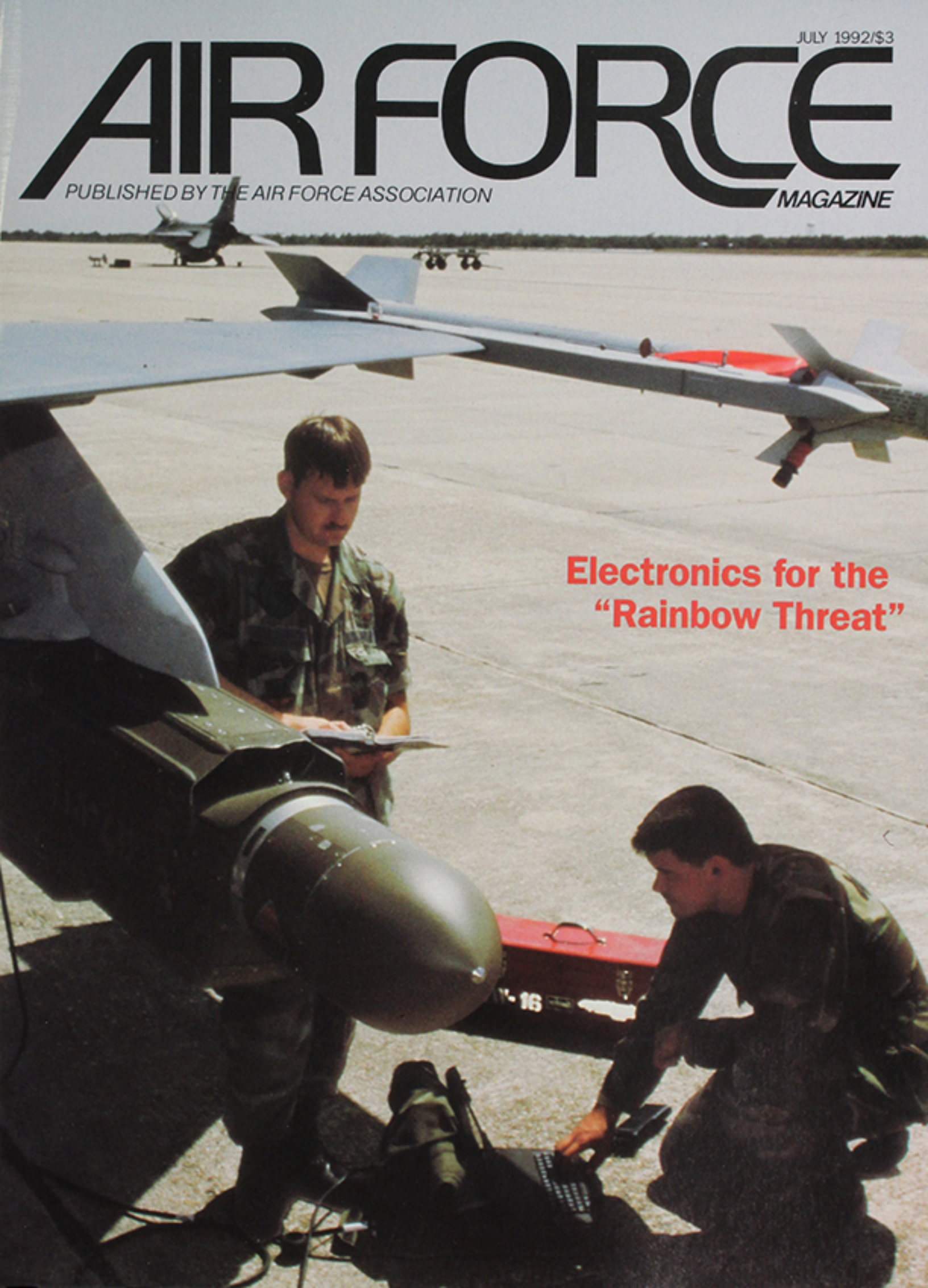


JULY 1992/\$3

# AIR FORCE

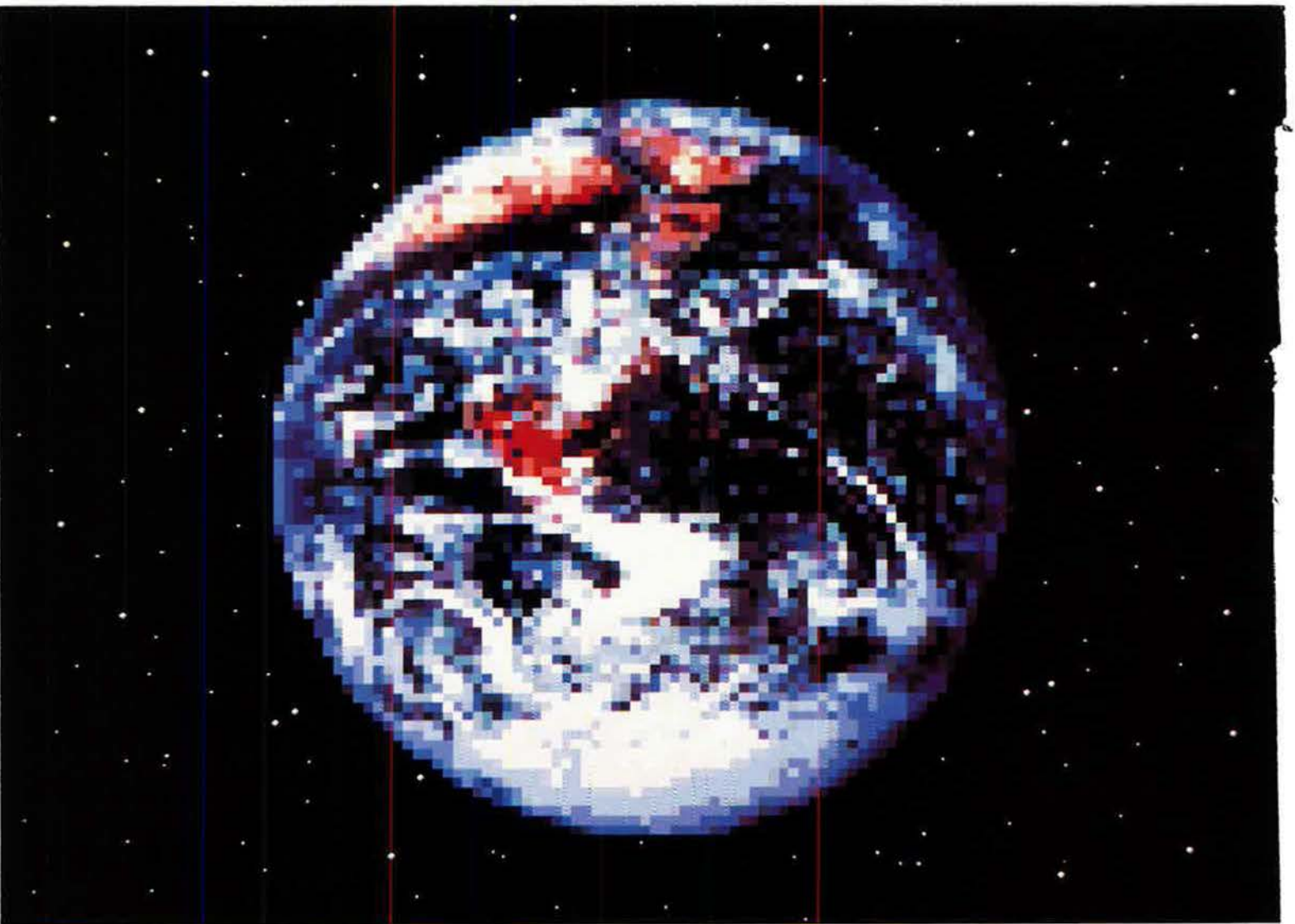
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MAGAZINE



**Electronics for the  
"Rainbow Threat"**





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By John T. Correll, Editor in Chief

## The Lone Superpower

**T**HE leak of a secret Pentagon working paper to the *New York Times* in March set off an uproar about the role of the United States as the world's only remaining superpower. Another leak, to the *Washington Post* of a much-modified revision in May, eased the turmoil but left some provocative questions hanging.

Both documents were draft versions of the Defense Policy Guidance for 1994-99 and outlined the perceived future for which the armed forces should prepare. With the Soviet Union defunct, the March paper said, "our first objective is to prevent the re-emergence of a new rival" posing a similar military threat. The US must provide leadership to convince "potential competitors that they need not aspire to a greater role or pursue a more aggressive posture to protect their legitimate interests."

The critics had a field day. Among the more vocal was Sen. Joseph R. Biden (D-Del.), who said a "Pax Americana" with the US as "globocop" was "a direct slap at two of our closest allies—Germany and Japan." Instead, he urged, we should "breathe life into the UN charter," which "envisages a permanent commitment of forces for use by the Security Council." He quoted the Secretary-General of the United Nations as saying the Pentagon paper approach would mean "the end of the UN."

Columnist Charles Krauthammer thought the Pentagon paper was just fine. "If America's allies believe they can rely on American power, they will have no reason to turn themselves into military superpowers," he said. "If, on the other hand, the United States gives up its worldwide predominance, Germany and Japan, military midgets today, will quite reasonably seek to ensure their own security by turning themselves into military giants." Trusting our security to the UN, "which requires us to get the approval of all kinds of despots in countries that do not share our interests, let alone our values, is not Utopian," he said. "It is merely stupid."

The Defense Department characterized the paper as a "low-level draft"

and repeated its commitment to collective security, but otherwise said little until May 22, when Secretary Dick Cheney acknowledged "reverberation around the world among our allies." Mr. Cheney disavowed go-it-alone strategy but said collective security "does not happen automati-



**Does anyone believe the world would be better off with a different leader—or with competing superpowers?**

cally." Someone must lead. "If the US doesn't provide that overall umbrella of security, with the network of alliances backed up by significant military forces, who will do it?" he asked.

Two days later, the *Washington Post* was in print with the second leak, "a near final draft" with the offending language removed. The critics celebrated victory, but the net effect may have been to drive the issue underground.

The first Pentagon paper understandably struck nerves in international pride, but it also reflected certain realities. If the United States retreats from leadership, the power vacuum will not long remain unfilled. Does anyone seriously believe the world would be better off with the dominance of power and influence in some other hands? Or that the emergence of two or three new military superpowers is desirable in any case?

Sensitivities aside, indignation centered on two points: that the US does not owe it to the world to shoulder this burden and, conversely, that American leadership might be in some way malevolent.

Other nations benefit from US strength, but that does not make it an act of charity. It happens to be the best way to ensure our own security and prosperity—and at less cost and risk than confronting military challenges that we might unwittingly encourage by taking a weak position.

