force within the Alliance."

Technicians of the 48th Fighter Wing, also known as the "Statue of Liberty Wing," work on an F-15E. The 48th is the only USAF wing with an official descriptive designation, which was given as a symbol of US-French cooperation.

Fewer, Better

In many ways, the 48th Fighter Wing's transition from the F-111 to the F-15E mirrors a broader Air Force trend toward relying on smaller numbers of more modern and capable aircraft. In 1991, the service announced that all F-111E and F aircraft based in Great Britain would be reassigned to bases in the United States, although some will remain assigned to NATO missions and redeploy to British bases for future exercises. The first of the F-111s left Lakenheath on August 10, 1991, and the last on November 12, 1992.

The 3.5 squadrons (including trainers) of F-111s that were based at Lakenheath will be supplanted by two full squadrons of F-15Es. At present, the 492d Fighter Squadron is fully operational, while the 494th is still accepting delivery of its complement of F-15Es. The second squadron is expected to reach initial operational capability by the end of this year.

Maintenance officials conceded that they had been going through a somewhat difficult transition as they learned more about the design and failure rate of various subcomponents of the F-15E. Because the F-111 had been in the Air Force arsenal since 1968, the aircraft had become a known quantity for support personnel. In its last year at Lakenheath, the F-111 was logging relatively high mission capable rates of around eighty-five percent.

Despite the teething period, however, the F-15E dual-role fighters at Lakenheath already average nearly fifty percent more sorties per month than had the typical F-111 (17.5 vs. twelve).

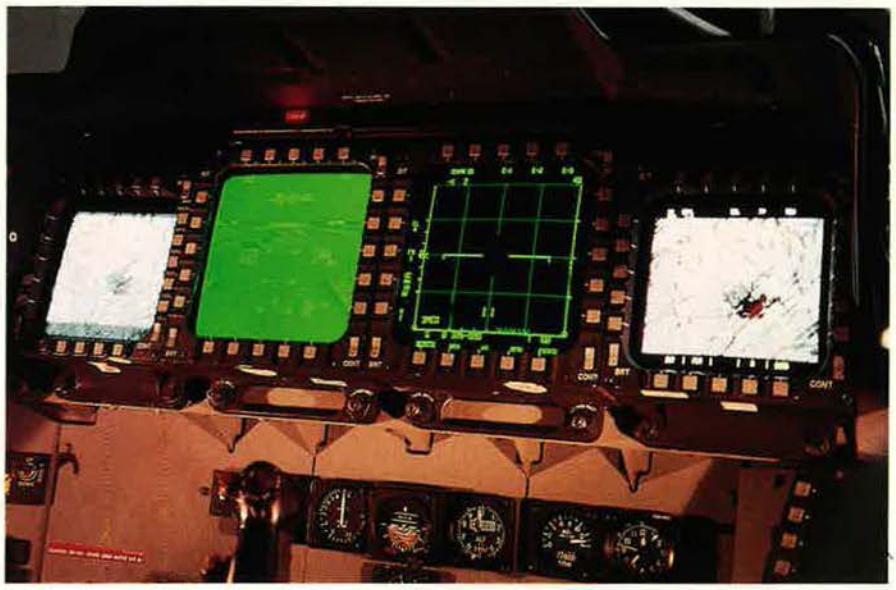
"We can turn the F-15E around quicker because it doesn't break as often or as hard as the F-111, and that higher utilization rate means we've been able to replace three combat squadrons with two without really giving up any combat capability," said General Anderson.

Because of the F-111's greater size (47,481 pounds empty, compared an empty weight of 32,500 pound

and an internal weapons bay, the older airplane has a slight edge in range. The first variable-geometry aircraft to enter service in any country, the F-111 also has sophisticated low-altitude capability, due in large part to a terrain-following radar and high wing loading when its wings are swept fully aft.

However, pilots at Lakenheath said the F-15E represents a quantum leap in overall capability. While both aircraft have all-weather and night attack capability, the Eagle has the added plus of a forward-looking infrared capability as part of the LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) system.

"While I don't know if there will ever be another fighter with quite the range of the F-111, the F-15E is close, it carries a greater weapons load, and at night its infrared system gives the pilot the added confidence of a visual lookout," said General Anderson, who has made the transition to the F-15E.



F-111 crews making the switch to the F-15E went through a rigorous program. After four months of instruction at Luke AFB, Ariz., crews trained on mission simulators (above) to prepare for emergencies that might arise in combat.

Deadlier in the Air

The F-15E most clearly surpasses its predecessor in air-to-air capability. While the F-111 is capable of carrying two AIM-9 Sidewinder missiles for self-defense, its air-to-air capability is not impressive, say pilots.

"We've transitioned from an aircraft that at best had a limited self-defense capability to one that carries the most advanced air-to-air weapons and radar and that, without bombs or extra fuel tanks, is as maneuverable as anything in the air," said General Anderson. "The F-15 is the best air-superiority aircraft in the world."

With that capability comes complexity. Air Force officials put pilots and weapon systems operators through a rigorous, four-month training program at Luke. USAF rushed an F-15E flight simulator to the 48th Wing so that they would be there when the first new aircraft arrived.

Experienced aircrews are required to log eight "missions" on the simulator each year. Less experienced aircrews must "fly" twelve simulated missions. According to Air Force officers at Lakenheath, those aircrews just beginning to make the transition from the F-111 to the F-15E were logging all the simulator time they could schedule.

"On the simulator, we can throw any number of emergencies at the aircrews, tasking them right up to their saturation point, without risking either their lives or an aircraft," asserted Ken Peterson, the project manager for the wing aircrew training device at Lakenheath.

"Because of national flight restrictions in Europe, they can also practice low-level ingress and egress at heights they could never actually fly short of a war."

Lakenheath officials say low-level flight restrictions in the United Kingdom have not been nearly as stringent as those on the Continent, especially in Germany. There is also an array of ranges dotting the eastern coast of England and the less populated reaches of Scotland and Wales. With the expected arrival of an F-15C squadron, the wing intends to make greater use of the Air Combat Maneuvering Instrumentation range over the North Sea for air-to-air training.

"The training environment in the UK is the best in Europe, bar none," said General Anderson.

While the notoriously soggy English weather sometimes presents challenges, he said, that's not all bad. Rainy and foggy conditions are certain to confront pilots during an actual deployment, so it is helpful to train in them as well.

As far as low-level restrictions, the 48th Fighter Wing has declined to go as low as the British government allows or as the Royal Air Force routinely flies. "The British people have a very strong appreciation of the value of airpower," said General Anderson, "and the government hasn't levied the restrictions on flying that our pilots face in Germany. We've gone to great pains to protect that capability."

Given the growing requirement for USAFE forces to deploy in response to worldwide contingencies, General Anderson also noted that the chances that the 48th Fighter Wing's training will be supplemented by flying in actual combat have never been greater.

"If you're operating in the European theater, there's a good chance you'll be presented with a real-world contingency, such as flying over northern Iraq," said General Anderson. "That's not just a simulator ride. There are real SAMs on the ground, and periodically they will really shoot at you. Those missions also drive home the point to our pilots that any fighting we do in the future will most likely occur from a forward operating base to which they've deployed." ■

---

nes Kitfield is a defense correspondent for Government Executive *magazine Vashington, D. C. His most recent article for* Air Force *Magazine was "The ret Doings at Tonopah" in the January 1993 issue.*

NATO E-3s, watching the skies over Bosnia, demonstrated their new emphasis on regional crises.

Balkan Patrol

By Eric Rosenberg

Photo © Bob Prothero / Arms Communications

NATO's eighteen E-3A Airborne Warning and Control System planes (which bear the insignia of Luxembourg) operate primarily out of Geilenkirchen, Germany. A NATO AWACS plane carries an international crew of seventeen, thirteen of whom are AWACS specialists. Since the end of the Cold War, the fleet's mission has shifted toward support of international peacekeeping efforts.

HIGH ABOVE the Adriatic Sea, skimming down the coastline of what used to be Yugoslavia, the E-3A Airborne Warning and Control System aircraft was all eyes and ears. Its radar scanned the sky in every direction. Its listening equipment scooped up audio signals throughout the region.

US Air Force SSgt. Melvin Bright listened on his headset to radio traffic from warships and from another E-3 orbiting over Hungary. He flipped channels, searching for the BBC. Suddenly, a surveillance operator barked, "Zombie!"—a potential bad guy. On a radar screen in the console area, the unidentified plane could be "seen" headed for Bosnian airspace.

"It's UN," Sergeant Bright said.

"No, it's not," retorted the other operator, a German.

The aircraft, tracking the coastline at low altitude, seemed prepared to turn eastward toward Sarajevo. That was a normal route for UN flights, but this flight could not be found on the latest schedule. Had it displayed the flight profile of a fighter—high and fast—it would have presented a challenge for US F-15Cs soaring nearby. The target, flying low and slow, looked more like a helicopter.

"We have a squawk on him, a code three," said Sergeant Bright. This squawk—a signal from the aircraft's transponder—identified the plane as a likely friend. Minutes later, the crew redesignated the aircraft, labeling it "UN Flight 174."

"We made a call to the ground and found the UN had filed a [late] flight plan," said Capt. Michael Hentrich, a Luftwaffe officer. "The ground let us know the track came out of Split [on the Croatian coast] and was heading toward Sarajevo."

That's how life went aboard this NATO E-3 flight—long stretches of calm peppered by short bursts of anxiety and action. That night's mission was one of more than 500 sorties that the AWACS fleet had flown since Operation Deny Flight began in April. The sorties underscored the evolution of the NATO aircraft from Cold War sentries on guard for a Warsaw Pact attack to clearing houses for commanders in regional conflicts.

NATO owns eighteen AWACS aircraft, their sides stamped with "NATO" and the Alliance insignia, and they are separate from their counterparts in the US Air Force. They are stationed at a German air base in Geilenkirchen and can operate from bases in Turkey, Greece, and Italy, and their crews include US Air Force members.

Big Changes

The NATO AWACS mission has changed dramatically over the past year and a half. Said Air Force Maj. Gen. John D. Logeman, Jr., commander of the NATO Airborne Early Warning Force, "What started out to be primarily a radar surveillance mission is now surveillance, command and control with communications links, and . . . positive control to the fighter interceptors. . . . We basically are the focal point for the execution of the mission. The tasking order comes out from the ground commanders to all the air forces and maritime forces. The decisions are communicated to the forces through AWACS."

That is a long way from the time when the NATO E-3s' main missions were looking for Soviet attack and controlling theater-wide operations. "We have come out from where we were during the Cold War days," said General Logeman. "That has now changed into the world of peacekeeping and crisis management and other kinds of operations, like Bosnia."

On July 16, 1992, the E-3 began day flights for Operation Maritime Monitor, flying above a NATO and Western European Union flotilla gathering on the Adriatic Sea to watch for embargo violators. The AWACS aircraft commenced Operation Sky Monitor on October 16, 1992, to support a flight ban while watching over UN relief aircraft.

Both Maritime Monitor and Sky Monitor were performed with a single AWACS orbit over the Adriatic. By late October, stymied by radar "dead spots" caused by mountainous terrain, the Alliance had negotiated an agreement with Hungary to allow a second AWACS orbit. Two AWACS planes working in tandem—one over the Adriatic and one over eastern Europe—afforded NATO and UN forces a more complete view of Bosnian airspace.

The E-3 gave the no-fly enforcement effort its means of command and control, close fighter control, and radar surveillance and communications links. None of these services is "part of our traditional bag of tricks," General Logeman said. "We're having to learn fast, create as we go, and train in new missions."

This flight began at Geilenkirchen with a weather forecast of thunderstorms. The flight to the Adriatic took about ninety minutes. From the cockpit of the E-3, one could faintly see the coastline of Croatia with lightning flashing in the anvil thunderheads above.

USAF Capt. Jaimie Mullis piloted the jet to a predesignated orbit, turned on the autopilot, and headed to the galley. For the cockpit crew—two pilots, a navigator, and a flight engineer—these flights were "pretty basic," said Captain Mullis. Their main job was to fly the plane in a pattern maximizing the reach and clarity of the signal from the radar, housed in its trademark thirty-foot-wide, pancake-shaped, rotating radome atop the fuselage. The crew did this by perodically varying the aircraft's fifteen-nautical-mile orbit from an elliptical racetrack pattern to a circular path to a figure eight.

Live Broadcasts

The radar turned 360° six times each minute. The information was sent regularly to ground forces via a data link, a two-way funnel system. The radar air picture was beamed live to NATO forces in Italy and to Western warships on the Adriatic. Ground and naval forces in turn could send data from their own radars up the link to the AWACS, which fused the information into an aggregate picture. Link control, in effect, allowed the AWACS crews to filter data from all participating forces and disseminate the crucial portions.

The E-3As could not enter Bosnian airspace, but their radars, with a range of 300 nautical miles, could peer deep into Bosnia from a safe distance. When the take from this aircraft was combined with radar imagery from the E-3A operating over Hungary, the "air picture" became extensive and detailed.

"We've been doing this for quite a while now," said Captain Mullis, who racked up 180 flight hours in two months this summer and has already flown 300 more hours this year than in all of 1992.

The heart of AWACS operation was in the aft section, where thirteen specialists, including a tactical director (TD), occupied their workstations. The flicking of switches and toggles accelerated as orbit was established and the crew officially went "on station" scouring the skies for violators.

Three surveillance operators interpreted raw radar data. Two surveillance control operators served as conduits between the surveillance operators and the tactical director. Two "weapon controllers" and a fighter allocator relayed coordinates of suspected violators to NATO fighters over Bosnia.

Sergeant Bright and his fellow surveillance operators were the first line of defense against suspect aircraft. One assessed airspace over the no-fly zone. A second watched Croatian airspace on his console. A third monitored Serbia.

On Second Thought

Sergeant Bright's green monochrome radar screen clearly showed the demarcation of Bosnia, Croatia, and Serbia. Several live images of aircraft traversed the screen in the area representing Serbia. The planes approached the Bosnian border but turned away at the last moment, heading back in the opposite direction.

The tactical director for this flight, USAF Maj. Mace Mercer, transmitted AWACS information to forces on the ground and was responsible for determining whether fighter aircraft

from the 5th Allied Air Force should be scrambled to investigate an aerial target.

"The TD relies on us to determine whether something is a good track," said Sergeant Bright. "If it is a good track, he sends it down to the ground stations."

The AWACS orbits had been relatively calm, said Major Mercer. "There hasn't been a change in these missions," he said. "This is twenty-four-hour surveillance of the no-fly zone. There are combat air patrols coming off station, combat air patrols coming on station."

The surveillance operators ensured that all aircraft in the region were "coordinated." This required the crucial determination of whether a particular plane was hostile or friendly.

Most commercial and military aircraft use transponders to emit an electronic squawk that announces an aircraft's direction, altitude, and status as friend or foe. Conceivably, a hostile aircraft could use a friendly squawk as cover. That was a concern for the E-3A over Hungary, which watched not only Bosnian airspace but also the air traffic in Hungary. "You've got jet traffic all over there," said Captain Mullis. "It could be very easy to send a plane in there and squawk a commercial aircraft code."

The consequences of misidentifying a jet could have been devastating. The E-3 has no self-protection equipment. "You've got to worry about the rogue aircraft," said Captain Mullis.

The mission rules were explicit: Only UN flights and Allied relief aircraft were to fly over Bosnia. Anything else was to be treated, at least initially, as hostile. Whenever an unknown target flew toward Bosnia, a surveillance operator tagged it with an electronic arrow visible on nine consoles.

The crew, in coordination with ground stations, had to determine the plane's identity within three minutes of detection. "It's basically assumed guilty until proven innocent," said Sergeant Bright.

The attempt at identification was done via communications between the aircraft and NATO ground stations in Italy, which talked to UN forces in Zagreb, Croatia. The AWACS crew had the evening's manifest for scheduled UN flights in the area. However, unscheduled UN flights were not uncommon; UN observers often would fly in by helicopter and the flight information would never make it onto the daily flight sheets. If no one on board the E-3 or on the ground could identify the suspect aircraft, the crew's fighter allocator, at the TD's order, would vector Navy or Air Force jets to investigate.

Electronic Nest

An AWACS E-3 is a nest of computers and high-tech communications gear. It takes two dedicated technicians just to watch over a wall of computer-driven communications suites. Two other technicians ensure that the radar and its computers function properly.

On this flight, USAF SMSgt. Tony Wickliffe watched over the aircraft's central computer. Sergeant Wickliffe was responsible for loading and maintaining the airborne operational program. He had to make certain that, from navigation suite to radar, the electronics were connecting properly with the central computer and were properly tuned to each other.

Sergeant Wickliffe conceded that shutdowns did occasionally occur, but he added that very few missions were scrubbed for computer troubles. "There are quite a few things we can do before we go home," he said. "We can kick in the redundant units. We can lose two or three memory units and still run. We can lose a computer processor."

Redundancy is an AWACS strength. This aircraft had two digital processors, each of which could function as the electronic brain of the plane. "One is on line all the time, while the other is backing up the system constantly," said Sergeant Wickliffe.

The most prevalent technical problems related to software. "We carry enough airborne operating computer tapes so we have some redundancy," said Sergeant Wickliffe. "If we hit three or four bad tapes, we may have to go home."

Before the crew would scrub a mission, the technician had to contact a computer expert on the ground. Half the battle was isolating the system that was failing. Failures often occurred in the computer interface with a particular system such as the radar. A simple rebooting of the airborne operational program could remedy that. "There are only a few times when you say, 'Yes, we're out of business,' " said Luftwaffe TSgt. Berd Schuch, who was responsible for the radar and the identification, friend or foe (IFF) system.

At times, the mission crew in action resembled a reserved Wall Street trading house. The audio traffic on the headsets crackled with activity, slowed, then picked up again in waves. Crew members mingled and examined the friendly air movement printout sheets, ate chicken box dinners at the radar consoles, and took breaks.

USAF officers were keen to note that a NATO AWACS plane is not a command post where tactical decisions are made. Rather, it functions as a flying middleman. The AWACS crew could not make the determination to order an Allied aircraft to shoot down a suspected violator. That had to come from superiors on the ground.

"We're collecting radar data, sending it down, and getting feedback from ground surveillance all the time," said Captain Hentrich. "We are all the time in the middle. The decisions are made at the ground in headquarters."

During this particular AWACS mission, two US F-15Cs dispatched from Aviano AB, Italy, appeared on Captain Hentrich's radar screen. These fighters were flying regular combat air patrols. On the screens, their image tracks wheeled around Sarajevo and then headed back west. Contacting the F-15s by radio, Captain Hentrich guided them to an airborne KC-135 tanker for refueling.

At that point, Deny Flight appeared to be having its intended effect. Before enforcement of the no-fly zone began, the UN tallied some 500 violations of the flight ban. Afterward, the UN had counted only about two dozen violations by the end of the summer. With USAF F-15 fighters roaming the skies, "there is not much flying," General Logeman said.

Major Mercer said that an Allied air attack would not have caused much change in the E-3's activity. "We'd be busier," he said. "A lot more people would be in the data link with more planes flying around. I don't think anything we [wouldn't] be able to handle."

Eric Rosenberg, an editor with Defense Week, *flew on a NATO E-3A AWACS aircraft during a mission in support of Operation Deny Flight. This is his first article for* Air Force *Magazine.*

One You'll Want to Keep

Up From Kitty Hawk

On December 17, 1903, Orville Wright flew for 120 feet.
It took him all of twelve seconds.
It was the first of four flights at Kitty Hawk, N. C.,
that day in the frail-looking craft he
and his brother Wilbur had built, but it unlocked
the secret of powered flight. It also changed the world forever.

In its December issue, on the ninetieth
anniversary of the Kitty Hawk flights, AIR FORCE
Magazine will publish a sweeping

Chronology of Airpower and the Air Force from 1903 to 1993.

This issue is one you'll want to keep
for your reference library. Don't miss it.

Bulk Rates Available: Twenty-five copies or more, 1/3 off
cover price for orders received by November 15.
Call 703/247-5800 ext. 5722

AIR FORCE

1501 Lee Highway · Arlington VA 22209-1198

Grit is in. Flamboyance is out. The main job is cargo, but at times it includes dropping paratroopers, fixing the heater, or helping deliver a baby.

The Loadmasters

By Robert F. Dorr

VISITING his daughter's fourth-grade class, TSgt. Rick Gehris stood to describe what he does for a living. In some ways, putting this into words was more difficult than jet lag, "bag drag," missing crew buses, and other hazards of his trade.

"A loadmaster makes sure the aircraft is set up to fly," explained Sergeant Gehris. "He checks the cargo and determines the weight and location of the load." He pointed out that much of his work is never seen by others because it takes place an hour or two before or after a mission—planning, calculating, loading, and unloading. Often, the crew bus has carted everybody else off to a hot meal and a warm bed while he is still at work.

The loadmaster needs to know many things, Sergeant Gehris continued. He or she needs math to make decisions about weight and balance and keep up on rules for packaging materials and hazardous cargoes. He or she must know how to rig special loads to be air-dropped—as did Sergeant Gehris (of the 37th Airlift Squadron, 435th Airlift Wing, Rhein-Main AB, Germany) when he flew the first C-130E drop of humanitarian supplies into Bosnia.

"You need rigging skills," said the Sergeant. "If you're carrying passengers, you supervise and watch after them. If you qualify for it, you need a whole set of skills to deliver things by low-altitude parachute extraction . . . or via airdrop."

Thus did one NCO articulate the tasks of what another loadmaster, SSgt. Steve Bartz, calls the "cargo compartment commander." Just about everyone who's flown in the huge, dim, almost windowless shell of an Air Force transport cabin has watched a loadmaster struggle with locks and latches, positioning cargo so that an airplane in flight will balance as beautifully over its designed center of gravity as if it were flying empty.

The loadmaster counts. If he or she tells the pilot that something is leaking, giving off dangerous fumes or vapors, and should be chucked overboard, the pilot is likely to concur. The loadmaster knows how to reconfigure the aircraft, changing it quickly from a cargo ship to a hospital plane or "prepping" it to carry the President's limousines or a Minuteman missile, which fits so snugly in a C-141 fuselage that it must be loaded with the aid of surveyors' instruments.

The Real Job: Cargo

Sergeants Gehris and Bartz and their colleagues work hardest when their C-130, C-141, or C-5 is hauling cargo. That's their real job; any mass movement of troops will rely on civil contractors and, in a pinch, the Civil Reserve Air Fleet. When passengers are on board, the loadmaster is responsible for the lights, the oxygen system, and the intercom that serve the cargo compartment. Loadmasters also routinely pass out coffee, minister to the airsick, give first aid, struggle to get the floor heater working, and on occasion help deliver a baby, though such tasks are not the focus of their work.

It is a job where steady, persistent grit is "in" and flamboyance is out. The loadmaster attends to the loading and unloading, participates in the preflight and postflight routines, arranges for supplies and equipment, handles passenger and troop safety, and conducts airdrops.

Loadmasters truck their way through time zones eating and sleeping when they can and typically are away from home two weeks at a time. It is especially hard on C-130 crew members, who deploy to distant locations for months (Saudi Arabia and Somalia are recent examples). The good news, says SMSgt. Randy Guy, the Air Staff's enlisted aircrew manager, is that "at any hot spot on the globe you'll see a C-130 landing on the tarmac and our people setting up tents to live in." The bad news: "There's an increase in these deployments, and it's a drain on a person's life."

Gen. Michael P. C. Carns, USAF Vice Chief of Staff, calls away-from-home demands on the C-130 fleet "one of the biggest problems we face." Among loadmasters, those on C-130s are the most junior and have the lowest retention rates.

Other loadmasters live the "crew dog" life. MSgt. Steve Bedsole, chief loadmaster with the 9th Airlift Squadron at Dover AFB, Del., saw a need to guard against mental fatigue when C-5 loadmasters paused at Taif, Saudi Arabia, during Operation Restore Hope in January 1993.

"We'd have seven people per room, one shower, no TV," he said. "Those who'd slept their eight hours would be milling around or playing cards while others were trying to sleep." Sergeant Bedsole develops techniques to prevent loadmasters from "hitting the wall" with stress during a surge in missions.

The job, often viewed as colorless, is rewarding to most because of camaraderie. "It's not a job, it's a brotherhood," says one loadmaster, using the term to include both sexes. There also is great variety. "It may be Black Hawks to Bangkok today or tanks to Taif tomorrow," says Sergeant Bedsole.

At one time or another, a loadmaster must grapple not just with the obvious—ammunition, foodstuffs, fuel in fifty-five-gallon drums—but also with the unexpected. For example, there is

Photo by Ross Harrison Koty

SSgt. Ted W. Herbert of the 22d Airlift Squadron, 60th Airlift Wing, Travis AFB, Calif., supervises the loading of a C-5B. One of the world's largest planes, the Galaxy can carry 340 passengers, two M60 tanks, or three CH-47 helicopters.

Photos by Ross Harrison Koty

The versatile KC-10 Extender tanker/airlifter has played a key role in many UN humanitarian and peacekeeping operations. These KC-10 loadmasters recently airlifted food and supplies to Somalia in Operation Restore Hope.

Last year, MSgt. Karl Hinkamp (now a loadmaster with the 62d Airlift Wing, McChord AFB, Wash.) set forth to research the background of his career field while attending the USAF Senior Noncommissioned Officer Academy at Maxwell AFB, Gunter Annex, Ala.

Surrounded by the best historical archives in the Air Force, Sergeant Hinkamp could find almost nothing to help him out. He could not find the word "loadmaster" in any World War II documents. Loadmaster duties were divided among a variety of specialties, officer and enlisted.

Sergeant Hinkamp found that crew chiefs were ordered to "check loading" of gliders during operations in Tunisia, a weight-and-balance officer ascertained that cargoes were distributed evenly, and officers supervised loading crews in the Pacific. Today's loadmaster seems to have originated in the China-Burma-India (CBI) theater.

a documented case of a whale being carried aboard a C-141.

Pack Rat

The loadmaster often rounds up the box lunches and usually has an extra stash for those long journeys through changing time zones. "The loadmaster is the pack rat of the crew," says Sergeant Bartz. "A good loadmaster will always have a bag of soup or an MRE [meal, ready-to-eat] when nobody else in the crew has thought that far ahead."

The job requires flying at strange hours, eating strange food, and sleeping at odd intervals—what's known as the "green hot dogs in Incirlik" syndrome. Caffeine jitters, a disrupted eating schedule, and climate changes are on Sergeant Bedsole's list of occupational annoyances.

One general rule is that, if you're scheduled for a stopover at Sigonella, Sicily, your aircraft will always settle into its parking slot one minute and thirty seconds after the fast-food restaurant next door to Operations closes down for the night. Sergeant Bartz says that "cold hamburgers and warm sodas are 'ops normal' for a loadmaster."

At the end of the day, there is the "bag drag"—hefting luggage from the cargo ramp and humping it to the crew bus—a chore all too familiar to other crew dogs, but ultimately the responsibility of the loadmaster. SrA. Matthew C. Davis talks of the "AMC big eye," a common affliction in which "you finally get to a billet and plunk down on a bed. Your mind says sleep, your body says get up, and your eyes refuse to close."

On all-cargo flights, loadmasters get to do what military folk have done since the first warrior walked out of a cave—hurry up and wait. Though no crew member begins sooner, works harder, or finishes later, the "cargo compartment commander" can have long, dead periods on a protracted mission. To some, these midmission doldrums are the hardest part of the job. Sergeant Bartz juggles golf balls on long missions.

Then Came "Kickers"

Crews flying "the Hump" included an enlisted flight traffic clerk, also known by a term that did not come into vogue until decades later in a different context—"flight attendant." This was the cargo expert aboard a C-46 or C-47 during some of the most difficult flying in air transport history.

When the first airdrops began in the CBI in March 1943, a separate crew position was established for a "kicker." An experimental air-dropping detail was formed from the 60th Laundry

Photos by Ross Harrison Kolv

On the KC-135 Stratotanker, the boom operator doubles as the loadmaster, as demonstrated by MSgt. Deborah McGuane of the 452d Air Refueling Wing, March AFB, Calif. Above, Sergeant McGuane is assisted by MSgt. Margaret Evans.

Company and the 3477th Ordnance Company; each crew included "three or four enlisted men who push the cargo from the plane." Subsequently, kickers were drawn from quartermaster units. Kickers began to receive flight pay in October 1943.

After World War II, loadmaster duties were performed by the flight traffic clerk, though the job description does not mention airdrop duties. The separate job of the kicker was revived for C-119 operations in Korea in 1950.

By 1951, the Air Force had received its first Douglas C-124 Globemaster II transports. Two C-124s from the 62d Troop Carrier Group (Heavy) were committed to Operation Blue Jay, the enormous construction project that built Thule AB, Greenland, in the summer of 1951. The after-action report identifies one crew member (an employee of the aircraft manufacturer) as the "Douglas loadmaster," one of the first appearances of the title.

On June 15, 1951, Military Air Transport Service directed establishment of a C-124 transition unit to train crews consisting of "pilot, copilot, flight engineer, flight mechanic technician, and loadmaster." The record is unclear, but the word "loadmaster" may have entered the lexicon because of a September 1951 recommendation by Maj. Milton B. Skelton of the 1705th Air Transport Wing at McChord AFB, which trained C-124 crews.

Major Skelton recommended "that the loadmaster and flight attendant should not be one person or military specialty. The duties of a loadmaster (C-124) normally will require his presence at the aircraft from four to six hours before flight time in order to complete computation of the load weight and balance, planning sheet, and actual loading. Upon completion of the flight after landing, the loadmaster would require up to four hours. In view of the long hours required to fulfill his duties as loadmaster, I do not believe that he could efficiently execute the additional duties of the flight attendant during flight. The C-124 is so designed that it is believed that numerous occasions will arise requiring a mixed load of passengers and cargo. During flight when carrying cargo, the loadmaster should make periodic checks of his tiedowns, and it would not be practical for him to be in Class A uniform."

Loadmaster finally became an Air Force career field in 1953 with a revision to Manual 35-1, which set forth a job description nearly identical to today's.

Some of the first Americans in the Vietnam War arrived in eight Fairchild C-123 Providers for Project Mule Train in January 1962. *Tactical Airlift* by Ray L. Bowers makes a rare mention of the loadmaster's job under tactical conditions in combat:

"The enlisted members of the C-123 aircrews deserved special credit, since they shared the risks of the officers along with the privations in pay and living conditions of the other airmen. Loadmaster work was wearisome and sometimes dangerous, since these men handled heavy cargo during loadings and drops. The Mule Train loadmasters were relatively junior, bringing with them the enthusiasm and physical stamina of youth."

Rare Praise

Such printed praise is rare—indeed, almost nonexistent—in the literature of mobility forces. Like police and firemen, loadmasters are rarely noticed when nothing goes wrong. But the Air Force noticed when loadmasters were needed and weren't there.

When USAF took over the Army's fleet of de Havilland C-7 Caribous in Vietnam in 1967, wrote Bowers, there was "a chronic shortage of flight engineers because of the undesirability of the job [because] Caribou flight engineers doubled as loadmasters, which entailed hot and dirty stevedore tasks."

In Vietnam, familiar transports became gunships, armed and able to concentrate firepower by loitering in a pylon turn over a target. The loadmaster went with these AC-47s, AC-119s, and AC-130s. He was better known as illuminator operator, as one of his tasks was to light up the target on night sorties.

In February 1969, A1C John L. Levitow was aboard an AC-47 gunship hit by Viet Cong fire just as another crew member pulled the pin to arm an illumination flare. With the pin loose, the flare would ignite in twenty seconds and reach 4,000° Fahrenheit. The badly damaged AC-47 careened through the sky while the flare rolled crazily on the fuselage floor amid a tangle of wounded men and cans containing 19,000 live rounds of ammunition.

Airman Levitow groped for the flare through smoke and confusion. In a desperate bid to save his eight-man crew and aircraft, he threw himself on the flare and painfully dragged it toward the cargo door, leaving a trail of blood. In a superhuman effort, Airman Levitow heaved the flare through the door. It barely cleared the AC-47 before igniting in an incandescent blaze. For his courage at the risk of his life, Levitow (who today lives in Connecticut) became the only loadmaster ever awarded the Medal of Honor.

Sleeping on the Flight Line

When prisoners of war in North Vietnam were picked up by C-141s in March 1973, loadmasters were the first of their fellow Americans to step out of the crowd at Hanoi's Gia Lam airport to welcome them home. The brain and brawn, the long hours accumulating jet lag, and the stress have been part of the loadmaster's lot in every major airlift since.

Many still on active duty remember Operation Nickel Grass in support of Israel during the October 1973 war, when more than 500 C-141 and C-5 missions were mounted on short notice under grueling conditions. The largest airlift in history, to support Operation Desert Shield, was so demanding that flight crews "downrange" in Saudi Arabia frequently could obtain crew rest only by sleeping aboard parked aircraft.

For most of 1993, 2,033 active-duty, 672 Air National Guard, and 644 Air Force Reserve loadmasters were assigned to four aircraft types. The Air Force's Chrysler C-27A Spartans supplement familiar Lockheed C-130 Hercules, C-141 StarLifters, and C-5 Galaxys. Curiously, the Douglas KC-10A Extender dual-role tanker/transport has no loadmaster position, although its sideways loading arrangement makes it, if anything, the most difficult hauler to fill and empty. Boom operators on the Extender receive training in cargo handling. The C-27A with US Southern Command intrigues everybody in the loadmaster field because it flies with just two pilots and one loadmaster—the same crew mix as the new C-17 transport.

Almost everyone who has traveled in an Air Force transport has seen a loadmaster grappling with the 463L pallets that fit lengthwise in airlifters (sideways on the cavernous C-17) or operating the ground vehicle, known as a K-loader, that moves the pallets. The C-17 handles eighteen pallets, the C-130 handles six, the C-141 thirteen, and the C-5 thirty-six. The development of a roll-on, roll-off palletized system for rapid handling of freight revolutionized the "trash hauling" business, but most vehicles aren't palletized when shipped, and heavy vehicles or helicopters may require wooden shoring on the fuselage floor. More specialized tasks are carried out aboard AC-130 gunships, MC-130 special operations craft, HC-130 rescue airplanes, and the handful of C-141B StarLifters assigned to special operations.

Then there's the ski-equipped LC-130H Hercules, operated by the 109th Airlift Group, New York ANG, at Schenectady Airport, to support operations in the Arctic. In the words of loadmaster MSgt. Ray Morgan, "Some days it gets so cold the engine exhaust creates a vapor trail . . . like a fog. You've got to make sure that forklift driver has good visual reference. His windshield can fog up. And, of course, in the Arctic, you always load and unload with all four engines running, so you've got to be careful not to breathe in toxic exhaust."

The C-130H can actually get stuck in the snow. Loadmasters and others have used snow shovels to try to shake the plane free. In one instance, a Hercules not fully stuck but not willing to fly was taxied for twenty-one miles before changed weight, temperature, and oil viscosity, and perhaps a little magic, combined to make a takeoff possible.

Four for One

The loadmaster works inside a dark fuselage with its ceiling maze of insulation, tubing, and pipes—two of

Photo by Ross Harrison Koty

C-130 loadmasters TSgt. Jeffrey Hamma (front) and SSgt. Joseph Warren of the 61st Airlift Squadron, 314th Airlift Wing, Little Rock AFB, Ark., rig parachutes for a LAPES (low-altitude parachute extraction system) airdrop.

which, belonging to the air-conditoning system, puff out opaque clouds of condensing cold air in the glow of yellow lamps—all of this reminiscent of gloomy starship interiors in a science-fiction film. It is not a glamorous spot.