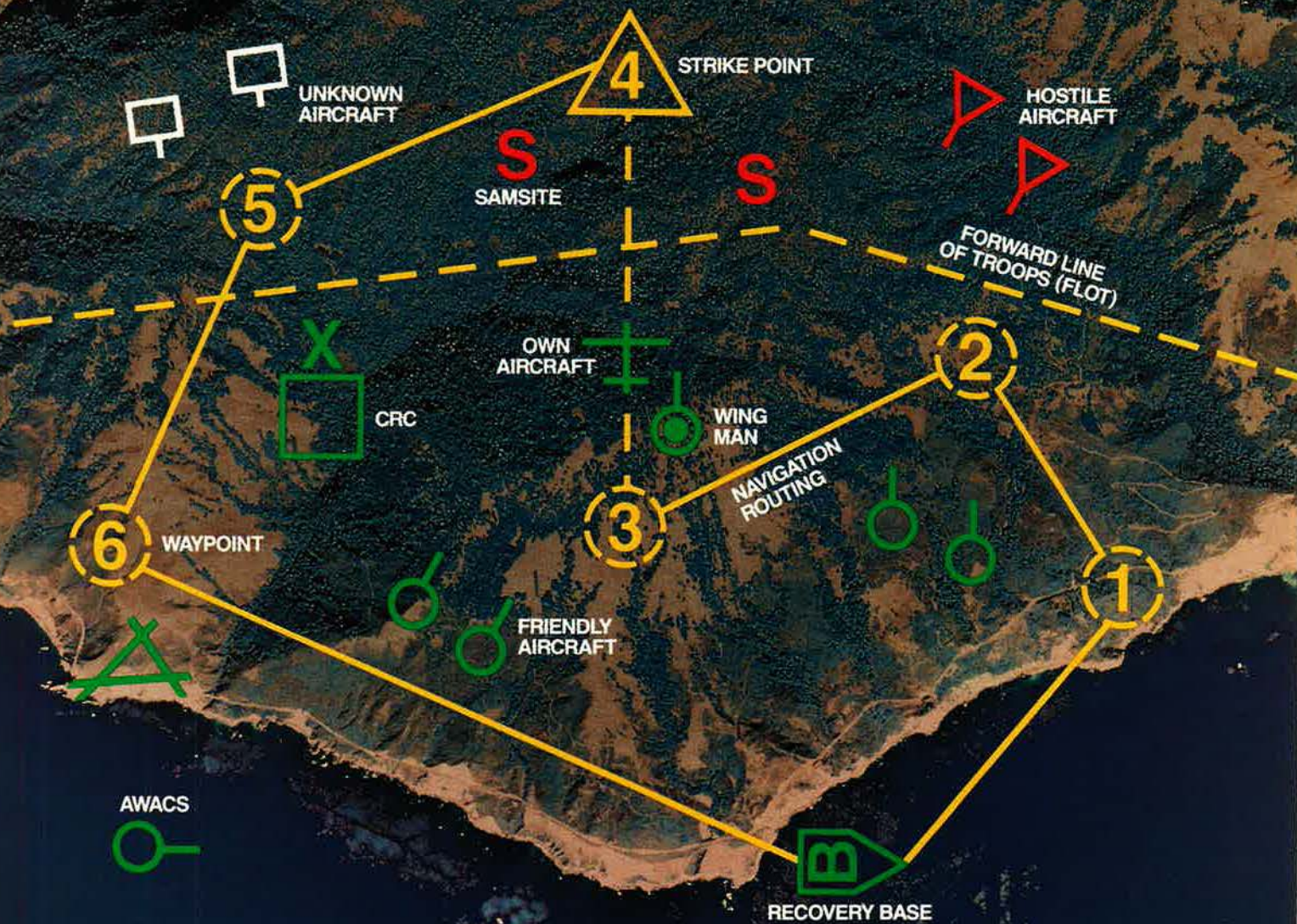
In the 1980s, with Soviet military power increasing relentlessly and with invasion forces camped in Afghanistan, it was popular for some fuddleheads in the West to depict the US and the USSR as "morally equivalent." Today, most people agree it was fortunate that the United States was around, not only to keep the repressive Soviet regime at bay until it collapsed but also to provide an example and inspiration for the geopolitical revolution that followed.

It was clear from the March leak that the idea was to block the rise of hostile powers and to reassure allies, not intimidate them. US foreign policy is not perfect, but the record stands far above that of former great powers in their heyday or of other nations that contended for power in this century. The United States has never had much taste for empire, and its influence tends to be stabilizing rather than destabilizing.

If there is an alternative to US leadership that offers more promise of global peace, it has not turned up in the agitation over the Pentagon papers. ■



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## The Raiders at McClellan

"The Doolittle Raid" [April 1992, p. 54] was well written but contains a statement that must be contested.

Through the years, the story of the "tampering" with the carburetors on the B-25 aircraft has been repeated, and it is often alluded to as the cause for the aircraft being lost. In the course of preparing an exhibit on the raid for the McClellan Aviation Museum at McClellan AFB, where the raiders were processed, we looked into the carburetor story at great length. We conclude that there were other reasons for fuel problems on some of the aircraft.

In preparation for the raid, 230-gallon fuel tanks were installed in all of the aircraft prior to their movement to McClellan for final staging. It was decided that these would not be adequate and that 270-gallon tanks would be shipped to the Sacramento Air Depot (McClellan) to replace the smaller tanks. Upon installation, however, a number of the new tanks were found to leak, and since replacements could not be secured in time, the 230-gallon tanks were reinstalled in some aircraft.

Adjusting the carburetors to operate with an extra-lean mixture would have required their removal from the aircraft and disassembly of the unit. With one of the crew standing by each aircraft, accomplishing this without Doolittle's knowledge would have been extremely difficult—especially if the depot had been instructed not to touch the carburetors. As was learned later, the aircraft was extremely difficult to start with the leaned-out carburetors installed. A mechanic unfamiliar with the problem would often experience violent backfiring if the throttles were not properly set.

Doolittle's experience with the mechanic and the backfiring engine has often been told. One version has the mechanic stating he was "correcting the carburetor, which was out of adjustment." In other versions, he merely answered Doolittle's question, "Do you know what you're doing?" with "I don't know!"

It would appear that a number of aircraft flew the mission with forty fewer gallons of fuel than others. Fuel man-

agement could also have had a large effect on the fuel usage. A plotting of the location of the crashed aircraft in Stan Cohen's *Destination: Tokyo* indicates that all but five of the raiders reached or overflew the field in China where they were to refuel. Had the homer beacon, which was supposed to be in place on the field, arrived, they might have landed safely.

Doolittle's annoyance with the service at McClellan was understandable. He had been told by depot people at Dayton that required parts were in place in Sacramento, which they were not. Only a few personnel knew of the importance of the mission. To most it was another "high-priority job," which most were at that time. Lack of parts stopped work until the necessary items arrived, and the aircraft were pulled out of the hangars and left until they could be worked on. When parts arrived, they did not always fit and had to be modified or left out. (The last shipment of parts were airlifted by blimp to the *Hornet* after it had sailed from Alameda.)

It has been a long time since those fateful days, but the people who worked the airplanes at McClellan still feel pride in the job that they did and deserve to have the blemish removed from their performance. The carburetor story is as much fiction as fact and should be put to rest.

Maj. William R. Dooner,  
USAF (Ret.)  
Carmichael, Calif.

## The First B-25 Off a Carrier

With regard to "The Doolittle Raid," I would like to point out that the first to fly

a B-25 from the deck of an aircraft carrier was Col. (then Lt.) John F. Fitzgerald.

Not one of the Doolittle Raiders, he was assigned in 1942 to the Materiel Division at Wright Field in Dayton. His task was to prove the credibility of the concept, which he did, first on paper, then in fact. The second to fly a B-25 from the deck of a carrier was another lieutenant assigned to the same office and the same project.

To my knowledge, the part played by the people at Wright Field in the development of this concept (not the mission) has never been fully explored or documented. Nor, for that matter, has the part played by the Navy in the proof-of-concept testing been fully explored. It's my understanding that the test B-25s flew to Langley, were loaded on a carrier at Norfolk, and were tested off the Virginia-North Carolina coast.

Terence R. St. Louis  
Albuquerque, N. M.

## Birch and the Raiders

Your fine Doolittle Raic article omitted one of the strangest developments. After the raid, John Birch, a Baptist missionary who spoke fluent Chinese, was dining in a small village when a Chinese man led him to a concealed boat. Birch was astonished to find Jimmy Doolittle and his crew hidden in the boat. Birch directed Doolittle to Chungking and, shortly after, received orders and money from the US Mission in Chungking to render all possible assistance to Doolittle crews. Eventually General Chennault commissioned Birch as a line officer when the chaplaincy Birch sought proved impossible. For the next three years, Birch was an outstanding US Army intelligence officer in China.

On August 25, 1945, after the atomic bombs and before the Japanese surrender, Captain Birch, accompanied by American and Chinese soldiers, was assigned to take charge of a Japanese prison camp in an area with Chinese Communist, Chinese Nationalist, Japanese, and American troops operating in an uneasy situation. Birch's party was stopped by a Chinese Communist unit who questioned their mission. Birch became angry, and he was cautioned

**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**





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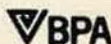
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## Letters

by the Americans and Chinese with him to cool his temper and use more cautious speech.

Shortly thereafter, Birch was shot dead, and a Chinese accomplice wounded, by Chinese Communist soldiers. Later, some critics charged the US government with covering up the details. Actually, the death of a mere army captain was a nonevent in the V-J Day celebration mood sweeping the world.

In September 1950, Sen. William Knowland (R-Calif.), reacting to early Korean War defeats for the United States, told the Birch story on the Senate floor. Robert Welch read the Knowland speech and published a biography of John Birch in 1954. In 1958, Mr. Welch founded the John Birch Society, named for the man he deemed to have been the first American killed in World War III. It all began when John Birch met Jimmy Doolittle.

Fred Donner  
Falls Church, Va.

### ■ Author Glines replies:

*John Birch was a true hero who risked his life many times and deserves to have the full story of his wartime service told. I want to emphasize, however, that he had absolutely nothing to do with the society that bears his name.*

### An Omitted Trainer

"The Year of Training" [April 1992, p. 36] states that the Joint Primary Aircraft Training System aircraft will be a "small jet," as though all other contenders are wasting their time and money. There is at least one turboprop in the running that can perhaps run circles around small jet aircraft in terms of life-cycle cost, as well as appropriate primary training performance for novice pilot trainees. This is the PC-9 Mk. II being developed and offered by Beech Aircraft Corp. You even ran a full-page ad inside the front cover of the April issue showing the Beech PC-9!

Maj. Frank Sisson,  
USAF (Ret.)  
Wichita, Kan.

■ *We regret the omission and assure Major Sisson that no favoritism was intended.*—THE EDITORS

### The Men and the Jammers

Much has been written about the B-66 in the March and May 1992 issues of AIR FORCE Magazine, but no one has told of the ultimate fate of one of the most effective aircraft in the Vietnam War. . . .

After I flew with the bomber in En-

gland, the B-66 returned to my life at Korat AB, Thailand, in 1971. Ten years after I put it in the boneyard, I was reunited with the same-numbered plane I flew at RAF Sculthorpe, UK. It was now an EB-66B, with no tailguns, a wiring system nobody could understand, and an EWO in the right seat. The navigator was now on the left with a Doppler and a five-inch radarscope. We had C models for passive reconnaissance.

The value of B-66s in the Vietnam War as ECM aircraft has never really been told. The B-52s would not go deep unless we were "on station, on time" for an event. Hunter/killer teams wanted the old bird all the time against SAM sites for jamming.

At war's end, the B-66 experienced the fate of all old planes. Korat's birds went for scrap . . . the end to a fine, crazy airplane and the crews that flew her.

I was the last squadron navigator of the last unit that flew the plane: the 39th TEWS. At the main gate at Shaw AFB, S. C., in Reconnaissance Park, is the last of its kind—an EB-66C.

Maj. Samuel F. Armer,  
USAF (Ret.)  
Sacramento, Calif.

I would like to respond to the three letters published in May 1992 concerning my article, "The Other Jammer." They illustrate better than I could the caliber of people who flew those birds.

Like Lieutenant Rowney, I was a proud member of the 42d TRS, except that I started in 1958 as a Raven 4 in RB-66Cs at Spangdahlem, West Germany. The whole squadron was made up of independent thinkers who just needed a start. I was fortunate to move to Wing Operations/Plans—and to get approvals for their ideas.