It's not quite true, as one loadmaster insists, that "they put four college boys up in the front of this airplane just so I can sit in the back and do my job," but while pilots, navigators, and flight engineers get a transport from Point A to Point B, loadmasters—almost always the lowest-ranking people on board—are responsible for every aspect of the mission from the flight deck aft. They practice combat offloads. They determine what can be carried and what can't.

Whether they are providing earthquake relief in Armenia, delivering foodstuffs to Somalia, or carrying paratroopers into Panama, loadmasters function without the facilities found at even the smallest air bases elsewhere. They have a critical role in Tanker Airlift Control Elements (TALCEs), which set up airheads when a deployment is made to a site without adequate facilities, whether in the US or a Third World backwater. When a TALCE deploys, a loadmaster often becomes mission team commander.

Photos by Ross Harrison Koty

Above, MSgt. Bruno Gutierrez (right) and MSgt. Dan Yepes of the 445th Airlift Wing (AFRES), March AFB, Calif., check out their C-141. Almost forty percent of the loadmasters assigned to USAF aircraft are from the Guard and Reserve.

As they face the lean 1990s, loadmasters share the concerns of other airmen about drawdowns, base closings, and tumultuous reorganization. Even while shrinking, the Air Force remains short of loadmasters and is now at ninety-four percent of projected manning (seventy percent in some C-130 squadrons).

With five years in, SrA. Jeffrey Faretra of the 9th Airlift Squadron at Dover wonders if he'll have a chance to become a senior NCO. Twenty years into a career, Sergeant Bedsole feels he can't make that final leap to the top enlisted ranks. "Things are 'down' right now, and I can't afford . . . to wait for the next 'up' cycle." For more than a generation, a horizontal "wiring diagram" meant that junior loadmasters reported to, and were judged by, senior loadmasters. With the current reorganization of Air Force squadrons into individual flights, even those near the top of the loadmaster field, like Sergeant Bedsole, will find themselves reporting instead to flight engineers who have more rank at the top of their career field and are more likely to occupy the superintendent job that is the senior NCO slot in a flight.

Some loadmaster duties—including scanning for ground clearance while taxiing, and doing the bag drag—never change, but innovations offered by the new airlifters are welcomed. The C-17 loadmaster can reconfigure his compartment in one hour or less in flight, making it possible to carry passengers on one trip, then shift to cargo or airdrop. Loading and unloading the C-17 is easier because the high-strength floor eliminates the need for wooden shoring to support heavy equipment.

Air Force loadmasters are flying the C-17 today with the 17th Airlift Squadron at Charleston AFB, S. C. All are glad to see a fifth aircraft type added to their world. ■

Robert F. Dorr, an Air Force veteran, is a free-lance writer in the Washington, D. C., area. This is his first article for AIR FORCE *Magazine in recent years.*

New University Offers Graduate Courses in Military Studies

FACTS AT A GLANCE:

- THREE 16 WEEK SEMESTERS EACH YEAR: JAN, MAY, AUG
- STUDY DIRECTLY WITH INSTRUCTOR THROUGH " DISTANCE LEARNING"
- MAXIMUM OF TWENTY STUDENTS PER COURSE
- ALL COURSE MATERIAL AVAILABLE THROUGH AMU
- SPECIALIZE IN LAND, AIR, OR NAVAL WARFARE, OR DEFENSE MANAGEMENT
- OVER 30 COURSES AVAILABLE FOR WINTER SEMESTER 1994

A GRADUATE SCHOOL OF MILITARY STUDIES

AMU, NOW BEGINNING ITS SECOND YEAR, OFFERS YOU THE OPPORTUNITY TO EARN A MASTER'S DEGREE IN MILITARY STUDIES ON YOUR OWN TIME, REGARDLESS OF YOUR GEOGRAPHIC LOCATION.

FOR COMPLETE INFORMATION, A CATALOG, AND APPLICATION FOR ENROLLMENT, SEND $5.00 TO:

AMERICAN MILITARY UNIVERSITY
OFFICE OF ADMISSIONS
(CODE-AFM)
9285 CORPORATE CIRCLE
MANASSAS, VA 22110
(703) 330-5398

MASTER'S DEGREE PROGRAM:

DEGREE REQUIREMENTS

36 Semester Hours of Graduate Level Work with a GPA of Not Less than 3.0
Final Comprehensive Examination

SELECTED COURSE OFFERINGS (Offered WINTER Semester - JANUARY 1993)

LW 501 Great Military Leaders
LW 500 American Military Experience to 1900
LW 503 The American Revolution
LW 518 History of Guerrilla Warfare
LW 522 German Military History
NW 500 Sea Power
NW 511 American Gunboat Diplomacy
AW 500 Air Power
AW 504 Air War in Korea
DM 507 Personnel Management
DM 509 Weapon Systems Acquisition I
MS 603 Strategy and Tactics of the Pacific War
MS 615 Low Intensity Conflict
MS 621 The Cold War
MS 623 History of the Japanese Military
MS 630 American Military Experience in China
MS 632 The War in Afghanistan
RC 700 The Study and Use of Military History

A COMPLETE LIST OF ALL COURSES IS CONTAINED IN THE UNIVERSITY CATALOG

American Military University is currently pursuing national accreditation through the procedures established by the U.S. Department of Education. Gaining accreditation is a two-year process. Upon approval of accreditation, all courses already completed by AMU students will be retroactively authorized for credit.

In the Korean War, the Air Force faced its first major conflict as a separate service.

Cold War Color

Photographs from the collection of Warren Thompson

The outbreak of the Korean War found the fledgling Air Force coping with new jet technology. In the 1952 photo at right, F-84 Thunderjets of the 182d Fighter-Bomber Squadron head north with a full ordnance load. The squadron, a Texas Air National Guard unit, flew as part of the 136th Fighter-Bomber Group.

Photo via Harold Beasley

Photo via Iven Kincheloe

No aircraft was more instrumental to the Air Force's success in Korea than the F-86 Sabre. Many jet pilots brought invaluable combat experience from World War II. At left are F-86 pilots from the 25th Fighter Squadron, Suwon AB, Korea, in 1952 under wing commander Col. Francis "Gabby" Gabreski, a World War II ace. Third from the left is Capt. Iven C. Kincheloe, Jr., the tenth jet ace of the Korean War. On the facing page is Lt. Joe Lynch, an F-86 pilot with the 35th Fighter-Bomber Squadron. The squadron was part of the 8th Wing, which flew a mix of F-86s, F-51s, and F-80s. It is still part of the famous "Wolf Pack," now flying F-16s out of Kunsan AB, South Korea.

Photo via Joseph Lynch


OXYGEN
FILLER

Photo via Al Wimer

Airpower played an important role in the early weeks of the war. The ancient gates of the town of Suwon were the scene of heavy fighting in August 1950. American airpower knocked out these T-34 tanks supplied to the North Korean People's Army by the Soviet Union.

Photo via W. Segerson

Photo via Bud Hesterman

Photo via Frank Swartz

Under Air Mobility Command's early counterpart, Military Air Transport Service, airlift was as important in Korea as it is today. Above, right, a C-124 at Kimpo AB in 1953 prepares to take a load of casualties back to the US. The Globemaster II, which began Korean operations in late 1951, carried an average cargo load of more than 34,000 pounds, twice the maximum load of the C-54. At left, a C-119 Flying Boxcar offloads equipment for the 18th Fighter-Bomber Wing at Osan AB in the spring of 1953. Many aircraft were moved to the combat arena by sea (above, left). F-84 Thunderjets of the 27th Fighter Escort Wing were moved by aircraft carrier from San Diego, Calif., to Itazuke AB, Japan, in November 1950 for eventual deployment at Taegu AB, Korea.

Photo via Jack Wingo

At right, an F-86 from the 336th Fighter Squadron, 4th Fighter Wing, undergoes major engine maintenance under less than ideal conditions at Taegu AB. The maintenance facilities were a far cry from the modern working environment of the 4th Wing, which today flies F-15Es out of Seymour Johnson AFB, N. C.

Photo via Dwight Lee

Photo via Dwight Lee

Photo via Ed Fletcher

On technical merits, the F-86 (above, both pictures) and its nemesis, the Soviet-built MiG-15, were an even match, but the pilots who flew the Sabre brought superior training and World War II combat experience to the battle. At left, Capt. James Jabara (center), the first US jet ace, faces the press at Johnson AB, Japan, in May 1951 after achieving his fifth and sixth MiG kills. The F-86's air supremacy was demonstrated by its Korean War total of 792 MiGs downed and its victory ratio of ten to one.

At right, the civilian work force is enlisted to mix napalm into drop tanks at an F-51 base. Developed during World War II, napalm was first used extensively during the Korean War as the most effective and feared weapon against Chinese ground troops and was later used widely in the Vietnam War.

Photo via Stephen Levandoski

Photo via Ed Nebinger

Photo via Ed Nebinger

Photo via Glen Wold

Under the new separate Air Force, the renowned P-51 became the F-51 Mustang, performing mainly close air support. Above, a fully loaded F-51 from the 12th Fighter-Bomber Squadron awaits its next mission at Pusan AB in 1950. Above left, Capt. Daniel "Chappie" James poses in front of his F-51 during his early days with the 12th FBS at Taegu AB. He became a four-star general and commander in chief of NORAD in 1975. At left are colorful operations shacks for the F-51 squadrons of the 18th Fighter-Bomber Group at its forward base at Hoengsong: 39th Squadron (blue), 12th Squadron (yellow and blue), 67th Squadron (red), and 2d South African Squadron.

Photo via Robert Parel

B-29 Superfortresses, some brought out of mothballs, operated out of air bases in Okinawa and mainland Japan. They often received heavy damage from MiG-15s and flak and sometimes were unable to make it back to base. The aircraft at right crash-landed at Taegu AB, the first place B-29s could stop for repairs.

Photo via Robert Haller

At left, F-94Bs from the 319th Fighter-Interceptor Squadron fly a loose formation over Osan AB, under construction in 1952. Capt. Ben Fithian made the first night kill for the squadron in January 1953. As the war dragged on, pilots frequently accumulated high sortie totals. Lt. Warren Guibor (left, below), an F-80C pilot with the 80th Fighter-Bomber Squadron, had the honor of flying the 50,000th combat sortie for the 8th Wing in October 1952. Lieutenant Guibor is shown in the cockpit of **The Spirit of Hobo.**

Photo via W.R. Guibor

If you have color slides from the Korean War, Mr. Thompson would like to consider including them in a book about the air war. Write to Warren Thompson, 7201 Stamford Cove, Germantown, TN 38138, or call 901-754-1852 or 901-755-4568 (fax).

A Checklist of Air Force Armament and

Edited by Tamar A. Mehuron, Associate Editor

Work in progress at the Air Force's major program offices, Aeronautical Systems Center's armament offices at Eglin AFB, Fla., and Wright Laboratory's Armament Directorate, Eglin AFB

Advanced Medium-Range Air-to-Air Missile Joint System Program Office

Advanced Tactical Fighter Weaponization
Initiative to ensure resolution of weapon issues, weapon integration, and weapon research and development activities concerning the F-22. **Contractor:** None. **Status:** Ongoing.

AIM-120 Advanced Medium-Range Air-to-Air Missile
Program to develop and deploy the Air Force's and Navy's next-generation, tactical air combat missile, replacing the radar-guided AIM-7 Sparrow. AMRAAM is a fire-and-forget missile that enables pilots to aim and fire several missiles at multiple targets while maneuvering. AMRAAM is to have all-weather, all-environment, radar-guided capabilities and be compatible with the F-14, F-15, F-16, F/A-18, British Tornado F. Mk. 2, Royal Navy Sea Harrier, and German F-4F. **Contractors:** Hughes, Raytheon. **Status:** Production.

AMRAAM Preplanned Product Improvement
Program to ensure that AMRAAM retains superiority against a changing threat, takes advantage of opportunities to use emerging technologies, and is compatible with future as well as current fighters. Focus on electronically erasable/programmable read-only memory chip insertion, ECCM, propulsion options, and ordnance enhancements. **Contractors:** Hughes, Raytheon. **Status:** Preplanned product improvement.

AMRAAM Producibility Enhancement Program
Comprehensive value engineering program designed to introduce less expensive, alternative designs and high technology into AMRAAM and to expand the competitive vendor base. **Contractors:** Hughes, Raytheon. **Status:** Production.

Missile Rail Launcher
Program to provide AMRAAM and Sidewinder rail launch capability on F-15, F-16, and F/A-18, maximizing use of common components. **Contractors:** Hughes, United Telecontrol Electronics. **Status:** Production.

Air-to-Surface Weapon System Program Office

Advanced Support Equipment
Effort to develop portable Modular Automatic Test Equipment–qualified tester to replace the existing AN/GJM-55 test set. It will operate with the AN/GJM-37A optical simulator, the infrared target simulator, and the RF coupler currently used in conjunction with the AN/GJM-55 test set. It will provide tactical air forces with a reliable capability to test and expedite repair of air-to-surface weapon systems. **Contractor:** General Dynamics. **Status:** Engineering and manufacturing development.

AGM-130A
Production of a rocket-powered, unitary (2,000-pound Mk. 84) version of the GBU-15 glide bomb, initiated through a product improvement program. The weapon provides a flexible, precision, standoff attack capability for the F-111F and the F-15E, increasing the tactical air forces' capability to destroy high-value targets. Upgrades include a new solid-state TV seeker, improved IR seeker, and inertial navigation system/Global Positioning System (INS/GPS) guidance. **Contractor:** Rockwell. **Status:** Production.

AGM-130C
Program to enhance the tactical air forces' ability to attack hardened vertical targets with precision guided standoff weapons. The AGM-130 (2,000-pound Mk. 84) warhead can be replaced with the BLU-109, a penetrating 2,000-pound warhead. This weapon can be delivered from the F-4, F-111F, and F-15E. **Contractor:** To be determined (TBD). **Status:** Development.

AGM-142 Have Nap
Production of an air-to-ground, rocket-powered, precision guided, conventional standoff missile system. The missile system, produced in Israel since 1983, demonstrated its capability to provide Air Combat Command's B-52s with significant standoff and precision accuracy in defeating fixed and mobile high-value targets during a Foreign Weapon Evaluation program at Eglin AFB in 1987. Delivery from F-4 and F-111 aircraft was also demonstrated. A streamlined concurrent development/production program implemented minor changes and provided units for USAF inventory. The USAF system is modular, allowing use of either a TV or IIR seeker and either a blast-fragmentation or penetrating warhead. Several engineering changes currently being incorporated provide additional flexibility in employment in low-level and semiautonomous modes, as well as enhanced system producibility and lower unit cost. **Contractor:** Rafael. **Status:** Production.

BSU-93 Air Inflatable Retarder
Program to procure new AIR for use with the M117 bomb for carriage on the B-52. The BSU-93 is a modified Navy BSU-85 used with the 1,000-pound Mk. 83 bomb. The BSU-85 ring was modified to mate with the 750-pound M117 bomb. This effort will satisfy ACC's requirement for M117 bomb retarders. **Contractor:** Irvine Industries. **Status:** Production.

D54-33 A1B Proximity Sensor
Product Improvement Program to give the FMU-139 fuze, through the FZU-48 power initiator, the capability to detonate general-purpose bombs at a present height of burst to ensure optimal blast and fragmentation effects against above-terrain (*i.e.*, soft) targets. **Contractor:** Motorola. **Status:** Improvement, production.

Depot Automatic Test System
Program to provide long-term depot diagnostic test support for the AGM-130/GBU-15 family of weapons. A primary objective is to procure modern equipment qualified in accordance with Modular Automatic Test Equipment program guidelines. Equipment selected will be configured to meet these objectives and, with associated equipment, will have a growth capability for future updates/modifications of the AGM-130/GBU-15 systems, including the improved data link and advanced support equipment. **Contractor:** Hughes. **Status:** Production.

FMU-143 B1B Fuze System
Program to provide an arming and firing system for guided or unguided penetration weapons with the BLU-109/B and BLU-113/B bombs. The fuze is also used with the I-800 bomb for the AGM-142, and a special version is being produced for the Navy's GBU-24 B1B laser-guided bomb program. **Contractor:** Dayron. **Status:** Production.

GBU-28 Product Improvement Program
Program to improve the GBU-28/B, which was developed to meet an Operation Desert Storm requirement to destroy buried hard targets. The

improved GBU-28 will provide operational flexibility while retaining the capability to destroy high-value hard targets. The warhead can penetrate more than 20 feet of reinforced concrete or 100 feet of soil. **Contractors:** Texas Instruments (TI) (guidance kit), TBD (warhead), and Dayron (fuze). **Status:** Improvement, production.

Improved Data Link
Program to replace the AN/AXQ-14 data link currently used on the GBU-15. The new data link will permit the munition to counter current and projected electronic warfare threats using advanced antijam techniques. The new pod is compatible with the F-4E, F-111F, and F-15E and can be used with the GBU-15 and the AGM-130. **Contractor:** Team of Harris and Magnavox. **Status:** Production.

Improved Special Operations Forces Munitions
Program to improve the lethality and standoff capability of AC-130 gunship munitions. Projects include 25-mm PGU-38 for long range; 40-mm PGU-9A/B refuze to provide improved safety; 20-mm M56 refuze for increased standoff; 105-mm fuze for improved hard-target penetration; and technology studies to improve munitions accuracy and lethality. **Contractors:** Alliant Techsystems, Bofors. **Status:** Various phases.

Joint Direct Attack Munitions (JDAM)
Multiphase program that, in Phase 1, will develop an accurate, all-weather INS/GPS guidance kit for integration on 2,000-pound bombs (Mk. 84s and BLU-109s) and 1,000-pound bombs (Mk. 83s) for Air Force and Navy use. Data from the aircraft navigation system will be used to calibrate and align the weapon's inertial unit prior to release. After release, the bomb will guide itself to designated target coordinates with no aircrew interface. Phase 2 will develop a Joint Programmable Fuze to meet Air Force and Navy requirements for a safe and effective, cockpit-selectable, multifunction, programmable fuze. Under Phase 3, a precision adverse-weather capability will be incorporated. **Contractor:** TBD. **Status:** Concept exploration and definition.

Joint Tactical System Program Office

AGM-88 High-Speed Antiradiation Missile
Production of defense-suppression weapons that locate, guide on, and destroy enemy radar sites that control surface-to-air missiles. HARM is deployed on the F-4G "Wild Weasel" and the F-16 and is being considered for the F-15E. The Navy also uses HARM. The HARM-B Block III is currently in production. Block III retrofit was completed in March 1991. A hardware and software upgrade, HARM-C-1 (Block IV), completed operational test and evaluation and was approved for production with delivery beginning in May 1993. **Contractors:** TI, Thiokol, Hercules. **Status:** Production.

F-16 HARM/Shrike Integration Program
Three-phase, quick-reaction-capability program to satisfy the tactical air forces' need to increase defense suppression capability by using the F-16 to augment the F-4G Wild Weasel force. No modification to the F-16 aircraft or the HARM/Shrike missile was permitted during Phases 1 and 2. Phase 3 will provide HARM Block IV capability. **Contractor:** TI. **Status:** Production.

Sensor-Fuzed Weapons and Airfield Attack System Program Office

Sensor-Fuzed Weapon
Program to produce the first wide-area cluster munition with "smart" warheads capable of multiple kills per pass against armored targets. The SFW is a 1,000-pound-class cluster weapon containing ten BLU-108/B submunitions, each of which contains four "smart" armor-piercing warheads. Each warhead uses an infrared sensor to independently detect and fire on enemy vehicles. SFWs will be compatible with all tactical aircraft. **Contractor:** Textron Defense Systems. **Status:** Low-rate initial production.

Wright Laboratory: Armament Directorate

Advanced Penetrator Explosives
Program to develop a very-high-energy explosive fill for penetrator warheads which can survive the high shock loads experienced during penetration and provide a large blast to increase weapon effectiveness against buried structures. **Contractor:** TBD. **Status:** Exploratory development.

Advanced Technology LADAR System
Program to develop and demonstrate an affordable, high-resolution, laser radar (LADAR) guidance system for medium- and long-range air-launched attack of high-value, fixed ground targets. Applies to cruise missiles and medium-range air-to-ground missiles. **Contractor:** Hughes. **Status:** Advanced development.

All-Up Round Fuze
Program to develop and demonstrate an all-up round fuze with a solid-state proximity sensor for general-purpose bombs. **Contractor:** TBD. **Status:** Exploratory development.

Antimateriel Submunition
Program to develop and demonstrate an ordnance package technology for the next generation of precision antimateriel submunitions for use against ground mobile and relocatable targets. **Contractor:** TBD. **Status:** Advanced development.

Autonomous Synthetic Aperture Radar Guidance
Program to develop and demonstrate an affordable, all-weather, midcourse and terminal guidance system for medium- and long-range air-launched attack of high-value relocatable and fixed ground targets. Applies to conventional cruise missiles and medium-range air-to-ground missiles. **Contractors:** Loral, Raytheon. **Status:** Advanced development.

Boosted Penetrator
Program to develop a large (2,000-pound-class) penetrator to defeat heavily hardened underground C^3I facilities. **Contractor:** Lockheed. **Status:** Advanced development.

Electromagnetic Launcher Technology
Program to design and develop component and subsystem technologies for rapid-fire hypervelocity gun systems. **Contractors:** Sparta, PKD. **Status:** Exploratory and advanced development.

Guided Weapon Technology Hardware-in-the-Loop Evaluation Facility
Program to develop high-fidelity ultraviolet, infrared, and visible scene-generation and scene-projection technologies that allow comprehensive evaluation of theater, strategic defense, and conventional air-to-air and air-to-ground guided weapons in realistic scenarios. **Contractors:** SAIC, CSA, NRC. **Status:** Exploratory and advanced development.

Insensitive Munitions Fuze Technology
Program will identify design concepts, critical technologies, and test techniques applicable to the development of an all-up round with insensitive munition fuzing. **Contractor:** AAI. **Status:** Exploratory development.

Low-Cost Aided INS/GPS Demonstration
Program to demonstrate the capability of low-cost aided INS/GPS precision guidance against fixed high-value targets. **Contractor:** TBD. **Status:** Advanced development.

Low-Cost, Low-Drag Weapon Airframe Technology
Program to develop a low-cost, low-drag weapon airframe that can carry unitary and submunition warheads and demonstrate sequential dispensing of submunitions. **Contractor:** TBD. **Status:** Advanced development.

Multispectral Air-to-Air Seeker
Technology program to develop a follow-on seeker for the AIM-120 AMRAAM. **Contractor:** TBD. **Status:** Advanced development.

Precision Adverse-Weather Seeker Demonstration
Program to demonstrate seeker technology that satisfies adverse-weather and precision guidance requirements against high-value fixed and relocatable targets and to provide a candidate seeker for the JDAM III. **Contractor:** TBD. **Status:** Exploratory and advanced development.

Programmable Ordnance Technology
Technology program to design and demonstrate an AIM-120 AMRAAM ordnance package to defeat the post-1995 air threat. The ordnance package will include an improved target detection device; a more lethal warhead; and an electronic safe, arm, and fire device. **Contractor:** Motorola. **Status:** Advanced development.

Space Target Vulnerability/Lethality Assessments
Program to develop threat descriptions, kill criteria, and test conditions to evaluate the effectiveness of BMDO conventional weapons concepts. **Contractors:** GRC, KSC, SAIC. **Status:** Exploratory and advanced development. ■

An AFA task force examines why airpower is the critical issue in the roles and missions debate.

Airpower at Center Stage

This article is adapted from "Long-Range Airpower: A Report of the AFA Advisory Group on Military Roles & Missions." Principal authors were Gen. Russell E. Dougherty, USAF (Ret.), Gen. Charles A. Gabriel, USAF (Ret.), Gen. Michael J. Dugan, USAF (Ret.), and Maj. Gen. John R. Alison, USAF (Ret.).

THE MAIN contributor to the environment of the current military "Roles, Missions, and Functions" debate is the defense budget. For all the talk among the critics and zealots, the main issue here is the claim on priorities in the shrinking defense budget—not doctrinal purity.

We think it fair to say that, at the center of the roles and missions debate—and the budgetary debate that underlies it—is *airpower*, and that the crux of it is *long-range airpower*. For our purpose in this report, we define long-range airpower as bounded on one end by the capability of air forces based in the United States and on the other end by air forces operating from bases abroad in the roles of deep attack and interdiction.

The key issue, as framed by Sen. Sam Nunn (D-Ga.), chairman of the Senate Armed Services Committee (and by others), is how the landbased capability of the Air Force and the seabased capability of the Navy and the Marine Corps should contribute to power projection.

There is no real question about the value of airpower or whether it can be held to some precise, absolute, and unique standard of "decisiveness." All of the services respect and emphasize airpower. Across the spectrum of conflict, the nation now looks to airpower as the initial, and possibly (given the circumstances) the primary, instrument of US force application. Airpower is widely recognized for the rapid results that it can now achieve, with minimum exposure, casualties, and force attrition.

US airpower is highly respected outside the domain of the defense resources debate. This is reflected, certainly, in the recent formulation by Les Aspin, the Secretary of Defense, of a principal requirement he foresees for the armed forces in the post–Cold War era: the capability to stop attacks quickly in multiple contingencies in locations we will not know until trouble starts and where we will not have adequate force already in place.

That capability, Mr. Aspin says, will derive largely from four factors: sufficient airlift; prepositioning of war materiel; precision guided antiarmor weapons, delivered mainly by bomber and fighter aircraft; and airborne electronic surveillance of the battlefield. The main ingredient in this prescription is clearly airpower.

The only real questions about military airpower are: How do you base it? Who procures and mans it? Who controls it? Beyond that, the issue is how much of it and what kind.

Four Airpower Developments

One-dimensional strategies—built solely around airpower or any other weapon category—are misguided. The nation needs a balance of land, sea, air, and space forces. We should approach any potential engagement with the optimum mix and optimum timing of application of forces to achieve best results with fewest casualties.

Nevertheless, it is shortsighted not to recognize that careful, timely use of airpower has emerged as a principal element in any multidimensional strategy—not necessarily *the* principal element (that depends on the circumstances), but certainly *a* principal element.

This is attributable to the basic characteristics of airpower—speed, range, flexibility, and the ability to transcend natural boundaries. Also, four comparatively recent developments have combined to make airpower a more potent force:

USAF photo by TSgt. Jerry Baker

■ Stealth. Stealthy platforms can pass through an enemy's airspace with low probability of being effectively engaged by radar-directed or -assisted air defenses. This is an important shift in advantage for the offensive force. A relatively small strike force may now be able to reach and destroy critical targets in the early rounds of war.

■ Accuracy. Not long ago, such terms as "surgical strike" and "pinpoint accuracy" were not to be taken literally. With the precision weapons now becoming available, surgical strikes have become a fact, and pinpoint accuracy may not be far away.

■ Battle management. As the 1991 Persian Gulf War demonstrated, military information—and effective use of it—ranks alongside firepower and maneuver in military importance. Airborne and aerospace sensors are capable of looking deep into enemy territory with stunning resolution, enabling commanders to manage the air and ground battles in ways not possible before.

■ Assistance from space. We are just beginning to see the leverage that space systems can provide to forces engaged in terrestrial conflict. This trend will intensify as operational commanders learn how to make full use of spacebased assets for communications, intelligence, navigation, command and control, and other purposes, some of which have yet to emerge.

These developments have been accompanied by a realization—brought home by the Gulf War—that airlifters and aerial refueling are absolutely crucial, especially to a shrinking military force that will henceforth be operating principally in an expeditionary mode, requiring deployment of forces worldwide from bases in the US.

The Air Force has no claim to a monopoly on airpower or the air-attack role. Carrier-based Navy aircraft provide useful options, and in some situations such forces may be best suited to the theater commander's needs. On the other hand, the rapidly available deep reach, the penetration capability, and the sustained, heavily concentrated firepower of longer-range, landbased aircraft will make them the force of choice.

Thus, it is to our national advantage to view long-range landbased and shorter-range seabased airpower as complementary rather than competitive. We need them both. Our national task, and the best direction for the roles and missions debate, is to concentrate on the capabilities the nation requires for future years and to consider the extent to which long-range airpower can best provide these capabilities in crisis or conflict. Only where such landbased airpower cannot meet these requirements should we resort to more expensive and more vulnerable sea basing.

The Yardstick of Capability

There is constant talk about "threat-based" planning. This of course is not new; evaluation of specific threats and planning forces to counter them has always been a cornerstone of strategy. We cannot, however, plan exclusively on the basis of threats and dangers that are clear and manifest. We just cannot see things that clearly.

Our record of anticipating conflicts and crises has been extremely poor. The most recent example—Bosnia—did not show up on anyone's scenario list for planning. While we must continue to study specific threats and to estimate the force packages required for envisioned scenarios, we would do well to remember that war seldom

follows anyone's plans. If we can accurately estimate capabilities and develop forces adequate to counter such capabilities, we can ameliorate the lack of precise scenarios.

The more appropriate criterion for weapon systems planning—especially for a strategy keyed to major regional contingencies rather than global war—is capability. If our technology can counter any capability of the adversary, then our problem is reduced to training and force sizing and is not constrained by weapon systems development.

Another key step in planning is to reckon with the objectives for which US forces are fielded and for which they might be employed. We have deliberately used a compound construction because armed forces serve an important function short of actual employment and conflict. By their very existence and capabilities, they deter conflict and serve notice that aggression will not be profitable.

Limited Objectives

Secretary Aspin, both in his Cabinet role and in his earlier position as chairman of the House Armed Services Committee, has served notice that he anticipates US forces to be employed increasingly in "limited objectives" modes—for sending signals, performing *ad hoc* air strikes, etc.

While we would urge caution in employing this concept, military forces certainly have the capability to perform such limited tasks. The hazard, of course, is that while our armed forces must make provision for limited actions, such objectives cannot be the planning standards. Otherwise, limited actions will become a self-fulfilling prophecy and will become the measure of our forces.

For some aspects of our force structure, "limited objectives" involve more operational activity than the term might suggest. Since the end of Operation Desert Storm, for example, the Air Force has flown more than 155,000 sorties in Iraq, Somalia, and the Balkans. The fighter and airlift fleets and other components of the force have continued to operate at an arduous tempo.

When the task is one of limited objectives and includes the delivery of firepower, the capability to employ airpower rapidly over intercontinental distances is important. It should not be dependent on forward positioning and the delays that go with it.

Unless deliberately constrained (by shortsighted decisions), long-range combat aircraft can always be used for limited objectives. Range is not a limitation when tankers are available. The delivery of firepower is not token; eight B-2 bombers, for example, can match the ordnance load of an entire aircraft carrier complement. A limited-objectives strike force with stealth characteristics can enter hostile airspace alone and unsupported, restricting the danger to a few aircraft launched from distant bases and only a few aircrew members, not thousands of personnel and fleet assets.

Forces and Capabilities

There is a curious paradox in the economic pressures and national priorities that drive the present debate on military roles and missions. Despite the recognized importance of modern, long-range airpower to national and defense strategy, four tactical aircraft developments, spread over twenty-five years, are seen by many as excessive and unaffordable.

Today we have 201 operational bombers. By early next year, we will have 184. Nevertheless, we as a nation are uncertain if we can maintain a fleet of that size and whether we should invest in a full capability for those we keep. Between 1986 and 1994, the Air Force will have lost about half of its active fighter force structure. By some estimates, the number of planes in the fighter force will drop below 800 before the turn of the century.

The other services are making large-scale reductions as well. It is a testimonial to the caliber of modern forces and to the nation's military planners that they may actually be able to provide a credible defense posture within such constraints. There is little room for miscalculation, though, and the price of failure may be great.

Except for those of extreme persuasions, it is now generally agreed that the nation has one Air Force—the US Air Force—but that all of the services have, and should have, aviation capabilities when they are integral to their primary mission. We think it will be conceded also that the responsibility to provide and prepare forces for sustained aerial warfare will remain with the Air Force.

Carrier-based airpower and the sea basing of forces are valuable options, but they should not be seen as a substitute for landbased airpower or for the comprehensive capability, flexibility, and deep striking power of the US Air Force.

The contributions of carrier-based and seabased forces are primarily (1) in functions that are an extension of the Navy's mission at sea, (2) in exploiting the particular advantages of seabased forces, *e.g.*, the positioning of several squadron equivalents of aircraft in geographic areas where the US has not established a presence on land, and (3) in closely integrated joint operations with landbased long-range airpower.

The Most Effective Use of Airpower

The air—to an equal degree with land and sea—has been established as a discrete medium for military operations. It has also been established (again, except to those of extreme persuasions) that airpower is most effective when employed as a whole, across a complete spectrum of combat situations.

Aside from special circumstances, or when the role clearly is an extension of land or sea operations, the preparation of forces for aerial warfare should be the responsibility of the service that specializes in the strategy and conduct of aerial warfare. In any conflict of significant scope or duration—and in many applications of limited force as well—the preponderance of the air effort will be and should be performed by forces of the US Air Force.

A fundamental part of that air effort is establishing air superiority, which is an absolute requirement for land, sea, and air operations. Seabased forces may contribute, but we must expect that the Navy's counterair assets will be allocated primarily to fleet defense. It will be the task of landbased airpower to establish and maintain air superiority in the broad battle area, including hostile territory and sea approaches. The capability to perform this role must not be just marginally better but overwhelmingly better than that of potential adversaries.

As for very-long-range aircraft, they will not be the answer in every instance when military force is required. However, the advantage of having the

assured capability to put a high-payload combat platform over any point on Earth from Stateside locations in hours is obvious, and this option must be developed, available, and recognized by decision-makers in all circumstances.

When ground operations are in progress, there will be a great requirement for airpower to assault the flanks, stop breakthroughs and plug holes, disrupt the enemy's second echelon, and strengthen the combat power of the assault (or the defense). Air Force attack aircraft, in coordination with Army attack helicopters and Navy and Marine airpower, must provide direct support to ground troops in contact with the enemy force.

Deep Attack and Interdiction

Armed conflicts vary, but the strategic heart of a theater air campaign usually will be deep attack and interdiction, used rapidly to deny enemy control of forces and events and reduce the enemy's assets and capabilities—which include forces, direct war-supporting materiel, essential war-supporting infrastructure, and lines of communication.

In all but the smallest conflicts, accomplishing these initial attacks with conventional weapons will require hundreds of aircraft flying thousands of sorties. The force performing this task will have to be of appreciable size.

Deep attack and interdiction forces must be survivable (to save lives and minimize attrition), accurate (to hit the targets and avoid collateral damage), and lethal (to destroy hardened and sheltered targets). The tactical intelligence must be timely—almost immediate—and the aircraft and weapons must be capable of identifying, locating, attacking, and destroying difficult targets, including mobile missiles.

Requirements for planning and successfully prosecuting regional conflicts include:

- A significant force of stealth aircraft, essential to planning with limited assets and important objectives. It is difficult to stipulate in advance the precise number of aircraft in the fleet that must be stealthy, but it is surely more than twenty B-2s and fifty-six F-117s.
- Precision guided weapons (some of them stealthy). They are expensive and not required for every target, but nothing else delivers the same results with the same economy of force. The Air Force says that destruction of a typical hard target that took thousands of bombs dropped from B-17s in World War II and hundreds of bombs dropped from F-4s in Vietnam was accomplished by a single laser-guided weapon delivered by an F-117 in Desert Storm.
- Highly reliable systems to sustain the number of sorties required with a smaller force and to minimize extensive field maintenance.
- Intelligence from air and space, which enables a commander to put his striking power where it counts. In most cases, it also denies the enemy the advantage of surprise. We are still learning how to use and exploit this capability.
- Rapid, all-weather target acquisition and identification. This is the *sine qua non* of effective attack planning; nothing is truer than the old adage that "you can't hit it if you don't know where it is."
- A full complement of modern airlifters and tankers to provide force flexibility and versatility.
- High-quality electronic warfare systems for defense, offense, and battle management, integrated with other forces.

Expectations and Tradeoffs

One must not forget that the US Air Force that waged the air campaign in the Gulf War drew combat units from a service at least a third larger than the Air Force of the next few years. It operated modern aircraft—some of them state-of-the-art. Until something new is operational, these aircraft will remain state-of-the-art. These are the aircraft (in reduced numbers) on which we must rely to fight the next conflict.

Iraq was not the most demanding scenario for regional conflict, yet operations in the highest-threat areas were restricted to a fraction of the force, principally the F-117s. The Gulf War occupied a large portion of what was then known as the tactical air forces. Very high percentages of the aircraft capable of deep precision strike—F-111s, F-117s, and F-15Es—were employed. Even with extraordinary sortie and turnaround rates, the air campaign in the Gulf War took six weeks (after a five-month buildup). The Air Force understands the imperative for economy, but the nation should not expect undersized forces with obsolescing equipment to ensure success in demanding regional conflicts of the future.

The trend is to seek aircraft modernization solutions in commonality, compromise, and the performance of specialized roles by general-purpose platforms. Such approaches seldom (if ever) enhance effectiveness. The rationale for them is economy; there is nearly always a tradeoff in capability and effectiveness.

A totally specialized force is neither feasible or desirable. We agree that a large percentage of the Air Force fleet should be multirole fighters, capable in both air-to-ground and air-to-air roles. The versatile F-16, for example, has been a mainstay of the force in such a dual role. Our point here is that the nation should take care not to cut too many corners or accept too many solutions of convenience in force modernization. If we are going to field only three or four new aircraft in the next twenty-five years, they need to be the best we can develop.

We are not merely building to the threat of today but also building to provide capabilities that, with upgrades and modifications, can handle all foreseeable threats—a margin of capability to ensure we are not second-best well into the 2020s and beyond. Force planning is inherently a long-term proposition. Old threats recede and evolve, and new threats emerge. Technology creates new options. As the nation redefines its interests and its place in the world, new requirements will appear.

The theater commander charged with responsibility for engagement and resolution of a conflict must be able to draw upon a full and flexible set of options to apply the optimum force to the situation that he faces—not to be forced to use second-best.

With genuine respect and regard for the contribution of other force components, we believe that any response to conflicts of the future will be heavily dependent on first-class, landbased airpower and that our planning should be directed to that end.

No other military instrument can project power so rapidly and flexibly or with comparable weight to any point on Earth. "Global Reach, Global Power" is more than an Air Force slogan. It is a primary ingredient of our national security. ■

THE US AIR FORCE

TODAY AND TOMORROW

An Air Force Association National Symposium • October 28–29, 1993

To make reservations at the LA Marriott at the special AFA $95.00 rate, call and identify yourself as a member of AFA.

Now in its eighteenth year, this in-depth update on our US Air Force, its new commands, and its future aerospace requirements is one you won't want to miss. The symposium will focus on how USAF's capabilities and requirements will affect national security and the defense industry in the years ahead.

For symposium information, call 1-800-727-3337, ext. 2030, twenty-four hours a day.

Los Angeles Airport Marriott Hotel • (310) 641-5700

Invited participants include:

The Hon. Sheila E. Widnall, Secretary of the Air Force
Gen. Merrill A. McPeak, Chief of Staff, USAF
Gen. Charles A. Horner, CINCNORAD
Gen. John M. Loh, Commander, ACC
Gen. Robert L. Rutherford, Commander, PACAF
Gen. Henry Viccellio, Jr., Commander, AETC
Lt. Gen. Walter Kross, Commander, 15th Air Force

Registration for all Los Angeles Symposium events is $350 ($400 for non-AFA members).

Coming in 1994: A comprehensive review of air warfare capabilities, a major AFA National Symposium in Orlando, Fla., February 17–18.

1993 AFA National Symposium
The US Air Force—Today and Tomorrow

Los Angeles Airport Marriott
Los Angeles, Calif.
October 28–29, 1993

Registration closes Tuesday, October 19, 1993. No refunds can be made for cancellations after that date.

Mail this form to:
Air Force Association
Attn: Miss Flanagan
1501 Lee Highway
Arlington VA 22209-1198

Phone: (703) 247-5805
Fax: (703) 247-5853

REGISTRATION FORM

Name (print) _____

Title _____

Address _____

City, State, Zip _____

Telephone (with area code) _____

My check covering the Symposium fee of $350 for AFA individual or Industrial Associate member, payable to the Air Force Association, is enclosed. The fee includes one Reception/Buffet ticket with two drink vouchers. (Fee for nonmember is $400.00.)

☐ Mark here for an extra guest Reception/Buffet ticket and enclose an additional $90.

Gallery of Middle East Airpower

By John W. R. Taylor and Kenneth Munson

Bombers

Su-24

Russia's counterpart to the F-111 is flown by the air forces of Iran, Libya, and Syria. The 24 Su-24MKs ("Fencer-Ds") bearing Iranian insignia were delivered originally to Iraq but were flown to intended sanctuary in Iran during Desert Storm and there treated as Iran-Iraq war reparations. The 15 aircraft serving with the Libyan Air Force were delivered in the spring of 1989, as a final supply of weapons from the former USSR before the United Nations embargo on military equipment for Libya ended such imports. Syria is negotiating for further Su-24MKs to supplement the 12 now operational.

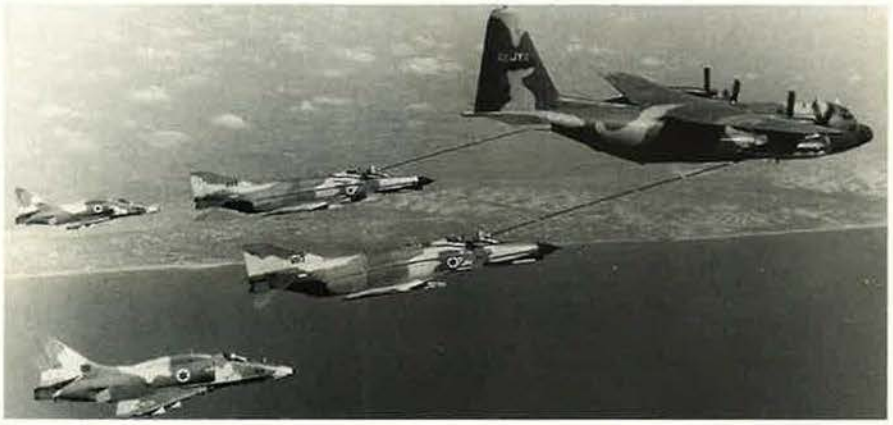
Export Su-24MKs are generally similar to the standard variable-geometry Su-24Ms of the CIS air forces. They are said to be capable of penetrating hostile airspace at night or in poor weather with great precision and then delivering ordnance within 180 ft of their target. Terrain-following radar, a laser ranger/designator, active and passive ECM, and a missile warning receiver are standard. An in-flight refueling probe and buddy refueling capability are optional.

Contractor: Sukhoi OKB, Russia.
Power Plant: two Saturn/Lyulka AL-21F-3A turbojets; each 24,690 lb thrust with afterburning.
Dimensions: span 57 ft 10 in (16° min sweep), 34 ft 0 in (69° max sweep), length 80 ft 5¾ in, height 20 ft 3¾ in.
Weights: empty 41,885 lb, gross 79,365–87,520 lb.
Performance: max speed at height Mach 1.35, at S/L Mach 1.08, service ceiling 57,400 ft, T-O run 4,265 ft, landing run 3,120 ft, combat radius 200–650 miles.
Accommodation: pilot and weapon systems officer side by side, on zero/zero ejection seats.
Armament: one GSh-6-23M six-barrel 23-mm Gatling-type gun on starboard side of belly; no internal weapon bay; nine pylons under fuselage, wingroot gloves, and outer wings (pivoting) for 17,635 lb of weapons, including up to four TV- or laser-guided bombs, conventional bombs (typically 38 x 220-lb FAB-100), 57-mm to 370-mm rockets, 23-mm gun pods, and such missiles as Kh-23 ("Kerry"), Kh-25ML ("Karen"), Kh-58 ("Kilter"), Kh-25MP ("Kegler"), Kh-59 ("Kingpost"), Kh-29 ("Kedge"), and Kh-31 ("Krypton"). Two R-60 ("Aphid") AAMs can be carried for self-defense.

Tu-16

The Egyptian Air Force has about eight 1950s-vintage **Tu-16K-16** ("Badger-G") intermediate-range bombers, based at Cairo West primarily for maritime missions. When used operationally during the Arab-Israeli War of October 1973, they launched against Israeli targets some 25 rocket-powered KSR-2 ("Kelt") ASMs. Twenty of the missiles were claimed as destroyed by air and ground defenses; the others hit two radar sites and a supply center in Sinai. Twenty years on, the Tu-16s cannot be regarded as a very formidable force. The same must be true of the similar number that Iraq possessed before the start of Operation Desert Storm, including, it is reported, four Chinese-built **Xian B-6D** uprated versions. It was feared that these might be used to drop chemical weapons on coalition troops, and three of the bombers were destroyed on the ground by F-117As at Al Taqaddum airfield on January 18, 1991. There are no reports of Tu-16s being used in action during Desert Storm, but they did launch Chinese C601 antiship missiles over the Persian Gulf during the war with Iran, in April 1988, and are believed to carry also the Mach 3 KSR-5 ("Kingfish") ASM. *(Data for Tu-16K-26 "Badger-G Mod" carrier for "Kingfish.")*

Contractor: Tupolev OKB, Russia.
Power Plant: two Mikulin RD-3M-500 turbojets; each 20,920 lb thrust.
Dimensions: span 108 ft 3 in, length 114 ft 2 in, height 34 ft 0 in.
Weights: empty 82,000 lb, normal gross 165,350 lb.
Performance: max speed at 19,700 ft 652 mph, service ceiling 49,200 ft, range with 6,600 lb weapon load 3,580 miles.



A-4N Skyhawks (left) and F-4 Phantom 2000s of Israeli Air Force with C-130 Hercules tanker

Tu-16K-16 "Badger-G," Egyptian Air Force

Accommodation: crew of six on ejection seats, including two pilots side by side, navigator/bombardier in nose, and rear gunner in tail turret.
Armament: seven 23-mm AM-23 guns, in twin gun turrets above front fuselage, under rear fuselage, and in tail, with seventh gun on starboard side of nose; two KSR-5 ("Kingfish") ASMs underwing, or up to 19,800 lb of bombs in internal weapons bay.

Tu-22

Iraq and Libya were the only nations outside the former USSR to receive small batches of the original Tu-22, Tupolev's first supersonic bomber. Iraq is thought to have had nine, including Tu-22Ks ("Blinder-Bs") able to carry a Kh-22 ("Kitchen") ASM with a speed of Mach 4.6 and range of 185 miles at low altitude or 285 miles at height. Versions of the Kh-22 exist with a 2,200-lb high-explosive warhead for antiship use and with an antiradiation warhead. Although used against Iran, the Tu-22s seem to have played no part in Desert Storm. Five appear to be serviceable. Libya acquired Tu-22s in the early 1970s, operated initially by Soviet aircrews. After operations in Uganda in early 1979 and against the forces of Chad in the 1980s, about seven are thought to continue in service, primarily for surveillance over the Mediterranean.

Contractor: Tupolev OKB, Russia.
Power Plant: two Koliesov VD-7M turbojets in pods above rear fuselage, on each side of tailfin; each 35,275 lb thrust with afterburning. Provision for four JATO rockets.
Dimensions: span 77 ft 1¼ in, length 139 ft 9 in, height 32 ft 9¾ in.
Weight: gross 187,390–207,230 lb.
Performance: max speed at 40,000 ft Mach 1.52, service ceiling, supersonic 43,635 ft, T-O run 7,385 ft, landing run 5,415–7,120 ft, combat radius 807–1,365 miles.
Accommodation: crew of three, in tandem, on ejection seats.
Armament: one 23-mm NR-23 gun in radar-directed tail mounting; conventional bombs in weapons bay (typically 24 FAB-500 or one FAB-9000), or Kh-22 ("Kitchen") ASM recessed in bay. Max weapon load 26,455 lb.

Fighters and Attack Aircraft

A-4 Skyhawk

The two Middle East operators of A-4s, Israel and Kuwait, both fly second-generation "camel" Skyhawks, with the characteristic saddleback hump (for avionics and extra fuel) first introduced by the A-4F and perpetuated in subsequent models such as the US Marine Corps' A-4M Skyhawk II. The A-4F introduced a zero/zero ejection seat, underwing spoilers to reduce landing run, and nosewheel steering; a tail braking parachute, square-tipped vertical fin, and other detail improvements came in with the A-4M. Israel's **A-4N** (117 built) and Kuwait's **A-4KU** (30) were both broadly equivalent to the A-4M, although the former have been life-extended, rewired, and upgraded by Israel Aircraft Industries since their delivery in the mid-1970s. The IAI upgrade included 30-mm (replacing 20-mm) guns, an extra underwing station on each side (making six), lengthened nose and jetpipe, a chaff/flare dispenser just ahead of the brake-chute fairing, dual disc brakes, and an advanced Elta WDNS (weapon delivery and navigation system) which includes provision for firing Gabriel ASMs. The number of Israeli A-4Ns has lately dwindled to about 70, but they still equip three squadrons of the IDF/AF, which also has 30 or so **TA-4H** and **-4J** Skyhawk trainers. A further 10 TA-4Js were promised by the US government in September 1992.

Kuwait's A-4KUs had dwindled to about 24 (plus six **TA-4KU**s) at the time of the Iraqi invasion in August 1990, serving with Nos. 9 and 25 Squadrons at Ahmed al Jaber air base. Representing, at that time, the country's principal combat aircraft type, 20 of the A-4KUs successfully escaped, initially to Bahrain and thence to Dhahran in Saudi Arabia. From here, temporarily emblazoned with the legend "Free Kuwait," they joined other coalition forces in fighting for the recovery of their home-

land, during which at least one was lost. Typical mission loads during these operations were five Mk 7 cluster dispensers (two underwing, three on a centerline triple ejector rack) or five Mk 82SE Snakeye bombs, plus a pair of 450-gallon drop tanks. Aircraft captured by the invading Iraqis were returned in early 1992, restoring the inventory to 23 single-seaters and two or more trainers. Kuwait has received F/A-18 Hornets as replacements for its Skyhawks. *(Data for original A-4N.)*

Contractor: Douglas Aircraft Company, USA.

Power Plant: one Pratt & Whitney J52-P-408A turbojet; 11,200 lb thrust.

Dimensions: span 27 ft 6 in, length 40 ft 3¾ in, height 15 ft 0 in.

Weights: empty 10,465 lb, gross 24,500 lb.

Performance: max speed at S/L 670 mph clean, 646 mph with 4,000-lb weapons load, service ceiling approx 40,000 ft; T-O run 2,730 ft, combat radius (hi-lo-hi) with 4,000-lb weapons load 340 miles.

Accommodation: pilot only, on zero/zero ejection seat (two seats in TA-4).

Armament: one 20-mm Mk 12 gun (30-mm DEFA in Israeli refit) in each wingroot; one centerline and four underwing stations (six in Israeli refit) for AAMs, ASMs, bombs, rockets, or gun pods; max (five-station) external load 9,195 lb.

Alpha Jet

Most advanced jet trainers have a secondary capability for close support/ground-attack missions, but the Franco-German Alpha Jet's design was undertaken with more attention to the latter role than many of them, initially to meet the requirements of the former West German Air Force. In addition to the 351 built for France and Germany, a further 152 were completed to meet orders from eight other countries, three of them (Egypt, Morocco, and Qatar) in the Middle East/North Africa region. Sales were 45, 24, and six, respectively. All three air forces employ their Alpha Jets for both advanced/weapons training and close support duties, those of the Qatar Emiri Air Force equipping No. 11 Squadron at Doha.

Egyptian Air Force Alpha Jets, most of which were license-assembled in that country by AOI (Arab Organization for Industrialization), are of two models. The first 30, designated **MS1**, are standard-model trainers generally similar to those built for the French Air Force and most export customers. The final 15, however, were optimized for the attack role. Known as **MS2**, this version is equipped with a SAGEM Uliss 81 inertial nav/attack system, Thomson-CSF HUD and nose-mounted laser rangefinder, and a Thomson-TRT radio altimeter, all managed by a Dassault Electronique multiplex digital data bus. This advanced system enables the MS2 to designate targets automatically, fire guns or rockets in a dive, release retarded bombs in level flight, and release free-fall bombs automatically in the toss mode.

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

Power Plant: two SNECMA/Turbomeca Larzac 04-C6 turbofans; each 2,976 lb thrust.

Dimensions: span 29 ft 10¾ in, length 43 ft 5 in, height 13 ft 9 in.

Weights: empty 7,749 lb, gross 17,637 lb.

Performance: max speed (clean) at 32,800 ft Mach 0.85, at S/L 621 mph, service ceiling 48,000 ft, T-O run 1,215 ft, landing run 1,640 ft, close support combat radius (hi-lo-hi) 363 miles on internal fuel, 668 miles with two 119-gallon drop tanks.

Accommodation: crew of two, in tandem, on zero/zero ejection seats.

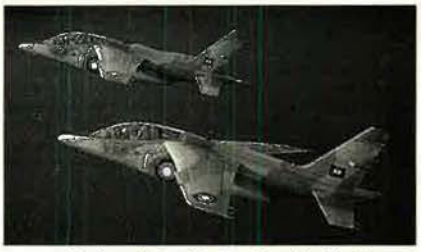
Armament: hardpoint under fuselage and two under each wing for 5,510 lb of stores, including centerline 27-mm or 30-mm gun pack; four free-fall, retarded, or cluster bombs; gun or rocket pods; and two 82- or 119-gallon drop tanks.

CM 170 Magister

As related in the "World Gallery of Trainers" *[December 1992, p. 31]*, the Magister, with more than 900 built, was the most successful of the European-designed first generation of jet trainers. Of five current Middle Eastern/North African operators of the type, four (Israel, Lebanon, Libya, and Morocco) were among the Magister's original customers, those of Israel being license-built in-country. Designed for advanced (including weapons) training, the Magister was also eminently suitable for light ground-attack duties, and the Royal Moroccan Air Force still uses a portion of its approximately 22 Magisters in the counter-insurgency role. The Algerian Air Force has a similar number for advanced and weapons training. Numbers in the other three inventories have naturally been depleted over the years and are now almost certainly retained only for training. Israel's original 80 Magisters, known locally as **Tzukits**, have dwindled to about 45, and a replacement is being sought; Libya has about a dozen, Lebanon about five.

Contractor: Aerospatiale (originally Fouga), France.

Power Plant: two Turbomeca Marboré IIA turbojets; each 880 lb thrust.



Alpha Jets, Qatar Emiri Air Force (P. Steinemann)

F-5E Tiger IIs, Royal Jordanian Air Force (P. Steinemann)

F-6, Egyptian Air Force (Denis Hughes)

Dimensions: span over tiptanks 39 ft 10 in, length 33 ft 9½ in, height 9 ft 2¼ in.

Weights: empty 4,268 lb, gross 6,978 lb.

Performance: max speed at 30,000 ft 443 mph, service ceiling 30,000 ft, T-O run 1,800 ft, range 576 miles.

Accommodation: crew of two, in tandem.

Armament: provision for two nose-mounted 7.62-mm machine guns, plus hardpoint under each wing for two 110-lb bombs, four 55-lb rockets, or a Nord SS.11 wire-guided missile.

F-4 Phantom II

Known to Israeli pilots as the Kurnass ("heavy hammer"), the **F-4E** Phantom has been a mainstay of that country's air force since the first of an initial 44 were delivered in September 1969. Subsequent deliveries, under a series of Peace Echo and other program names, increased that total to nearly 210 by the time of the last arrival in late 1976. Originally a mixture of new-build and former USAF aircraft, with or without the leading-edge wing slats that characterized the mainstream F-4E, they have suffered considerable attrition in Israel's Yom Kippur, Lebanon, and other wars, but about 120 remain in IDF/AF service, with four squadrons at Hatzor (two), Tel Nov, and Ramat David.

Various improvements have been made over the years—though not necessarily to every aircraft; they include addition of slats to nonslatted aircraft, TISEO target identification sensors, radar warning receivers, a Litton LW-33 inertial nav/attack system, Elbit/Singer-Kearfott Jason weapon delivery system, and night attack capability. More recent is the **Phantom 2000** upgrade program to extend operational life and improve both maintainability and safety. New avionics include an Elbit mission computer, Kaiser-licensed wide-angle HUD, multifunction electronic displays in both cockpits, HOTAS (hands on throttle and stick), and improved ECM and self-protection systems. Airframe changes include reinforced skins and fuel cells in the fuselage and wings, dual MIL-1553B data buses, all-new electrical wiring and hydraulic lines, improved crew comfort, and small strakes added to the engine air intake trunks to enhance maneuverability and stability. Series redeliveries of Phantom 2000s to the IDF/AF began in April 1989, and at least half of Israel's F-4Es are now to this standard. A Norden/UTC multimode high-resolution radar is to be retrofitted during the 1990s.

An earlier Middle East customer was Iran, which began receiving 32 **F-4D**s ordered by the Shah in September 1968, followed by 177 F-4Es between March 1971 and August 1979. Originally they equipped more than a dozen squadrons, but spares embargoes after the Shah's overthrow, and attrition during the Iran-Iraq war of the 1980s, have made extensive inroads into this total. Estimates of how many remain operationally usable vary from 50 to as few as 20. They have been used in recent years to attack Iranian rebels based across the border in Iraq. Egypt, which received the first of 35 early-model former USAF F-4Es about a year after the first Iran deliveries, still has about the same number with two squadrons at Cairo West, but they are said to have suffered from poor maintenance through most of their career. *(Data for F-4E.)*

Contractor: McDonnell Aircraft Company, USA.

Power Plant: two General Electric J79-GE-17A turbojets; each 17,900 lb thrust with afterburning.

Dimensions: span 38 ft 7½ in, length 63 ft 0 in, height 16 ft 5½ in.

Weights: empty 31,853 lb, gross 41,487–61,795 lb.

Performance: max speed at height above Mach 2, average speed 580 mph, service ceiling 54,400 ft, T-O run 3,180–4,390 ft, landing run 3,040–3,780 ft, combat radius 494–786 miles.

Accommodation: crew of two, on tandem ejection seats.

Armament: one M61A1 20-mm multibarrel gun under nose; four semisubmerged underbelly mounts and four underwing pylons for AAMs, ASMs, bombs, cluster bombs, rocket packs, gun or ECM pods, totaling about 16,000 lb. Alternative weapons adapted to Israeli F-4s include AGM-45 Shrike and AGM-78 Standard ARMs, AGM-65 Maverick and AGM-142 Popeye ASMs, Luz TV-guided ASMs, and Gabriel antiship missiles. Although assigned almost exclusively to air-to-ground attack, provision is retained for Shafrir, Python, Sidewinder, or Sparrow AAMs for self-defense.

F-5E/F Tiger II

Original versions of Northrop's lightweight, supersonic Freedom Fighter were the single-seat F-5A and the tandem two-seat F-5B trainer. In the Middle East/North Africa region, only the Royal Moroccan Air Force, with 10 F-5As and two F-5Bs, continues to deploy them in a combat role, although Saudi Arabia and Yemen each retain some of the trainers.

Far more numerous are the single-seat **F-5E Tiger II** and its combat-capable two-seat counterpart, the **F-5F**, serving seven air forces in the region. Building on experience in southeast Asia, in the fall of 1965, the F-5E was given the Dash 21A version of the J85 engine, providing 22.5 percent more thrust than the A model's J85-GE-13; wings of 10 percent greater area, with full-span leading-edge maneuvering flaps; increased internal fuel tankage; a two-position nosewheel leg, enabling angle of attack to be increased to shorten the takeoff run; and a runway arrester hook. It was chosen as America's IFA (international fighter aircraft) for export to friendly nations in November 1970. The first production F-5E flew for the first time on August 11, 1972. Morocco has about 20 F-5Es and four F-5Fs in its F-5 fleet; Bahrain has eight Es and four Fs; Iran is thought now to have fewer than half of the 169 E/Fs it received; Jordan is estimated to have 52 Es and seven Fs, Saudi Arabia 61 Es and 21 Fs, Tunisia 15 Es and four Fs, and Yemen 10 Es. *(Data for F-5E.)*

Contractor: Northrop Corporation, USA.

Power Plant: two General Electric J85-GE-21A turbojets; each 5,000 lb thrust with afterburning.

Dimensions: span 26 ft 8 in (27 ft 11⅞ in over wingtip AAMs), length 48 ft 2 in, height 13 ft 4 in.

Weights: empty 9,683 lb, gross 24,676 lb.

Performance: max speed at 36,000 ft at 13,350 lb combat weight 1,077 mph, service ceiling 51,800 ft, T-O run 2,000–5,700 ft, landing run with brake-chute 2,500 ft, typical hi-lo-hi combat radius with max internal fuel, two 530-lb bombs, and two Sidewinder AAMs 553 miles.

Accommodation: pilot only, on ejection seat (two seats in F-5F).

Armament: two 20-mm M39A2 guns in nose (one in F-5F); AIM-9 Sidewinder AAM at each wingtip; one underfuselage and four underwing stations for up to 7,000 lb of bombs (incl one 2,000-lb), cluster bombs, rocket launchers, napalm tanks, or auxiliary fuel tanks; provision for AGM-65 Maverick ASMs or laser-guided bombs.

F-6

China's **F-6** version of the Russian MiG-19 supersonic fighter-bomber was introduced into the Middle East by Egypt in 1979. In a deal that included transfer of MiG-23s for study by the Chinese aircraft industry, the Egyptian Air Force first received 40 Shenyang-built F-6s, followed by others for assembly at the Helwan factory, near Cairo. Around 70 of these are believed to remain in service, plus six **FT-6** tandem two-seat trainers. Egypt also assembled about 40 F-6s for Iraq, but it is doubtful that any of these remain airworthy. Equally little is known about the current status of 16 F-6s once flown by

Iran's Revolutionary Guard pilots. *(Data for F-6 day fighter.)*

Contractor: Shenyang Aircraft Corporation, People's Republic of China.

Power Plant: two Shenyang/Chengdu WP6 turbojets; each 7,165 lb thrust with afterburning.

Dimensions: span 30 ft 2¼ in, length incl probe 48 ft 10½ in, height 12 ft 8¾ in.

Weights: empty 12,700 lb, gross 22,045 lb.

Performance: max speed at 36,000 ft Mach 1.45, at S/L Mach 1.09, service ceiling 58,725 ft, range 1,366 miles.

Accommodation: pilot only, on ejection seat (two in tandem in FT-6 trainer).

Armament: three 30-mm NR-30 guns, in nose and each wingroot; two pylons under each wing, inboard of hardpoint for external fuel tank, to carry packs of eight air-to-air rockets, AAMs, two 550-lb bombs, or air-to-surface rockets of up to 212-mm caliber.

F-14A Tomcat

It is indicative of the influence held in Washington in the mid-1970s by the Shah of Iran that this then-new and advanced weapon system—once described as having "the best mix of air-to-air weapons available to any fighter in the world"—was approved for sale outside the US. An initial 40 were ordered in June 1974—a month before the F-14A achieved IOC with the US Navy—and a second batch of 40 the following January; they differed from standard USN F-14As only in having slightly different ECCM for the AN/AWG-9 aiming and firing system for their AIM-54A Phoenix missiles. Seventy-nine of the ordered 80 Tomcats were delivered to Iran, along with 284 Phoenix AAMs and other missiles (AIM-7 Sparrows and AIM-9 Sidewinders).

These Tomcats—the only export sale of the F-14—were expected to be a powerful weapon for peace in the Middle East, but with the overthrow of the Shah their value soon diminished under the Khomeini regime. Iran's Air Force did not have the expertise necessary to maintain the Phoenix weapon system, and obtaining airframe and engine spares became virtually impossible. Consequently it is difficult to be certain how many Iranian F-14As remain airworthy (perhaps about two dozen, according to one estimate) or how effective their armament may be.

Contractor: Grumman Aircraft Systems Division, USA.

Power Plant: two Pratt & Whitney TF30-P-412A turbofans; each 20,900 lb thrust with afterburning.

Dimensions: span 64 ft 1½ in (min 20° sweep), 38 ft 2½ in (max 68° sweep), length 62 ft 8 in, height 16 ft 0 in.

Weights: empty 40,104 lb, gross 58,715–74,349 lb.

Performance: max speed at high altitude 1,544 mph, at low altitude 912 mph, service ceiling above 50,000 ft, T-O run 1,400 ft, landing run 2,900 ft, max range with external fuel 2,000 miles.

Accommodation: crew of two, in tandem, on zero/zero ejection seats.

Armament: one 20-mm M61A1 gun in port side of forward fuselage; four AIM-7 Sparrow or AIM-54 Phoenix AAMs semirecessed under fuselage; pylon under each inboard (fixed) wing portion for additional Phoenix/Sparrows, and/or Sidewinder AAMs, or various missile/bomb combinations.

F-15 Eagle

The first Middle East customer for the Eagle was Israel, which received an initial 23 single-seat **F-15A**s and two **F-15B** trainers in 1976–78, a further 15 improved **F-15C**s in 1981–82, 11 more (nine Cs and two Ds) in 1984, 20 ex-USAF As and five more Bs in 1991–92, and a final five **F-15D**s in 1992, for a total of 81. With F-16s and F-4s and controlled by E-2C Hawkeye AEW&C aircraft, Israeli F-15s fought fierce battles with Syrian MiG-21s and MiG-23s over the Bekaa Valley in Lebanon in 1982. Eighty-five victories were claimed, 40 by F-15s, without loss in air combat. They have Israeli-developed ECM and can be fitted with McDonnell Douglas's conformal fuel tanks (CFTs), which allow tangential stores carriage. Weapons include Rafael Shafrir and Python 3 infrared AAMs.

Second (and so far only other) customer in this region is the Royal Saudi Air Force, which has four squadrons (Nos. 5, 6, 13, and 42) of F-15Cs and Ds. Initial 1981–84 deliveries, plus two attrition replacements later, comprised 46 single-seat Cs and 16 tandem-seat Ds. These were augmented during the 1990–91 Persian Gulf campaign by a further 20 Cs and four Ds, and by nine more Cs and three Ds delivered from August 1991 as attrition replacements. About 92 of these 98 remain in service. Most effective fighters in the region, Eagles proved their capability in the Persian Gulf War. Thirty-eight Iraqi aircraft were destroyed by F-15s in air combat, including five MiG-29s and two MiG-25s, without loss. Two of the victories, both Mirage F1s, were claimed by an F-15C pilot of the Royal Saudi Air Force. Since Desert Storm, they have taken part with other coalition forces in Operation Southern Watch patrols over southern Iraq.

The basic F-15 radar is a Hughes X-band pulse-Doppler APG-63, able to provide long-range detection and tracking of small high-speed targets flying at all altitudes down to treetop level. Data are fed to an IBM central computer to ensure optimum missile launch and gun firing. The pilot has head-up and head-down weapon system, navigation, and IFF displays. Radar warning, automatic ECM jamming, and chaff dispensing systems are standard.

Between 1995 and 1998, the Royal Saudi Air Force will receive a further 72 Eagles, 24 optimized for an air-superiority role and 48 for air/ground attack. Designated **F-15S**, these aircraft will be generally similar to USAF's dual-role F-15E, though with a slightly lower radar and weapons capability. Their AN/APG-70 radars will be "detuned" to the performance level of the APG-63, some of the F-15E's ECM will be omitted, and a Martin Marietta Sharpshooter system will replace the AN/AAQ-14 LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) targeting pod. Like other Saudi Eagles, the F-15Ss are not intended to have stores-carrying CFTs, but they will still be well armed: the contract includes supply of 900 AGM-65D/G Maverick ASMs, 600 AIM-9M/S Sidewinders, and 1,300 CBU-87 bomblet dispensers and GBU-10/12 Paveway laser-guided bombs. The F-15S is powered by two 29,100 lb thrust F110-PW-229 afterburning turbofans. *(Data for F-15C.)*

Contractor: McDonnell Aircraft Company, USA.

Power Plant: two Pratt & Whitney F100-PW-100 or F100-PW-220 turbofans; each approx 23,450 lb thrust with afterburning.

Dimensions: span 42 ft 9¾ in, length 63 ft 9 in, height 18 ft 5½ in.

Weights: empty 28,600 lb, gross 44,630–68,000 lb.

Performance: max speed Mach 2.5, service ceiling 60,000 ft, T-O run (interceptor) 900 ft, landing run without brake-chute 3,500 ft, ferry range with external tanks more than 2,878 miles, with CFTs 3,570 miles.

Accommodation: pilot only, on zero/zero ejection seat (two seats in F-15B/D).

Armament: one M61A1 20-mm multibarrel gun in starboard wingroot; four AIM-7 Sparrow and four AIM-9 Sidewinder AAMs; provision for up to 23,600 lb of bombs, rockets, or additional ECM.

F-16 Fighting Falcon

To date, 416 F-16s have been ordered by four Middle Eastern air forces. The Bahrain Emiri Air Force began equipping with eight **F-16C**s and four **F-16D**s in March 1990. These have General Electric F110-GE-100 engines and were supplied with Sparrow and Sidewinder AAMs, Maverick ASMs, Mk 20 Rockeye cluster bombs, GBU-10/12 laser-guided bombs, ALQ-131 ECM and laser designator pods, and ALE-40 chaff/flare dispensers. The first batch of Egyptian aircraft, comprising 34 **F-16A**s and seven **F-16B**s, was delivered from March 1982 with Pratt & Whitney F100-PW-200 engines and AIM-9L Sidewinder AAMs, as MiG-21MF replacements. Thirty-six F-16Cs and four F-16Ds, with F100-PW-220 engines, followed. A third batch of 40 F-16Cs and seven F-16Ds, for 1991–93 delivery, switched to F110-GE-100 engines. Sparrow AAMs and Egyptian IFF introduced on these aircraft were also retrofitted to early models, and Mavericks became available for air-to-ground missions. The 46 additional F-16C/Ds ordered for 1994 delivery will come from license production by TAI of Turkey.

Eight of the 67 F-16As and eight F-16Bs with F100-PW-200 engines supplied to Israel from January 1980 were the first Fighting Falcons used in combat. Escorted by six F-15s, they destroyed Iraq's Osirak nuclear reactor on June 7, 1981. In 1982 they shot down 44 Syrian MiG-21s and MiG-23s over the Bekaa Valley in Lebanon. Political embargo delayed until the end of 1986 delivery of the first of 51 F-16Cs and 24 F-16Ds, with F110-GE-100 engines. Some of these F-16Ds have deep spines housing equipment for "Wild Weasel" defense-suppression roles, including Elisra SPS 3000 self-protection ECM; locally modified F110-GE-100A engines give much-increased thrust at low level. A further engine change, to F110-GE-200s, has been made in the latest batch of 30 F-16Cs and 30 F-16Ds for Israel, together with Elta ECM instead of the usual Loral Rapport. Standard armament of Israeli F-16s includes Sidewinder, Sparrow, and Python 3 AAMs, Maverick ASMs, GBU-10/12 laser-guided bombs, and Rockeye cluster bombs. LANTIRN pods are being made available for the latest aircraft.