Major High's letter does not really point out glaring errors, but it highlights the types who were involved with the EB-66. The 10th TRW was originally set up in 1958 as a self-contained electronic warfare unit, with the 42d TRS RB-66Cs collecting the radar intelligence used by the jammers. The B-66B cradle airplanes were added to that squadron to form a full-capability EW unit. When activities increased during the Vietnam War, the organizations were divided, but the concept of an integrated operation still existed. I apologize for not mentioning the 6460th TEWS. Unit designations changed rapidly during that time.

Referring to the third statement by Major High, he did indeed support the Navy by refueling from an A-3D and covering the A-6s. On top of that, he



argued with higher headquarters over his unauthorized actions. The B-66 flyers were truly a unique group of action-oriented men!

With regard to Colonel Bruenner's letter, there are many more stories that need to be told about the B-66. Before I left the 10th TRW in June 1961, I helped lay the groundwork for the "Dancing Doll" exercises he cited. From the first capability in late 1958, we participated in many excellent exercises, including NATO-wide, individual nations, and combined air-naval operations. It was all classified and, although known by some, the contribution was not widely advertised.

Gus Seefluth  
Troy, Ohio

#### Taxation Without Representation

When I read your editorial on "The Source Tax" in the March 1992 issue, I realized our American system had crossed the line and was out of control.

If a government, in this case the state of California, can tax someone, and that individual cannot vote or have a say in the way taxes are raised or spent, and that individual cannot send representation to that government, then that constitutes "taxation without representation."

California is taxing a group of people who, like those in the original thirteen colonies, cannot vote, cannot send an elected representative, and are refused access to the public officials who are levying the tax. Sound similar? It does to me!

The same definition of "taxation without representation" that applied in our early history fits now. US citizens are being taxed but cannot vote, nor are they represented. . . . However, the Supreme Court says that such taxation without representation is legal. Federal officials who permit this have lost any sense of control over our fair country. They have truly brought the American people to their knees. . . .

Lester A. Van Blaricom  
Millbrook, Ala.

#### Amazing Benefits

I must have missed something. As a survivor of the Vietnam War and the subsequent reduction in force, I knew many fine combat veterans who were forced out with nothing close to the \$14,000 per year for twenty-eight years that I calculate a fourteen-year major has "earned" under the Volunteer Separation Incentive program.

We owe separating officers as smooth a transition as possible, and

perhaps a modest separation "bonus," but a pension for twenty-eight years? I was amazed.

Lt. Col. Lawrence R. Nilssen,  
USAF (Ret.)  
Alexandria, Va.

#### Hazardous Conditions?

With reference to "When Weather Is an Enemy" [April 1992, p. 68] and the caption to the photo on p. 69, I have come to the following conclusion:

I have never seen water droplets stand still on my windshield long enough for me to take pictures of them, and since the airspeed and all engine instruments are reading zero, the hazardous conditions referred to must be those of refueling on the ramp in the rain.

Col. Ray W. Schrecengost,  
USAF (Ret.)  
Tempe, Ariz.

#### A Mystery Solved

Thank you for "The Bad Luck of Harriet Quimby" [April 1992, p. 72]. I was terribly frustrated after searching my local library to find out why she was qualified to adorn my fifty-cent stamp.

Laurence Cummings  
Philadelphia, Pa.



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By Brian Green, Congressional Editor

## Helping Industry Convert

Both the Senate and the House have drafted plans to help companies and workers as they diversify from full-time defense production.

**I**N BOTH houses of Congress, lawmakers have proposed comprehensive plans to help convert US defense industries to diversified enterprises and to help ease the economic hardship of communities and defense workers hurt by the military drawdown.

Two main plans have emerged. One was prepared by the office of Rep. Les Aspin (D-Wis.), chairman of the House Armed Services Committee. The other was produced by a group of twenty-one Democratic senators, including Sen. Sam Nunn, the Georgia Democrat who chairs the Senate Armed Services Committee, and six other members of that defense-minded panel.

The proposals portend a more active federal role in dealing with such problems, despite White House and congressional Republican distaste for anything resembling "industrial policy."

The House plan, in essence, maintains that competitiveness and conversion are key parts of efforts to sustain an industrial base capable of meeting future defense needs. It aims to "stimulate growth by encouraging cross-fertilization between DoD and commercial high-tech firms."

Rep. Dave McCurdy (D-Okla.), who chaired a panel on the defense industrial base and whose report undergirded much of the Aspin proposal, argued that conversion should be viewed as a long-term plan to sustain industrial skills, along with growth in technology and manufacturing "that can support defense needs if a threat emerges."

The plan prepared by the Democratic senators, though it focused more on creation of economic growth, also acknowledges this connection.

A key part of the Aspin proposal is to "underwrite partnerships between DoD and high-technology firms to commercialize specific high-payoff applications for dual-use critical technologies." In this plan, DoD would take an equity posi-

tion in a commercial venture, sharing in the profits and expenses. This program, in the view of the House proposal, would push new military and civilian uses for advanced manufacturing and process application technologies into the market and help break down barriers between DoD and civilian firms.

The House measure (and the Senate package) emphasizes DoD involvement in the development of dual-use technology. Representative Aspin's plan would allow the Defense Advanced Research Projects Agency (DARPA) to set up more consortiums like SEMATECH, the Austin-based semiconductor research consortium, to focus on a single dual-use technology and explore military and commercial applications. The consortiums would be funded by federal money and corporate venture capital.

Representative Aspin would also expand (as would the senators' plan) DoD Small Business Innovation Research grants to promote development of dual-use technologies.

Representative Aspin's measure also proposes a DoD technology extension program to serve as a clearinghouse for technical information on manufacturing processes and technologies with both military and commercial application. This, the Committee argues, would expand the base of potential industrial suppliers from which DoD could draw.

Representative Aspin's proposed package is funded at \$1 billion in the House Armed Services Committee version of the Fiscal 1993 defense authorization bill. Representative McCurdy originally recommended devoting at least twenty-five percent of the additional cuts to the defense budget to improve US economic competitiveness, but that formula was not adopted.

The Senate Democrats estimate that their proposals would cost \$1.2 billion in Fiscal 1993. Harshly critical of what they called the Administration's lack of leadership in this area, the senators generated proposals to assist "many thousands if not tens of thousands" of industries and subcontractors affected by the decline in defense spending.

Their recommendations include:

- Changing a current federal policy that requires DoD to recoup R&D money

spent on military technologies in the event that they become commercially marketable. Currently, defense companies must repay the Pentagon's expenditures on R&D for systems and components that are sold overseas in commercial products. Companies must thus bear the accounting burden of tracking the use of technologies in components and systems. In the senators' view, recouping R&D costs on components is a powerful disincentive to the application of defense technologies in the civilian sector. They would limit recoupment to the sale of defense equipment to foreign countries.

- Funding a variety of manufacturing extension programs and technology centers at the state, regional, and federal levels to ease the transition of small and medium-size firms into new markets and to "bring the overall level of US manufacturing technology up to world-class standards."

- Reorienting defense labs and R&D work toward dual-use technology and cooperative ventures with industry. Specifics include establishing a "set-aside fund to support industry-led R&D projects" in DoD and DoE laboratories, requiring that "dual-use R&D be done in partnership with industry whenever possible," and expanding DARPA dual-use technology partnerships with the private sector.

- Establishing "AgileTech," a consortium of industry and existing consortiums to explore manufacturing technologies, work force skills, standards, and organization that can respond "rapidly to demand for high-quality, highly customized products." The senators claim that the Pentagon has a strong interest in AgileTech and, along with industry, would fund the program because "the defense industrial base of the future must have the ability to respond rapidly to changes in the security threat and ramp up specialized production if necessary." Moreover, the "defense-dependent companies, particularly the small and medium-size firms that make up the backbone of the defense industrial base, do not have the agility or supplier-customer connections necessary to successfully compete in the commercial sector." ■



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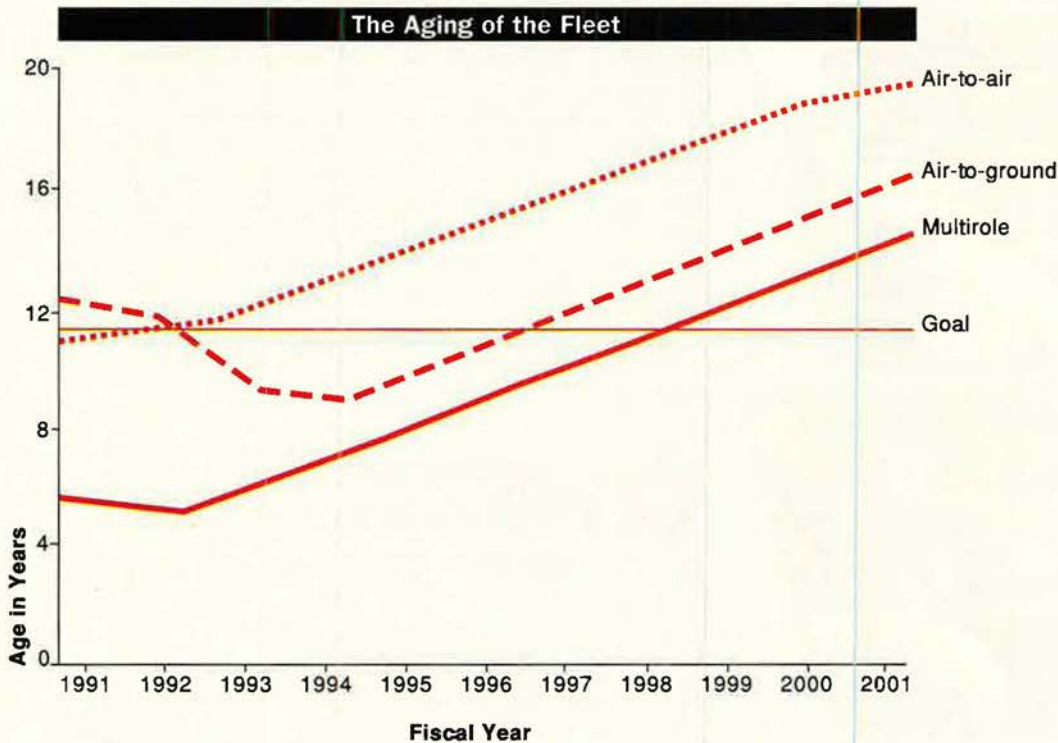
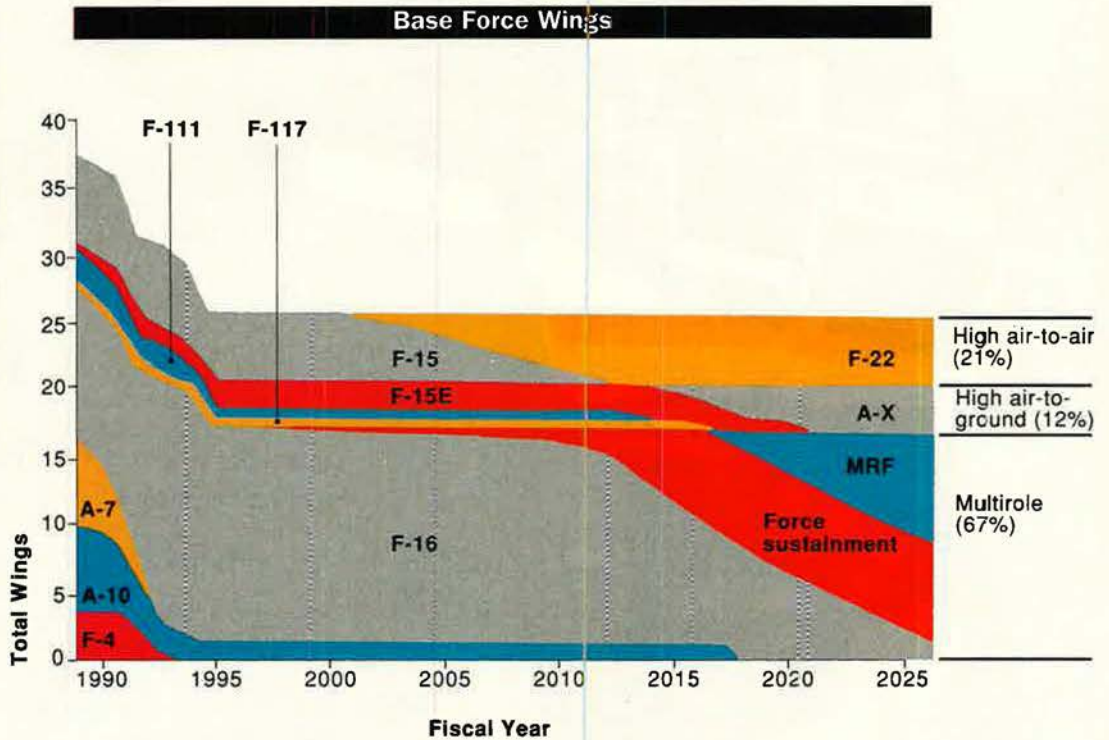


# The Chart Page

By Tamar A. Mehuron, Associate Editor

## Fighter Modernization

The Pentagon's Base Force calls for 26.5 Air Force fighter wings as of FY 1995. The F-16 component starts to decrease in 2005, while the proposed new Multirole Fighter does not come into play until 2015. To fill the resulting gap, the Air Force may buy up to 500 improved F-16s to serve as "force sustainment fighters" until MRFs fill out the force. The F-22 begins replacing the F-15 after 2000. The A-X enters the interdicator force around 2012.