Allowing for slight attrition, Egypt now is believed to have about 119 F-16s; Israel will have more than 200 when batch three deliveries are complete. Morocco, listed as a potential customer in the last edition of this Gallery, has abandoned its intention to purchase F-16s. *(Data for F-16C with F110-GE-100 engine.)*

Contractor: General Dynamics Corporation, USA.

Power Plant: one General Electric F110-GE-100 turbofan; 28,984 lb thrust with afterburning.

Dimensions: span over missiles 32 ft 9¾ in, length 49 ft 4 in, height 16 ft 8½ in.

Weights: empty 19,020 lb, gross 27,185–42,300 lb.

Performance: max speed at height above Mach 2, service ceiling above 50,000 ft, typical T-O and landing distance 2,500 ft, radius of action 392–852 miles.

Accommodation: pilot only, on zero/zero ejection seat (two seats in F-16B/D).

Armament: one M61A1 20-mm multibarrel gun in port wing/body fairing; up to 12,000 lb of stores on wingtip AAM mounts, centerline hardpoint, and six underwing pylons, as listed above.

F/A-18C/D Hornet

The Hornet is no stranger to the region, for in 1986 an attack on targets in Libya by four F/A-18A squadrons (VFA-131 and -132, US Navy, and VMFA-314 and -323, USMC) marked the first combat deployment of this twin-turbofan fighter/attack aircraft, and the type is on regular service in the Mediterranean with units of the US Sixth Fleet. In September 1988, Kuwait became the first export customer in the region to buy Hornets, ordering 32 single-seat **F/A-18C**s and eight dual-seat **F/A-18D** combat-capable trainers, in a multimillion-dollar package that also included AGM-65G Maverick, AGM-84 Harpoon, AIM-7F Sparrow, and AIM-9L Sidewinder missiles.

Deliveries had not begun when Iraq invaded Kuwait in August 1990, but they were not long delayed once the country's sovereignty had been restored. The first Kuwaiti Hornet made its first flight on September 19, 1991, was formally handed over by the US the following month, and the first three two-seaters were handed over to No. 25 Squadron of the Kuwaiti Air Force in January 1992; deliveries were completed this August. Operating initially from Kuwait International Airport, they are to be based temporarily at Ali el Salem until their war-ravaged permanent base at Ahmed al Jaber has been restored. Kuwait's Hornets, which will replace its now-elderly A-4KU Skyhawks, were the first to be powered by the Dash 402 version of the F404 engine, which produces some 1,700 lbs more thrust than the original Dash 400.

Israel, too, is looking for an all-weather, multirole combat aircraft with night attack capability to replace the Kfir. Leading contenders are the LANTIRN-equipped F-16 and the F/A-18C/D, and two D model Hornets were evaluated in the spring of this year as a prelude to final selection. The IDF/AF requirement is for 40–48 aircraft. *(Data for F/A-18C.)*

Contractor: McDonnell Aircraft Company, USA.

Power Plant: two General Electric F404-GE-402 turbofans; each approx 17,600 lb thrust with afterburning.

Dimensions: span 37 ft 6 in, length 56 ft 0 in, height 15 ft 3½ in.

Weights: empty 23,050 lb, gross 36,710 lb (fighter), 56,000 lb (attack).

Performance (F404-GE-402 engines): max speed at high altitude above Mach 1.8, service ceiling approx 50,000 ft, T-O run less than 1,400 ft, typical combat radius (interdiction) 340 miles.

Accommodation: pilot only, on zero/zero ejection seat (two seats in F/A-18D).

Armament: one 20-mm six-barrel M61A1 gun in nose; nine external stations (wingtips, four underwing, two nacelle, and one centerline). Weapons can include AIM-9 Sidewinder AAMs at wingtips; Sidewinders, AIM-7 Sparrows, AIM-120 AMRAAMs, AGM-84 Harpoons, or AGM-65 Mavericks underwing; Sparrows or sensor pods (nacelles). Centerline and inboard underwing stations suitable for drop fuel tanks.

Hawk

After beginning life as an advanced flying and weapons trainer for the UK's Royal Air Force, the Hawk progressed through a series of increasingly aggressive dual-role trainer/light attack versions to the 100 series two-seat enhanced ground-attack model and the 200 series single-seat multirole combat aircraft. After the United Arab Emirates formed a Central Air Force, they decided to standardize on the Hawk as their basic trainer. Dubai contributed eight **Mk 61**s, with a 5,700 lb thrust Adour 861 turbofan, equipping what is designated a fighter squadron. Abu Dhabi's 15 similar Mk 63s have been upgraded to **Mk 63A**, with an Adour 871 and new "combat wing" with four stores pylons and wingtip AAMs. It is also acquiring 18 **Mk 102**s, with Adour 871, combat wing, MIL-1553B data bus, HOTAS controls, HUD, color multipurpose CRT in each cockpit, radar warning receiver, and provision for an ECM pod, plus laser ranging and FLIR in the extended nose.

Five or six of the Kuwaiti Air Force's 12 **Mk 64**s remain airworthy after escaping to Bahrain during the August 1990 Iraqi invasion. Four others were returned by Iraq after the war but were in very poor condition. The former batch was placed under the control of the Royal Saudi Air Force, which is believed to have used some of the 30 Hawk **Mk 65**s bought for its own Nos. 21 and 37 Squadrons for light attack missions into occupied Kuwait. Under its Al Yamamah II program, it is expected to purchase a further 60 Hawks. Most will be single-seat **Mk 205**s, with Westinghouse APG-66H multimode radar, but some 100 series may be included. Oman is another customer for these latest versions, with orders for four **Mk 103**s and 12 **Mk 203**s. The two-seaters will have a radar warning receiver and wingtip AIM-9 Sidewinders; the single-seaters will have a fixed in-flight refueling probe and 6,614-lb weapons load. *(Data for 100 series.)*

Contractor: British Aerospace plc, UK.
Power Plant: one Rolls-Royce Turbomeca Adour 871 turbofan; 5,845 lb thrust.
Dimensions: span 30 ft 9¾ in, length 40 ft 9 in, height 13 ft 8 in.
Weights: empty 9,700 lb, gross 20,061 lb.
Performance: never-exceed speed at height Mach 1.2, max speed at S/L 632 mph, service ceiling 44,500 ft, T-O run 2,100 ft, landing run 1,980 ft, combat radius 620–900 miles.
Accommodation: basically, crew of two in tandem, on zero/zero ejection seats. Pilot only in combat role.
Armament: one 30-mm Aden Mk 4 gun pack on centerline; four underwing pylons for packs of 18 x 68-mm or 12 x 81-mm rockets, bombs up to 1,000 lb, cluster bombs, Maverick ASMs, or Sidewinder/Magic AAMs. Optional AAM on each wingtip. Max stores load 6,614 lb.

Hunter

The dozen or so Hunters flown by No. 6 Squadron of the Royal Air Force of Oman are survivors of a variety of **Mk 6, 10, 73A,** and **73B** single-seat fighter-bombers that once carried the insignia of the Royal Jordanian Air Force. Before that, they belonged to the Royal Air Force and Royal Netherlands Air Force. Despite such longevity, they have undergone a number of conversions and updates; their current weapons include AIM-9P Sidewinder AAMs and BL 755 cluster bombs. Oman also has three Hunter **T.67** side-by-side two-seat trainers. About five Hunter **F.70** single-seaters and a single **T.66C** trainer form the sole combat inventory of the Lebanese Air Force. *(Data for Hunter Mk 73A.)*
Contractor: Hawker Aircraft Ltd, UK.
Power Plant: one Rolls-Royce Avon 207 turbojet; 10,000 lb thrust.
Dimensions: span 33 ft 8 in, length 45 ft 10½ in, height 13 ft 2 in.
Weights: empty 12,760 lb, gross 17,750 lb.
Performance: max speed at height 627 mph, at S/L 715 mph, service ceiling 51,500 ft, range 1,840 miles.
Accommodation: pilot only, on ejection seat.
Armament: four 30-mm Aden guns in lower nose; five hardpoints under each wing; two bombs of up to 1,000 lb, two clusters of six 3-in rockets, or two packs each with 24 or 37 x 2-in rockets on inboard hardpoints; up to 24 x 3-in rockets on outboard hardpoints; alternative weapons include napalm containers, BL 755 cluster bombs, and Sidewinder AAMs.

Jaguar International

Jaguar International, first flown in August 1976, is the export version of the basic attack aircraft of which 403, including two-seat combat trainers, were built for the air forces of Great Britain (203) and France (200). After India, the largest export customer was the Sultanate of Oman, which ordered 24 in the late 1970s in two batches of 12 (20 single-seat and four two-seat); the 21 that survive currently equip No. 8 and No. 20 Squadrons, based at Masirah, having been upgraded at the end of the 1980s with a Ferranti FIN 1064 inertial navigation system. Destined to continue in service for the remainder of the 1990s, they are employed in the air defense role as well as that of ground attack, in the former configuration carrying a pair of underwing AIM-9P Sidewinder AAMs. Omani Jaguars were not involved in the 1991 Persian Gulf War.
Contractor: SEPECAT, a Franco-British company.
Power Plant: two Rolls-Royce Turbomeca Adour Mk 811 turbofans; each 8,400 lb thrust with afterburning (8,040 lb Mk 804s in first 12 Omani aircraft).
Dimensions: span 28 ft 6 in, length 55 ft 2½ in, height 16 ft 0½ in.
Weights: empty 15,432 lb, gross 24,149–34,612 lb.
Performance: max speed at 36,000 ft 1,056 mph, at S/L 840 mph, service ceiling approx 50,000 ft, T-O run with typical tactical load 4,100 ft, landing run without brake-chute 2,200 ft, typical hi-lo-hi combat radius 530 miles on internal fuel, 875 miles with auxiliary fuel.
Accommodation: pilot only, on zero/zero ejection seat (two seats in trainer).
Armament: two ventral internal 30-mm guns (one in trainer); one centerline and four underwing stations for mixed loads including free-fall, retarded, cluster, or laser-guided bombs, or air-to-surface rockets, on understations; provision for one wing-mounted AIM-9 Sidewinder, Matra Magic, or similar AAM each side. Max external stores load 10,500 lb.

Kfir

Israel received 72 single-seat Mirage IIICJ interceptors from France in 1972, and it was the Israeli requirement for a simplified, VFR ground-attack version that was chiefly responsible for Dassault developing the Mirage 5 (which see), but an order for 50 Mirage 5Js was embargoed by the French government after the Six-Day War of 1967. As a result, and aided by smuggled Mirage III/5 drawings, IAI first developed the Nesher, retaining the French Atar 9C engine. The Kfir was the second stage in this domestic development cycle, in which the Atar turbojet was replaced by the somewhat larger US J79; associated airframe changes included a shorter and fatter rear fuselage, a large dorsal airscoop for afterburner cooling, strengthened landing gear, and a lengthened nose. Only 27 of the initial Kfir variant, the **C1,** were built before the appearance of the **C2,** which featured fixed canards, small nose strakes, and dog-tooth wing leading-edges for improved maneuverability and shorter runway requirements. IAI produced 185 C2s (including a proportion of combat-capable **TC2** tandem-seat trainers with longer noses), later upgrading most to **C7/TC7** standard with more advanced avionics, notably HOTAS controls, an improved weapon delivery and navigation system, two additional external weapon stations, and a "combat plus" engine power reserve giving an extra 890 lb of optional thrust in afterburner mode.

The Kfir still equips about four IDF/AF interceptor or attack squadrons, but up to half of those built have been in storage for years, for some of which IAI has received export orders, though naturally not from elsewhere in the Middle East. Because of its J79 engine, US restrictions limit the number of other countries to which Israel can offer the Kfir, but relaxation of imports from France now permits it to be offered with a more powerful version of the "original" engine, the Atar 9K50—in effect "reinventing" Dassault's own Mirage 50. More recently, IAI has offered potential customers a **C10** version, incorporating in-flight refueling and the radar and other avionics of the abandoned Lavi multirole fighter. *(Data for Kfir C7.)*
Contractor: Israel Aircraft Industries Ltd, Israel.
Power Plant: one General Electric J79-J1E (Israeli modified J79-GE-17) turbojet; 17,860 lb thrust with afterburning (18,750 lb with "combat plus" reserve).
Dimensions: span 26 ft 11½ in, length 51 ft 4¼ in, height 14 ft 11¼ in.
Weights: empty 16,060 lb, gross 22,961–36,376 lb.
Performance: max speed (clean) at 36,000 ft and above more than Mach 2.3, at S/L 863 mph, service ceiling 58,000 ft, T-O run 4,750 ft, landing run 4,200 ft, combat radius 482 miles (high-altitude interception), 737 miles (hi-lo-hi ground attack).
Accommodation: pilot only, on zero/zero ejection seat (two seats in TC7).
Armament: one 30-mm DEFA 552 gun in lower lip of each air intake duct; five underfuselage and four underwing stations for weapons, ECM or other sensor pods, or drop tanks, to max weight of 13,415 lb. Python 3, Shafrir 2, or Sidewinder AAM on each outer wing station as interceptor; bombs (standard, smart, cluster, or other), Shrike or Maverick ASMs, napalm tanks, or rocket launchers for ground attack.

L-39/L-59 Albatros

First flown on November 4, 1968, the L-39 advanced jet trainer/light attack aircraft has been in continuous production for more than 20 years, with more than 2,800 built by the beginning of this year. The great majority of these have been trainer-only **L-39 C**s for the Czech and Slovak Air Forces and the former USSR, but, of more than 700 non-Soviet exports, approximately 370 have been to countries in the Middle East and North Africa, with Iraq (81), Libya (181), and Syria (99) the major customers. All three have the **L-39 ZO** version, first flown in August 1975, which has increased stores-carrying ability on four (instead of two) underwing pylons and a correspondingly reinforced airframe. Syria's fleet, which included 44 **ZA**s, remains at nearly full strength, but that of Iraq may have dwindled to as few as 20 through attrition in its long war with Iran, and their airworthiness is uncertain. Libya, too, is thought to have lost more than a few in its border conflicts with neighboring Chad, and in 1990 donated 10 of its L-39s to Egypt, but more than 100 probably remain. The fifth operator in the region is Algeria, whose Air Force received 32 of the L-39 ZA specialized ground-attack/reconnaissance version, which has an underfuselage gun as standard in addition to the four underwing weapon stations.

The **L-59** is an improved Albatros, first flown (as the L-39 MS) on September 30, 1986. It has a more powerful (4,850 lb thrust) Progress (Lotarev)/ZVL DV-2 turbofan, strengthened airframe, and upgraded Western avionics that include head-up/head-down displays, IFF, and a radar altimeter. The Egyptian Air Force placed a $204 million order for 48 L-59Es, deliveries of which began last January. Tunisia is also believed to be an L-59 customer. *(Data for L-39 ZA.)*
Contractor: Aero Vodochody Aeronautical Works Ltd, Czech Republic.
Power Plant: one Progress/Ivchenko AI-25 TL turbofan; 3,792 lb thrust.
Dimensions: span over tiptanks 31 ft 0½ in, length 39 ft 9½ in, height 15 ft 7¾ in.
Weights: empty 7,859 lb, gross 10,218–12,346 lb.
Performance: max speed at 16,400 ft 391 mph, at S/L 379 mph, service ceiling 24,600 ft, T-O run 3,182 ft, landing run 2,625 ft, range (unarmed) with max internal/external fuel approx 1,000 miles.
Accommodation: crew of two, on tandem low-speed/zero-height ejection seats, but normally flown solo in attack role.
Armament: underfuselage pod for 23-mm GSh-23 gun, with up to 150 rds; four underwing stations for up to 2,425 lb of external stores, including bombs of up to 1,102 lb, UB-16-57 rocket pods (16 x 57-mm), infrared AAMs (outer stations only), daytime reconnaissance pod (port inner only), or drop fuel tanks (inboard stations only).

MiG-21/F-7

Variants of the MiG-21 continue to be flown by more air forces in the Middle East and North Africa than any other fighter/attack type of aircraft. Current estimates, including F-7s produced in China, total at least 800, serving in seven nations. Three of Algeria's four interceptor squadrons have early-model **MiG-21F/MF**s (mostly the former), of which about 80 remain in service. The Egyptian Air Force continues to deploy about 150 Soviet-built MiG-21s of some half a dozen versions from F to MF, and up to 80 Chinese-manufactured **F-7B**s. Most of those in Egypt have been updated with a GEC-Marconi HUD, air data computer, RWR, ECM jamming, and armament of Sidewinder or Magic AAMs. Some are **MiG-21R**s with a locally designed underfuselage pack of three reconnaissance cameras. Syria still has about 180 MiG-21s, including **PF**s, MFs, and late-model **MiG-21bis,** in eight squadrons. Libya has at least 50 MiG-21s operational, with possibly more in store. The now-unified Yemen has about 45 MiG-21Fs and 30 PFs, from the formerly separate northern and southern parts of the country, respectively.

Many MiG-21s and F-7s were among the 250 Iraqi aircraft destroyed in the air and on the ground in the Persian Gulf War. With so many MiG-29s lost, the survivors of some 70 prewar MiG-21s and 80 F-7Bs are likely to have extended service lives. Meanwhile, Iran had begun rebuilding its Air Force by ordering 100 of Chengdu's much-refined **F-7M Airguard,** with a GEC-Marconi HUDWAC (head-up display and weapon-aiming computer), new ranging radar, IFF, more secure radio communications, air data computer, two additional underwing pylons, provision for PL-7 infrared AAMs, birdstrike-resistant windshield, strengthened landing gear, zero height/81 mph ejection seat, and 13,448 lb thrust WP7B(BM) turbojet, requiring no separate gasoline starting tank. *(Data for MiG-21MF.)*
Contractor: Mikoyan OKB, Russia.
Power Plant: one Soyuz/Gavrilov R-13-300 turbojet; 14,550 lb thrust with afterburning.
Dimensions: span 23 ft 5¾ in, length 51 ft 8½ in, height 14 ft 9 in.
Weight: gross 18,078–20,725 lb.
Performance: max speed at height Mach 2.1, service ceiling 50,000 ft, T-O run 2,625 ft, landing run 1,805 ft, combat radius (internal fuel and four underwing 550-lb bombs) 230 miles, range with three drop tanks 1,118 miles.
Accommodation: pilot only, on zero/zero ejection seat.
Armament: one GSh-23L twin-barrel 20-mm gun, with 200 rds, under fuselage; four underwing hardpoints for K-13 ("Atoll"), Matra Magic, or AIM-9 Sidewinder AAMs, pods of 24 x 57-mm rockets, four 240-mm rockets, or bombs of up to 1,100 lb.

MiG-23

Mikoyan's sole venture into variable-geometry design, with the MiG-23/27 series, has met with little success in the Middle East and North Africa. Egypt was so unimpressed with 16 MiG-23s received in 1974 that it quickly retired them, passing on some to the US and China for evaluation. Libya's 85 MiG-23MS interceptors, 35 MiG-23BN light attack aircraft, and 15 MiG-23UB tandem two-seat trainers survived the bombing of their assembly center by the US in 1986, though US Navy F-14s shot down two MSs in 1989. Syria also lost MiG-23s in combat with the Israeli Air Force over the Bekaa Valley in 1982; replacements came from Libya to rebuild the Syrian Air Force squadrons to their estimated current strength of 90 MiG-23MS/ML interceptors, 60 MiG-23BNs, and a few trainers.

Of 20 MiG-23MFs and 70 BKs (some with in-flight refueling capability) equipping the Iraqi Air Force before Desert Storm, eight were shot down by F-15Cs, 12 fled to Iran (including some two-seaters), and others were destroyed on the ground. They made little use of available weapons, including French Magic AAMs and Russian Kh-29 ("Kedge") ASMs guided by French Atlis laser-designation pods. Other operators are the Algerian Air Force, with about 60 MiG-23MF/BMs, and the Republic of Yemen Air Force, with around 25 MiG-23BMs.

The **MiG-23MF** and **MS** interceptors ("Flogger-E") are single-seat aircraft with a 22,045 lb thrust Tumansky R-27F2M-300 afterburning turbojet, Sapfir-21 ("Jay Bird") radar with an 18-mile search range and 12-mile tracking range, no IR sensor or Doppler, and armament of R-3R/S ("Atoll") or R-60 ("Aphid") AAMs and 23-mm GSh-23 gun. The lighter-weight **MiG-23ML** ("Flogger-G"), identified by a much smaller dorsal fin, has a 28,660 lb thrust Soyuz/Khachaturov R-35-300 afterburning turbojet, no rear fuselage fuel tank, Sapfir-23ML ("High Lark 2") radar with search range of 43 miles and tracking range

of 34 miles, undernose pod for TP-23M IRST, and armament of R-23R/T ("Apex") and R-60T AAMs.

The single-seat light attack **MiG-23BM** and **BN** ("Flogger-F") differ from the interceptors in having the front fuselage tapered in side elevation to house a nav/attack system (slaved to a computer in the BM), a 25,350 lb thrust Soyuz/Khachaturov R-29B-300 afterburning turbojet, armored cockpit sides, low-pressure tires, explosion-resistant fuel tanks, active and passive ECM, and six pylons under wings and fuselage for R-3S or R-13M AAMs, Kh-23 ("Kerry") or Kh-29 ASMs, up to 6,600 lb of bombs, or napalm. The **MiG-23BK** has equipment changes, including RWR fairings on the bottom of the fuselage. *(Data for MiG-23MF.)*

Contractor: Mikoyan OKB, Russia.

Power Plant: one Tumansky R-27F2M-300 turbojet; 22,045 lb thrust with afterburning.

Dimensions: span 45 ft 10 in (18° 40' min sweep), 25 ft 6¼ in (74° 40' max sweep), length excl probe 51 ft 7¼ in, height 15 ft 9¾ in.

Weights: normal gross 40,565 lb, max gross 45,570 lb.

Performance: max speed at height Mach 2.35. *(See "Gallery of Russian Aerospace Weapons," March 1993, p. 69, for MiG-23ML data.)*

Accommodation: pilot only, on zero/zero ejection seat (two seats in tandem in MiG-23UB trainer).

Armament: one 23-mm GSh-23L twin-barrel gun in belly pack; two pylons under fuselage and two under fixed wing panels for R-13M, R-23R/T ("Apex"), or R-60 ("Aphid") AAMs. For other roles, packs of 20 x 80-mm or 32 x 57-mm rockets, bombs, container weapons, or 240-mm S-24 rockets.

MiG-25

Four nations in North Africa and the Middle East have received this Mach 2.83 combat aircraft. Libya began with about five MiG-25R reconnaissance aircraft, based at Okba ibn Nafa by 1978 and probably flown initially by Soviet crews. They were followed within three years by 60 MiG-25P/PD single-seat interceptors for three air defense squadrons. The **MiG-25P** ("Foxbat-A") had Smertch-A ("Fox Fire") radar, with a search range of 62 miles and tracking range of 31 miles; its 22,500 lb thrust R-15B-300 afterburning turbojets had a service life of only 150 hours. The **MiG-25PD** ("Foxbat-E"), built in 1978–82, switched to uprated (24,700 lb thrust) R-15BD-300 engines, with a 1,000-hour life, and an IRST and Saphir-25 radar providing look-down/shoot-down capability comparable with the MiG-23M.

MiG-25Rs were observed in Algeria in 1979, supplemented later by enough MiG-25Ps and **MiG-25PU** ("Foxbat-C") two-seat trainers to equip a single squadron. Iraq's Air Force was flying both the reconnaissance and interceptor variants by 1982, of which about 20 may have survived the Persian Gulf War. The fourth operator in the region is the Syrian Air Force, with about 30 MiG-25P/PDs. *(Data for MiG-25P.)*

Contractor: Mikoyan OKB, Russia.

Power Plant: two Soyuz/Tumansky R-15B-300 turbojets, each 22,500 lb thrust with afterburning.

Dimensions: span 45 ft 11¾ in, length 78 ft 1¾ in, height 20 ft 0¼ in.

Weight: gross 76,985–80,950 lb.

Performance: max speed at height Mach 2.83, service ceiling 67,900 ft, T-O run 4,100 ft, landing run with brake-chute 2,625 ft, range 776 miles supersonic, 1,075 miles subsonic.

Accommodation: pilot only, on zero-height/81 mph ejection seat (two seats in tandem in MiG-25PU trainer).

Armament: four underwing pylons for R-40R/T ("Acrid"), R-23 ("Apex"), R-60T ("Aphid"), or R-73A ("Archer") AAMs; no gun.

MiG-29

The precise number of MiG-29s serving with three Middle Eastern air forces is anybody's guess. Iraq had 35 single-seat counterair/attack **MiG-29**s ("Fulcrum-A") and six MiG-29UB ("Fulcrum-B") combat trainers before Desert Storm. Half of these may still be serviceable. The four that sought refuge in Iran during the Persian Gulf campaign were repainted in Iranian Air Force markings to join the single squadron of 14 MiG-29s acquired earlier by Tehran. Syria is reported variously to have 20, 40, or 48; a single three-squadron regiment with 12 aircraft per squadron seems likely. Both Syria and Iran would almost certainly like to have more.

The integrated weapon system of the MiG-29 includes an RP-29 coherent pulse-Doppler look-down/shoot-down radar ("Slot Back") with a search range of 62 miles and tracking range of 43 miles, collimated with a laser rangefinder, and an IRST with a fighter detection range of 9¼ miles. It operates in conjunction with the pilot's helmet-mounted target designator for off-axis aiming of AAMs. 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. "Fences" forward of the dorsal tailfins house flare dispensers.

Contractor: Mikoyan OKB, Russia.

MiG-21F, Egyptian Air Force (Denis Hughes)

Contractor: Dassault Aviation, France.

Power Plant: one SNECMA Atar 9K50 turbojet; 15,873 lb thrust with afterburning.

Dimensions: span 27 ft 6¾ in, length 49 ft 11¾ in, height 14 ft 9 in.

Weights: empty 16,314 lb, gross 24,030–35,715 lb.

Performance: max speed at high altitude Mach 2.2, at low altitude Mach 1.2, service ceiling 65,600 ft, T-O run 1,970 ft, landing run 2,200 ft, combat radius 265–435 miles.

Accommodation: pilot only, on ejection seat (two seats in F1-B/D).

Armament: two ventral internal 30-mm DEFA guns; one centerline, four underwing, and two wingtip stations

Mirage F1-CK, Kuwait Air Force

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: empty 24,030 lb, gross 33,600–40,785 lb.

Performance: max speed at height Mach 2.3, at S/L Mach 1.06, service ceiling 55,775 ft, T-O run 820 ft, landing run with brake-chute 1,970 ft, range 932–1,305 miles.

Accommodation: pilot only, on zero/zero ejection seat (two seats in tandem in MiG-29UB).

Armament: one 30-mm GSh-301 gun in port wingroot extension; six underwing pylons for R-27R1 ("Alamo-A"), R-60MK ("Aphid"), or R-73E ("Archer") AAMs. Able to carry bombs, submunitions dispensers, napalm tanks, and 80-mm, 130-mm, and 240-mm rockets in attack role. Max weapon load 6,615 lb.

Mirage F1

With the exception of its more recent imports from the former Soviet Union, the Iraqi Air Force aircraft perhaps expected to offer the coalition forces the most serious opposition during the campaign to liberate Kuwait in early 1991 was the Mirage F1. The basic Mirage **F1-C** is an all-weather, all-altitude interceptor with capability for VFR ground attack, while the **F1-E** is a multirole fighter/ground-attack/reconnaissance version; their tandem-seat, combat-capable trainer equivalents are the **F1-B** and **F1-D**, respectively. The Iraqi fleet was large—the last of 116 F1-EQs and BQ trainers had been delivered only as recently as the end of 1989—and was equipped with Thomson-CSF Agave fire-control radar and Exocet ASMs. In the event, confrontation was minimal. No fewer than 24 fled to Iran; a further eight were lost in air combat with USAF and Saudi F-15Cs, and five others were captured on the ground in Kuwait. The 15 "Free Kuwait" aircraft (14 F1-CKs and a single BK) of Nos. 18 and 61 Squadrons operated from the Saudi air base at Dhahran, while No. 7 Squadron of the Qatar Emiri Air Force, with 12 F1-EDAs and a pair of DDAs, operated out of Doha AB.

Jordan has one squadron (No. 25) of 16 F1-CJs and one (No. 1) of 17 EJs, plus a pair of BJ trainers. Two North African air forces, unconnected with the Gulf crisis, also fly a mix of F1s. Libya has 16 early **F1-AD** interceptors, about 36 ED multiroles, and half a dozen BD trainers; Morocco has about 19 F1-CHs (down from an original 30 due to frequent clashes with Polisario guerrillas) and 18 (from 20) F1-EHs, plus a pair of F1-Bs. Most export Mirage F1s, except those of Iraq, have one or another version of the French Cyrano IV fire-control radar. Some pre- or postdelivery variations have also been noted. For example, some Moroccan aircraft have been equipped with chaff/flare dispensers, and Iraq is reported to have adapted the Kh-29 "Kedge" ASM for carriage by its remaining F1s. *(Data for F1-C.)*

for typical practical max load of 8,818 lb, including Matra Super 530 AAMs, single Armat ARM or Exocet antiship missile, ASMs, conventional or antirunway bombs, rocket launchers, Atlis laser designator pod with laser-guided bombs or AS.30L missiles, alternative sensor pods, drop fuel tanks, and (at wingtips) Magic or Sidewinder AAMs.

Mirage 5

Dassault originally developed the Mirage 5 as a clear-weather, low-level, ground-attack derivative of its Mirage III interceptor, to meet the requirements of the Israeli Air Force. When an order for 50 was embargoed (leading Israel to develop the Kfir, which see), no fewer than four Arab states became involved in subsequent export sales of the Mirage 5.

With no need of the Mirage III's bulky AI radar, the Mirage 5 was able to afford a much slimmer nose, accommodating both a range-only radar and the transfer of some avionic equipment from a bay behind the cockpit, the latter space being taken up instead by an additional fuel tank that increased internal capacity by 15 percent. Initial Middle Eastern/North African orders, including batches of two-seat **5D** trainers, emanated from Libya (53 5Ds and 15 5DDs) and Abu Dhabi (12 5ADs and three 5DADs). Both countries also later ordered the **5E** strike version (Libya 32 5DEs, Abu Dhabi 14 5EADs), as did Egypt (29 5SDEs, 22 5SSEs, plus six 5SDD trainers, with funding assistance from Saudi Arabia). Egypt's final batch, consisting of 16 5SDE2s, was of an upgraded version equipped with the same inertial nav/attack system as that fitted to its MS2 Alpha Jets; its earlier Mirage 5s have also recently undergone a midlife update program. Approximate numbers now in service are: Egypt 68, Libya 65, Abu Dhabi 26. All three nations also operate small numbers of the Mirage 5R photoreconnaissance version (which see).

Contractor: Avions Marcel Dassault-Breguet Aviation, France.

Power Plant: one SNECMA Atar 9C turbojet; 13,670 lb thrust with afterburning.

Dimensions: span 27 ft 0 in, length 51 ft 0½ in, height 13 ft 11½ in.

Weights: empty 15,212 lb, gross 20,500–29,760 lb.

Performance: max speed at 40,000 ft Mach 2.1, at S/L 864 mph, service ceiling 55,775 ft, T-O run 2,625 ft clean, 5,250 ft at max gross weight, landing run 2,295 ft, combat radius with 2,000 lb weapon load 404 miles lo-lo-lo, 808 miles hi-lo-hi.

Accommodation: pilot only, on ejection seat (two seats in 5D).

Armament: one 30-mm DEFA 552A gun in lower lip of each air intake duct; one or three underfuselage and four underwing stations, with multiple launchers, for more than 8,818 lb of stores, including single or cluster bombs, rocket pods, ASMs, two self-defense AAMs, or two drop tanks.

Mirage 2000

Now nearing the completion of its first decade in French service, the Mirage 2000 has already collected a series of designation suffixes (not to mention "alternative" designations) that promise to become as bewildering to the uninitiated as those of earlier Mirage families. The basic models, and their primary differences, were outlined in some detail in the "Gallery of NATO Airpower" in the July 1992 issue of AIR FORCE Magazine; so far as the Middle East is concerned, it is necessary to consider only the Mirage **2000E,** essentially a single-seat multirole version of the 2000C interceptor, which has been chosen by both present operators in that area.

Egypt was in fact the first export customer for the Mirage 2000, ordering 16 single-seat 2000EMs and four two-seat **2000BM**s in December 1981, which were delivered between 1986 and 1988; one of each is since believed to have been lost. Abu Dhabi's order was somewhat larger, comprising not only 22 single-seat 2000EADs and six **2000EDAD** trainers but also eight examples of the **2000RAD** reconnaissance model; after some initial delay, they were delivered between November 1989 and October 1990. The RAD aircraft are equipped for compatibility with either a COR 2 multicamera pod, a SLAR 2000 side-looking airborne radar pod, or a HAROLD long-range optical sensor pod. The EADs carry a 2,205-lb standoff ground-attack weapon and are fitted with French Spirale chaff/flare dispensers and RDM radar, and an Italian Elettronica ELT/158 radar warning receiver and ELT/558 jamming equipment. *(Data for 2000C; 2000E generally similar.)*

Contractor: Dassault Aviation, France.
Power Plant: one SNECMA M53-P2 turbofan; 21,385 lb thrust with afterburning.
Dimensions: span 29 ft 11½ in, length 47 ft 1¼ in, height 17 ft 0¾ in.
Weights: empty 16,534 lb, gross 23,940–37,480 lb.
Performance: max speed at high altitude Mach 2.2, at low altitude 690 mph, service ceiling 59,000 ft, range with four 550-lb bombs more than 920 miles.
Accommodation: pilot only, on zero/zero ejection seat (two seats in 2000B and ED).
Armament: two 30-mm DEFA 554 guns. Five underfuselage and four underwing stations for up to 13,890 lb of external stores, which can include Matra Super 530D, Magic, or Magic 2 AAMs; free-fall, retarded, cluster, antirunway, or laser-guided bombs; 68-mm or 100-mm rocket launchers; Armat ARM or Exocet antiship missile(s); or a centerline 30-mm twin-gun pod.

Strikemaster

Of four Middle Eastern air forces that purchased BAC 167 Strikemasters, only two continue to operate these training and light attack developments of the Jet Provost jet basic trainer. The 12 Strikemaster **Mk 82/82A**s serving with No. 1 Squadron of the Royal Air Force of Oman, at Masirah AB, are now used mainly for training. They retain their attack potential, as do the 36 **Mk 80/80A**s of the Royal Saudi Air Force, based at King Faisal Air Academy, Riyadh. First flown in October 1967, the Strikemaster has a robust airframe, docile handling qualities, and an ability to fly from unprepared airstrips that made it an attractive low-cost ground-attack aircraft for the Middle East environment.

Contractor: British Aircraft Corporation, UK.
Power Plant: one Rolls-Royce Bristol Viper Mk 535 turbojet; 3,410 lb thrust.
Dimensions: span over tiptanks 36 ft 10 in, length 33 ft 8½ in, height 10 ft 11½ in.
Weights: empty 6 195 lb, gross 9,303–11,500 lb.
Performance: max speed at 18,000 ft 481 mph, service ceiling 40,000 ft, T-O to 50 ft 3,500 ft, landing from 50 ft 2,400 ft, combat radius lo-lo-lo with 3,000 lb weapons load 145 miles, hi-lo-hi with 1,000 lb load 575 miles.
Accommodation: crew of two, side by side on zero-height/104 mph ejection seats (pilot only in ground-attack role).
Armament: one 7.62-mm FN Herstal machine gun in lower lip of each air intake duct; two weapon stations under each wing for maximum 3,000 lb (single-seat) of bombs, rocket pods, napalm tanks, or 7.62-mm or 20-mm gun pods.

Su-7/20/22

A handful of the original fixed-wing **Su-7BM** ("Fitter-A") single-seat attack aircraft can still be seen in the insignia of the air forces of Algeria and Iraq. Far more numerous, and effective, are the variable-geometry derivatives of the Su-7 operated by these nations, and by Libya, Syria, and Yemen. The first of these to enter service was the **Su-20** ("Fitter-C"), an export version of the Su-17M operated by CIS air forces, with the same 24,800 lb thrust Saturn/Lyulka AL-21F-3 afterburning turbojet. Algeria is believed to have received 32; Iraq had a few before Desert Storm; Yemen is said to have had 30.

When the **Su-22M-3** ("Fitter-J") became available, with internal Doppler nav radar, a laser rangefinder in the intake centerbody, and a more powerful Tumansky engine, more than 40 were supplied to Iraq, 90 to Libya, 40 to Syria, and 20 to Yemen. Most of the Iraqi aircraft were flown to Iran during Desert Storm and are still there. Comparable in size, speed, and engine power to the F-105 "Thuds" that once served with USAF, they are formidable Mach 2+ attack fighters, with heavy weapon loads. Inevitably for an aircraft with an ancestry dating back to the first sighting of an Su-7 in 1956, their age shows, but 9,370 lb of external stores can still do a great deal of damage. *(Data for Su-22M-3.)*

Mirage 2000EADs, Abu Dhabi Air Force

Strikemaster Mk 80, Royal Saudi Air Force

Tornado IDS, Royal Saudi Air Force

Contractor: Sukhoi OKB, Russia.
Power Plant: one Tumansky R-29BS-300 turbojet; 25,350 lb thrust with afterburning.
Dimensions: span 45 ft 3 in (30° min sweep), 32 ft 10 in (63° max sweep), length 61 ft 6¼ in, height 16 ft 5 in.
Weight: gross 36,155–42,990 lb.
Performance: max speed at height Mach 2.09, at S/L Mach 1.14, service ceiling 49,865 ft, T-O run 2,955 ft, landing run 3,120 ft, range 870 miles at low altitude, 1,430 miles at high altitude.
Accommodation: pilot only, on ejection seat (two seats in tandem in Su-7U/22U trainers).
Armament: two 30-mm NR-30 guns in wingroots; nine pylons under wings and fuselage for bombs, rocket packs, SPPU-22 twin-barrel 23-mm gun pods, R-60 ("Aphid") AAMs, and Kh-23 ("Kerry") or Kh-25ML ("Karen") ASMs.

Su-25

The Iraqi Air Force is estimated to have 22 of these attack aircraft, designed to much the same specification as USAF's A-10s. It ordered 45, but seven of those delivered by 1991 were flown to Iran during Desert Storm, and two others were shot down en route by F-15Cs. NATO reporting name for the basic version is "Frogfoot-A."

Su-25 design emphasis was on survivability features that would enable it to attack ground targets at treetop height in the face of intense opposition. The pilot is seated high above the sharply sloping nose, in an all-welded cockpit of titanium armor. A total of 256 IRCM flares are packed into dispensers above the engine nacelles and tailcone for protection against ground-fired SAMs during eight attack runs. To enhance combat readiness, the turbojets will run on any fuel likely to be found in forward areas, including MT gasoline and diesel oil.

Contractor: Sukhoi OKB, Russia.
Power Plant: two Soyuz/Tumansky R-195 turbojets; each 9,921 lb thrust.
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 speed at S/L Mach 0.8, max attack speed, airbrakes open, 428 mph, service ceiling 22,965 ft, T-O run 1,970–3,930 ft, landing run 1,312–1,970 ft, range 466 miles at S/L, 776 miles at height.
Accommodation: pilot only, on zero/zero ejection seat (two seats in tandem in Su-25UBK trainer).
Armament: one twin-barrel 30-mm gun in port side of nose; eight underwing pylons for 9,700 lb of air-to-surface weapons, including SPPU-22 pods for 23-mm guns with twin barrels that pivot downward, 57-mm to 330-mm rockets, Kh-23 ("Kerry"), Kh-25 ("Karen"), and Kh-29 ("Kedge") ASMs, laser-guided rocket-boosted bombs up to 1,450 lb, and 1,100 lb incendiary, antipersonnel, and chemical cluster bombs; two small outboard pylons for R-3S ("Atoll") or R-60 ("Aphid") self-defense AAMs.

Tornado

In its **IDS** (interdictor/strike) form, the Tornado was one of the stars of the Persian Gulf War. Eleven Royal Air Force squadrons contributed to Tornado detachments based at Dhahran and Tabuk, Saudi Arabia, and Muharraq, Bahrain. They were supplemented by other IDS aircraft of No. 7 Squadron, Royal Saudi Air Force, and from No. 66 Squadron, then forming. Primary targets were Iraqi airfields, which were attacked first with JP 233 cluster weapons from low altitude, and later with Paveway laser-guided bombs from medium heights.

The original RSAF order for 48 Tornado IDSs was part of the Al Yamamah I agreement signed with the UK in 1985. One of these aircraft was lost in the war with Iraq, but another 48 IDSs were ordered earlier this year under the follow-up Al Yamamah II. Equipment of this version includes a Texas Instruments multimode terrain-following and ground-mapping radar, digital INS, electronic HUD, laser rangefinder and marked target seeker, IFF, RWR, and active ECM. Six aircraft of each Saudi squadron are configured for reconnaissance, and 14 of the original batch have dual controls. The RSAF has two BAe Jetstream 31s with IDS avionics, on which it trains the navigators of its Tornado force.

Under Al Yamamah I, the RSAF also ordered 24 Tornado **ADV** (air defense variant) interceptors. Those of Nos. 29 and 34 Squadrons flew CAPs with USAF and RSAF F-15s and RAF Tornado ADVs during Desert Storm without seeing action. Generally similar to the IDS, the ADV has a slightly longer fuselage to house Foxhunter pulse-Doppler radar and to allow four Sky Flash AAMs to be carried in tandem underbelly pairs. The lengthening reduced drag, especially at supersonic speed, and provided a 10 percent increase in internal fuel capacity. The ADV's RB199 Mk 104 engines are each rated at 16,520 lb thrust. *(Data for Tornado IDS.)*

Contractor: Panavia Aircraft GmbH, a UK-German-Italian consortium.
Power Plant: two Turbo-Union RB199 Mk 103 turbofans; each 16,075 lb thrust with afterburning.

Dimensions: span 45 ft 7½ in (25° min sweep), 28 ft 2½ in (67° max sweep), length 54 ft 10¼ in, height 19 ft 6¼ in.
Weights: empty 31,065 lb, gross 45,000–61,620 lb.
Performance: max speed at height Mach 2.2, max speed with external stores Mach 0.92, balanced runway length 2,950 ft, combat radius 863 miles.
Accommodation: crew of two, on tandem zero/zero ejection seats.
Armament: two 27-mm IWKA-Mauser guns in fuselage; seven hardpoints under fuselage and wings for 19,840 lb of external stores, including Sidewinder AAMs; AGM-65 Maverick, AGM-88 HARM, ALARM, Kormoran, and Sea Eagle ASMs; cluster bombs; napalm; "smart," retarded, and conventional bombs up to 1,000 lb; rockets; incendiary and flare bombs.

Helicopters

AH-1 HueyCobra

To offset the supply of Mi-24 combat helicopters to nations in the region that were favorable to the former USSR, the US government allowed the air arms of Israel, Iran, and Jordan to equip with variants of the Bell Cobra family of gunship helicopters. By far the largest customer was the former Shah's Imperial Iranian Army Aviation, which in December 1971 placed an order for 202. These were of a variant known as the **AH-1J International,** powered by a 1,673 shp Pratt & Whitney Canada T400-WV-402 Turbo Twin Pac turboshaft unit. They were generally similar to the US Marine Corps AH-1J SeaCobra but incorporated some features of Bell's YAH-63 KingCobra (the unsuccessful AAH candidate) and an improved gun turret; most of them were adapted to carry the TOW antitank missile system. Many were lost in the long war with Iraq, and estimates of those still serviceable (and with enough TOWs to equip them) have been drastically revised since the last appearance of this Gallery, with perhaps no more than a dozen still possessing full operational capability. This lends credence to a report late last year that Iran had regrouped its Army Cobras, Chinooks, and Bell 214 Isfahans into a new airmobile force under the operational control of the Revolutionary Guard.

The 24 single-engine Cobras received by Jordan's No. 10 and No. 12 Squadrons, and an estimated 40 in Israel, are all believed to be broadly similar to the US Army's AH-1F fully upgraded TOW version. This embodies lessons learned in combat, from Vietnam to Soviet experience in Afghanistan, including an IR jammer, hot metal and plume IR suppressor, RWR, a low-airspeed sensor probe, a 20-mm three-barrel gun in an electrically powered undernose turret, automatic compensation for off-axis firing, a laser rangefinder and tracker, HUD, Doppler, and IFF transponder. Israeli HueyCobras also have a US-funded Rafael night targeting system. Over the past year or more, Israel's Cobras figured frequently in attacks on Hezbollah guerrilla forces based in southern Lebanon. Israel is expected to receive a further batch of AH-1s as part of a package promised by the US government after the Persian Gulf War. *(Data for AH-1F.)*
Contractor: Bell Helicopter Textron, USA.
Power Plant: one Textron Lycoming T53-L-703 turboshaft; 1,800 shp.
Dimensions: rotor diameter 44 ft 0 in, fuselage length 44 ft 7 in, height 13 ft 5 in.
Weights: empty 6,598 lb, gross 10,000 lb.
Performance: max speed 141 mph, service ceiling 12,200 ft, range 315 miles.
Accommodation: pilot and copilot/gunner in tandem armored cockpits.
Armament: one 20-mm three-barrel M197 gun, with 750 rds, in GE turret; outer of two weapon pylons under each stub-wing can carry four TOW ASMs; inner pylon can carry a pack of 7–19 x 2.75-in rockets.

AH-64A Apache

Since deliveries began in January 1984, more than 700 of these formidable attack helicopters have been delivered to the US Army and ArNG, achieving IOC (initial operational capability) in July 1986 and executing their first operational deployment, in Operation Just Cause in Panama, in December 1989. Their participation in Operations Desert Shield and Desert Storm was massive—nearly 300 deployed, their activities including the conflict's first air strike.

With production completion of the total US requirement of 807 Apaches within sight, exploration of its export potential got under way in January 1990 with a joint offer to Israel and Egypt. Both accepted readily, Israel placing an order for 18 two months later, the first two of which were delivered that September. All are now in service with the IDF/AF's "Wasp" squadron. The Israeli name for the AH-64A is Petan ("Cobra"). A further 24 were due to be delivered during 1993 in return for Israel's restraint during the Persian Gulf War. Delivery of Egypt's 24 will begin in 1994, by which time at least three other Middle East air arms will possess the AH-64A. The sale of eight, with Hellfire missiles, to Bahrain was approved in October 1990; 12, with Hellfires, were ordered for the Royal Saudi Land Forces in April 1991, and delivery began this year; in December 1991, Abu Dhabi of the UAE ordered 20, with Hellfires and Hydra-70 rocket armament. The first six were due for delivery this year and the balance of 14 in 1994. Kuwait has also expressed interest in acquiring the AH-64A.
Contractor: McDonnell Douglas Helicopter Company, USA.
Power Plant: two General Electric T700-GE-701C turboshafts; each 1,800 shp.
Dimensions: rotor diameter 48 ft 0 in, fuselage length, tail rotor turning 48 ft 2 in, height 14 ft 1¼ in.
Weights: empty 11,225 lb, gross 14,445–21,000 lb.
Performance: max speed at S/L 182 mph, service ceiling 21,000 ft, max range (internal fuel, including reserves) 300 miles, typical mission endurance 1 h 50 min.
Accommodation: crew of two, in tandem (gunner in front seat).
Armament: turreted 30-mm M230 Chain Gun under front fuselage; four underwing stations, each for four AGM-114 Hellfire antitank missiles or 2.75-in FFAR rockets in seven-round M200 or 19-round M260 launchers.

AS 330 Puma and AS 332 Super Puma/ AS 532 Cougar

The prototype of the original Aerospatiale SA 330 (now **AS 330**) **Puma** flew on April 15, 1965. From it evolved a family of military assault and civilian transport helicopters, of which 697 had been built for delivery to 46 countries by 1989, from assembly lines in France, the UK, Indonesia, and Romania. Manufacture by IAR SA in Romania continues. The typical **AS 330H** military export Puma is powered by two 1,400 shp Turmo IVB engines and carries 16 fully equipped troops, six litter patients and six seated casualties, or internal or external freight. The **AS 330L** differs in having 1,575 shp Turmo IVCs. Current inventory estimates include Abu Dhabi (11 early **330C/F**s with Turmo IVB/A engines), Algeria (five), Iraq (20, including two VIP transports), Kuwait (six 330Hs), Lebanon (nine 330Ls), and Morocco (30 330Fs).

The **AS 332 Super Puma** (military designation **AS 532 Cougar**), first flown on September 13, 1978, differs in having a new power plant, uprated transmission, and airframe changes to improve crew survivability, payload, performance, and ease of maintenance. Suffixes C and L signify short (*court*) and long fuselage, for 21 or 25 passengers/troops, respectively. Oman's Royal Flight has two **AS 332Ls** for VIP use. No. 9 Squadron of the Qatar Emiri Air Force has a mix of Westland Commandos and six **AS 532SC** Cougars for naval antiship/ antisubmarine and SAR missions. The S in this designation indicates the navalized version of the Cougar, with a folding tail rotor pylon, deck landing assist device, and mountings for Exocet missiles. The Royal Saudi Navy has six AS 532SCs, the Kuwait Air Force four. The basic transport version serves with Jordan's No. 7 Squadron (eight **AS 532ULs**) and the Abu Dhabi element of the United Arab Emirates Air Force (also eight AS 532ULs, including two furnished as VIP transports). *(Data for AS 532SC.)*
Contractor: Eurocopter SA, a Franco-German company.
Power Plant: two Turbomeca Makila 1A1 turboshafts; each 1,877 shp.
Dimensions: rotor diameter 51 ft 2¼ in, fuselage length 50 ft 11½ in, height 16 ft 1¾ in.
Weights: empty 9,920 lb, gross with internal load 19,841 lb, with slung load 20,615 lb.
Performance: cruising speed at S/L 149 mph, service ceiling 13,450 ft, range 540 miles.
Accommodation: crew of two or three; optionally, 21 passengers, nine litters and three seated persons, or freight.
Armament: options include two Exocet missiles or two lightweight torpedoes.

AS 365 Dauphin/AS 565 Panther

Discounting two ex-US search-and-rescue **HH-65A**s purchased by Israel only for evaluation, the sole Middle Eastern customer for this most versatile twin-turbine French helicopter is Saudi Arabia, whose armed forces have a total of 30. Six of these are **AS 365N2 Dauphins** used as medevac helicopters by the Royal Saudi Land Forces, with outward-opening (instead of sliding) rear cabin doors permitting the side-loading of up to four casualty litters, accompanied by medical attendants. Four of the Royal Saudi Navy's 24 are **AS 565MA Panther**s, equipped for surveillance, search, and rescue; the other 20 are frigate-based **AS 565SA Panther**s, equipped with search radar and AS.15TT missiles for the antiship role. They made their combat debut during the 1991 Persian Gulf War when one AS 565SA sank two Iraqi patrol boats with its missiles on January 30 and three more four days later. *(Data for AS 565SA.)*
Contractor: Eurocopter SA, a Franco-German company.
Power Plant: two Turbomeca Arriel 1M1 turboshafts; each 749 shp.
Dimensions: rotor diameter 35 ft 0¾ in, fuselage length 35 ft 10½ in, height 10 ft 11½ in.
Weights: empty 4,938 lb, gross 9,370 lb.
Performance: max cruising speed at S/L 170 mph, hovering ceiling IGE 8,530 ft, combat radius 155–173 miles, max range 544 miles.
Accommodation: crew of two, plus systems operators.
Armament: four Aerospatiale AS.15TT radar-guided antiship missiles or (in ASW role) two homing torpedoes, mounted on cabin sides.

Bell 205 and UH-1 Iroquois

About 150 examples of this workhorse helicopter are in service with the air arms of half a dozen Middle Eastern and North African nations: Iran (Army 20 or more, Navy 15), Morocco (Air Force 45), Oman (Air Force 20), Saudi Arabia (Air Force 20), Tunisia (Air Force 24), and Dubai (Air Force six). Most of these are Agusta-built **205/205A/205A-1**s, although Tunisia's inventory includes six ex-US **UH-1H**s. They perform a broad range of utility and general transport duties. *(Data for Agusta-Bell 205.)*
Contractors: Bell Helicopter Textron, USA; Agusta SpA, Italy.
Power Plant: one Textron Lycoming T53-L-13B turboshaft; 1,400 shp.
Dimensions: rotor diameter 48 ft 0 in, fuselage length 41 ft 10¾ in, height 14 ft 5½ in.
Weights: empty 4,800 lb, gross 9,500 lb.
Performance: max speed at S/L 138 mph, max cruising speed 127 mph, service ceiling 15,000 ft, max range 360 miles.
Accommodation: one pilot; up to 14 troops, six litters plus one medical attendant, or 3,880 lb of cargo.
Armament: none.

Bell 212

Developed from the Bell 205/UH-1 Huey series, the 212 is able to provide an increased payload of 4,000 lb internally or 4,500 lb externally and enhanced reliability, especially in hot and high environments, by using the compact Canadian Twin Pac engine. This comprises two PT6 turboshafts, side by side and driving a combining gearbox, with full engine-out operability. Nearly a dozen air forces in the Middle East/North Africa region fly 212s, although comparatively few were built in the US, most of them coming from Bell's Italian licensee, Agusta, which also developed its own antisubmarine version, the **AB 212 ASW**. Nations in the Middle East/North Africa now operating 212s are Dubai (four), Iran (Air Force 18, Army 12 or more, Navy six or more ASW), Iraq (eight ASW/SAR), Israel (20), Lebanon (eight), Libya (two VIP), Morocco (five), Oman (two VIP), Saudi Arabia (29 SAR and VIP), and Yemen (five, plus one VIP).

The Agusta ASW version is equipped with Tacan, ECM, and a Bendix AN/AQS-13 sonar; for antiship missions, the sonar can be replaced by a GEC-Ferranti Seaspray search radar. *(Data for Agusta-Bell 212 ASW.)*
Contractor: Agusta SpA, Italy.
Power Plant: one Pratt & Whitney Canada PT6T-6 Turbo Twin Pac turboshaft; 1,875 shp.
Dimensions: rotor diameter 48 ft 0 in, fuselage length 42 ft 4¾ in, height 14 ft 10¼ in.
Weights: empty 5,621 lb, gross 10,692 lb.
Performance: max speed at S/L 122 mph, max cruising speed 115 mph, service ceiling 13,000 ft, search range with 10 percent fuel reserves 382 miles, max range with auxiliary fuel and 15 percent reserves 414 miles.
Accommodation: flight crew of one or two; one or two ASW/ASV systems operators, or seven/eight passengers, or four litters plus medical attendant.
Armament: two Motofides 244 AS or Mk 44/46 homing torpedoes, or depth charges, for ASW; two Marte Mk 2, Sea Skua, or similar antiship missiles for ASV operations.

Bell 214

Like the Bell 212, the 214 was developed as a derivative of the Bell 205/UH-1 with increased power and payload. Known originally as the HueyPlus, it flew for the first time in October 1970. Just over two years later, Iran ordered 287 Model **214A**s, all of which were delivered in 1975. Further orders followed, for six more 214As and 39 of an SAR version designated **214C**. Plans to produce many more in Iran, including an enlarged version known as the **214ST** (Stretched Twin), were negated by the overthrow of the Shah in early 1979. Bell built a relatively small number of a commercial version of the 214A as the **214B** BigLifter and decided also to continue with the stretched model. The latter, with ST now standing for SuperTransport, made its first flight in July 1979; it had a new power plant and an 8 ft longer fuselage, seating four more passengers.

More than 300 of these workhorse helicopters still operate in the Middle East, most of them with Iranian

Islamic Army Aviation, plus a VIP 214B and a few 214Cs with the Air Force. Iraq is believed to retain most of an original 45 214STs, Dubai has four 214Bs, and Oman has a mixed fleet of about 10 Bs and STs. *(Data for Bell 214A.)*

Contractor: Bell Helicopter Textron, USA.

Power Plant: one Textron Lycoming LTC4B-8D turboshaft; 2,930 shp.

Dimensions: rotor diameter 52 ft 0 in, fuselage length 49 ft 3½ in, height 15 ft 0 in.

Weights: empty 7,460 lb, gross 11,480 lb.

Performance: max cruising speed at S/L 161 mph, service ceiling 20,000 ft, max range 215 miles.

Accommodation: crew of two; up to 14 passengers or equivalent cargo.

Armament: none.

Bell 406 CS Combat Scout

First flown in June 1984, the Combat Scout was intended as a simplified scout/attack export version of the US Army's OH-58D Kiowa Warrior. The Royal Saudi Land Forces received 15 in 1990, under the designation **MH-58D,** with folding rotor blades and stabilizer, "squatting" skids, a roof-mounted Saab-Emerson HeliTOW sight, and a SFENA hybrid cockpit combining conventional instruments with electronic displays for TOW missile and communications control. Production of the Combat Scout has now ended.

Contractor: Bell Helicopter Textron, USA.

Power Plant: one Allison 250-C30U turboshaft; 650 shp.

Dimensions: rotor diameter 35 ft 0 in, fuselage length 34 ft 4¾ in, height 12 ft 10⅝ in.

Weights: empty 2,271 lb, gross 5,000 lb.

Performance: max speed at 4,000 ft 144 mph, max cruising speed 138 mph, range with max fuel 251 miles.

Accommodation: crew of two, side by side.

Armament (RSLF MH-58D): cabin-side outriggers for four TOW 2 antitank missiles, 0.30- and 0.50-in machine-gun pods, and 2.75-in FFAR rocket pods.

CH-47C Chinook

In its standard transport role, the CH-47C carries a payload of 33 to 44 troops, litters on casualty evacuation flights, or internal or slung cargo. The cabin is loaded via a rear ramp/door. Typical loads include a complete artillery section, with personnel and ammunition. Optional equipment includes RWR, missile approach warning equipment, IR jammers, chaff/flare dispensers, and INS with GPS.

Except for two Boeing-built Chinooks of the 60-plus operated by the Army of the Islamic Republic of Iran, the CH-47Cs serving with air and land forces in the Middle East and North Africa were license-manufactured by Meridionali of Italy, an Agusta subsidiary. The Egyptian Air Force has 14, Libya about 19 (Air Force six, Army 13), and the Royal Air Force of Morocco eight. Most of the Libyan CH-47Cs are used to support Army missile and radar sites from their bases at el-Kufra and Sebha. As noted in the AH-1 entry, Iran's Chinooks are now believed to be part of an airmobile helicopter force under the control of the Revolutionary Guard, which has been integrated with the regular Army.

Contractor: Elicotteri Meridionali SpA, Italy.

Power Plant: two Textron Lycoming T55-L-11A turboshafts; each 3,750 shp.

Dimensions: rotor diameter (each) 60 ft 0 in, fuselage length 51 ft 0 in, height 18 ft 7¾ in.

Weights: empty 21,464 lb, gross 33,000–46,000 lb.

Performance: max speed at S/L 189 mph, average cruising speed 131–160 mph, service ceiling 15,000 ft, mission radius with 11,650 lb internal payload 115 miles, with 21,700 lb slung payload 23 miles.

Accommodation: crew of two or three; up to 44 troops, or 24 litter patients and two attendants, vehicles, or freight.

Armament: provision for one machine gun in forward hatchway.

CH/RH-53D Sea Stallion and Yasur 2000

The MATA Helicopters plant of Israel Aircraft Industries, with Elbit as avionics integrator, is upgrading the 30 **CH-53D**-standard (S-65C-3) heavy-lift helicopters of the Israeli Defense Force/Air Force under the designation **Yasur 2000.** Service life is being extended beyond the year 2000, together with armored cockpits, crashworthy seats, external sponson fuel tanks, an in-flight refueling probe, rescue hoist, and an Elbit-led avionics suite that includes a mission computer, two multifunction displays, a moving map display, and new autopilot. The first flight of a Yasur 2000 took place on June 4, 1992; redeliveries began in February of this year.

At least two of the six **RH-53D** mine-sweeping helicopters delivered to the Iranian Navy at the time of the Shah are believed to be in service. *(Data for CH-53D.)*

Contractor: Sikorsky Aircraft, USA.

Power Plant: two General Electric T64-GE-413 turboshafts; each 3,925 shp.

Dimensions: rotor diameter 72 ft 3 in, fuselage length 67 ft 2 in, height 24 ft 11 in.

Weights: empty 23,485 lb, gross 42,000 lb.

Performance: max speed at S/L 196 mph, max cruising speed 173 mph, service ceiling 21,000 ft, max range at 173 mph, with reserves, 257 miles.

Accommodation: flight crew of three; up to 55 troops, 24 litters plus four medical personnel, or equivalent cargo.

Armament: none in CH-53D; RH-53D, provision for two 0.50-in machine guns to detonate surfaced mines.

Ka-25

In addition to its Mi-14 maritime helicopters, Syria continues to operate five veteran Ka-25BSh "Hormone-As" on coastal patrols from shore bases, under naval direction. The compactness of the Ka-25's typical Kamov contrarotating coaxial rotor design and its other qualities are offset to some extent by a lack of autohover capability that prevents use of the aircraft's dipping sonar at night or in bad weather. Standard equipment includes search radar in a large flat-bottomed undernose radome, ESM, sonobuoys on a rack on the starboard side of the fuselage, and a cylindrical canister on each side for markers, smoke generators, or beacons. The cabin is roomy enough to carry 12 persons on folding seats in a search-and-rescue mission.

Contractor: Kamov OKB, Russia.

Power Plant: two Glushenkov GTD-3M turboshafts; each 986 shp.

Dimensions: rotor diameter (each) 51 ft 7¾ in, fuselage length 32 ft 0 in, height 17 ft 7½ in.

Weights: empty 10,505 lb, gross 15,873 lb.

Performance: max speed 130 mph, service ceiling 11,000 ft, range 250–405 miles.

Accommodation: crew of two, side by side on flight deck; two or three systems operators in main cabin.

Armament: one 18-in ASW torpedo, depth charges, and other stores in underfuselage weapons bay.

McDonnell Douglas 500MD Defender

Although these military export versions of the (originally Hughes) OH-6A have sold successfully in many parts of the world, comparatively few of the sales have been in the Middle East. No. 5 Squadron of the Royal Jordanian Air Force at Mafraq has eight unarmed **500MD**s for training, and six others are used by the Israeli Defense Force/Air Force in a liaison capacity, but the only combat-equipped Defenders are Israel's 30 antitank **500MD/TOW**s, delivered from mid-1979. They carry a stabilized telescopic sight in a prominent turret on the port side of the nose. *(Data for 500MD/TOW.)*

Contractor: McDonnell Douglas Helicopter Company, USA.

Power Plant: one Allison 250-C20B turboshaft; 375 shp.

Dimensions: rotor diameter 26 ft 4 in, fuselage length 25 ft 0 in, height 8 ft 10¾ in.

Weights: empty 1,676 lb, gross 3,000 lb.

Performance: max speed at S/L 150 mph, max cruising speed at 5,000 ft 132 mph, service ceiling 13,800 ft, range with standard fuel 242 miles at S/L, 266 miles at 5,000 ft.

Accommodation: crew of two, side by side.

Armament: four Hughes TOW antitank missiles, in twin pod at each end of tubular beam through cabin.

Mi-6

By far the largest helicopter in the world when first flown, on June 5, 1957, the Mi-6 ("Hook") is now outclassed by the Mi-26 but remains in service with four air forces in the Middle East/North Africa region. Algeria has about four, Egypt six, and Syria 10. Iraq is said to have received 15 to support construction and operation of its missile and radar sites, and one source has suggested that these were supplemented by three Mi-10 ("Harke") heavy-lift flying cranes developed from the Mi-6. This has never been confirmed, and it is unclear how many of Iraq's 450+ military helicopters survived Desert Storm.

Contractor: Mil OKB, Russia.

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

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

Weights: empty 60,055 lb, gross 84,657–93,700 lb.

Performance: max speed 186 mph, max cruising speed 155 mph, service ceiling 14,750 ft, range with 17,637 lb payload 385 miles, with 9,920 lb payload and external tanks 621 miles, ferry range 900 miles.

Accommodation: crew of five (two pilots, navigator, flight engineer, and radio operator); 70 combat-equipped troops, or 41 litter patients and two attendants; rear ramps, 1,765 lb capacity winch, and pulley block system for handling max internal freight payload of 26,450 lb; and sling for max external freight load of 17,637 lb (normally with stub-wings removed).

Armament: provision for 12.7-mm machine gun in nose.

Mi-8/17

Of at least 40 air forces worldwide that fly **Mi-8**s and uprated **Mi-17**s, six are in the Middle East/North Africa region. Equipped largely with the standard military Mi-8 armed transports ("Hip-C" and "E"), they are the air forces of Algeria (at least 12), Egypt (about 50), Iraq (possibly 75 following Desert Storm), Libya (seven), Syria (at least 100), and Yemen (about 50). These totals may include a few Mi-17s ("Hip-H") or Mi-8s uprated as **Mi-8MT/MTB/MTBK** to Mi-17 standard, with 1,923 shp TV3-117MT engines in shorter nacelles and with the tail rotor transferred to the port side. Basic military tasks are assault, troop transport, and general-purpose duties, with a sliding, jettisonable passenger door at the front of the cabin on the port side, clamshell rear freight loading doors, hook-on ramps for vehicle entry, cargo tie-downs in the floor, a 330-lb capacity winch and pulley block system for cargo handling, and 6,614-lb capacity cargo sling. All versions can be used for casualty evacuation. Ten of the Syrian Mi-8s are equipped for ECM ("Hip-J" standard) with small equipment boxes on each side of the cabin, or as communications jammers ("Hip-K") with a large antenna array on each side. *(Data for standard Mi-8.)*

Contractor: Mil OKB, Russia.

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

Dimensions: rotor diameter 69 ft 10¼ in, fuselage length 59 ft 7½ in, height 18 ft 6½ in.

Weights: empty 16,007 lb, gross 24,470–26,455 lb.

Performance: max speed at 3,280 ft 161 mph, max cruising speed 137 mph, service ceiling 14,765 ft, range with 24 troops 311 miles, cargo version 280–596 miles.

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

Armament: provision for 12.7-mm machine gun in nose; twin rack each side for total of four 32-round packs of 57-mm rockets or other stores ("Hip-C" standard), or triple stores rack each side for six similar rocket packs, and four 9M17P Skorpion ("Swatter") antitank missiles on rails above packs ("Hip-E" standard).

Mi-14

The Mi-14 shore-based amphibious helicopter has the basic airframe, power plant, and dynamic components of the Mi-17. The most obvious difference is the addition of a boat-type planing bottom of the kind designed by Sikorsky for the S-61, a sponson carrying an inflatable flotation bag on each side, a small float under the tail, and fully retractable wheel landing gear. Libya and Syria each have 12 of the Mi-14PL ("Haze-A") ASW version, with a large undernose radome, retractable sonar, sonobuoys and signal flares, towed MAD bird stowed against the rear of the fuselage, and life raft. An autopilot/autohover system and autocontrol system are standard. The Libyan and Syrian Mi-14s are under Navy direction for coastal surveillance.

Contractor: Mil OKB, Russia.

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

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

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

Performance: max speed 143 mph, normal cruising speed 127 mph, service ceiling 11,500 ft, range with max fuel 705 miles.

Accommodation: crew of four.

Armament: torpedoes, bombs, depth charges, and other stores in weapons bay in bottom of hull.

Mi-24/25

Most of the Mi-24 helicopter gunships delivered to the Middle East and North Africa are of the basic **Mi-24D** ("Hind-D") version, as described below, but Iraq is known to have some **Mi-24V**s ("Hind-E"). These carry up to 12 radio-guided, tube-launched 9M114 ("Spiral") antitank missiles in place of the less effective 9M17P Skorpions ("Swatters") on the Mi-24D. The Mi-24V also has a HUD instead of the D's reflector sight and can carry R-60 ("Aphid") AAMs for self-defense. Both models have a heavily armored airframe containing a cabin for eight troops or four litters in an assault transport role; an undernose missile guidance pod (port) and electro-optical sight (starboard); and pilot's Doppler-fed mechanical map display, IFF, RWR, IR jammer, and chaff/flare dispensers. Engine exhaust IR suppression mixer boxes are optional. **Mi-25** is an export designation for the Mi-24D.

Iraqi Mi-24s were first used against Iran in 1982 and achieved notoriety when an Mi-24V destroyed an Iranian F-4 Phantom II with a 9M114 antitank missile. They took little part in the Desert Storm campaign, and 30 or more are estimated to remain available. Algeria is believed to have at least 24, Libya 21, Syria more than 35, and Yemen 12. *(Data for Mi-24D.)*

Contractor: Mil OKB, Russia.

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

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

Weights: empty 18,520 lb, gross 24,250 lb.

Performance: max speed 192 mph, max cruising speed 183 mph, service ceiling 14,750 ft, combat radius with max military load 99 miles, with four external fuel tanks 179 miles.
Accommodation: crew of two in tandem; flight mechanic, and provisions for eight troops or four litters in main cabin.
Armament: one YakB-12.7 four-barrel 12.7-mm machine gun in nose turret, slaved to electro-optical sight; four underwing hardpoints for 32-round UB-32 packs of 57-mm rockets, 20-round B-8V-20 packs of 80-mm rockets, UPK-23-250 twin-barrel 23-mm gun pods, 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, 3,300 lb of conventional bombs or mine dispensers. Provisions for firing AKMS guns from cabin windows.

S-70/UH-60 Black Hawk

The **S-70A** is the basic export version of Sikorsky's infantry squad transport and general-purpose helicopter. It is essentially similar to the US Army's **UH-60A**, some of which have also been supplied to Middle East customers either through FMS or by transfer from US Army stocks. Bahrain, for example, received one FMS UH-60A, followed in early 1991 by two US Army standard **UH-60L**s, which have a more powerful engine. Israel, in return for its cooperation with the coalition forces during the Persian Gulf War, was promised 10 ex–US Army UH-60As for delivery during 1993, and eight UH-60As were transferred to Saudi Arabia during Operation Desert Shield.