By 1998, Air Force fighters will be older than the optimum 11.5 years. The Congressional Budget Office estimates that US tactical aircraft will still be far more capable than those of all regional powers.





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The first AMRAAM test involving multiple, near simultaneous missile launches from two aircraft was a success, concluding the Air Force's in-flight reliability test program. During a combat-like test scenario, at Eglin Air Force Base in Florida, two U.S. Air Force F-16s launched two missiles each at four oncoming targets. All four missiles — two built by Hughes Aircraft Company — proved their in-flight reliability, guiding within lethal distance of drone targets, including one direct hit. The AMRAAM's ability to guide and track to targets in a stressful combat environment of multiple maneuvering targets and electronic countermeasures demonstrates its high, unparalleled performance. With its unique fire and maneuver capability, it is believed AMRAAM will double the combat effectiveness of the F-15 and increase the F-16's effectiveness in air-to-air combat by six times.

In troubleshooting electronic countermeasures, U.S. Air Force maintenance crews use simulators that rely on computer models of various aircraft subsystems. Now, a new software tool, developed by Hughes, makes it easier and faster to create simulation software, and makes the software more dependable and versatile. Hughes' "Model Builder™" automatically translates systems concepts into computer instruction. Armed with ready-made inventory, systems analysts can concentrate on solving simulation problems, rather than implementing software.

To prevent casualties from friendly fire, Hughes is producing an advanced communications system, called the Enhanced Position Location Reporting System (EPLRS) for the U.S. Army. This computer-controlled, digital communications network furnishes jam-resistant data to U.S. Army troops and commanders on the battlefield. With EPLRS, commanders can precisely locate their forces, as well as direct units in real-time command and control operations, to enhance their safety.

The problem of viewing instrument information in the bright sunlight of military aircraft cockpits can be eliminated with a new full-color display system being developed by Hughes. The Highbright™ display provides high brightness, high color contrast, sunlight rejection, high color saturation and high color stability; and it offers the widest range of colors currently available in an avionics display. It features Hughes' patented liquid crystal projection technology, which dramatically improves reading displays in sunlight over other display technologies. In addition to standard cockpit displays, liquid crystal projection technology can be used to create panoramic displays that will enhance situation awareness for pilots.

Now in its third cycle of mapping the surface of Venus, the spacecraft Magellan is close to its goal of producing a complete map of the planet. The key to gathering data is the Hughes-built synthetic aperture radar, the sole scientific instrument aboard Magellan. Even before the first cycle ended, in mid-1991, Magellan had mapped 84% of Venus' surface, returning more digital data than all previous U.S. planetary missions combined, with resolutions 10 times better than those provided by earlier missions. To optimize radar performance, Hughes also designed a computer software program capable of handling the nearly 950 commands required per cycle. Each cycle takes one Venusian "day," the equivalent of 243 Earth-days.

For more information write to: P.O. Box 80032, Los Angeles, CA 90080-0032

**HUGHES**



# Aerospace World

By Frank Oliveri, Associate Editor

## HASC's New Aircraft Plan

The House Armed Services Committee embraced a new tactical aircraft plan that, if enacted by Congress, would substantially reorient Air Force and Navy fighter programs. The panel adopted the new scheme in May as part of its rewrite of the Fiscal 1993 defense budget.

The service blueprint comprises three new-development and one derivative aircraft. In order of procurement, they are the Air Force F-22 air combat fighter, the Navy F/A-18E/F derivative strike fighter, the joint Navy and Air Force A-X attack aircraft, and the new Air Force Multirole Fighter (MRF).

The committee's plan, written by Chairman Rep. Les Aspin (D-Wis.) and ranking Republican Rep. Bill Dickinson (R-Ala.), would halt the Air Force's MRF program. It would change Fiscal 1993 spending patterns by cutting \$200 million from the \$2.2 billion F-22 budget, cutting \$535 million from the \$1.1 billion F/A-18E/F budget, and adding \$575 million to the \$150 million A-X budget.

The committee wants a restructuring of the A-X program. The Navy planned to choose a winning contractor from paper studies and then build a prototype. The Aspin-Dickinson plan calls for competitive prototyping and for using engines and avionics from the F-22 and the terminated A-12. The aircraft would incorporate current-generation stealth features.

In place of the MRF, the panel would continue procuring F-16s. In the F/A-18E/F program, the Navy planned to start full-scale development without building a prototype. The committee called for a restructuring that would include a prototype. The House plan barely dents the funding for the F-22, which the Air Force has deemed its top aircraft priority, yet the committee called for the Pentagon to consider buying fewer F-22s. The Air Force wants 648.

## POW/MIA Reports to Be Declassified

The Department of Defense has begun declassifying Vietnam-era doc-

uments pertaining to persons who are missing in action (MIA) or were held as prisoners of war (POW).

The department announced in May that its POW/MIA Central Documentation Office has been tasked to review and declassify all documents regarding 2,266 Americans still listed as missing in southeast Asia. The first priority will be to declassify reports involving live sightings. The Pentagon said there are about 5,000 firsthand and hearsay reports of live sightings of Americans allegedly held prisoner or living freely in Vietnam, Laos, and Cambodia.

"The declassification process will encompass all live sighting reports [that] have been investigated and for which the conclusions of the investigation have been reviewed and approved," said a department statement. "Reports still under active investigation will remain protected." The Pentagon said these reports number about 100.

Declassified reports will be made available in the Library of Congress in early 1993.

## Fourth B-2 Bomber Flies

The fourth B-2 bomber entered developmental flight testing, completing a 2.5-hour first flight over the California desert.

The aircraft flew in April from its final assembly area at Palmdale, Calif., to the Air Force Flight Test Center at Edwards AFB, Calif. The flight included tests of the aircraft's general aeronautical performance, including taxi, takeoff, flight maneuvers at various altitudes up to 35,000 feet, aerial refueling by a KC-10 aircraft, and landing.

Air Vehicle 4 is one of six aircraft to be built under the developmental program. The aircraft will serve as an avionics and armament test-bed. The other three flying B-2s are being used in flight envelope expansion and for stealth and avionics testing.

## CIS Bombers Visit Barksdale

Two Tu-95 "Bear" bombers and an An-124 "Condor" transport from the Commonwealth of Independent States (CIS) visited Barksdale AFB, La., as part of a reciprocal agreement between the US and the CIS.



*Damaged but not destroyed, the YF-22 was lifted by a crane, its gear was lowered, and it was towed to a hangar. Black plastic covers the areas that were burned or otherwise damaged in the April crash, to prevent the wind from separating and blowing the burned composite fibers of the aircraft.*

USAF photo by A1C Scott Mertens





*Air Force Chief of Staff Gen. Merrill A. McPeak is briefed in May by Capt. Michael Long (left) and Air Force Intelligence Command Commander Maj. Gen. Gary W. O'Shaughnessy on the Threat Engagement Analysis Model (TEAM), a computer program that evaluates the effectiveness of electronic combat systems.*

The crews of the CIS delegation came as guests of Gen. George Lee Butler, former Strategic Air Command commander in chief and now commander in chief of US Strategic Command, based at Offutt AFB, Neb. The crews arrived in mid-May during the Proud Shield awards symposium at Barksdale.

The first portion of the bilateral aircraft exchange took place in early March when two US Air Force B-52 bombers and one Air Force KC-10 refueling and cargo aircraft visited Dyagilevo AB, near Ryazan, Russia. The Americans also toured the Kremlin and the city of Ryazan.

The Americans flew to Kubinka AB, near Moscow, where they reviewed a number of CIS fighter, bomber, and transport aircraft and were treated to low-level demonstration flights by an elite MiG-29 team.

#### Separation Program Extended

After initially setting an April 15 deadline, the Air Force extended acceptance of applications for the Voluntary Separation Incentive (VSI) and Special Separation Benefit (SSB) programs to May 29.

The extension was ordered in a further effort to minimize reduction in force (RIF) actions that service leaders would have to take to trim Air Force end strength to authorized levels. By April 15, USAF had approved officer and enlisted applications totaling 19,419 for both programs. The service had hoped to achieve 31,500

voluntary separations—24,000 enlisted and 7,500 officers.

The VSI provides a separating member annual payments equal to 2.5 percent of his or her annual basic pay, multiplied by the member's years of service. The payments will be made in equal installments for a period equal to twice the number of years of service. Under the SSB, DoD would provide the separating member a lump-sum payment equal to fifteen percent of annual pay multiplied by the number of service years.

The programs were expanded to include people ineligible for Phase I of the program. The Air Force was confident that, by expanding the program, it would meet its enlisted requirement. However, on the officer side, where only about fifty percent of the requirement was achieved, the service was less optimistic. Preparations for a RIF board have been made. It will meet this month at the Air Force Military Personnel Center, Randolph AFB, Tex.

#### Aircraft Plan Optimistic?

The Congressional Budget Office claims that the Air Force and Navy, in planning long-term tactical aircraft modernization, are using highly optimistic assumptions.

CBO Director Robert D. Reischauer told two House subcommittees in April that it will take "billions" more than is currently budgeted to produce the F-22, the Multirole Fighter, the F/A-18E/F, and the A-X attack aircraft.

The usual types of delays, technical problems, and funding shortfalls will likely drive up the cost, he said.

CBO said that, at the high end, the combined cost of the four aircraft will hit \$9.6 billion a year (in constant Fiscal 1993 dollars) from 1998 to 2010. At the low end, the cost would be about \$7.1 billion. Mr. Reischauer said that even the low figure exceeds the amount that the services have set aside.

CBO produced four possible alternative approaches:

- Stretch the MRF and A-X or reduce annual purchases of the F-22 and F/A-18. CBO said this would cost DoD more for the same number of aircraft.

- Buy a cheaper MRF for the Air Force and Navy instead of the F-22, or buy fewer high-quality aircraft like the F-22 and A-X, coupled with large numbers of less capable MRFs and F/A-18s.

- Go to a smaller force, with eighteen Air Force wings and twelve Navy wings.

- Sequence purchases of aircraft to mesh with the aging and retirement of current systems.

#### Insurance for Separating Personnel

Under a recently signed contract between DoD and the Mutual of Omaha Insurance Co., eligible US military personnel departing from active service now have insurance coverage available for up to one year for pre-existing medical conditions.

The coverage is designed to ease the transition from military to private health coverage for involuntary separatees and their dependents who qualify for transition benefits and for voluntary separatees and their dependents who separate under the Special Separation Benefit program.

To obtain the coverage, personnel who separated on or after October 2, 1991, must purchase Mutual of Omaha's Uniformed Services Voluntary Insurance Plan (US VIP).

The Pentagon announced that, for those individuals (and their families) who separated between October 1, 1990, and October 1, 1991, and who purchased the US VIP policy, the effective date of their preexisting condition coverage will begin on the effective date of their US VIP policy.

The Defense Department statement went on to say that, for an individual in this group who did not purchase the US VIP policy, his or her preexisting condition coverage begins on the sixty-first or 121st day of separation, depending on whether he or she had



fewer than six or more than six years of service, respectively. "This means the policy picks up coverage when military medical coverage ends," said the Pentagon statement.

Questions regarding expenses and claim procedures should be directed to the Mutual of Omaha Insurance Co. at (402) 978-2119.

### **McDonnell Douglas Absorbs C-17 Costs**

McDonnell Douglas, acknowledging that it has gone beyond the contract ceiling price for the C-17 advanced airlifter, reset its estimate at completion for developing and building the first two production lots at \$7.39 billion.

This comes in about \$790 million higher than the contract ceiling price of \$6.6 billion. The contractor may have to absorb about \$1.2 billion in costs on the C-17 contract. That figure would include not only the \$790 million above ceiling but also another \$480 million that represents the difference between the C-17's target price and ceiling price.

Because of previous write-offs and contract modifications, however, the firm probably will never feel the full effects of an actual \$1.2 billion loss. In fact, because of the effects of the learning curve, the firm expects to make about \$2 billion over the life of the program, if all 120 aircraft planned are built.

McDonnell Douglas said that it has completed ninety percent of the original contract and is confident of its new estimate.

### **C-17 Flight Restrictions**

In other C-17 news, Pentagon spokesman Pete Williams disclosed in mid-May that as many as nine of the first C-17s may have defective control surfaces and the problem has led to restrictions on flights of the first aircraft. C-17 aircraft T-1 and P-1 through P-8 are being inspected to see if composite elevators and ailerons are suffering from delamination.

The problem may stem from a faulty cutting procedure performed by Grumman at its Milledgeville, Ga., plant.

Mr. Williams said the C-17 matter was not a design problem but a problem of workmanship. T-1 was inspected, and no problem was found, but it has been restricted from maneuvers that might strain the control surfaces. The plane will be checked after every twenty hours of flight. P-1 was inspected for delamination.

If delays and cost increases are incurred as a result of the problem, the contractors will bear the costs, Mr. Williams said.

### **McPeak's Flying Hours Defended**

Gen. Merrill A. McPeak, the Air Force Chief of Staff, hit a patch of controversy in April when NBC News reported that he had accumulated about 400 flying hours in Air Force aircraft since becoming the service's top uniformed leader. Secretary of Defense Dick Cheney stoutly defended General McPeak's flying practices, adding that he wished that all the members of the Joint Chiefs of Staff would follow the General's example of continuing to train like his troops.

According to the Air Force, General McPeak logged 184.3 hours on the C-135, 128.6 hours on the C-20B, 31.5 hours on the C-21, 39.7 hours in the F-15C/D, and 9.6 hours in other aircraft. The flight time was accumulated between November 1990 and mid-April 1992. The controversy focused on the expense. The cost of flying the F-15 for forty hours is about \$160,000, according to the Air Force.

The General also flew F-15 missions near the Saudi-Iraqi border in the days before the start of Operation Desert Storm. He said he did so in order to provide his Pentagon superiors with a firsthand perspective on the

status and preparation of the Air Force for the war.

The General said that, when he became Chief of Staff, he swore to remain close to the operational side of the Air Force and its personnel, and this was his way of doing so. He said that, while he may require the help of his staff when it comes to budget questions, he could speak authoritatively about issues regarding personnel and operations.

### **Gulf War Cost**

US taxpayers paid \$7.4 billion for the Persian Gulf War, while allies provided \$48 billion in cash and \$5.6 billion in in-kind services, the Pentagon said in April.

Saudi Arabia, Kuwait, the United Arab Emirates, Japan, Germany, and South Korea were major contributors. In total, allied nations pledged \$53.953 billion and delivered \$53.733 billion in cash and in kind. About \$304 million of in-kind donations from Germany and Korea were refused because they could not be used or the war had ended.

Saudi Arabia and Kuwait were the largest contributors, providing \$16.8 and \$16 billion, respectively. Japan provided approximately \$10 billion.



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### US Marches in Russian Parade

During the annual Peace Victory parade, the American flag waved for the first time in Moscow's Red Square.

A US armed services color guard, a US military band, and a group of Medal of Honor recipients joined with Hero of the Soviet Union honorees to march in the May 1 parade to commemorate the end of World War II.

Maj. Gen. Patrick H. Brady, deputy commander, 6th US Army, the Presidio, San Francisco, represented the Pentagon's Fiftieth Anniversary of World War II Commemoration Committee. The General, who is the senior active-duty US Medal of Honor recipient, was one of several grand marshals in the parade.

### DoD Spurs Private Investment

From 1990 through 1993, the Office of Economic Adjustment (OEA), the executive staff of the Economic Adjustment Committee (EAC), will have budgeted about \$10 million in planning assistance grants to help communities hurt by base closures, realignments, or reductions in defense industry employment.

Christopher Jehn, Assistant Secretary of Defense for Force Management and Personnel, who also serves as vice chairman of the EAC, told the Senate Armed Services Committee's Subcommittee on Readiness, Sustainability, and Support that federal, state, and local government resources are being used to spur private sector investment and jobs.

When US military installations are turned over to the private sector quickly, local communities and DoD benefit, he claimed: "New jobs are created quickly, and DoD lowers its costs for property maintenance and protection."

OEA, with the National Governors' Association and the National League of Cities, is exploring alternatives for states and municipalities to assess their vulnerability to defense reductions, Mr. Jehn said. "The product of these joint activities will be manuals for governors and mayors, providing information about programs around the country that are proving successful in generating jobs and the lessons learned from others' experiences."

### GD Sells Missile Division

Hughes Aircraft Co. has agreed to acquire General Dynamics' missile business. Hughes, which is owned by General Motors Corp., will deliver to GD approximately 21.5 million shares of GM Class H common stock, General Dynamics said in May.

In a prepared statement, GD said that "the General Dynamics missile business will be operated by Hughes Aircraft Company, a unit of General Motors' GM Hughes Electronics subsidiary. GM Class H common stock provides holders with financial returns based on the performance of GMHE."

Once the stocks are sold, General Dynamics will receive a minimum of \$450 million for the shares. If the

market value of the shares exceeds \$450 million at the time of the sale or reacquisition, Hughes and General Dynamics will share the excess value.

CEO and Chairman of GD William Anders said, "This transaction makes good sense for everyone. It brings together a broad line of products as well as superior manufacturing facilities, work force skills, and state-of-the-art technology. At the same time, it allows General Dynamics to build further financial strength as we focus on strengthening our four core defense businesses."

The acquisition will include GD's Air Defense Systems Division and the Unmanned Strike Systems portion of Convair Division. The units acquired have about 9,000 employees. The major programs involved in the deal are the Standard shipboard surface-to-air missile, the Stinger man-portable anti-aircraft missile, the Tomahawk sea-launched cruise missile, the Advanced Cruise Missile, and the Phalanx shipboard antimissile gun and Rolling Airframe Missile ship defense system.

GD is also looking to sell its electronics, commercial aircraft, and construction operations. GD's missile division earned \$76 million in profit last year on declining sales of \$1.4 billion. Mr. Anders said GD will focus on its tactical aircraft, submarines, armored vehicles, and space divisions as its base for the future.

### EMD Approved for F/A-18E/F

Under Secretary of Defense for Acquisition Donald Yockey approved Milestone IV for the McDonnell Douglas F/A-18E/F in May and authorized its entry into engineering and manufacturing development (EMD).

The approval is subject to the E/F variant's getting sufficient funding in the Navy's Program Objective Memorandum, which the service expects to complete in the summer.

Mr. Yockey said in an Acquisition Decision Memorandum that he intended to review the letter contracts for EMD for the airframe and engine prior to their award.

However, in an unusual twist, Mr. Yockey tied the award of the F/A-18E/F letter contract to initial data in the A-X attack aircraft cost and operational effectiveness analysis, which also addresses the F/A-18C/D and E/F alternatives.

A Defense Acquisition Board Milestone IIIA is required prior to approval of low-rate initial production for Fiscal 1997 (twelve aircraft and thirty-four engines), Fiscal 1998 (twelve aircraft



*The first four F-117 Stealth fighters were officially accepted in May by the commander of the 49th Fighter Wing at Holloman AFB, N. M., Brig. Gen. Lloyd W. Newton. Note the new Holloman insignia on the aircraft. They were transferred from Tonopah Test Range, Nev., which is scheduled for deactivation.*



and thirty-one engines) and Fiscal 1999 (eighteen aircraft and forty-six engines).

#### Finland Chooses F/A-18

The government of Finland chose the F/A-18 Hornet in May as the winner of its fighter competition, which also included the F-16, the Swedish JAS-39 Gripen, the French Mirage 2000-5, and the Russian MiG-29. Finland will use the F/A-18 as its primary air defense fighter, replacing Soviet MiG-21s and Swedish Drakens.

Larry Lemke, a McDonnell Douglas vice president and general manager of the F/A-18 program, said Finland plans to buy sixty-four aircraft for about \$3 billion.

The first seven aircraft, all two-seat D models, will be manufactured at McDonnell Aircraft in St. Louis. Final assembly of the remaining fifty-seven single-seat C model aircraft will take place at Valmet Aviation Inc. facilities in Halli, Finland, through 2000. McDonnell Aircraft will continue to supply kits for the aircraft through the life of the program.

Subcontractors are Northrop, General Electric, and Hughes Aircraft Co. Mr. Lemke said that the sale "bodes well for future international sales of the F/A-18, and it adds considerably to our efforts to maintain the US defense industrial base."

GE will supply 137 F404-GE-402 engines worth about \$350 million. GE will produce complete engine kits to be assembled by Valmet.

#### Lockheed Delivers 2,000th C-130

Lockheed delivered its 2,000th C-130 Hercules transport in May after completing routine testing on the aircraft, the firm said. The aircraft was purchased by DoD for the Kentucky ANG's 123d Airlift Wing.

Lockheed said that no other military transport has been in continuous production as long as the C-130, which has been around for thirty-seven years. The aircraft is operated by sixty-two nations and exists in more than forty versions.

#### Joint STARS Production

Air Force Systems Command's Electronic Systems Division (now Materiel Command's Electronic Systems Center) and Grumman signed a \$107.8 million production contract in April for the first two production-model E-8C Joint Surveillance and Target Attack Radar System (Joint STARS) aircraft.

The contract provides for advanced procurement of items for the first two production aircraft. Included in the contract will be the purchase of two 707-300 series aircraft, inspection



Photo courtesy Russell Cheyne/All Sport-London

*Persian Gulf War veteran 1st Lt. Chad Hennings traded his A-10 pilot's helmet for a Dallas Cowboys helmet in May. The Air Force Academy graduate left the 92d Tactical Fighter Squadron at RAF Bentwaters, UK, to play football. In 1987 he won the Outland Trophy, awarded to the best collegiate interior lineman.*

and refurbishment of both aircraft, and the purchase of long-lead components for the radar systems and aircraft modifications.