The Royal Saudi Land Forces Army Aviation Command is, in fact, the Middle East's largest operator of this helicopter. In addition to the eight UH-60As mentioned, it took delivery in January–April 1990 of 12 S-70A-1s in **Desert Hawk** configuration (15 troop seats, Jaguar 5 frequency-hopping radio, special rotor blade erosion protection, and provision for an external hoist, searchlights, and internal auxiliary fuel tanks). A 13th S-70A-1 was added in December 1990, followed a year later by the first of eight medevac S-70A-1Ls (signifying use of the uprated UH-60L engine), each with fittings for six litters, air-conditioning, an IR-filtered searchlight, rescue hoist, and improved avionics. Eight more A-1Ls are required, and an RSLF order for up to 88 Westland-built **WS-70L**s (UH-60L equivalent) is expected soon as part of the Al Yamamah II program.

Two other Middle East air arms operate the S-70. No. 8 Squadron of the of the Royal Jordanian Air Force, based at Amman, acquired three S-70A-11s in 1987 (one since reported lost), and two S-70A-21s, outfitted as VIP transports, were acquired by the Egyptian Air Force in 1990. *(Data for current production standard UH-60L.)*
Contractor: Sikorsky Aircraft, USA.
Power Plant: two General Electric T700-GE-701C turboshafts; each 1,800 shp (1,723 shp T700-GE-701A optional for export).
Dimensions: rotor diameter 53 ft 8 in, fuselage length 50 ft 0¾ in, height 16 ft 10 in.
Weights: empty 11,500 lb, gross 22,000 lb.
Performance: max speed 184 mph, max cruising speed 173 mph, service ceiling 19,000 ft, range with internal fuel 363 miles, with four external tanks 1,380 miles.
Accommodation: crew of three; 11–14 troops, or up to six litters and 1–3 attendants, or cargo, in cabin. VIP configurations for 7–12 persons. Up to 8,000 lb load on external cargo sling.
Armament: provision for up to 10,000 lb of external stores, including 16 Hellfire laser-guided antiarmor or other missiles, gun pods, mine dispensers, rockets, or ECM pods. Two pintle mounts in cabin for a 0.50-in or 7.62-mm machine gun.

SA 321 Super Frelon

The Super Frelon is a three-engine, heavy-duty helicopter with a boat hull and, in its maritime versions, a stabilizing float on each side at the rear of the fuselage pod. IFF and dipping sonar are standard in versions used for ASW missions. Iraq acquired 10 **SA 321GV**s in the 1970s, each equipped with ORB-31D radar in a large nose radome and armed with two Exocet antiship missiles. Six more were bought in the early 1980s. Ten are thought to remain in service following Desert Storm. Libya ordered eight **SA 321M**s for SAR and logistical support in the early 1970s, followed in the 1980s by six maritime **SA 321GM**s with ORB-32WAS search radar. About six of each batch are believed to remain available. *(Data for SA 321G.)*
Contractor: Aerospatiale, France.
Power Plant: three Turbomeca Turmo $IIIC_6$ turboshafts; each 1,550 shp.
Dimensions: rotor diameter 62 ft 0 in, fuselage length 65 ft 10¾ in, height 21 ft 10¼ in.
Weights: empty 15,130 lb, gross 28,660 lb.
Performance: cruising speed 155 mph, service ceiling 10,325 ft, range 509–633 miles.
Accommodation: crew of five, including equipment operators; provision for 27 passengers.

Bell 406 CS Combat Scout, Royal Saudi Land Forces

Yasur 2000, Israeli Air Force

Commando Mk 3, Qatar Emiri Air Force (P. Steinemann)

Armament: two Exocet ASMs or four homing torpedoes carried on sides of hull.

SA 342 Gazelle

Nearly 40 nations have bought military Gazelles, 11 of them in the Middle East and North Africa. Egypt imported 60 SA 342Ls and assembled another 30 locally, 12 of these serving with its Navy as antiship helicopters and most of the remainder as an Air Force antitank element. Iraq and Syria are each thought to have more than 50, Libya about 40, Morocco 24, Kuwait 20, Qatar 16, and Abu Dhabi 11, with smaller numbers operated by Jordan, Lebanon, and Tunisia. The predominant version is the SA 342L, and the great majority, as in Egypt, are equipped for antitank, antiship, or counterinsurgency duties, with only small numbers allocated to such nonbelligerent tasks as observation and liaison. *(Data for SA 342L.)*
Contractor: Aerospatiale, France.
Power Plant: one Turbomeca Astazou XIVM turboshaft; 858 shp.
Dimensions: rotor diameter 34 ft 5½ in, fuselage length 31 ft 3⁹⁄₁₆ in, height 10 ft 5½ in.
Weights: empty 2,202 lb, gross 4,410 lb.
Performance: max cruising speed at S/L 161 mph, service ceiling 13,450 ft, range with standard fuel 440 miles.
Accommodation: crew of one or two; up to three other persons.
Armament: outriggers on fuselage sides for variety of weapons which can include up to six HOT wire-guided antitank missiles, two launchers for 68-mm or 2.75-in rockets, two 7.62-mm machine guns, or a single 20-mm gun.

Sea King, Commando, and AS-61

All of the S-61/SH-3-type helicopters operated by the air arms of six Middle Eastern nations were manufactured by Sikorsky's two European licensees: Westland of the UK and Agusta of Italy. Westland's score is the higher of the two, with 34 aircraft delivered to Egypt between 1973 and 1976, and 12 to Qatar (four in 1975–76 and eight in 1982–83). Six of the Egyptian aircraft, of which five remain, were ASW/ASV **Sea King Mk 47s** for the country's Navy, but the remaining British-built aircraft are of a model exclusive to Westland, the land-based **Commando** tactical transport. An initial Egyptian Air Force order for 24 Commandos, partly funded by Saudi Arabia, comprised five Mk 1s, minimally modified from the Sea King airframe, 17 tactical transport Mk 2s, and two VIP transport Mk 2Bs. A later acquisition was a quartet of electronic warfare Mk 2Es, equipped with Elettronica ECM and ESM. Qatar's Commandos are an equally varied mixture of three Mk 2A transports, one VIP Mk 2C, and eight Exocet-equipped antiship Mk 3s; the four transports serve with No. 8 (Multirole) Squadron and the Mk 3s with No. 9 (ASV) Squadron.

Agusta's contribution in the area includes two VIP **AS-61s** supplied to Egypt, two VIP AS-61As and 10 or more antisubmarine **ASH-3D**s for Iran, one VIP and four utility AS-61TSs for Iraq, a single VIP AS-61A for Libya, and three similar aircraft for Saudi Arabia. *(Data for Commando Mk 2.)*
Contractor: Westland Helicopters Ltd, UK.
Power Plant: two Rolls-Royce Gnome H.1400-1 turboshafts; each 1,660 shp.
Dimensions: rotor diameter 62 ft 0 in, fuselage length 55 ft 10 in, height 16 ft 10 in.
Weights: empty 12,390 lb, gross 21,500 lb.
Performance: max speed at S/L 140 mph, cruising speed at S/L 126 mph, hovering ceiling IGE 6,500 ft, range 246 miles with max payload and fuel reserves, 920 miles with max fuel.
Accommodation: crew of two; up to 28 troops (21 in Mk 1).
Armament: provision for guns, missiles, rocket pods, bombs, torpedoes, depth charges, or other weapons according to mission requirements.

Reconnaissance and Special Mission Aircraft

Beechcraft 1900C-1

The first of three Beechcraft 1900 prototypes flew for the first time on September 3, 1982, and most of the 255 1900Cs built before the current 1900D model was introduced in 1991 were commuter, cargo, or executive aircraft for the civil market. Among early military orders, however, was a 1985 contract for six for the Egyptian Air Force: four for electronic surveillance and two for maritime patrol. All were of the improved 1900C-1 model, with a "wet" wing that conferred considerably better payload/range performance than the original design. Four aircraft were delivered in 1988 and two the following year. The maritime pair are each equipped with weather radar, Dalmo Victor S-3075 electronic support measures, and a long ventral pod containing a Motorola SLAMMR (side-looking airborne modular multimission radar). The cargo door of the standard 1900C-1, and about half of the main cabin windows, are deleted; the ESM are thought to include a tailcone-mounted radar warning receiver.

Equipment in the elint aircraft is classified, but a fifth and sixth EW aircraft were delivered to Egypt in September 1992. These were described as having all main cabin windows deleted, an underfuselage radome forward of the wing, and more antennas above and below wings and fuselage than the previous elint quartet. Two of these antennas were of the "hockey stick" shape associated with the US Army's own latest RC-12 Guardrail Common Sensor aircraft.

Contractor: Beech Aircraft Corporation, USA.
Power Plant: two Pratt & Whitney Aircraft of Canada PT6A-65B turboprops; each 1,100 shp.
Dimensions: span 54 ft 5¾ in, length 57 ft 10 in, height 14 ft 5¼ in.
Weights: empty approx 9,850 lb, gross 16,600 lb.
Performance: max cruising speed at 8,000–16,000 ft 307 mph, service ceiling more than 25,000 ft, T-O run 2,200 ft, landing run 1,530 ft, range 1,806 miles.
Accommodation: crew of one or two; mission systems operators according to role.
Armament: none known.

E-2C Hawkeye

Although developed for USN carrier-borne deployment, the E-2 has been ordered by six other air forces, all of which operate them, or will, from land bases—no small tribute to the Hawkeye's overland, as well as overwater, capability. Israel, the first export customer, received four E-2Cs in 1977–78; Egypt received five from 1987, and a sixth is due this year.

The Hawkeye carries its radar antennas in a 24-ft diameter rotating disc-shaped housing above the centerfuselage, the four vertical tail surfaces to the rear being manufactured from glassfiber to avoid compromising the radar's efficiency. A Litton AN/ALR-73 passive detection system, with receiver antennas in the nose and tailcone and looking out laterally from the outer tailfins, can locate hostile radar emitters over a range twice that of the AEW radar. An ATDS (airborne tactical data system) compartment in the center-fuselage receives and displays incoming intelligence to the combat information center officer, air control officer, and radar operator.

Although the AN/APS-125 radar systems of the Egyptian and Israeli E-2Cs are less advanced than the later types fitted to current US Navy Hawkeyes, current US plans include upgrading at least 54 early-standard Navy E-2Cs and the FMS aircraft to current US Navy Group II standard from FY 1995. This would give them the AN/APS-145 radar, which has greater resistance to jamming, better overland detection, and can detect and classify approaching aircraft more than 345 miles away, track more than 2,000 targets simultaneously and automatically, and control more than 40 intercepts. Other Group II improvements include JTIDS tactical software, upgraded engines, and provision for GPS navigation. *(Data for US Navy Group II E-2C.)*
Contractor: Grumman Aerospace & Electronics Group, USA.
Dimensions: span 80 ft 7 in, length 57 ft 6¾ in, height 18 ft 3¾ in.
Weights: empty 39,373 lb, gross 53,267 lb.
Performance: max speed 389 mph, cruising speed for max range 298 mph, service ceiling 37,000 ft, min T-O run 1,850 ft, min landing run 1,440 ft, on-station endurance 200 miles from base 4 h 24 min, max endurance 6 h 15 min.
Accommodation: flight crew of two; three mission personnel.
Armament: none.

E-3A Sentry

Under the Peace Sentinel program, the Reagan Administration approved in 1981 the sale of five Boeing E-3A AWACS aircraft to the Saudi Arabian government. The first of these was handed over at Seattle in June 1986 and the fifth delivered in September 1987. Operated by No. 18 Squadron of the Royal Saudi Air Force from Riyadh Military City Airport, they combined with USAF E-3B/Cs to provide 24-hour surveillance and intelligence for the coalition forces during the 1991 Persian Gulf War. Carrying one or more relief crews, each E-3 can stay aloft for an average mission time of 16–18 hours, with two or more orbiting aircraft providing a constant radar picture of the region from the Red Sea to the Arabian Sea.
Contractor: Boeing Aerospace Company, USA.
Power Plant: four CFM International CFM56-2A-2 turbofans; each 24,000 lb thrust.
Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 41 ft 9 in.
Weights: empty (estimated) 160,000 lb, gross 325,000 lb.
Performance: max speed at 40,000 ft 530 mph, service ceiling approx 40,000 ft, T-O run approx 5,200 ft, landing run approx 2,500 ft, on-station endurance 1,000 miles from base 6 h, max endurance (unrefueled) 11 h.
Accommodation: flight crew of four; up to 13 specialist AWACS personnel.
Armament: none.

MiG-25R

The four Middle Eastern and North African air forces that operate fighter versions of the MiG-25 also have small numbers of reconnaissance MiG-25Rs. All are believed to be of the original RB series ("Foxbat-B"), with a nose-mounted pack of cameras and elint sensors. Like their counterparts in the CIS air forces, they have no guns but can be assumed to offer the same capability of making precision automatic attacks with bombs in all weather, day and night, at supersonic speed, and from heights above 65,000 ft, against targets whose geographic coordinates are known. Equipment includes an inertial navigation system, updated by Doppler. Range can be extended to nearly 1,500 miles by attaching a 1,400-gallon conformal underbelly fuel tank. Supersonic cruising speed is Mach 2.35.
Contractor: Mikoyan OKB, Russia.
Power Plant: two Soyuz/Tumansky R-15BD-300 turbojets, each 24,700 lb thrust with afterburning.
Dimensions: span 44 ft 0¼ in, length 78 ft 1¾ in, height 20 ft 0¼ in.
Weight: gross 81,570–90,830 lb.
Performance: max speed at height Mach 2.83, at S/L Mach 0.98, service ceiling 68,900 ft, range at supersonic speed on internal fuel 1,015 miles, subsonic with underbelly tank 1,490 miles.
Accommodation: pilot only, on zero-height/81 mph ejection seat.
Armament: provision for six 1,100-lb bombs on two underfuselage and four underwing pylons.

Mirage 5R

The 5R is a tactical reconnaissance version of the Mirage 5 fighter/ground-attack aircraft, recognizable by the different profile of a nose adapted to accept a pallet housing five (three oblique and two vertical) Omera 31 film cameras for all-altitude day and night photographic missions. It is operated by the air forces of Abu Dhabi (five 5RADs), Egypt (six 5SDRs), and Libya (eight 5DRs). *(Data generally as for Mirage 5.)*

RC-12D and EU-21A

The **RC-12D** is a sigint/elint aircraft using the airframe of the Beechcraft Super King Air 200. It is operated by the US Army for battlefield intelligence-gathering in Improved Guardrail V configuration. It is characterized by numerous large dipole antennas sprouting above and below the wings. Five RC-12Ds were supplied to the Israeli Defense Force under FMS. Israel also has three much older aircraft for similar duties, in the form of ex-US Army **EU-21As** (converted U-21As); these combine the unpressurized fuselage of the Beech Queen Air 65-80 with the wings of the King Air 90. *(Data for RC-12D.)*
Contractor: Beech Aircraft Corporation, USA.
Power Plant: two Pratt & Whitney Canada PT6A-41 turboprops; each 850 shp.
Dimensions: span over wingtip pods 57 ft 10 in, length 43 ft 10 in, height 15 ft 5 in.
Weights: empty 8,143 lb, gross 14,200 lb.
Performance: max speed at 14,000 ft 299 mph, service ceiling 31,000 ft, T-O run approx 1,850 ft, landing run approx 1,750 ft, range approx 1,750 miles.
Accommodation: flight crew of two; up to eight other personnel.
Armament: none.

RF-4 Phantom II

All 16 of the **RF-4E** day/night, all-weather tactical reconnaissance aircraft supplied to Iran's Air Force in early 1971 were reported lost, or cannibalized for F-4E spares, by 1986, but a handful may have been restored to an airworthy state. The only undisputed operator of reconnaissance Phantoms in the Middle East is Israel, which began with 18 RF-4Es, delivered in 1970–76 with the standard pack of oblique/panoramic cameras and SLAR/IR sensors in a modified nose. This equipment was intended to be supplemented by a unique 22-ft-long, 4,000-lb underbelly pod for the huge 1,228-lb General Dynamics HIAC-1 high-altitude, high-resolution camera, but this reduced the aircraft's maximum speed to below Mach 1.5 and its ceiling to around 50,000 ft. Agility also suffered, and the HIAC pod did not become operational on the RF-4E. Instead, three Israeli F-4Es were sent to the US in 1975–76 for conversion to **F-4E(S)** (for "Special") standard. This involved deleting the AN/APQ-120 radar and fitting the HIAC camera, a normal vertical KS-87 camera, and data link and other equipment, into a new nose with a volume of 70 cu ft, which increased the Phantoms' length by 12 in. Redelivered in 1978, and still in use (though one has reportedly been lost), the F-4E(S) offers a reconnaissance capability as good as that of any similar system in the world. *(RF-4E data similar to those for F-4E, except as follows.)*
Weights: empty 31,110 lb, gross 52,835 lb.
Performance: max speed at 40,000 ft Mach 2.25, at S/L Mach 1.2, service ceiling 62,250 ft, ferry range 2,170 miles.
Armament: normally none, but Israeli aircraft carry Python, Shafrir, or Sidewinder self-defense AAMs.

RF-5E TigerEye

Ten RF-5Es of No. 17 Squadron, at Tabuk, constitute the only dedicated tactical reconnaissance unit of the Royal Saudi Air Force. Capable of round-the-clock operation, the single-seat TigerEye differs from the standard F-5E Tiger II fighter in having a longer nose of modified shape. A KS-87D oblique camera is installed as standard, with which can be combined one of three interchangeable nose pallets: one with a single LOROP (long-range oblique photography) camera, one with one medium- and one low-altitude pan camera, and a third that adds a Texas Instruments RS-700 series infrared linescan to the two pan cameras. The Royal Moroccan Air Force has a single example of the earlier RF-5A. *(RF-5E data generally as for F-5E, except as follows.)*
Dimensions: length 48 ft 0¾ in.
Performance: combat radius with three drop tanks and two AIM-9 Sidewinder AAMs 403 miles (lo-lo-lo), 610 miles (hi-lo-hi).

Transports and Tankers

An-12

Since deliveries began in 1959, more than 900 An-12s ("Cubs") have given stalwart service with at least 15 air forces worldwide. Their major shortcoming has been the lack of an integral rear-loading ramp/door, which hastened their replacement with Il-76s. 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 or air-dropping of supplies and equipment. Sixty paratroops can be dispatched via this exit in under one minute. Fewer than a dozen An-12s remain in service with air forces in this region, with an estimated five in Algeria, five in Iraq, and one in Yemen.
Contractor: Antonov OKB, Ukraine.
Power Plant: four ZMKB Progress AI-20M turboprops; each 4,190 ehp.
Dimensions: span 124 ft 8 in, length 108 ft 7¼ in, height 34 ft 6½ in.
Weights: empty 76,235 lb, gross 134,480 lb.
Performance: max speed 385 mph, normal cruising speed 354 mph, service ceiling 33,500 ft, T-O run 2,575 ft, landing run 2,756 ft, range with 39,680 lb payload 900 miles, with max fuel 4,225 miles.
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.

An-24/26

The first of these short-range, twin-turboprop transports to fly, in April 1960, was the **An-24**. By the time production ended in 1978, about 1,100 had been built, the final versions with 2,515 ehp AI-24A engines, an optional Type RU-19-300 auxiliary turbojet in the rear of the starboard nacelle, and a payload of up to 50 passengers or 10,168 lb of freight. The freighter had a belly cargo door at the rear of the cabin, with an electrically powered winch and conveyor to facilitate loading. Not content with this makeshift arrangement, Oleg Antonov designed a unique rear-loading ramp that forms the underside of the fuselage when retracted but can slide forward under the rear of the cabin for direct loading onto the floor of the hold, or when the cargo is to be air-dropped. He then swept up the rear fuselage to provide much-improved access, and the **An-26** was born. With uprated turboprops, it offered increased performance and payload. More than 1,000 were built, and derivatives are still in production in China.

At least eight of Iraq's An-26s are thought to have survived Desert Storm. Libya has 10, bought in 1983 when Italy embargoed a second batch of G222s. Syria's two An-24s and four An-26s operate in civil markings but are available to the military. The unified Yemen Air Force is reported to have a total of 13 An-24s and An-26s. *(Data for An-26.)*
Contractor: Antonov OKB, Ukraine.
Power Plant: two ZMKB Progress AI-24VT turboprops; each 2,780 ehp. One 1,765 lb thrust RU-19A-300 auxiliary turbojet 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 19,685 ft 270 mph, service 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. Provision for carrying 40 paratroops or 24 litters. Improved An-26B version has roll-gangs and mechanical handling system, enabling two men to load or unload three 8-ft-long standard freight pallets in 30 minutes.

Armament: provision for bomb rack on fuselage below each wingroot trailing-edge.

Boeing 707-320

Tanker/transport, elint, and other versions of this veteran airliner serve with half a dozen air forces in the Middle East and North Africa. The largest fleets are those of Iran and Israel, each with about 10 in general transport configuration plus four (Iran) or six (Israel) converted to flight refueling tankers; eight tankers, illogically designated **KE-3A,** serve with No. 18 Squadron of the Royal Saudi Air Force. The tanker version can transfer up to 123,190 lb of fuel to fighters or other aircraft 1,150 miles from its base. The Saudi and Iranian conversions were undertaken by Boeing, those of Israel by IAI's Bedek Aviation Division, which has also converted at least one other 707 as a dedicated sigint aircraft and one for Chile with Elta's Phalcon AEW detection system. The Royal Moroccan Air Force has a short-fuselage 707-138 tanker, converted in-country by AMIN. Other 707-320s serve in the region as VIP transports with the air forces of Egypt, Israel, Libya, and Morocco (one each), and Saudi Arabia (two). *(Data for basic 707-320, except where indicated.)*

Contractor: Boeing Company, USA.

Power Plant: four Pratt & Whitney JT3D-7 turbofans; each 19,000 lb thrust.

Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 42 ft 5 in.

Weights (IAI tanker/transport): empty 145,000 lb, gross 335,000 lb.

Performance: max cruising speed at 25,000 ft 605 mph, service ceiling 39,000 ft, T-O to 35 ft 10,020 ft, landing run 2,575 ft, range with 88,000 lb payload 3,625 miles, with max fuel 5,755 miles.

Accommodation: flight crew of three; standard airliner seats up to 219 passengers; elint/tanker variants carry appropriate mission personnel; VIP transports individually customized.

Armament: none.

C-130 Hercules

A few older **C-130Es** still serve with the Air Forces of Iran, Israel, and Saudi Arabia, but most of the main Hercules fleets in the Middle East are to current-production **C-130H/L-100** standard. "Regular" C-130Hs equip the Air Forces of Abu Dhabi (six), Algeria (10), Egypt (19), Iran (about 10), Israel (10), Jordan (four), Libya (seven), Morocco (15), Oman (three), Saudi Arabia (28), Tunisia (two), and Yemen (two). Egypt and Saudi Arabia also each have one **VC-130H** as a VIP transport; Israel has two **KC-130H** hose/reel tankers, Morocco (two) and Saudi Arabia (eight); Egypt has two (unofficially "EC-130H") converted for electronic warfare/elint duties, and Morocco two "RC-130H" border surveillance Hercules with a SLAR (side-looking airborne radar) installed in the starboard mainwheel fairing.

Stretched Hercules are operated by Algeria (seven **C-130H-30s**), Dubai (one H-30, one **L-100-30**), Egypt (two H-30s), Kuwait (four L-100-30s), and Saudi Arabia (six L-100-30s). Saudi Arabia, whose No. 4 and No.16 Squadrons formed part of the coalition forces during the 1991 Persian Gulf War, has fitted out three of its C-130Hs and five of its L-100-30s in AEH (airborne emergency hospital) configuration. Recent reports suggest that this country is now seeking proposals to convert some of its C-130Es or Hs to gunship standard similar to the US AC-130 versions. *(Data for current basic C-130H.)*

Contractor: Lockheed Aeronautical Systems Company, USA.

Power Plant: four Allison T56-A-15 turboprops; each 4,508 ehp.

Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 3 in.

Weights: empty 76,469 lb, gross 155,000–175,000 lb.

Performance (at 155,000 lb gross weight): max cruising speed at 20,000 ft 374 mph, service ceiling 33,000 ft, T-O run 3,580 ft, landing run 1,700 ft, range with max payload 2,356 miles, with max fuel incl external tanks 4,894 miles.

Accommodation: flight crew of four, plus optional loadmaster/jumpmaster; up to 64 paratroops, 92 troops, or 74 litters plus two medical attendants standard (92/128/97 in H-30), or light armored vehicles/artillery, supply pallets, or equivalent cargo.

Armament: none.

CN-235 M

Military sales of this twin-turboprop, general-purpose transport have exceeded those of the civil version by nearly four to one, and the initial export customer for the military version was Saudi Arabia, whose first two aircraft were in fact the first production CN-235s off the Spanish production line. Configured as VIP transports, they were delivered in February 1987 and followed two months later by two more in standard transport configuration. These early aircraft were **Series 10** CN-235s, with 1,700 shp CT7-7A engines; current production aircraft, with Dash 9C engines, are designated **Series 100.** The Royal Moroccan Air Force has seven Series 100s, including one to VIP standard, and a similar order has been placed by Abu Dhabi for the United Arab Emirates Air Force. *(Data for Series 100.)*

Contractor: Aircraft Technology Industries (Airtech), a Spanish-Indonesian company.

Power Plant: two General Electric CT7-9C turboprops; each 1,750 shp (1,870 shp with automatic power reserve).

Dimensions: span 84 ft 8 in, length 70 ft 0¾ in, height 26 ft 10 in.

Weights: empty 19,400 lb, gross 36,376 lb.

Performance: max cruising speed at 15,000 ft 286 mph, service ceiling 26,600 ft, T-O to 50 ft 4,235 ft, landing run with propeller reversal 1,306 ft, range with 13,227 lb max payload 932 miles, with 7,826 lb payload 2,706 miles.

Accommodation: flight crew of two; up to 46 paratroops, 48 troops, 24 litters and four medical personnel, or equivalent cargo, plus jumpmaster/loadmaster when appropriate.

Armament: provision for six underwing stations for up to 7,716 lb of ASMs, bombs, or other weapons or stores.

F27 Friendship/Troopship

At the last reliable count, some years ago, the Iranian Air Force continued to operate about 13 F27 **Mk 400M** military transports, as described below, and four **Mk 600s.** At least 10 of these short-haul transports are believed to remain serviceable, including the four Mk 400Ms modified by Fokker for target-towing duties. Both the Mk 400M and Mk 600 are fitted with a large cargo door, but the latter lacks the reinforced and watertight cabin floor of the dedicated military version. The Mk 600 has airline-type seating for its 44 passengers, whereas the Mk 400M has folding sidewall canvas seats. Both can be operated in all-cargo or combi forms. Most of Algeria's F27s were transferred to the country's civil airlines a decade ago, but a single Mk 400M was retained by the Air Force, primarily for maritime surveillance on behalf of the Navy.

Contractor: Royal Netherlands Aircraft Factories NV Fokker, the Netherlands.

Power Plant: two Rolls-Royce Dart Mk 532-7R turboprops; each 2,140 ehp.

Dimensions: span 95 ft 2 in, length 77 ft 3½ in, height 27 ft 11 in.

Weights: empty 25,696 lb, gross 45,000 lb.

Performance: normal cruising speed at 20,000 ft 298 mph, service ceiling 30,000 ft, T-O run 3,200 ft, landing run 2,000 ft, range (all-cargo) with standard fuel 1,375 miles, with max fuel 2,727 miles.

Accommodation: crew of two or three; 13,283 lb of freight, up to 46 troops, or 24 litter patients and nine attendants or sitting casualties.

Armament: none.

G222

While USAF operates its Italian-built G222s happily as C-27A Spartans, those supplied to air forces in northern Africa have had checkered careers. One of the pair delivered to Somalia is parked among other vandalized wrecks of that nation's former Air Force at Mogadishu Airport. Libya's decision to purchase a large fleet of G222s was frustrated initially by a US embargo on the aircraft's standard General Electric T64 turboprops and US avionics. Aeritalia engineered a revised version, designated **G222T,** with Rolls-Royce Tyne turboprops and UK/French equipment. Twenty were delivered, from 1981. Within five years, these were spending long periods on the ground because of an Italian embargo on spares. Libya was not permitted to take up its option on further G222Ts and decided to buy An-26s instead. Only the single standard G222 of the Dubai Air Force appears to have experienced a normal military transport flying life in this region. *(Data for G222T.)*

Contractor: Aeritalia SpA, Italy.

Power Plant: two Rolls-Royce Tyne RTy.20 Mk 801 turboprops; each 4,860 shp.

Dimensions: span 94 ft 2 in, length 74 ft 5½ in, height 32 ft 1¾ in.

Weights: empty 39,685 lb, gross 63,935 lb.

Performance: long-range cruising speed at 30,000 ft 345 mph, T-O run 2,130 ft, landing run 1,240 ft, range with max payload 1,174 miles, with max fuel (ferry) 3,166 miles.

Accommodation: crew of three; 53 troops on folding and stowable seats; 42 paratroops; 36 litters, two seated casualties, and four attendants; or 19,840 lb of freight, vehicles, and guns.

Armament: none.

IAI 201/202 Arava

The Israeli Air Force has about 12 of these light multipurpose aircraft. Standard version is the **IAI 201;** the **IAI 202** variant has a 3-ft-longer fuselage pod, winglets, PT6A-36 engines (of the same rating as the -34), and 1,600 lb more fuel.

Of more interest than the standard transports are the elint conversions, of which at least two configurations have appeared. One of these has a number of blade antennas located on the wings, tailbooms, flight deck roof, and elsewhere. Another, equipped with an Elta EL/L-8310 elint system, features a canister-shaped antenna stowed against the lower fuselage on the port side, just aft of the propeller plane; in operation this is lowered to an underfuselage location to allow it to scan through a full 360°. Other Aravas are used for multiengine pilot training. *(Data for IAI 201.)*

Contractor: Israel Aircraft Industries, Israel.

Power Plant: two Pratt & Whitney Canada PT6A-34 turboprops; each 750 shp.

Dimensions: span 68 ft 9 in, length 42 ft 9 in, height 17 ft 1 in.

Weights: empty 8,816 lb, gross 15,000 lb.

Performance: max cruising speed at 10,000 ft 198 mph, service ceiling 25,000 ft, T-O run 960 ft, landing run 820 ft, range with max payload 174 miles, with max fuel 656 miles.

Accommodation: flight crew of one or two; 16 paratroops plus two dispatchers, 24 troops, 12 litters plus two medical personnel, small wheeled vehicles (loaded via rear fuselage swing-tail), or equivalent cargo.

Armament (optional): 0.50-in Browning machine-gun pack and/or six-round 82-mm rocket pod on each side of fuselage.

Il-76 and Adnan 1

Details of this workhorse of CIS air transport forces can be found in the "Gallery of Russian Aerospace Weapons" in the March 1993 issue of AIR FORCE Magazine. Those exported, especially to nations in the Middle East/North Africa region, often spend their time in the insignia of national airlines that make aircraft and crews available to the military when needed. **Il-76Ms,** with a rear gun turret but no weapons installed, arrive at civil airports on commercial business, while turretless **Il-76Ts** may be called in to haul military cargoes. Typically, Jamahiriya Libyan Arab Airlines has a mix of 18 Il-76Ts and Ms; Syrianair has two of each version. Iraqi Airways has operated a fleet of around 30 Il-76Ts and Ms, mainly for military duties, of which 15 were flown to sanctuary in Iran during Desert Storm. This total may include two of the three AEW&C conversions produced in Iraq under the name **Adnan 1**; the third was put out of commission during an attack on Al Taqaddum Airfield. With a dorsal rotodome, Adnan 1 closely resembles the Russian A-50 AEW&C derivative of the Il-76 but can be identified by two large strakes under the rear fuselage. Iraq also developed an in-flight refueling tanker version of the Il-76, with a single hose/drogue pack at the base of the rear loading ramp. A further Il-76 operator in this region is the Algerian Air Force, which took delivery of four standard transports in 1989. *(Data for Il-76M.)*

Contractor: Ilyushin OKB, Russia.

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.

Weight: gross 374,785 lb.

Performance: cruising speed at 29,500–39,350 ft 466–497 mph, ceiling 50,850 ft, T-O run 2,790 ft, landing run 1,475 ft, nominal range with 88,185 lb payload 3,100 miles, max range 4,163 miles.

Accommodation: crew of seven, incl two freight handlers; 88,185 lb of freight, or 140 troops, or 125 paratroops.

Armament: two 23-mm twin-barrel GSh-23L guns in tail turret.

Skyvan 3M

This dumpy little transport has the same 6 ft 4 in square cabin cross section, low floor, and general configuration as USAF's much larger C-23A Sherpa, enabling it to handle a surprising variety of awkwardly shaped loads or cabin installations. The Royal Air Force of Oman has 15, of which eight are standard transports; the other seven are equipped with Racal ASR 360 surveillance radar for maritime patrol and search and rescue. The Sharjah Emiri Guard Air Wing of the United Arab Emirates has a single Skyvan 3M, plus a Shorts 330 UTT (generally similar to the C-23A but with cabin windows, and seats for up to 33 troops, or 30 paratroops and jumpmaster, or accommodation for 15 litters and four seated personnel in an ambulance role). *(Data for Skyvan 3M.)*

Contractor: Short Brothers plc, UK.

Power Plant: two Garrett TPE331-2-201A turboprops; each 715 shp.

Dimensions: span 64 ft 11 in, length 41 ft 4 in, height 15 ft 1 in.

Weights: empty 7,400 lb, gross 13,700–14,500 lb.

Performance (at 13,700 lb gross weight): max cruising speed at 10,000 ft 202 mph, service ceiling 22,000 ft, T-O run 780 ft, landing run 695 ft, range with 5,000 lb payload 240 miles, with max fuel 670 miles.

Accommodation: flight crew of one or two; 16 paratroops plus dispatcher, 22 troops, 12 litters plus two medical personnel, or 5,200 lb of cargo.

Armament: none. ■

You can help today's and tomorrow's Air Force leaders

The Air Force Association's Aerospace Education Foundation is now a member charity of the Combined Federal Campaign.

For more than 35 years, the Aerospace Education Foundation has championed AFA's educational mission. Today, AEF funds scholarship and educational programs for US Air Force personnel at all levels.

Donations to the Combined Federal Campaign will help AFA's Foundation continue these and other US Air Force-related scholarships and programs:

The Eagle Grants program provides annual $250 scholarships to 350 active-duty, Reserve and Guard enlisted graduates of the Community College of the Air Force.

The Dr. Theodore von Karman Graduate Scholarship program provides ten $5,000 scholarships to AFROTC graduates pursuing advanced degrees before entering active-duty service.

Ten $1,000 grants are awarded annually to **Angel Flight/Silver Wings Society** members whose abilities and accomplishments best reflect those of AFROTC and the US Air Force.

AEF publishes books such as "Airpower in the Gulf," as well as reports and proceedings from US Air Force symposia.

A Member Organization Of
ICA Independent Charities of America
Share The American Way

To find out more information, contact
AFA's Aerospace Education Foundation
1501 Lee Highway, Arlington, VA 22209-1198
703-247-5839 (Fax) 703-247-5853

Designate CFC Code #0201

Helping the Air Force—that's what we do best!