Delivery of the first of a total of twenty Joint STARS aircraft will begin in 1996. The two preproduction E-8A systems being used in the test

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program will be upgraded to E-8C standard and will be the last of the twenty to be delivered.

**Thurmond to Displace Warner**

Sen. John Warner (R-Va.) will be displaced in the next congressional session as ranking Republican on the Senate Armed Services Committee. His seat will be taken by Sen. Strom Thurmond (R-S. C.), Senator Thurmond's office said in April.

Senator Thurmond, who came to the upper chamber in 1955, has served in the Senate far longer than has Senator Warner, who began his Senate service in 1979. The South Carolinian's seniority allows him to bump Senator Warner if he chooses, and he evidently decided to do so to help protect his state's interests in the allocation of defense resources.

Senator Warner said in April that he would not seek to be governor of Virginia in part because of his position on the Armed Service Committee, which enables him to reduce the impact of defense cuts on his home state. Senator Warner's office said that Senator Thurmond's move will in no way affect the Virginia Republican's ability to promote his state's interests.

**More ACMs May Not Be Needed**

The Air Force should take no further action to procure Fiscal 1992 Advanced Cruise Missiles (ACMs) until the need for additional missiles is validated, the General Accounting Office (GAO) said in a May report.

The report stated that validation should consider the evaporation of the former Soviet threat, the realignment of US strategic forces, the utility of air-launched cruise missiles (ALCMs), and the availability of funds.

In January, the President decided to end ACM production at no more than 640 missiles, a number that includes the authorized buy of 120 missiles in 1992. GAO said there are indications that the Air Force may choose to buy no more than 520 ACMs. "However, as of April 7, 1992, the Office of the Secretary of Defense had not concurred in this plan," the report states.

GAO said that one of the main reasons the Air Force may limit the buy to 520 missiles is its need for a source of funds to cover funding shortfalls in prior-year ACM contracts: "The shortfalls, estimated at \$121.2 million, were due mainly to costs incurred when deliveries were suspended while design and quality problems were resolved."

The report explains that the Air Force was forced to partially terminate the

contract for 1987 and 1988 when it discovered in 1992 it lacked sufficient funds to cover the shortfall. The Air Force immediately awarded a new letter contract to continue work under the partially terminated contract, using Fiscal 1992 funds.

**AMRAAM Full-Rate Production**

Under Secretary Yockey approved the Air Force's request to move the Advanced Medium-Range Air-to-Air Missile (AMRAAM) program to full-rate production.

According to an April Acquisition Decision Memorandum, Mr. Yockey directed the Air Force to accelerate lethality enhancements during the Preplanned Product Improvement program to ensure that as many missiles as possible receive the enhancement. The lethality enhancements would improve the missiles' effectiveness against aircraft with greater redundancy in their flight-control systems.

Mr. Yockey approved the Air Force's plans to continue dual-sourcing of the missile to Raytheon and Hughes through Lot VII of the planned buy. However, the Air Force must submit a new acquisition strategy and requests for proposal for approval in Fiscal 1994-95. Lot VIII would begin in Fiscal 1994.

The Air Force has reduced the production buy of the missile to 13,000.

**Peruvians Fire on C-130**

Two Peruvian fighters fired on an unarmed USAF C-130 transport off the coast of Peru in April, killing one crew member and wounding four. The C-130 was on a routine counterdrug mission, according to US officials, when it was attacked about sixty nautical miles off the coast of Peru.

Officials in Lima said the Peruvian pilots attempted to make contact with the pilot of the C-130, but the transport did not respond. The crew member was killed when machine-gun bullets blew open a door and he was sucked from the aircraft.

The lost crew member was MSgt. Joseph C. Beard from Kalamazoo, Mich. His body was not recovered. The last of the wounded crew members was discharged from the hospital in early May.

The Peruvian Government said it regretted the incident and regarded it as an accident. An investigation is under way.

**News Notes**

■ Gen. John R. Galvin, Supreme Allied Commander Europe and Commander in Chief, US European Command, was nominated in April to be placed on the retired list in his current grade. General Galvin was replaced by Lt. Gen. John M. Shalikashvili of the US Army, currently assistant to

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the Chairman of the Joint Chiefs of Staff, who was appointed to the rank of general. General Galvin has been the top US and allied military officer in Europe since 1987. During his tenure, the Warsaw Pact, the Soviet Union, and NATO forces all underwent tumultuous change.

■ Air Combat Command has more than 1,380 aircraft and 177,000 personnel under its control, according to a fact sheet on the new command. ACC also controls fifty Peacekeeper and 900 Minuteman ICBMs. When mobilized on June 1, ACC had more than 87,000 members of the Air National Guard and Air Force Reserve, along with 933 aircraft.

■ The 1st Space Wing and 3d Space Support Wing, headquartered at Peterson AFB, Colo., merged in May to form the 21st Space Wing. The new wing is under the command of Air Force Space Command. The new structure moves more day-to-day operational responsibilities to the wings and reduces the command headquarters staff, according to the service. Brig. Gen. Ronald D. Gray will command the new wing.

■ Beech Aircraft received its first flight-qualified Pratt & Whitney Canada PT6A-68 engine in late April for the Pilatus PC-9 Mk. 2 aircraft to be used in competition for the Joint Primary Aircraft Training System (JPATS) program.

■ Raytheon Co. said in April that it had successfully tested the newly developed Patriot PAC-3 multimode missile at White Sands Missile Range, N. M. The fire unit engaged an un-augmented Beech Aircraft MQM-107D subscale drone and destroyed it.

■ A Swedish Defense Materiel Administration report, released in May, found that the JAS-39 Gripen will achieve all technical goals of the Swedish Air Force. Nearly 450 test flights have been completed on the aircraft. The fifth test aircraft is expected to fly late this year. Sweden also decided to purchase 110 more from Saab Aircraft.

■ Westinghouse's Airborne Early Warning and Control Division was selected in April to provide AWACS radar system improvement program enhancements to the fleet of NATO AWACS aircraft, under an agreement with Air Force Electronic Systems Center. The AWACS enhancement includes design, development, and flight test of improvements to the AWACS AN/APY-1 and -2 radars to maintain operational capability against smaller radar cross section targets, cruise missiles, and electronic countermeasures.



**Lt. Gen. Richard E. Hawley (left), commander of 5th Air Force, talks with RAAF Group Capt. Rox McLennan and Australian Army Col. J. Crocker (right) after dedication ceremonies for the 5th Air Force memorial in Townsville, Australia. Thousands of 5th Air Force airmen operated out of Townsville from 1942 to 1945.**

■ A Texas Instruments-built Javelin antitank missile destroyed a former Soviet T-62 tank in a test at Redstone Arsenal, Ala., in late April. The firing, the first with a live warhead, took place about 1,000 meters from the target. The missile locked on to the target, tracked through a top attack trajectory, and destroyed the tank. The Javelin has had eight hits in nine tests.

■ A Raytheon AEGIS extended-range missile was successfully tested in April at White Sands Missile Range. The test demonstrated the system's long-range, high-altitude maneuverability. The surface-to-air missile will complement medium-range Standard missiles on AEGIS cruisers and destroyers fitted with a Mk. 41 vertical launch system.

#### Purchases

The Air Force awarded Pratt & Whitney an \$8.9 million face-value increase to a firm fixed-price contract for Fiscal 1993 full funding of two F100-PW-229 Increased Performance Engines for use on F-15 aircraft and Fiscal 1993 long lead for twelve F100-PW-229 IPEs for use on F-16 aircraft. Expected completion: March 1994.

The Air Force awarded General Electric a \$57 million face-value increase to a firm fixed-price contract for twelve spare F110-GE-129 engines, applicable to the F-16 aircraft, and long lead for installation of twelve F110-GE-129 engines and thirteen F110-GE-129 engine moni-

toring system computers in Fiscal 1993. Expected completion: August 1996.

The Navy awarded Bath Iron Works a \$749.9 million fixed-price incentive contract for three DDG-51-class AEGIS destroyers. Expected completion: October 31, 1997.

The Navy awarded Ingalls Shipbuilding a \$571.6 million fixed-price incentive contract for two DDG-51-class AEGIS destroyers. Expected completion: April 30, 1997.

The Air Force awarded an \$18 million face-value increase to a firm fixed-price contract for an upgrade of the Mission Data Processing System for the F-117A aircraft. Expected completion: July 1994.

The Navy awarded McDonnell Douglas a \$1.4 billion ceiling price advanced acquisition contract for Fiscal 1993 procurement of thirty-four F/A-18C and fourteen F/A-18D aircraft weapon systems and associated supplies and data, including F/A-18 weapon systems equipped with AN/APG-73 radars. Expected completion: September 1995.

#### Honors

The 3246th Test Wing of Air Force Systems Command (now Air Force Materiel Command) was awarded the Daedalian Maintenance Award in May, the first ever by an AFSC unit.

Lt. Gen. Thomas S. Moorman, Jr., vice commander of Air Force Space Command, won the 1991 Gen. Thomas D. White Space Trophy for out-



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standing contribution to the nation's progress in aerospace. The award recognizes General Moorman's leadership in US military space operations, including thirty-one consecutive successful space launches, near flawless space support to tactical

forces in Operation Desert Storm, and innovative quality-of-life improvements throughout AFSPACECOM.

DoD awarded the Commander in Chief's Award for Installation Excellence to Altus AFB, Okla., among other bases. Fort Sill, Okla.; MCB

Camp Lejeune, N. C.; Puget Sound Naval Shipyard, Bremerton, Wash.; and Defense Construction Supply Center, Columbus, Ohio, were also winners. Each winner provided superior working, housing, and recreational conditions. ■

## Senior Staff Changes

**RETIREMENTS:** B/G Dennis C. **Beasley**; L/G Robert D. **Beckel**; M/G Edward R. **Bracken**; B/G James F. **Grant**; B/G Arthur E. **Johnson**; B/G Roger A. **Jones**; B/G Kenneth F. **Keller**; Gen. Donald J. **Kutyna**; L/G Charles A. **May, Jr.**; Gen. Charles C. **McDonald**; M/G Kenneth V. **Meyer**; M/G William J. **Porter**; M/G Robert R. **Rankine, Jr.**; M/G David C. **Reed**; L/G Donald **Snyder**; L/G David J. **Teal**; B/G Robert V. **Woods**.

**PROMOTIONS:** To be **General:** Charles A. **Horner**.

To be **Lieutenant General:** Buster C. **Glosson**; Arlen D. **Jameson**; Joseph W. **Ralston**.

**CHANGES:** M/G **Harold N. Campbell**, from DCS/P&P, Hq. AFCL, Wright-Patterson AFB, Ohio, to DCS/P&P, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . B/G **Stewart E. Cranston**, from Vice Cmdr., ASD, AFSC, Wright-Patterson AFB, Ohio, to DCS/Ops., Hq. AFMC, Wright-Patterson AFB, Ohio. . . . B/G **Robert S. Dickman**, from Dep. Dir., Space Prgms., Ass't Sec'y of the Air Force for Acquisition, Hq. USAF, Washington, D. C., to DCS/Plans, Hq. AFSPACECOM, Peterson AFB, Colo., replacing B/G (M/G selectee) **William E. Jones**. . . . B/G (M/G selectee) **Kenneth E. Eickmann**, from DCS/Log., Hq. PACAF, Hickam AFB, Hawaii, to C/S, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . M/G **James A. Fain, Jr.**, from Prgm. Dir. for F-22, ASD, Hq. AFCL, Wright-Patterson AFB, Ohio, to DCS/Requirements, Hq. AFMC, Wright-Patterson AFB, Ohio.

M/G **John C. Fryer, Jr.**, from Dep. Def. Advisor, US Mission to NATO, and Mil. Advisor to the US Perm. Rep. on the NAC, Brussels, Belgium, to Commandant, National War College, Fort McNair, D. C. . . . B/G **Francis C. Gideon, Jr.**, from Cmdr., Foreign Aerospace Science & Tech. Ctr., AFIC, Wright-Patterson AFB, Ohio, to Vice Cmdr., Sacramento ALC, AFMC, McClellan AFB, Calif., replacing retired B/G Robert V. **Woods**. . . . B/G **Timothy D. Gill**, from Command Dir., NORAD Combat Ops. Staff, J-31, Hq. NORAD, Cheyenne Mountain AFB, Colo., to Dir., NORAD Planning Staff, Hq. NORAD, Cheyenne Mountain AFB, Colo., replacing retired B/G **Harold B. Adams**. . . . M/G (L/G selectee) **Buster C. Glosson**, from Dir., Leg. Liaison, OSAF, and Dir., Air Force Issues Team, Hq. USAF, Washington, D. C., to DCS/P&O, Hq. USAF, Washington, D. C., replacing L/G **Michael A. Nelson**. . . . B/G **Ronald D. Gray**, from DCS/Ops., Hq. AFSPACECOM, Peterson AFB, Colo., to Cmdr., 21st Space Wg., Hq. AFSPACECOM, Peterson AFB, Colo.

B/G (M/G selectee) **John C. Griffith**, from Vice Cmdr., Ogden ALC, AFCL, Hill AFB, Utah., to Cmdr., Keesler Training Center, ATC, Keesler AFB, Miss., replacing B/G (M/G selectee) **Paul E. Stein**. . . . B/G (M/G selectee) **Thomas R. Griffith**, from DCS/Plans; Dep. Dir., Plans, TACOS; and DCS/Plans, USAFLANT, TAC, Langley AFB, Va., to Cmdr., USAF FWC, ACC, Nellis AFB, Nev., replacing M/G **Billy G. McCoy**. . . . M/G **William P. Hallin**, from DCS/Materiel Mgmt. and Ass't to the Cmdr., AFCL, for R&M, Hq. AFCL, Wright-Patterson AFB, Ohio, to Cmdr., Warner Robins ALC, AFMC, Robins AFB, Ga., replacing retiring M/G **Richard F. Gillis**. . . . Col. (B/G selectee) **John W. Hawley**, from ACOS, Offensive Ops., and Sr. US Rep. AAFCE, Ramstein AB, Germany, to Cmdr., 52d Fighter Wg., USAF, Spangdahlem AB, Germany. . . . M/G **Larry L. Henry**, from DCS/P&R, Hq. ATC, Randolph AFB, Tex., to Dir., Operational Requirements, DCS/P&O, Hq. USAF, Washington, D. C., replacing M/G (L/G selectee) **Joseph W. Ralston**.

L/G (Gen. selectee) **Charles A. Horner**, from Cmdr., 9th AF, TAC, and Cmdr., USCENTAF, Shaw AFB, S. C., to CINCNORAD; CINC, Hq. USSPACECOM; Cmdr., Hq. AFSPACECOM, Peterson AFB, Colo.; and DoD Mgr. for Space Transportation Sys. Contingency Support Ops., replacing retired Gen. Donald J. **Kutyna**. . . . Col. (B/G selectee) **Dennis K. Hummel**, from Vice Cmdr., AFMC (Prov.), Wright-Patterson AFB, Ohio, to Vice Cmdr., ASC, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . M/G **James M. Hurley**, from Dir., Manpower and Organization, Hq. USAF, Washington, D. C., to DCS/Plans; Dep. Dir., Plans, TACOS; and DCS/Plans, USAFLANT, Hq. ACC, Langley AFB, Va., replacing B/G (M/G selectee) **Thomas R. Griffith**. . . . M/G (L/G selectee) **Arlen D. Jameson**, from C/S, Hq. SAC, and Dep. Vice Dir., JSTPS, Offutt AFB, Neb., to Cmdr., 20th AF, ACC, Vandenberg AFB, Calif. . . . Col. (B/G selectee) **Robert G. Jenkins**, from Dep. Dir., Ops., DCS/P&O, Hq. USAF, Washington, D. C., to Cmdr., 51st Fighter Wg., PACAF, Osan AB, Korea.

B/G (M/G selectee) **William E. Jones**, from DCS/Plans, Hq. AFSPACECOM, Peterson AFB, Colo., to DCS/Ops., Hq. AFSPACECOM, Peterson AFB, Colo., replacing B/G **Ronald D. Gray**. . . . M/G **Jay W. Kelley**, from Spec. Ass't to Cmdr., AFSPACECOM, Peterson AFB, Colo., to Dir., Public Affairs, Hq. USAF, Washington, D. C., replacing B/G **Hallie E. Robertson**. . . . B/G **Lester L. Lyles**, from DCS/Requirements, Hq. AFSC, Andrews AFB, Md., to Vice Cmdr., Ogden ALC, AFMC, Hill AFB, Utah., replacing B/G (M/G selectee) **John C. Griffith**. . . . M/G **Billy G. McCoy**, from Cmdr., USAF FWC, TAC, Nellis AFB, Nev., to Cmdr., Lackland Training Center, ATC, Lackland AFB, Tex., replacing retired M/G **David C. Reed**. . . . L/G **Thomas G. McInerney**, from Cmdr., Alaskan Command, USPACOM; Cmdr., 11th AF, PACAF; and Cmdr., Alaskan NORAD Region, Elmendorf AFB, Alaska, to Ass't Vice C/S, Hq. USAF, Washington, D. C., replacing retired L/G **Charles A. May, Jr.**

B/G **John M. Nauseef**, from DCS/Financial Mgmt. & Comptroller, Hq. AFSC, Andrews AFB, Md., to DCS/Comptroller, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . L/G **Michael A. Nelson**, from DCS/P&O, Hq. USAF, Washington, D. C., to Cmdr., 9th AF, ACC, and Cmdr., USCENTAF, Shaw AFB, S. C., replacing L/G (Gen. selectee) **Charles A. Horner**. . . . Col. (B/G selectee) **Richard R. Paul**, from Cmdr., Wright Lab, ASD, AFSC, Wright-Patterson AFB, Ohio, to DCS/Technology, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . B/G (M/G selectee) **Glenn A. Proffitt II**, from Cmdr., CTF, Operation Provide Comfort, USAF, Incirlik AB, Turkey, to Dir., Manpower and Organization, Hq. USAF, Washington, D. C., replacing M/G **James M. Hurley**. . . . B/G **Robert F. Raggio**, from Prgm. Dir., Systems, ASD, AFSC, Wright-Patterson AFB, Ohio, to Prgm. Dir. for F-22, ASC, AFMC, Wright-Patterson AFB, Ohio, replacing M/G **James A. Fain, Jr.**. . . . M/G (L/G selectee) **Joseph W. Ralston**, from Dir., Operational Requirements, DCS/P&O, Hq. USAF, Washington, D. C., to Cmdr., Alaskan Command, USPACOM; Cmdr., 11th AF, PACAF; and Cmdr., Alaskan NORAD Region, Elmendorf AFB, Alaska, replacing L/G **Thomas G. McInerney**.

B/G **James C. Roan, Jr.**, from Staff Judge Advocate, Hq. AFCL, Wright-Patterson AFB, Ohio, to Staff Judge Advocate, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . B/G **Hallie E. Robertson**, from Dir., Public Affairs, Hq. USAF, Washington, D. C., to Command Dir., NORAD Combat Ops. Staff, J-31, Hq. NORAD, Cheyenne Mountain AFB, Colo., replacing B/G **Timothy D. Gill**. . . . M/G **John D. Slinkard**, from DCS/Contracting, Hq. AFSC, Andrews AFB, Md., to DCS/Contracting, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . M/G **Richard D. Smith**, from DCS/Log., Hq. AFCL, Wright-Patterson AFB, Ohio, to DCS/Log., Hq. AFMC, Wright-Patterson AFB, Ohio. . . . B/G (M/G selectee) **Paul E. Stein**, from Cmdr., Keesler Training Center, ATC, Keesler AFB, Miss., to Dir., Leg. Liaison, OSAF, and Dir., Air Force Issues Team, Hq. USAF, Washington, D. C., replacing M/G (L/G selectee) **Buster C. Glosson**.

**SENIOR EXECUTIVE SERVICE (SES) RETIREMENT:** Herbert M. **Kaiser, Jr.**

**SES CHANGES:** **John W. Beach**, from Dep. for Budget, Dep. Ass't Sec'y, Budget, OSAF, Washington, D. C., to Prin. Dep. Ass't Sec'y (Financial Mgmt.), Ass't Sec'y, Financial Mgmt. & Comptroller, OSAF, Washington, D. C., replacing **C. Ronald Hovell**. . . . **Donald J. Campbell**, from Dir., Aero Propulsion and Power, Wright Lab, Wright-Patterson AFB, Ohio, to Dir., Science and Tech., OSAF, Washington, D. C. . . . **Spain W. Hall, Jr.**, from Dir., Studies & Analyses, Hq. AFCC, Scott AFB, Ill., to Dir., Std. Sys. Ctr., AFCC, Gunter AFB, Ala., replacing B/G **Frederick A. Zehrer III**. . . . **Charles H. Hooper**, from Prin. Ass't DCS/Product Assurance and Acq. Log., Hq. AFSC, Andrews AFB, Md., to Dir., Manufacturing and Quality Assurance, DCS/Integrated Engineering and Tech. Mgmt., ASC, Hq. AFMC, Wright-Patterson AFB, Ohio. . . . **Ronald Hovell**, from Prin. Dep. Ass't Sec'y (Financial Mgmt.), Ass't Sec'y, Financial Mgmt. & Comptroller, OSAF, Washington, D. C., to Dir., Columbus Ctr., Def. Finance and Accounting Service, Columbus, Ohio. . . . **James J. Mattice**, from DCS/Development Planning, ASD, AFCL, Wright-Patterson AFB, Ohio, to Dep. Ass't Sec'y, Research and Engineering, OSAF, Washington, D. C. . . . **James A. Vinarskai, Dir.**, Sys. Analysis, Hq. SAC, Offutt AFB, Neb., to DCS/Plans & Engineering, Human Sys. Ctr., AFMC, Brooks AFB, Tex. ■



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**The missile danger to aircraft has diminished in Europe, but it is on the rise elsewhere.**

Staff photo by Guy Aceto

# Electronics for the "Rainbow Threat"

By James W. Canan, Senior Editor

**T**HE AIR FORCE treasures its F-15s, its premier air-to-air and deep-attack fighters for many years to come. They proved their worth in Operation Desert Storm, and they may be called on for repeat performances in other wars well into the next century.

There could be a problem with this. F-15C/D air-combat fighters are out of production, and F-15E strike fighters soon will be. The Air Force will have only so many of both types to go around and must see to their self-protection and survival under attack.

Their survivability is by no means a sure thing. As of now, the F-15s are more vulnerable than the Air Force would like. They are equipped with capable electronic warfare (EW) systems—jammer, radar warning receiver, and chaff and flare dispensers—for self-protection against enemy missiles. Those systems did well in the Persian Gulf War, enabling the fighters to come through virtually unscathed, but they still need work.

The catch is that the elements of the F-15's EW suite—called TEWS (Tactical Electronic Warfare System)—are not fully integrated among themselves and with other electronic systems aboard the aircraft. Thus they

often work at cross purposes, creating dangerous gaps in the fighter's defensive coverage.

To narrow the gaps, the Air Force has moved to upgrade and integrate TEWS component systems. It plans to outfit the entire F-15E fleet of about 200 fighters with the refurbished TEWS before moving on to retrofit it in F-15C/Ds. The Air Force reasons that the ground-attack F-15Es need it more. In combat, they are often called on to go it alone, and the going is often heavy.