The Air Force Academy's 24th Squadron wins the AFA trophy.

The Phantoms Get the Job Done

By James A. McDonnell, Jr.

"I AM proud of all the outstanding cadets at the Academy this year. However, I am especially proud of the members of 24th Squadron. Their accomplishments reflect the cohesion and qualities of character . . . so crucial to the success of any military organization. It is this unity of effort that provided the stimulus for this squadron to win the . . . battle for . . . outstanding squadron."

In this way did Lt. Gen. Bradley C. Hosmer, USAF Academy Superintendent, characterize the 1993 competition for AFA's annual Outstanding Squadron award. He spoke at the thirty-fourth annual black-tie salute in late May. The event, sponsored in cooperation with the Colorado Springs/Lance Sijan Chapter, each year recognizes one of the Academy's forty squadrons for achievement across the spectrum of Academy life—military training, athletics, and academic achievement.

General Hosmer told some 500 guests assembled to honor the 24th Squadron that, "of all the individual and organizational awards presented during graduation week," the one received by the "Phantoms" was "the award most coveted by cadets—the Air Force Association trophy."

The 24th consistently finished among the top three squadrons in group competition. Academically, it finished third in the entire wing in the fall, and the spring rankings saw it finish high again. For the year, all four 24th Squadron classes ranked among the wing's top five academically.

In intramural athletics, the squadron competed hard and turned in several winning records. Individual Phantoms contributed to intercollegiate winning records for the Academy's alpine ski team, women's tennis team, and rugby team. Their ranks included an All-American swimmer and a tight end from the varsity football team that won the Commander in Chief's Trophy.

AFA's Outstanding Squadron Trophy, presented annually since the Academy graduated its first class in 1959, went to the 24th Squadron Phantoms this year. AFA National President James M. McCoy presented the trophy to Fall Squadron Commander Dustin Zierold (right) and Spring Squadron Commander Peter R. Wilkie.

Gen. Henry Viccellio, Jr., commander of Air Education and Training Command, was this year's traditional "returning graduate." Speaking to the audience but aiming his remarks at the victorious cadets, General Viccellio said his Academy experience established a solid foundation for his subsequent Air Force career. He noted that the US military faces unprecedented change as it steers toward the twenty-first century and said that the ability to adapt to such change probably would be the most significant attribute cadets acquired at the Academy.

In his remarks accepting the AFA trophy on behalf of the Squadron, Fall Squadron Commander Cadet Dustin Zierold said victory resulted from teamwork. Each squadron member contributed his or her "fair share" to the mission, said Cadet Zierold, by adapting to several changes in academics and Academy procedures this school year: "We were not overwhelmingly outstanding in any one area but were above average in every area . . . as a team."

That's what it took for the Phantoms to capture first place this year. In General Hosmer's words, "This squadron has provided the entire cadet wing with an example of teamwork at its best—the one intangible that allows the Air Force and the military to get the job done." ■

Books

Compiled by Frank Oliveri, Associate Editor

Adams, Col. Gerald M., USAF (Ret.). *A History of US Strategic Air Bases in Morocco, 1951–1963.* Moroccan Reunion Association, P. O. Box 13362, Omaha, NE 68113-0362. 1992. Including photos and index, 210 pages. $42.95.

Brzezinski, Zbigniew. *Out of Control: Global Turmoil on the Eve of the 21st Century.* Charles Scribner's Sons, 866 Third Ave., New York, NY 10022. 1993. Including index, 240 pages. $21.00.

Charters, David A.; Milner, Marc; and Wilson, J. Brent, eds. *Military History and the Military Profession.* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including bibliography and index, 242 pages. $47.95.

Cohen, Roger, and Gatti, Claudio. *In the Eye of the Storm: The Life of General H. Norman Schwarzkopf.* The Berkley Publishing Group, 200 Madison Ave., New York, NY 10016. 1992. Including photos and index, 372 pages. $5.99.

Feuer, A. B., ed. *Coast Watching in the Solomon Islands: The Bougainville Reports, December 1941–July 1943.* Praeger Publishers, One Madison Ave., New York, NY 10010. 1992. Including index, 172 pages. $42.95.

Fletcher, Eugene. *The Lucky Bastard Club: A B-17 Pilot in Training and in Combat, 1943–45.* University of Washington Press, P. O. Box 50096, Seattle, WA 98145-5096. 1993. Including photos and appendix, 505 pages. $29.95.

Gabriel, Richard A., and Metz, Karen S. *A History of Military Medicine. Vol. 1, From Ancient Times to the Middle Ages. Vol. 2, From the Renaissance Through Modern Times.* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including indexes, Vol. 1, 247 pages; Vol. 2, 304 pages. Vol. 1, $75.00; Vol. 2, $65.00.

Griehl, Manfred. *Do 217-317-417: An Operational Record.* Smithsonian Institution Press, 470 L'Enfant Plaza, Suite 7100, Washington, DC 20560. 1992. Including photos, 237 pages. $34.95.

Guderian, Maj. Gen. Heinz. *Achtung—Panzer!* Sterling Publishing Co., Inc., 387 Park Ave. S., New York, NY 10016-8810. 1993. Including photos, bibliography, and index, 220 pages. $24.95.

Halberstadt, Hans. *F-15E Strike Eagle.* Specialty Press, 123 N. Second St., Stillwater, MN 55082. 1992. Including photos, 96 pages. $17.95.

Halliday, Hugh A. *Typhoon and Tempest: The Canadian Story.* CANAV Books, 51 Balsam Ave. Toronto, Ontario M4E 3B6, Canada. 1992. Including photos, appendix, and index, 208 pages. $37.50.

Hogan, David W., Jr. *Raiders or Elite Infantry: The Changing Role of the US Army Rangers from Dieppe to Grenada.* Greenwood Publishing Group, 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including bibliography and index, 272 pages. $47.95.

Mazarr, Michael J.; Snider, Don M.; and Blackwell, James A., Jr. *Desert Storm: The Gulf War and What We Learned.* Westview Press, 5500 Central Ave., Boulder, CO 80301-2847. 1993. Including charts, notes, and index, 207 pages. $33.00.

McKercher, B. J. C., ed. *Arms Limitation and Disarmament: Restraints on War, 1899–1939.* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including notes, bibliography, and index, 250 pages. $55.00.

Moran, Theodore H. *American Economic Policy and National Security.* Council on Foreign Relations Press, 58 E. 68th St., New York, NY 10021. 1993. Including notes, 100 pages. $10.95.

Oliver, Rear Adm. Dave, Jr. *Lead On! A Practical Approach to Leadership.* Presidio Press, 505 B San Marin Dr., Suite 300, Novato, CA 94945-1340. 1992. 207 pages. $9.95.

Peters, John E. *The US Military: Ready For the New World Order?* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1993. Including bibliography and index, 176 pages. $49.95.

Pisano, Dominick A.; Dietz, Thomas J.; and Schneide, Karl S. *Legend, Memory, and the Great War in the Air.* University of Washington Press, P. O. Box 50096, Seattle, WA 98145-5096. 1993. Including photos, appendix, and index, 144 pages. $18.95.

Polmar, Norman. *The Naval Institute Guide to the Ships and Aircraft of the US Fleet.* Fifteenth Edition. Naval Institute Press, Annapolis, MD 21402. 1993. Including photos and index, 639 pages. $56.95.

Pribylovskii, Vladimir. *Dictionary of Political Parties and Organizations in Russia.* Center for Strategic and International Studies, 1800 K Street, N. W., Suite 400, Washington, DC 20006. 1992. Including index, 129 pages. $16.95.

Reardon, D. F., Ph.D. *In or Out of the Military: How to Make Your Own Best Decision.* Pepper Press, 1254 W. Pioneer Way, Suite A266, Dept. Y, Oak Harbor, WA 98277-3288. 1993. Including charts, illustrations, appendix, and index, 120 pages. $14.95.

Reinhart, Richard O. *Basic Flight Physiology.* TAB Books, Blue Ridge Summit, PA 17294-0214. 1992. Including index, 235 pages. $34.95.

Rusbridger, James, and Nave, Eric. *Betrayal at Pearl Harbor: How Churchill Lured Roosevelt Into World War II.* Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020. 1992. Including photos, index, and notes, 302 pages. $12.00.

Samuels, Martin. *Doctrine and Dogma: German and British Infantry Tactics in the First World War.* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including notes, bibliography, and index, 225 pages. $45.00.

Samuels, Richard J., and Weiner, Myron, eds. *The Political Culture of Foreign Area & International Studies.* Brassey's (US), Inc., 8000 Westpark Dr., First Floor, McLean, VA 22102. 1992. Including notes, 218 pages. $30.00.

Schubert, Frank K. *Building Air Bases in the Negev.* Center of Military History, US Army, Washington, DC 20005-3402. 1992. Including photos, glossary, and index, 303 pages. $16.00.

Scruggs, Jan C., and Swerdlow, Joel L. *To Heal a Nation: The Vietnam Veterans Memorial.* HarperCollins Publishers, 10 E. 53d St., New York, NY 10022-5299. 1992. Including photos, 415 pages. $16.00.

Sharff, Lee E.; Borden, Eugene; and Stein, Fred. *Veterans' Benefits Handbook.* Simon & Schuster Consumer Group, 15 Columbus Circle, New York, NY 10023. 1992. 784 pages. $10.00.

Simonsen, Erik. *This Is Stealth: The F-117 and the B-2—in Color.* Presidio Press, 505 B San Marin Dr., Suite 300, Novato, CA 94945-1340. 1992. Including photos, 92 pages. $29.95.

TAB/Aero Staff. *AIM/FAR 1992: Airman's Information Manual/Federal Aviation Regulations.* TAB Books, Blue Ridge Summit, PA 17294-0214. 1991. Including index, 571 pages. $12.95.

Tucker, Robert W., and Hendrickson, David C. *The Imperial Temptation: The New World Order and America's Purpose.* Council on Foreign Relations, 58 E. 68th St., New York, NY 10021. 1992. Including notes, 219 pages. $14.95.

Twining, David T., ed. *Beyond Glasnost: Soviet Reform and Security Issues.* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including bibliography, 176 pages. $45.00.

Wills, Donald A. *The Laws of Land Warfare: A Guide to the US Army Manuals.* Greenwood Press, Inc., 88 Post Rd. W., Box 5007, Westport, CT 06881. 1992. Including bibliography and index, 201 pages. $47.95.

Wilson, George C. *Flying the Edge: The Making of Navy Test Pilots.* Naval Institute Press, Annapolis, MD 21402. 1992. Including photos and index, 271 pages. $22.00.

Yonay, Ehud. *No Margin for Error: The Making of the Israeli Air Force.* Pantheon Books, 201 E. 50th St., New York, NY 10022. 1993. Including photos and index, 426 pages. $27.50. ■

Valor

By John L. Frisbee, Contributing Editor

Night Rescue at Loc Ninh

The jungle strip was restricted to daylight use, but this was an emergency—a challenge to the SC-47 Farm Gate air commando crew.

THE UNITED States established the Military Assistance Advisory Group–Indochina in Saigon in 1950 to assist the French in combating Ho Chi Minh's attempt to drive them out. After the French withdrew from southeast Asia in 1954, US advisors remained to help South Vietnam in its continuing conflict with the North. Direct US participation in the war began the first year of the Kennedy Administration. The President and his staff were convinced that counter-insurgency or guerrilla warfare was the correct strategy against infiltration from the North.

In April 1961, USAF established the 4400th Combat Crew Training Squadron ("Jungle Jim") at Hurlburt Field, Fla., to develop counterinsurgency tactics and train air commandos. The first detachment, code named Farm Gate, consisting of eight armed T-28s, four RB-26s, and four SC-47s, arrived in South Vietnam in November and December 1961. Its mission was to train South Vietnamese Air Force (VNAF) crews and to support Vietnamese Army (ARVN) Special Forces by air-landing and air-dropping at more than twenty remote locations.

Farm Gate crews were forbidden to fly combat missions unless accompanied by VNAF personnel "in training." That restriction often was honored more in the breach than in the observance, especially by the SC-47 crews, for whom any warm VNAF body would do. The rule was lightly enforced, sometimes with tongue in cheek. On one occasion, four Farm Gate pilots in two T-28s helped break up a Viet Cong night attack. The pilots were commended for their initiative and reprimanded for flying combat with no VNAF crewmen aboard.

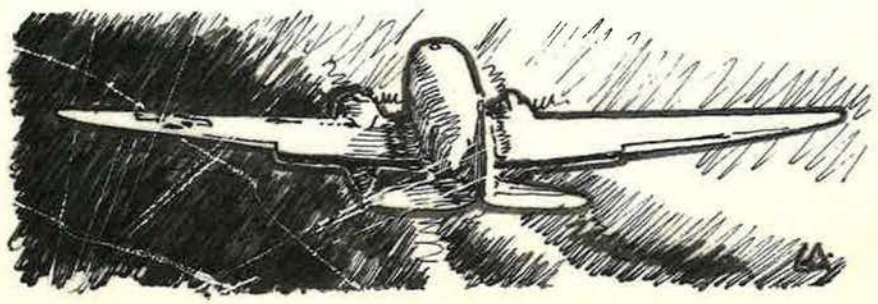
This story is about the Farm Gate SC-47s, of which there were never more than seven. The SC-47 was a beefed-up version of the reliable "Gooney Bird." Like all C-47 variants, it was heavy on the controls, slow to respond, and tough to land in a crosswind—a bird that wasn't designed for short-field operations. Nevertheless, the strips to which the SC-47s were dispatched were short—generally around 2,500 feet—narrow, rough, and often surrounded by tall trees. Since there were few navigation aids at that time, most flights to remote Mekong Delta and jungle strips were made under a liberal interpretation of visual flight rules. It was a tough, demanding environment with a seven-day work week, but Farm Gate men were imbued with the commando spirit.

Few Farm Gate missions could be considered routine. One on the night of July 20, 1963, definitely was not. An SC-47, *Extol Pink,* on ground alert at Bien Hoa took off before midnight on a flare mission over the Delta. Along with Capt. Warren P. Tomsett were Capts. John R. Ordemann and Donald R. Mack, TSgt. Edsol P. Inlow, and SSgts. Jack E. Morgan and Frank C. Barrett. Two hours later, the operations center at Saigon radioed Tomsett, asking if he would attempt a pickup of badly wounded ARVN soldiers at Loc Ninh, a jungle strip along the Cambodian border. Tomsett and his crew agreed to give it a try. They knew the strip, which was limited to daylight use. A pronounced hump rose in the middle of the runway, with tall trees at both ends.

Loc Ninh had no navigation aids or lights. Finding it in the jungle on a dark night would be a major achievement. The ARVN troops had soaked strips of paper in gasoline and ignited them, dimly outlining the landing area. On his first try, Captain Tomsett came in too high, but on a second attempt, full flaps, power off, he made it over the trees and, despite a crosswind, kept the SC-47 on the narrow runway. Six ARVN soldiers were hastily brought aboard with an American Special Forces medical advisor to care for them. Small-arms fire came from both sides of the strip, but the aircraft was not hit.

Takeoff with a load of fuel would have been a challenge under the best conditions. As the aircraft began to roll down the dark strip, its instrument panel lights went out. A crew member lit the panel as best he could with a pocket flashlight, while enemy fire continued to search for the darkened plane. Over the hump in the middle of the runway and down the reverse side lumbered the heavy transport. Captain Tomsett horsed back the control column. With engines screaming at full power, the plane barely cleared the trees at the end of the runway. After that, the flight to Bien Hoa was a breather they all needed.

On July 9, 1964, Air Force Chief of Staff Gen. Curtis LeMay awarded the crew of *Extol Pink* the Mackay Trophy for the most meritorious flight of 1963 by an Air Force pilot or crew. Six Farm Gate air commandos thus joined the roll of Mackay Trophy recipients that includes Hap Arnold, Eddie Rickenbacker, Jimmy Doolittle, Ira Eaker, and Chuck Yeager—distinguished company for a distinguished crew. ■



AFA State Contacts

Following each state name are the names of the communities in which AFA chapters are located. Information regarding these chapters or any of AFA's activities within the state may be obtained from the appropriate contact.

ALABAMA (Birmingham, Gadsden, Huntsville, Mobile, Montgomery): **William B. Divin,** 6404 Pinehurst Run, Mobile, AL 36608 (phone 205-433-4848, ext. 278).

ALASKA (Anchorage, Fairbanks): **Steven R. Lundgren,** P. O. Box 83658, Fairbanks, AK 99708-3658 (phone 907-459-3291).

ARIZONA (Green Valley, Phoenix, Prescott, Sedona, Sierra Vista, Sun City, Tucson): **William A. Lafferty,** 1342 W. Placita Salubre, Green Valley, AZ 85614 (phone 602-625-9449).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Hot Springs, Little Rock): **William A. Kehler,** 2800 Gray Fox Ln., Jacksonville, AR 72076-2629 (phone 501-843-3562).

CALIFORNIA (Apple Valley, Bakersfield, Camarillo, Edwards, Fairfield, Fresno, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, Sunnyvale, Vandenberg AFB, Yuba City): **Cheryl L. Waller,** 10449 Shore Crest Terr., Moreno Valley, CA 92557 (phone 909-382-3689).

COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Pueblo): **Don Dandurand,** 4450 E. Fountain Blvd., Suite 204, Colorado Springs, CO 80916 (phone 719-591-1011).

CONNECTICUT (Brookfield, East Hartford, Middletown, Storrs, Stratford, Torrington, Waterbury, Westport, Windsor Locks): **John F. McCormack,** 218 Tryon St., Middletown, CT 06457 (phone 203-344-5113).

DELAWARE (Dover, New Castle County, Rehoboth Beach): **Robert M. Berglund,** 128 W. Loockerman St., Dover, DE 19901 (phone 302-674-0200).

DISTRICT OF COLUMBIA (Washington): **Grant Miller,** 1501 Lee Highway, Arlington, VA 22209-1198 (phone 703-247-5820).

FLORIDA (Avon Park, Broward County, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Hurlburt Field, Jacksonville, Leesburg, Miami, New Port Richey, Ocala, Orlando, Palm Harbor, Panama City, Patrick AFB, Port Charlotte, Saint Augustine, Sarasota, Spring Hill, Tallahassee, Tampa, Titusville, Vero Beach, West Palm Beach, Winter Haven): **Bernard R. Hanlon,** 1179 Talbot St., Port Charlotte, FL 33952-2872 (phone 813-624-0234).

GEORGIA (Athens, Atlanta, Columbus, Dobbins AFB, Rome, Saint Simons Island, Savannah, Valdosta, Warner Robins): **Donald N. Edmands, Jr.,** 126 Baybridge Dr., Brunswick, GA 31525-1817 (phone 912-264-6224, ext. 100).

GUAM (Agana): **William Dippel,** P. O. Box 12861, Tamuning, GU 96931 (phone 671-646-4445).

HAWAII (Honolulu, Maui): **John A. Parrish, Jr.,** 98-1349 Kulawai St., Aiea, HI 96701 (phone 808-836-2966).

IDAHO (Boise, Mountain Home, Twin Falls): **Ralph D. Townsend,** P. O. Box 45, Boise, ID 83707-0045 (phone 208-389-5226).

ILLINOIS (Belleville, Champaign, Chicago, Elmhurst, Moline, Peoria, Rockford, Springfield-Decatur): **Richard W. Asbury,** 502 Slavens Manor, Bettendorf, IA 52722-4114 (phone 319-355-8409).

INDIANA (Bloomington, Evansville, Fort Wayne, Grissom AFB, Indianapolis, Lafayette, Marion, Mentone, New Albany, South Bend, Terre Haute): **Don McKellar,** 2324 Pinehurst, Kokomo, IN 46902 (phone 317-455-0933).

IOWA (Des Moines, Marion, Sioux City, Waterloo): **Carl B. Zimmerman,** 208 Waterloo Bldg., Waterloo, IA 50701-5495 (phone 319-234-0339).

KANSAS (Garden City, Topeka, Wichita): **E. D. Brown,** 4209 Westport, Wichita, KS 67217 (phone 316-523-5317).

KENTUCKY (Lexington, Louisville, Paducah): **Vaiden Q. Cox,** 3249 Cross Bill Rd., Louisville, KY 40213-1284 (phone 502-636-2316).

LOUISIANA (Alexandria, Baton Rouge, New Orleans, Shreveport): **Ivan L. McKinney,** 331 Greenacres Blvd., Bossier City, LA 71111 (phone 318-425-8877).

MAINE (Bangor, Loring AFB, North Berwick): **Philip B. Turner,** P. O. Box 202, Caribou, ME 04736 (phone 207-496-6461).

MARYLAND (Andrews AFB, Baltimore, College Park, Rockville): **Robert B. Roit,** P. O. Box 263, Poolesville, MD 20837-0263 (phone 301-349-2262).

MASSACHUSETTS (Bedford, Boston, East Longmeadow, Falmouth, Hanscom AFB, Taunton, Westfield, Worcester): **Carol A. Chrest,** 134 Ember Ln., Carlisle, MA 01741 (phone 617-275-6100).

MICHIGAN (Alpena, Battle Creek, Detroit, East Lansing, Kalamazoo, Marquette, Mount Clemens, Oscoda, Traverse City, Southfield): **George E. Copher,** 1015 S. County Rd. 557, Gwinn, MI 49841 (phone 906-346-2400).

MINNESOTA (Duluth, Minneapolis–Saint Paul): **Vic Seavers,** 8259 131st St. W., Apple Valley, MN 55124 (phone 612-726-6558).

MISSISSIPPI (Biloxi, Columbus, Jackson): **Leonard R. Vernamonti,** 718 Country Place Dr., Pearl, MS 39208 (phone 601-960-3600).

MISSOURI (Richards-Gebaur AFB, Saint Louis, Springfield, Whiteman AFB): **John J. Politi,** 2308 Jason Ct., Jefferson City, MO 65109-5825.

MONTANA (Bozeman, Great Falls): **Charles F. Curtis,** 119 W. College, Bozeman, MT 59715 (phone 406-586-0291).

NEBRASKA (Lincoln, Omaha): **C. Howard Vest,** 301 S. 70th St., Suite 140, Lincoln, NE 68510-2452 (phone 402-489-9255).

NEVADA (Las Vegas, Reno): **P. K. Robinson,** 3440 Moberly Ave., Las Vegas, NV 89118 (phone 702-385-8600).

NEW HAMPSHIRE (Manchester, Pease AFB): **Baldwin M. Domingo,** 5 Birch Dr., Dover, NH 03820 (phone 603-742-0422).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, Forked River, Fort Monmouth, Gladstone, Jersey City, McGuire AFB, Newark, Old Bridge, Trenton, Wallington, West Orange): **Joseph M. Capriglione,** 179 Newbrook Ln., Springfield, NJ 07081-3022 (phone 201-344-6753).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): **Charles Vesely,** 808 Piedra Vista N. E., Albuquerque, NM 87123-1954 (phone 505-881-3552).

NEW YORK (Albany, Bethpage, Binghamton, Brooklyn, Buffalo, Chautauqua, Griffiss AFB, Nassau County, New York City, Plattsburgh, Queens, Rochester, Staten Island, Suffolk County, Syracuse, Westhampton Beach, White Plains): **Allen G. Harris,** 202 Riverside Dr., 6C, New York, NY 10025-7298 (phone 212-222-0446).

NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Greenville, Havelock, Kitty Hawk, Littleton, Raleigh, Wilmington): **William W. Michael,** P. O. Box 36, Fayetteville, NC 28302-0036 (phone 919-323-4400).

NORTH DAKOTA (Fargo, Grand Forks, Minot): **John O. Syverson,** 6450 N. 13th St., Fargo, ND 58102-6011 (phone 701-232-2897).

OHIO (Cleveland, Columbus, Dayton, Mansfield, Newark, Youngstown): **William J. Schaff,** 429 Oakmead Pl., Dayton, OH 45419 (phone 513-429-0100).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **Larry M. Williams,** 11819 S. Douglas Ave., Oklahoma City, OK 73170-5635 (phone 405-736-5512 or 736-4317).

OREGON (Eugene, Klamath Falls, Portland): **Robert S. Furrer,** 19 S. W. Greenridge Ct., Lake Oswego, OR 97035-1428 (phone 503-697-7585).

PENNSYLVANIA (Allentown, Altoona, Beaver Falls, Bensalem, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Johnstown, Lewistown, Philadelphia, Pittsburgh, Scranton, Shiremanstown, State College, Washington, Willow Grove, York): **Robert C. Rutledge,** 129 Arlington St., Johnstown, PA 15905 (phone 412-235-2711).

PUERTO RICO (San Juan): **Vincent Aponte,** P. O. Box 8204, Santurce, PR 00910 (phone 809-764-8900).

RHODE ISLAND (Warwick): **John A. Powell,** 700 Saint Paul's St., North Smithfield, RI 02895 (phone 401-766-3797).

SOUTH CAROLINA (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **David V. Massey,** 101 Kerryton Rd., Columbia, SC 29223 (phone 803-695-6202).

SOUTH DAKOTA (Rapid City, Sioux Falls): **Robert J. Johnson,** 2400 Southeastern Dr., Sioux Falls, SD 57103 (phone 605-338-4532).

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tullahoma): **Jack K. Westbrook,** P. O. Box 1801, Knoxville, TN 37901-1801 (phone 615-523-6000).

TEXAS (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **Larry L. Miller,** 8322 Van Pelt Dr., Dallas, TX 75228-5950 (phone 214-653-3537).

UTAH (Bountiful, Clearfield, Ogden, Salt Lake City): **Richard E. Schankel,** 370 S. 500 E., #120, Clearfield, UT 84015-4046 (phone 801-776-2101).

VERMONT (Burlington): **William C. Austin,** 10 Southwind Dr., Burlington, VT 05401 (phone 802-863-5909).

VIRGINIA (Alexandria, Charlottesville, Danville, Harrisonburg, Langley AFB, Lynchburg, McLean, Norfolk, Petersburg, Richmond, Roanoke, Winchester): **James E. Cvik,** 1919 Commerce Dr., Suite 445, Hampton, VA 23666-4269 (phone 804-838-2424).

WASHINGTON (Seattle, Spokane, Tacoma): **Philip Giambri,** 131 S. W. 194th St., Seattle, WA 98166-4040 (phone 206-773-1838).

WISCONSIN (Madison, Milwaukee, Mitchell Field): **Gilbert M. Kwiatkowski,** 8260 W. Sheridan Ave., Milwaukee, WI 53218-3548 (phone 414-463-1849).

WYOMING (Cheyenne): **Robert S. Rowland,** 9001 Red Fox Rd., Cheyenne, WY 82009 (phone 307-632-8746).

AFA/AEF Report

By Doug Stucki, Editorial Associate

Massachusetts Convention

Gen. Ronald W. Yates, commander of Air Force Materiel Command, was guest speaker at the annual Massachusetts State Convention and Awards Banquet, held this year at the John F. Kennedy Library in Boston, where displays include a detailed model of the White House and memorabilia from the Kennedy Administration. Music was provided by an ensemble from the Air Force Band of Liberty from nearby Hanscom AFB.

The awards banquet was hosted by State President Carol Chrest and Vice President Capt. John B. Steele. General Yates assisted in the presentations. The Man of the Year was Michael L. Salis, president of the **Paul Revere Chapter,** which was named Chapter of the Year.

Among the attendees were Rep. Peter G. Torkildsen (R-Mass.), Lt. Gen. Gordon E. Fornell, commander of Hanscom AFB's Electronic Systems Center, and AFA National Director R. L. Devoucoux. Chapter Vice President (Communications) David R. Cummock termed the convention "a class act" held at "a truly spectacular facility."

Chapter News

The **Tacoma (Wash.) Chapter,** in conjunction with the 62d Airlift Wing at nearby McChord AFB and the Clover Park School District, has initiated an aviation science program for local high school students. The program, which uses personnel and resources from the 62d AW, consists of classroom work, visits to the Seattle Museum of Flight and the McChord Air Museum, and hands-on field work at McChord in maintenance, operations, weather, air traffic control, flight safety, and other aviation career fields. Active-duty Air Force personnel teach in both the classroom and the field. The Tacoma Chapter contributes the funds for materials not provided by the school district.

The **Joe Walker–Mon Valley (Pa.) Chapter** recently sent local high school senior B. McCrae Rawlins on an all-expense-paid trip to the Space Academy in Huntsville, Ala. On his return, Mr. Rawlins was honored at a dinner hosted by Monessen Mayor Robert Leone, where he gave a briefing and slide presentation on his trip. The dinner's keynote speaker, Westmoreland County Commission Chairman Richard Vidmer, compared the US educational system with its foreign counterparts. He noted that US colleges are superior but that US secondary schools need to improve to remain competitive. Chapter President Jim Cain and National Director Robert Carr also attended the dinner.

Pennsylvania high school senior B. McCrae Rawlins was recently awarded an all-expense-paid trip to the Space Academy in Huntsville, Ala., by the Joe Walker–Mon Valley Chapter. From left are Chapter President Jim Cain, Mr. Rawlins, Monessen, Pa., Mayor Robert Leone, and AFA National Director Robert Carr.

Ohio University AFROTC cadet Christopher Bazeley, Jr., recently enjoyed a good month. First, he received the AFA Award at the annual Ohio University AFROTC Awards Day, held at the campus. Later, at an Armed Forces banquet in Columbus, he was presented with a plaque by **Capt. Eddie Rickenbacker Memorial Chapter** President Henry R. Harlow.

The **Pope (N. C.) Chapter** honored AFJROTC cadets at Pinecrest High School in Southern Pines. At the school's annual awards dinner, Chapter Vice President (Communications) Robert Grover presented the AFA Award to cadet Courtland Morrison and an AFA scholarship to cadet Jason Davis.

AFROTC cadets were also honored at the annual Military Ball at the University of Cincinnati. **Wright Memorial (Ohio) Chapter** (and State) Treasurer Chuck Spencer presented the AFA Award to cadet Thomas Miller. Cincinnati Mayor Dwight Tillery was the guest speaker. Also participating in the awards ceremony were The Reserve Officers Association, VFW, and American Legion.

At his first business meeting as president of the **Dale O. Smith (Nev.) Chapter** (newly christened the "Screaming Eagles"), Don Schwartz honored longtime chapter officers Ed McCormick and Vic Hollandsworth with Exceptional Service Awards. The meeting was attended by National Vice

Eagle (Pa.) Chapter President Edmund J. Gagliardi and membership chairman Robert Barbush stand in front of the sound equipment truck for a musical program presented by the chapter. The concert, which was attended by more than 1,200 people, featured local community and USAF musical groups.

President (Far West Region) H. A. Strack, State President Pete Peterson, and former State President Clarence Becker, as well as representatives of the Air National Guard.

Freedoms Foundation Taps McCoy

AFA National President James M. McCoy served on the Freedoms Foundation jury to select this year's National Awards recipients. The National Awards program honors exceptional efforts of individuals, organizations, corporations, and schools to promote an understanding of responsible citizenship. Entries are judged in eight categories: economic education, educators, military, individual achievement, programs and activities, public communications, schools, and youth. Award recipients receive the George Washington Honor Medal, the Valley Forge Teacher's Medal, or a US savings bond and a certificate. ■

Col. Gregory Maciolek (right) receives AFA's citation from Tennessee State President Jack K. Westbrook at the Air National Guard Professional Military Education Center's twenty-fifth anniversary celebration at McGhee Tyson Airport, Knoxville.

Dorothy L. Welker (1926–1993)

Dorothy L. Welker died of cancer in June on Long Island, N.Y. Ms. Welker had been Iron Gate (N.Y.) Chapter Secretary for close to twenty-five years. For the past fifteen years, she was coordinator of the chapter's annual Air Force Salute, which has raised more than $2 million for AEF and USAF-related charities over the years.

A graduate of Long Island University, Ms. Welker became involved in aviation in the early 1950s with Trans World Airlines in Washington, D. C. In 1956, she joined the Civil Air Patrol, eventually attaining the rank of CAP lieutenant colonel. Working in public relations at the group, wing, and regional levels, she rounded out her CAP career as public affairs advisor to CAP's National Commander.

Throughout her forty-year career in public relations and real estate, Ms. Welker was active in fund-raising and social work for charities, hospitals, and homes for the aged. She will be best remembered by USAFand AFA leaders for ensuring the continued success of the Air Force Salute, a fund-raising, formal dinner-dance held each spring in New York City.

Ms. Welker received many awards, among them several from CAP and AFA for exceptional service. In 1988 she was presented with the Iron Gate Chapter's first Goldwater Fellowship for her many years of dedicated service to the chapter and its mission of educating the public on aerospace issues. In 1990, the Air Force honored her with its highest award presented to a civilian, the Exceptional Service Award.

Ms. Welker was active in many other organizations, including the Air Force Academy's Falcon Foundation, the National Aeronautic Association, and the National Aviation Hall of Fame. Prior to her death, she was notified that the Iron Gate Chapter would establish a Falcon Foundation Scholarship in her name.

Ms. Welker is survived by two sons, two daughters, and several grandchildren.

Unit Reunions

Class 42-D
Members of Class 42-D who served at Jackson, Greenville, or Columbus Fields, Miss., will hold a reunion November 5–7, 1993, at Columbus AFB. **Contact:** J. Kemp McLaughlin, Sr., 49 Abney Cir., Charleston, WV 25314.

314th Fighter Squadron
Veterans of the 314th Fighter Squadron "Warhawks" will hold a reunion October 15–19, 1993, at Luke AFB, Ariz. **Contact:** 1st Lt. Patricia L. York, Reunion Coordinator, 14350 W. Spad St., Suite 2, Luke AFB, AZ 85309-1835. Phone: (602) 856-5714.

339th Fighter Squadron Ass'n
Veterans of the 339th Fighter Squadron who served between 1947 and 1953 will hold a reunion October 25–29, 1993, at the Sands Hotel in Las Vegas, Nev. **Contact:** Richard Cowles, 745 Harrison St., Belding, MI 48809. Phone: (616) 794-2083.

648th AC&W Radar Squadron
Members of the 648th Aircraft Control and Warning Radar Squadron will hold a reunion October 22–24, 1993, at the Best Western-Genetti Hotel and Convention Center in Wilkes-Barre, Pa. **Contact:** Bernard Wall, 528 Ridgewood Dr., Northfield, NJ 08225. Phone: (609) 646-1079.

USAF Communications Security Squadrons
Seeking contact with veterans of USAF Communications Security Squadrons who served between 1952 and 1957 for a reunion in 1994. I am especially interested in the 36th CSS (Brooks AFB, Tex., in flight or detachment duties) and 32d CSS (Nagoya, Japan, Okinawa, the Philippines, and Korea). **Contact:** Richard J. White, 5301 Northwood Lake Dr. W., Northport, AL 35476. Phone: (205) 339-2519.

11th Night Photorecon Squadron
For the purpose of organizing a reunion, I am seeking contact with veterans of the 11th Night Photoreconnaissance Squadron, 67th Night Photo Wing, who served between 1946 and 1949 at March Field, Calif. **Contact:** Robert R. Allen, 1104 Wild Plum Dr., St. Charles, MO 63303. Phone: (314) 447-6637.

Class 44-A
Seeking contact with members of Class 44-A for the purpose of planning a reunion. **Contact:** Eugene R. McCutchan, 16220 N. 7th St., Apt. 2034-61, Phoenix, AZ 85022. Phone: (602) 548-9722. ■

Readers wishing to submit reunion notices to "Unit Reunions" should mail their 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.

Bulletin Board

Seeking information on the **Long Island Aviation Club Airport** in Hicksville, N. Y. Interested in personal recollections, photographs, and memorabilia. **Contact:** Lynne Matarrese, Levittown Historical Society, P. O. Box 57, Levittown, NY 11756.

Historian seeks contact with pilots or crewmen who served on **F-86 Sabre** or **FJ Fury** aerobatic demonstration teams in the 1950s or 1960s. **Contact:** Michael A. Fox, 18321 Empire, Eastpointe, MI 48021.

Seeking information about the **B-32** (or XB- or YB-32), an oversized B-24 proposed near the end of World War II. **Contact:** Clarence J. Wyant, 3229 Beechwood Dr., Del City, OK 73115.

Seeking contact with the following B-17 crew members with the 412th Bomb Squadron, 95th Bomb Group, 8th Air Force: **TSgts. John B. Murphy, Jr., Walter H. Rees,** and **David Roth** and **Lt. Richard Serowski.** They were stationed at Horsham, England, in 1944–45. **Contact:** Roy E. Squyres, 4117 Twilight Dr. S., Fort Worth, TX 76116.

Author seeks photo of a **monument to Bob Mooney,** who was shot down over Chan Yun, China, in December 1942. The town erected the monument, which has since been destroyed. **Contact:** Charles Goodman, Castle Books, P. O. Box 17262, Memphis, TN 38187.

Seeking contact with veterans of the **5th Troop Carrier Squadron,** 10th Troop Carrier Group, who served from 1941 to 1945. **Contact:** O. C. Wilkins, 2329 Maben Ave., Palm Harbor, FL 34683.

Seeking the whereabouts of **Robert Burge,** of New York, N. Y., now seventy-five, who worked with Constance Bingham at RAF Medmenham, England, in 1943. **Contact:** Bridget Reed, Baytree Cottage, Budock Water, Falmouth, Cornwall TR11 5DT, England.

Seeking information on the combat career of **Col. Donald J. M. Blakeslee. Contact:** John S. McConnell, 106 Woodcrest Dr., San Antonio, TX 78209.

Author seeks high-quality color slides of the **A-7 Corsair II.** Examples of all versions are needed; air-to-air images preferred. **Contact:** David F. Brown, R. D. 4, Box 4609G, Spring Grove, PA 17362.

Seeking the whereabouts of **Col. (or Capt.) Claude A. Daigle, Albert Marquez, SSgt. Milford R. Moore,** and **Lt. Col. R. E. Wilson.** They were stationed at Clinton-Sherman AFB, Okla., in the 1960s. **Contact:** Kathy Burchard, 905 N. Bailey, Fort Worth, TX 76107-1011.

Seeking the whereabouts of **MSgt. Larry Ames,** who was stationed near Bedford, England, from 1943 to 1945. His last known address was Pittsburgh, Pa. **Contact:** Anthony J. Kettle, 17 Eilam Rd., Kimberworth Park, Rotherham, S. Yorkshire S61 3PG, England.

Writer seeks photos and "There I Was" stories about the **Douglas RB-26s** modified for electronic reconnaissance, radar busting, and jamming during the Korean War. **Contact:** August R. Seefluth, 1080 Dorchester Rd., Troy, OH 45373.

Seeking information about **Gary Brouse** and **Donald Solt,** who served in photomapping units at Palm Beach AFB, Fla., and Turner AFB, Ga., and were field training instructors in Air Training Command. **Contact:** Billy J. Woodfin, 12554-A E. Pacific Cir., Aurora, CO 80014.

Seeking contact with US servicemen or former SAC personnel who studied **Jodo karate** overseas during the 1940s and 1950s. **Contact:** David Palumbo, 144 Mishnock Rd., W. Greenwich, RI 02817.

Writer seeks personal accounts of World War II raids on the Japanese airfield at **Ballalae, Solomon Islands,** in 1943–44. Also seeking information about reunions of participants in the Ballalae raids or **Operation Cartwheel. Contact:** David Gaddis, P. O. Box 5621, Bellevue, WA 98006.

Seeking the whereabouts of **David Rice,** of the 10th Tactical Reconnaissance Wing, RAF Alconbury, UK, 1969–72. **Contact:** Emma Haradine, 57 Northfield Hs., Peckham Park Rd., London SE15 6TN, England.

Seeking contact with **Bernard G. McIntyre,** radio operator on the B-17 *Larrupin' Lou* of the 367th Bomb Squadron, 306th Bomb Group, 8th Air Force, based at Thurleigh, England. **Contact:** Fred Mitchell, 54 Loire, Carson City, NV 89701.

Seeking contact with **Frank E. Watson, Jr.,** of Decatur, Ga., and **Edward C. Zuniga,** of Los Angeles, Calif. Both were members of Crew 4 of *Lady Leone,* 864th Bomb Squadron, 494th Bomb Group, 7th Air Force. **Contact:** Richard O. Hartwig, Rte. 3, Box 138, Anamosa, IA 52205-9427.

Seeking contact with veterans of the **494th Bomb Group** and support units who served in 1944–45 on Angaur, Palau, or Okinawa. **Contact:** Ralph W. Moore, P. O. Box 366, Oak Grove, LA 71263.

Collector wishes to copy cassettes of **Armed Forces Radio** programs recorded during the Vietnam War. Unedited tapes with music and news

are preferred. **Contact:** Sgt. Chris Andrews, 1305 River Rd., Des Plaines, IL 60018.

Seeking contact with graduates of **Class 57-D,** Freising, West Germany. Also seeking information on or a photo of the **NB-36. Contact:** MSgt. Thomas W. Young, Sr., USAF (Ret.), 830 W. Amsden St., Denison, TX 75020-7929.

Seeking information on **William P. McCloud,** a pilot killed in action in Europe in 1944. He was previously stationed at Portland AFB, Ore., and may have served in the RCAF before that. **Contact:** Frances E. Hillesland, 4220 S. E. Crystal Springs Blvd., Portland, OR 97206-0936.

Seeking contact with **CMSgt. Clifton R. Heath,** formerly with the 354th Tactical Fighter Wing, Myrtle Beach AFB, S. C. **Contact:** David K. Ribbe, 57 Whispering Hills Pl., Chester, NY 10918.

Seeking information about the **35th Tactical Fighter Wing** stationed in Vietnam in 1967–68. Particularly interested in evidence that **Australian ground personnel** with No. 2 Squadron (Canberra Bombers), stationed at Phan Rang, flew aboard C-123s of the 35th TFW or served as observers with their forward air controllers. Also interested in photos of aircraft or patches from that wing. **Contact:** Col Gardner, P. O. Box 110, Thuringowa Central, Queensland, Australia 4817.

Author seeks photos of and information on the **O-2 Super Skymaster,** both A and B models. Particularly interested in photos from the Vietnam era and photos of aircraft flown by services other than USAF, including foreign services. **Contact:** Ray Hain, 1206 Dodd Dr. S. W., Decatur, AL 35601.

Seeking contact with **John Perkins** and **John Farmer,** who were stationed at RAF Fairford or RAF Molesworth, UK, in 1952–53. **Contact:** J. Smith, 21 Mude Gardens, Christchurch, Dorset BH23 4AR, UK.

Seeking the whereabouts of **MSgt. George Grooms,** who was assigned to a supply squadron at Williams AFB, Ariz. His last known assignment was the USAF Hospital Squadron, Shaw AFB, S. C. His wife's name was Winnie. **Contact:** MSgt. Paul D. Costello, USAF (Ret.), 109 N. Sulleys Dr., Mesa, AZ 85205-8508.

Historian seeks information on the **704th Fighter-Bomber Squadron** from its inception to the present. **Contact:** Andy Meyer, 8516 Racine Trail, Austin, TX 78717-5305.

Seeking information on **Edward W. Strzalkowski,** a P-51 pilot in training at Perry AAF, Fla., in 1945. He was in Class 44-K at Foster Field, Tex. His home address at that time was Hillside, N. J. **Contact:** Theodore J. Turek, 128 Fiesta Heights, Meriden, CT 06451-2785.

Seeking contact with members of the **3d Attack Group** ("Grim Reapers") who were stationed in New Guinea in 1943. Would particularly like photos of the A-20 *Steak & Eggs* and the B-25 *Fat Cat* to copy and return. **Contact:** Paul W. Sernak, 700 Delaware St., Mayfield, PA 18433.

Collector seeks **patches** from the 15th and 18th Tactical Fighter Wings, 51st Fighter-Interceptor Wing, and the 15th, 18th, and 51st FMSs. **Contact:** John I. Geiman, 1173 S. Main St., #401, Clyde, OH 43410.

Collector seeks **scarves** from the 42d ECS, 20th FW, 495th TFS, and 77th, 492d, and 494th FSs. Also seeking subdued FB-111A squadron patches and F-111C/G patches from the RAAF's No. 82 Strike Wing. **Contact:** Curtis J. Lenz, 32 June St., Nashua, NH 03060-5345.

Collector seeks **B-52 squadron and wing patches.** Most interested in units closed before the mid-1970s. Also seeking patches from B-52-related weapons, systems, and events. **Contact:** Capt. Jon Drieling, AFRES, 437 Highland Ave., Zelienople, PA 16063.

Historian seeks photos of aircraft from squadrons of **6th Air Force** and the **Antilles Air Command** (World War II). All photos will be returned. **Contact:** Dan Hagedorn, P. O. Box 682, Centreville, VA 22020-0682.

Writer seeks **Vietnam War stories** for an anthology. **Contact:** David E. Martin, P. O. Box 9099, Tamuning, GU 96931.

Seeking the whereabouts of **Maj. Arthur E. Geriaux (or Geraux),** commander of the Numazu Sea Survival School, Yokota AB, Japan, in 1969. **Contact:** Charles R. Porchia, 21545 Delta Dr., Reno, NV 89511.

Historian seeks information on the **combat cargo (or ATC) squadron** that flew out of **Imphal, India,** in late 1944. Also seeking information on the US engineers who built the **runways on Rameree Island** near Burma in 1945. **Contact:** Norm Collard, P. O. Box 902, Elfers, FL 34680.

Collector seeks blue or green nylon **flight jackets** from the 1940s or 1950s. **Contact:** J. McGuire, 536½ Altair Pl., Venice, CA 90291.

Historian seeks contact with **aerial gunners** from any service, any war, who flew on any type of aircraft. **Contact:** William F. Kirwan, 15500 Bubbling Wells, #80, Desert Hot Springs, CA 92240.

Seeking contact with **Donald F. Blaicher,** a pilot trainee in Class 44-F, San Antonio, Tex. **Contact:** Rudolph Perez, 25906 Matel Rd., Valencia, CA 91355.

Seeking contact with **Christopher Braggs, Leonard (or Kenneth) Mostella,** and **Douglass O. Wells.** Braggs was stationed at McGuire AFB, N. J., in 1975; Mostella at Kadena AB, Japan, in 1969; and Wells at Whiteman AFB, Mo., in 1981. **Contact:** MSgt. Edward Alexander, USAF (Ret.), 4624-3 Ashdale Ct., Sacramento, CA 95841.

Seeking the whereabouts of **Roscoe Robert Simmons,** who served with the 20th Fighter-Bomber Wing, RAF Wethersfield, UK, in 1953. **Contact:** W. Allington, The Police House, Colchester Rd., Ardleigh, Essex CO7 7NS, UK.

Author seeks information on or photos of the **single-tail B-24N.** Also seeking contact with anyone who flew or worked on **XB-** or **YB-24N Liberators,** as well as photos or tech orders of those aircraft. All material will be copied and returned. **Contact:** Frederick A. Johnsen, P. O. Box 901000, Palmdale, CA 93590.

Seeking information on **USAF southeast Asia veterans organizations,** especially any that include the **432d Tactical Reconnaissance Wing,** Udorn RTAFB, Thailand. **Contact:** James J. Reardon, P. O. Box 444, Holyoke, MA 01041-0444.

Collector seeks **patches** from the 79th Air Refueling Squadron, the 79th KC-10A, and the 336th KC-135E, as well as the patch with a KC-10 wearing sunglasses and saying, "Cowabunga, Dude." **Contact:** Steve Preston, 1806 S. W. 3d St., Lee's Summit, MO 64081.

Seeking the whereabouts of **Carl Turner Weaver, Jr.,** from Jackson, Tenn., who was a P-38 pilot in the South Pacific during World War II. **Contact:** M. K. Russom, 233 Lunie Dr. S. W., Mableton, GA 30059.

Seeking the whereabouts of **SSgt. Jack Ryder,** who was stationed at Hickam AFB, Hawaii, in 1956–57. He may have been stationed in Japan in 1955–56. **Contact:** Rosemary Gick–Von Ohlen, 25-11 College Point Blvd., Flushing, NY 11354-1034.

Seeking the whereabouts of **James Andrew "Drew" Coleman,** who was stationed at Offutt AFB, Neb., and whose last known address was Fort Walton Beach, Fla. His rank at retirement may have been colonel. His wife's name is Geri, their daughters are Beth, Karen, and Drew, and he would be in his late fifties. **Contact:** Diane M. Carver, 1005 S. 21st St., Terre Haute, IN 47803.

Collector seeks **patches** from squadrons that flew the **F-106 Delta Dart** in William Tell weapons loading competitions during 1970–80. Also seeking color or subdued patches from the ANG. **Contact:** Christian Sabon, 23815 Manila, Clinton Twp., MI 48035.

Author seeks information on a **bombing raid** or reconnaissance mission by three B-17s over **Davao City, the Philippines,** in 1942 or 1943. The center plane was shot down, but some crew members ejected. **Contact:** Lt. Col. James S. Oliver, USAF (Ret.), 4371 S. Billings Cir., Aurora, CO 80015.

Seeking uniforms of USAAF **8th, 9th,** or **12th Air Forces. Contact:** Edward Heacook, 1710 Pheasant Hollow Dr., Plainsboro, NJ 08536.

If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Letters should be brief and typewritten; we reserve the right to condense them as necessary. We cannot acknowledge receipt of letters. Unsigned letters, items or services for sale or otherwise intended to bring in money, and photographs will not be used or returned.—THE EDITORS

Seeking pictures of **SSgt. John Fead** of the 94th Air Services Squadron, Foggia, Italy, during 1943–45. Also interested in the history of the 94th. **Contact:** William R. Fead, 7445 Idledale Ln., Omaha, NE 68112-2805.

Seeking contact with **SSgts. Donald J. Frank** and **Edwin W. Guest,** with the 719th Bomb Squadron, 449th Bomb Group, in 1944. **Contact:** William C. Apgar, 3608 Embudito N. E., Albuquerque, NM 87111.

Seeking identities of the pilots who witnessed **Charles Lindbergh** attacking Japanese planes during World War II. **Contact:** Roger D. Ayers, 9112 Jefferson St., Jessup, MD 20794.

Seeking information on **1st Lt. Clarence J. Rieman,** P-38 pilot with the 433d Fighter Squadron, 475th Fighter Group, 5th Air Force. He flew out of Port Moresby, New Guinea, and the Philippines in 1943–44. He was from New Jersey and moved to Texas after the war. **Contact:** Richard J. Ryan, Grand View, Apt. 330, Westernport, MD 21562.

Seeking photos of **F-86D #52-3864.** Also seeking information on the following units it was assigned to: 62d Fighter-Interceptor Squadron (1954), 85th FIS (1955–56), 4750th Air Defense Wing (1956), 173d FIS (1957), and 1001st Air Base Wing (1959). **Contact:** Kurt C. Gibson, 6494 Duquesne Pl., Virginia Beach, VA 23464.

Seeking **squadron patches, wings,** and **medals** from veterans from World War I through Desert Storm. Especially interested in the service histories of their owners. Also seeking information on the design and manufacture of **unauthorized insignia** overseas for US personnel. **Contact:** Daniel J. Miller, 1055 W. Northwood Dr., Caro, MI 48723.

Seeking contact with members of the **16th Bomb Squadron,** 16th Bomb Group, who have information on the B-29 *Reddy Teddy,* which was downed in Japan in July 1945. **Contact:** Lt. Col. Silver C. Crim, USAF (Ret.), 1603 Poets Corner, San Antonio, TX 78232.

Seeking information on **John Crabtree,** who was stationed with the US Army in Gloucester, England, in 1940–46, where he knew Ruth Watkins. **Contact:** E. J. Smith, 62 Alfred St., Gloucester GL1 4DD, UK.

Seeking contact with **Emelio A. "Mel" Ragucci,** from Boston, Mass., who was stationed with the Ohio ANG at Toledo Express Airport in 1961–62. Also seeking patches, pictures, or other information on the **112th Tactical Fighter Squadron** during this period. **Contact:** J. R. Detrick, 6916 Winchester Pl., Fort Worth, TX 76133.

Seeking **patches** from the 420th Air Refueling Squadron. **Contact:** Col. Ray Hunter, USAF (Ret.), 1601 Dicken Dr., Ann Arbor, MI 48103.

Seeking information on **TSgt. John "Jack" Renz,** from the Bronx, N. Y., who served on a B-17 crew in Italy with 15th Air Force. He reportedly was killed in Czechoslovakia in August 1944. **Contact:** Robert J. Flood, 4380 Vireo Ave., Apt. 40, Bronx, NY 10470.

Seeking patches from **Explosive Ordnance Disposal** squadrons and detachments, past and present. **Contact:** Phil Philcox, 131 N. Bay Dr., Lynn Haven, FL 32444.

Seeking information on the **B-24 *Black Magic*** of the 757th Bomb Squadron, 459th Bomb Group, 15th Air Force, based at Giulia, Italy. Its last mission was on June 25, 1944, to Avignon, France. The crew included pilot **1st Lt. Stacy** and radio operator **TSgt. Paul M. Beardslee. Contact:** Richard N. Beardslee, 1118 Creekdale Dr., Clarkston, GA 30021.

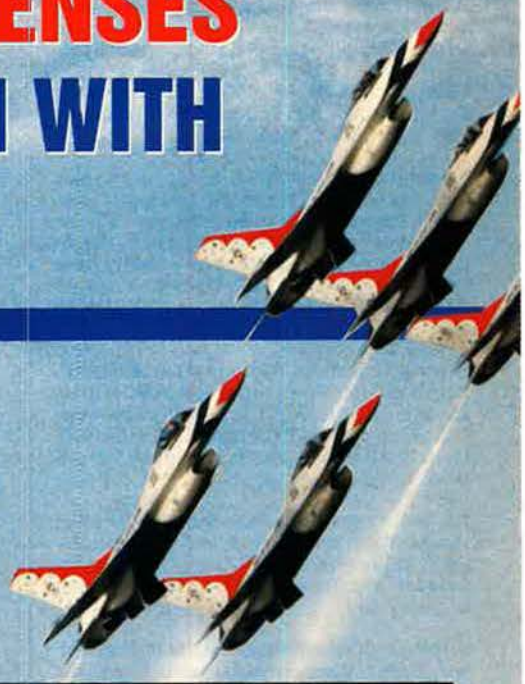
Collector seeks **patches** from any units or commands. **Contact:** David Guihot, P. O. Box 149, Woomera, S. A., Australia 5720.

Seeking contact with F-106A personnel of the **5th Fighter-Interceptor Squadron,** Minot AFB, N. D. Particularly interested in those associated with F-106 #59-0003 to save the aircraft for a museum. **Contact:** C. T. Carey, Aeolus Aerospace, 5705 Rosedale Way, Sacramento, CA 95822.

Seeking **US military decorations** from all services for public display. **Contact:** TSgt. Daniel M. DiCristi, USAF, 480th Air Intelligence Group, 34 Elm St., Langley AFB, VA 23665-2092.

Collector seeks **Strategic Air Command** memorabilia, 1946–92, especially patches from Strategic Reconnaissance, Bomber, and Air Refueling units. Photos, documents, plaques, and books would also be appreciated. **Contact:** Charles R. Orr, 11404 Turnmill Ln., Reston, VA 22091. ■

DON'T LET MEDICAL EXPENSES SOAR... GET PROTECTION WITH AFA's CHAMPLUS®



A CHAMPUS Supplement Which Helps Limit Your Unreimbursed Medical Expenses.

CHAMPUS is a federally-funded health benefits program designed to help service families pay for medical care in civilian medical facilities, including doctors' charges. However, with CHAMPUS there is a gap between the percentage of medical expenses which are reimbursed and the amount you have to pay out-of-pocket. That's why you need CHAMPLUS®. As a member of the Air Force Association, you are eligible to purchase one of the best CHAMPUS Supplements available, with competitively low rates.

FEATURES THE NEW EXPENSE PROTECTOR BENEFIT

This benefit limits out-of-pocket expenses (expenses beyond CHAMPUS-allowable charges) for covered services in any single calendar year to $1,000 for any one insured person (or $2,000 for all insured family members combined). Once those out-of-pocket expense maximums are reached, CHAMPLUS® will pay 100% of excess reasonable and customary charges for the remainder of that year.

An example of how the Benefit works:

You are hospitalized for 35 days and the hospital charges you $330 per day — $95 per day more than allowed by CHAMPUS. Your out-of-pocket expense would be $3,325. With the Expense Protector Benefit your cost would be limited to $1,000. All reasonable and customary costs over this amount — for the entire calendar year — would be paid.

ELIGIBLE APPLICANTS

All AFA members under age 65 who are receiving retirement pay based on their military service, spouses under age 65 of active duty or retired members and their unmarried dependent children under age 21, or 23 if in college, are eligible. Upon reaching age 65, your coverage may automatically be converted to AFA's Medicare Supplement Program.

RENEWAL PROVISION

Your coverage will continue as long as you remain eligible for CHAMPUS benefits, the Master Policy with AFA remains in force, your membership continues, and you pay your premiums.

There is no waiting period for active duty members who enroll within 30 days of retirement if their dependents have been insured for two years previously.

EXCEPTIONS AND LIMITATIONS

Coverage will not be provided under this plan for pre-existing conditions (conditions which were treated during the 6 months prior to the effective date), until the expiration of 6 consecutive months of coverage during which time no further treatment is received for the condition. After the coverage has been in effect for 12 consecutive months, ALL pre-existing conditions will be covered. Children of active duty members over age 21 (age 23 if in college) will continue to be eligible if they have been declared incapacitated and if they are insured under CHAMPLUS® on the date so declared. Contact AFA for details.

EXCLUSIONS

This plan does not cover and no payment shall be made for: routine physical examinations or immunizations; domiciliary or custodial care; dental care (except as required as a necessary adjunct to medical or surgical treatment); well-baby care after the age of 2 years; injuries or sickness resulting from declared or undeclared war or any act thereof or due to acts of intentional self-destruction or attempted suicide, while sane or insane; treatment for prevention or cure of alcoholism or drug addiction; eye refraction examinations; prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses; expenses for which benefits are or may be payable under Public Law 89-614 (CHAMPUS).

LOOK AT WHAT AFA CHAMPUS® PAYS

Care	Retired	Active Duty
Inpatient civilian hospital care	the 25% of allowable charges not paid by CHAMPUS, plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year	the greater of the total daily subsistence fees, or the $25 hospital charge not paid by CHAMPUS
Inpatient military hospital care	the daily subsistence fee	the daily subsistence fee
Outpatient care (covers emergency room treatment, doctor bills, pharmaceuticals, and other professional services; see exclusions for limitations)	the 25% of allowable charges not paid by CHAMPUS, after the deductible has been satisfied, plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year	the 20% of allowable charges not paid by CHAMPUS after the deductible has been satisfied, plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year

CHAMPUS® offers many attractive benefits. For a complete description of the Plan, including exceptions and limitations, please refer to the Certificate of Insurance, or call our Insurance Division toll-free at

1-800-727-3337

To enroll in the program complete the application.→

RATES

Plan I: For Military Retirees
QUARTERLY PREMIUM SCHEDULE
In-Patient Benefits Only

Member's Attained Age	Member	Spouse	Each Child
Under 45	$ 24.64	$ 37.87	$ 22.71
45-49	$ 34.11	$ 65.04	$ 22.71
50-54	$ 43.79	$ 79.69	$ 22.71
55-59	$ 59.31	$ 85.29	$ 22.71
60-64	$ 81.16	$107.54	$ 22.71

Plan I: For Military Retirees and Dependents
QUARTERLY PREMIUM SCHEDULE
In-Patient and Out-Patient Benefits

Member's Attained Age	Member	Spouse	Each Child
Under 45	$ 49.85	$ 74.37	$ 49.04
45-49	$ 60.14	$ 94.20	$ 49.04
50-54	$ 89.06	$134.54	$ 49.04
55-59	$ 115.31	$171.28	$ 49.04
60-64	$ 143.77	$194.22	$ 49.04

Plan II: For Dependents of Active Duty Personnel
ANNUAL PREMIUM SCHEDULE
In-Patient Benefits Only

	Member	Spouse	Each Child
All Ages	N/A	$ 24.73	$ 16.08
In-Patient and Out-Patient Benefits			
All Ages	N/A	$ 105.21	$ 55.58

APPLICATION FOR AFA CHAMPUS®

Group Policy 4609—G1
Metropolitan Life Insurance Co.,
Home Office: New York

Full name of Member _____
Rank Last First Middle

Address _____
Number and Street City State Zip Code

Date of Birth _____ Current Age _____ Height _____ Weight _____ S.S.N. _____
Month/Day/Year

This insurance coverage may only be issued to AFA members. Please check the appropriate box below:

❑ I am currently an AFA member

❑ I enclose $25 for annual AFA membership dues, (includes subscription ($18) to AIR FORCE Magazine)

PLAN & TYPE OF COVERAGE REQUESTED

Plan Requested (check one)
❑ AFA CHAMPUS® PLAN I (for military retirees & dependents)
❑ AFA CHAMPUS® PLAN II (for dependents of active-duty personnel)

Coverage Requested (check one)
❑ Inpatient Benefits Only ❑ Inpatient and Outpatient Benefits

Person(s) to be insured (check one)
❑ Member Only
❑ Spouse Only
❑ Children Only
❑ Member & Spouse
❑ Member & Children
❑ Spouse & Children
❑ Member, Spouse & Children

PREMIUM CALCULATION

All premiums are based on the attained age of the AFA member applying for this coverage. Plan I premium payments are normally paid on a quarterly basis, but, if desired, they may be made an annual (multiplied by 4) basis. Plan II premiums are payable annually ONLY.

Quarterly (annual) premium for member (age ____) $ _____
Quarterly (annual) premium for spouse (based on members' age) $ _____
Quarterly (annual) premium for ____children @ $ $ _____
_____
Total premium enclosed $ _____

If this application requests coverage for your spouse and/or eligible children, please complete the following information for each person for whom you are requesting coverage.

Names of Insured Dependents Relationship to Member Date of Birth (Month/Day/Year)

_____

_____

_____

(To list additional dependents, please use a separate sheet.)

In applying for this coverage, I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed drugs or medicine within 6 months prior to the effective date of this insurance coverage will not be covered until the expiration of 6 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such preexisting conditions will be covered after this insurance has been in effect for 12 consecutive months.

Date _____, 19_____ _____
(Member's Signature)

10/93

Application must be accompanied by a check or money order. Send remittance to:
Air Force Association, Insurance Division, 1501 Lee Highway, Arlington, VA 22209-1198

AFA AFA

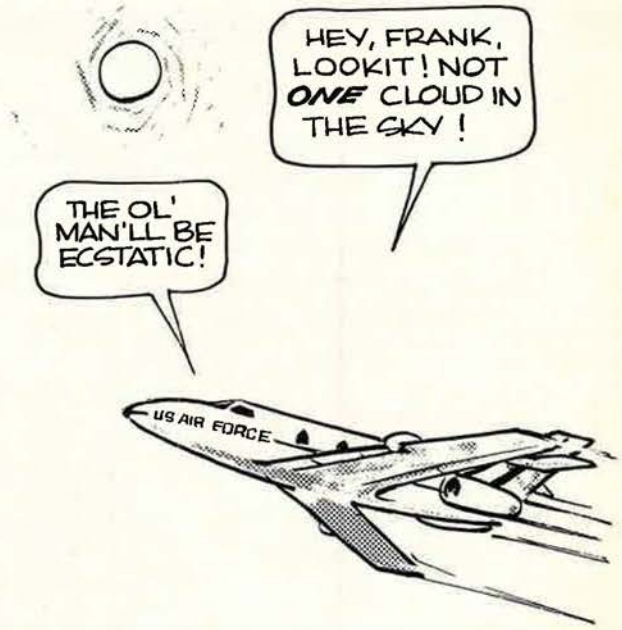
Bob Stevens'

"There I was..."

OUR STORY INVOLVES A PITHY OL' GENERAL WHO ***NEVER*** FOUND THE WEATHER TO HIS LIKING.

WEATHER FORECASTING IS A BLACK ART. MEN PEER INTO RADAR SCREENS *and* TWIRL KNOBS. BALLOONS ASCEND, SATELLITES BEAM BACK CODE GROUPS, ANEMOMETERS SPIN, PSYCHROMETERS WHIRL, *and* MAPS SPEW FROM COMPUTERS. WITH ***ALL*** OF THIS, IF THEY HIT IT RIGHT 50% OF THE TIME, THEY'VE WHIPPED THE ODDS!

AFTER MONTHS OF THIS, THE LADS FLY TO A TDY BASE TO PICK UP THE OL' CURMUDGEON -



WE CAN'T PREDICT THE FUTURE, BUT WE CAN PREPARE FOR IT.

The world bristles with MiG-29 and Su-27 upgrades readily available to those with hard currency. What's more, the new century promises to find even more advanced fighters in the hands of tomorrow's regional aggressors.

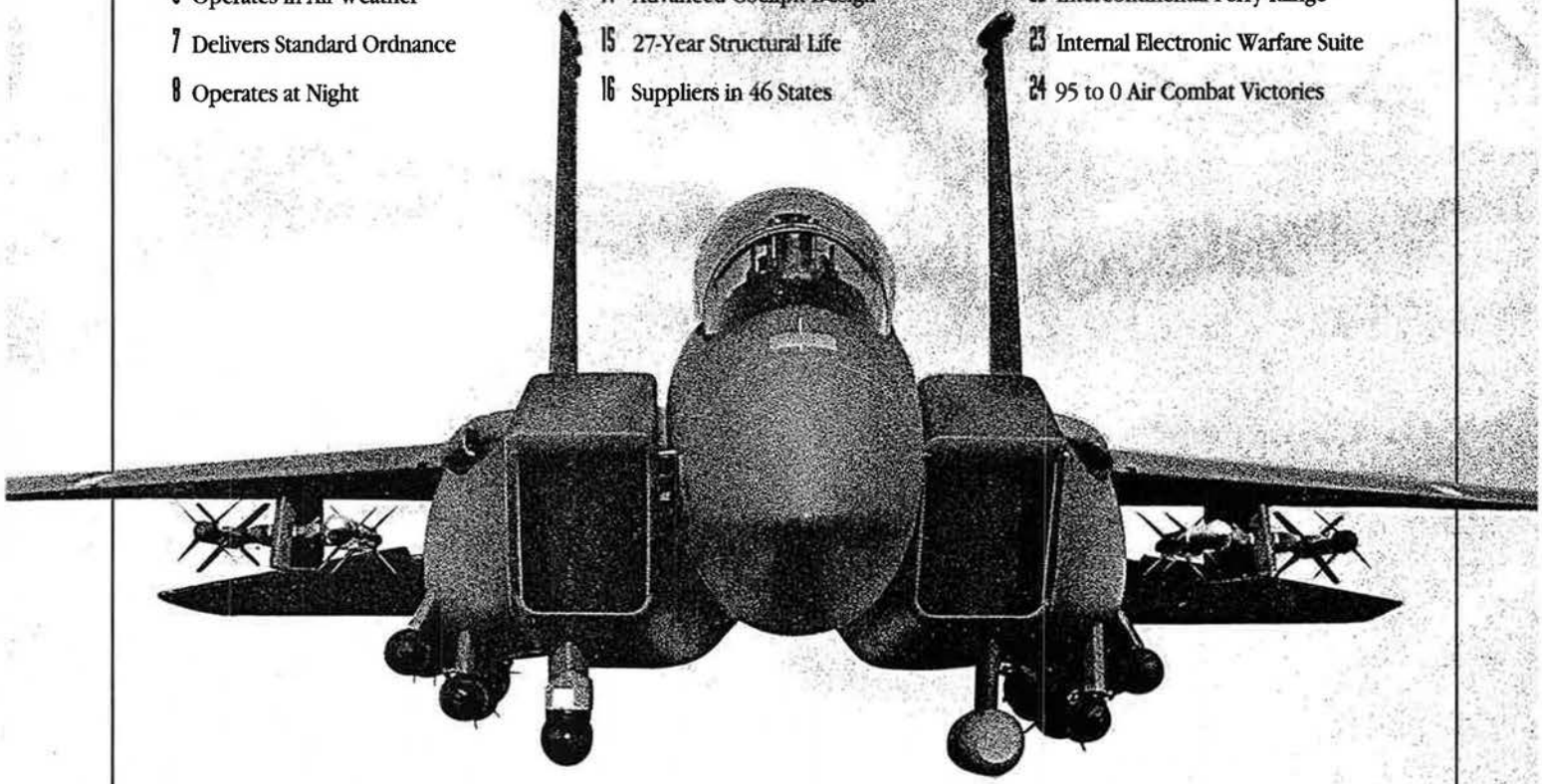
Yet, by the year 2000, the air superiority fighters in the current U.S. inventory will be approaching thirty years old. The challengers will be much younger.

The solution is the F-22 Advanced Tactical Fighter. A long range, high Mach fighter with supercruise, thrust vectoring, and revolutionary F119 engines. A front-line fighter with low radar cross section. A lethal first-look, first-shot, first-kill fighter with an unmatched agility. A supportable fighter with greatly reduced maintenance demands. A deployable fighter with greatly reduced tanker and airlift requirements. A robust and reliable fighter built to last.

The F-22 program is on track–which means American air superiority will exist tomorrow and well into the future.

F-15E

1 Backbone of the Interdiction Force
2 Carries up to 23,000 lb of Payload
3 Delivers Precision-Guided Munitions
4 Long Range - 800 mi. Radius of Action
5 Round-the-Clock Operations With High Fly Rates
6 Operates in All Weather
7 Delivers Standard Ordnance
8 Operates at Night
9 Deep Strike of High-Value Targets
10 95.5% Mission-Capable Rates in Operation Desert Storm
11 Infrared Accurate Targeting Sensor
12 High Resolution Radar Ground Maps
13 99% Made in the U.S.A.
14 Advanced Cockpit Design
15 27-Year Structural Life
16 Suppliers in 46 States
17 Safest Fighter in USAF History
18 USAF's Most Modern Fighter
19 Capability to Grow to More Missions
20 Unequalled Air Superiority
21 Carries 4 Medium-Range and 4 Short-Range Air-to-Air Missiles
22 Intercontinental Ferry Range
23 Internal Electronic Warfare Suite
24 95 to 0 Air Combat Victories



In An Era When Every Plane Must Count, Nothing Counts More Than The f-15E Eagle.

These days every defense dollar has to count. So go ahead, count.

Here are twenty-four good reasons to fund the F-15E. Start with the fact that this is America's only fighter capable of performing long-range, air-to-ground missions while providing its own air defense. That fact alone not only makes this aircraft a smart strategic choice, it makes it the most prudent choice for the Air Force.

And that's something you can count on.

MCDONNELL DOUGLAS