TEWS integration is a blue-chip Air Force tactical program. Testing looks good thus far. If the program pans out as expected, "it will make the F-15E even deadlier" as a weapon system, claims Maj. Gen. John Corder, commander of the Air Warfare Center (AWC) at Eglin AFB, Fla. Why? Because, says General Corder, the strike fighter will "be able to step up to threats not now covered" by its electronic countermeasures and, thus, will be able to go more places and do more things.

## Essential to Survival

Unlike the stealthy F-117A attack plane, "the F-15E is a 'high observable' airplane that has to have self-

*SSgt. Michael A. Porter and TSgt. Clifton D. Garrett, weapons loading specialists with the 113th Fighter Wing, D. C. ANG, install a flare box on an F-16A at Andrews AFB, Md. Protecting combat aircraft with such electronic warfare devices as decoys, jammers, and missile warning receivers becomes ever more important as SAM and air-to-air missile threats diversify and spread around the globe.*







protection," General Corder notes. "TEWS is essential to survival if the F-15E flies any place where radar can see it."

Although the cold war is over, shielding combat aircraft from enemy fire by means of electronic countermeasures is at least as important to the Air Force as it ever was. Missile threats to aircraft may have diminished in Europe, but they are on the rise elsewhere.

After some rocky years, the Air Force seems to be making steady progress in electronic warfare systems. Operation Desert Storm demonstrated that many of USAF's EW development programs through the 1980s were more successful than critics had claimed. EW systems were given much of the credit for the extraordinarily high survival rate of Air Force aircraft under sometimes withering antiaircraft fire.

Even so, there are trouble spots in the EW scene. For one, tactical aircraft have difficulty defending against infrared (IR) guided, heat-seeking missiles. The Defense Department made this point among others in "Conduct of the Persian Gulf War," the voluminous report submitted to Congress earlier this year.

The report noted that "at least fifteen coalition aircraft were lost to AAA or IR SAMs" and that they were especially vulnerable to such weapons while "operating at lower altitudes to ensure target acquisition and destruction." It concluded that "all [US tactical] aircraft require improved protection," such

as "automatic warning systems" against IR, electro-optical, and radar missiles and "automatic defensive systems," including "improved flares."

All Air Force tactical combat aircraft are now equipped with one or another of the electronic countermeasures (ECM) systems that did the job in Desert Storm, chiefly the Northrop ALQ-135 internally mounted jammer, the upgraded Westinghouse ALQ-131 ECM pod, the venerable Westinghouse ALQ-119 pod, and the Raytheon ALQ-184 pod, an upgraded variant of the ALQ-119.

The ALQ-135, a so-called deception jammer, is carried only by F-15C/D air-superiority fighters and by F-15E strike fighters. The Sanders ALQ-137, an older, internally mounted noise jammer, is peculiar to F-111s, which are now being replaced by F-15Es throughout the active force. The ALQ-137 must be augmented under certain conditions by ALQ-131 pods.

F-4G Wild Weasels are equipped with ALQ-184 pods. All other types of tactical aircraft carry one or another of three pod systems—the ALQ-119, which is being retired, the ALQ-184, or the ALQ-131.

The Air Force once planned to outfit its F-16C/D fighters with the Westinghouse/ITT ALQ-165 internal Airborne Self-Protection Jammer (ASPJ). It withdrew from the USAF-Navy ASPJ development program in 1990, citing high costs, spotty test results, and production restrictions imposed by Congress.

Thus it appeared that F-16s would have to continue carrying jammer pods on outboard stations.

This cuts down on the number of bombs and other weapons the F-16 can carry into combat. Pods crowding out weapons are a particular problem on recently produced Block 40 F-16s. They lug LANTIRN navigation and targeting pods along with ECM pods.

Appearances may be deceiving, however. The solution for the F-16 may lie in what some officials call "the black alternative"—an ECM deception device, likely a decoy, that the fighters will tow behind rather than tote underneath. It is said to be much less expensive than ASPJ and far more effective against oncoming missiles guided by monopulse radars.

The Navy, which long ago opted for internal jammers instead of ECM pods on its tactical aircraft, seems intent on staying the course with ASPJ. It plans to install the jammer on F-14s, F/A-18s, A-6Es, and AV-8Bs. So-called "outboard [counter] measures"—towed decoys and the like—are said to account for much of the Navy's EW development work.

#### Vindicated in Combat

By all accounts, the Air Force is in better shape for EW than it had been for a long while. Operation Desert Storm demonstrated that USAF and its EW contractors had done a good job through the 1980s of developing new systems. The trend persists.

Reprogrammable radar warning receivers (RWRs)—devices that sound the alarm when radar-guided missiles approach—are prime examples of recent progress in EW for tactical aircraft. The Air Force is now installing new-generation Loral ALR-56M RWRs on F-16s in place of outdated Litton ALR-69 RWRs. Litton is the second-source supplier of the ALR-56M, which may also find a home on other types of Air Force planes, including the C-17 airlifter and the B-1B bomber.

Loral designed the ALR-56M as a miniaturized variant of its ALR-56C, the RWR carried in the Gulf War by all F-15Es and by many of the F-15Cs that took part in the combat. Other F-15Cs in the war were equipped with the first model of the line, the ALR-56A.

"We're doing considerably better than we did through the early 1980s," General Corder says. "We understand

Photo by Mic Ward / Dynacorp



An Air Force F-16 is prepared for testing at Eglin AFB, Fla., with a Westinghouse ALQ-131 Block II electronic countermeasures pod. All F-16s, F-15s, A-10s, F-111s, and F-4Gs equipped with those pods survived the Persian Gulf War.





**This SA-2 emplacement was among SAM sites in Iraq devastated by USAF F-4G Wild Weasels on Suppression of Enemy Air Defense (SEAD) missions during the Gulf War. Electronic warfare specialists claim that the SAM threat to US aircraft is spreading rather than withering as a result of the end of the cold war.**

the threats, and we know how to meet them. We're not doing some things at the pace I'd like, but we've settled on our requirements and priorities."

High among these are missile approach warning systems (MAWS) to alert aircrews to the approach of all types of missiles. RWRs detect only radar-guided missiles. MAWS do that and more. They also sense the approach of missiles guided by IR and electro-optical sensors.

All types of Air Force combat aircraft are well equipped to stave off radar-guided missiles by means of RWRs, jammers, and chaff dispensers. Only a few types—B-52s, F-111s, and special operations planes—have MAWS to warn that IR-guided and TV-guided missiles are coming their way.

This deficiency proved fatal all too often in Operation Desert Storm. Heat-seeking enemy missiles accounted for most of the twenty-seven US combat aircraft downed in the Gulf War. In many instances, the victimized aircrews "were not even aware that they were being attacked" and, as a result, did not deploy flares to fool the missiles, General Corder says.

MAWS programs suffered a setback not long ago when the Air Force, trimming its budget, deferred additional funding for them. Even so, no one is giving up on MAWS development. It has come a long way, shows great promise, and is expected to get back on track sooner or later.

MAWS advocates believe time and circumstances are on their side. The missile threat to aircraft that influenced the Air Force to take an interest in missile warning systems has not gone away now that the cold war is over. Indeed, it may be getting worse.

### Spreading Missile Menace

Among knowledgeable defense officials who think so is Anthony R. Grieco, director of electronic combat in the Directorate of Defense Research and Engineering. "The threat has not

diminished," he asserts. "If anything, it has increased—in terms of Third World contingencies—because more of the [Soviet missile] technology is available for sale around the world." He expects this trend to continue for the next five to eight years.

"The Russians have basically everything for sale," Mr. Grieco continues. "They have a cash problem, and they have to generate cash flow. They are now willing to sell some of the technology they once would have held back."

The good news, says Mr. Grieco, is that the technology will dry up.

"What we won't see any more out of the old Soviet Union—out of Russia—is the continual growth of technology," he predicts. "The numbers [of advanced missiles] in the Third World will diminish. They'll be dense, but not nearly as dense as those of the [former] Warsaw Pact."

The missile threat to US military systems has many faces. "There is more emphasis now on what I call the 'rainbow threat'—the threat from non-Soviet systems," Mr. Grieco says. "In the future, we may have to face Western technology, including our own."

This has already happened. Iraqi air defense forces fired American-made Hawk missiles against allied coalition aircraft in the Gulf War. "We were able to defend ourselves against the Iraqi Hawks," says General Corder, who was Central Air Forces' deputy commander of operations in that war.



**An underwing shot of an A-10 shows one of its four stations for deploying such ECMs as chaff and flare dispensers to counter oncoming radar-guided missiles and infrared-guided, heat-seeking missiles. Flares are becoming more sophisticated.**



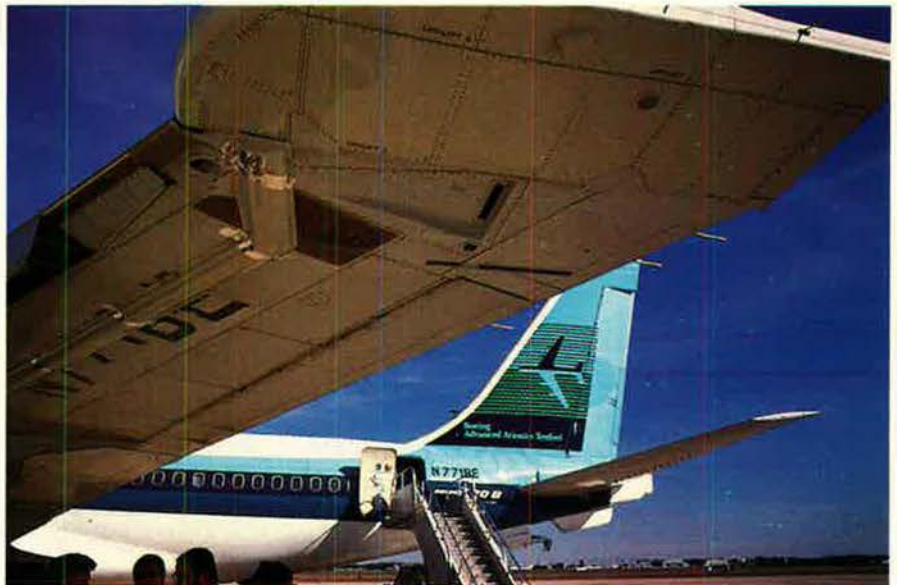
Next-generation US combat aircraft should have it all over those of the present generation in handling anything that comes their way. They will be models of EW systems integration. The elements of their electronic warfare suites are designed to work in harmony and with optimum effect.

"We are in a time of transition in terms of EW," says Mr. Grieco. "The [Air Force] F-22 fighter and the [Navy-USAF] A-X [attack plane] will have completely integrated EW systems. EW systems made up of contiguous black boxes are going away."

### The Totally Integrated Airplane

Such integration was a major goal of the Advanced Tactical Fighter development program that brought forth the F-22. The idea was to coordinate all EW functions and operations and harmonize them with the rest of the avionics in what the Air Force took to calling the "totally integrated airplane."

This appears to have happened. The F-22's EW suite is an outgrowth of the Integrated Electronic Warfare System (INEWS) that the Air Force began developing in the early 1980s. It is designed to counter advanced air-to-air and surface-to-air weapons of all types. It combines the functions of a radar warning receiver, a missile approach warning system, IR and RF (radio frequency) countermeasures, and electronic support measures (ESMs). All functions are embodied in about seventy electronic modules meshed with a



Staff photo by Guy Acello

**Led by Boeing, a half-dozen companies specializing in electronic warfare gear teamed up to configure this 707 as an avionics test-bed to provide proof-of-concept data for emerging EW technologies. The plane, funded by the companies under Air Force auspices, made its first flight in January 1989.**

Hughes common integrated processor (CIP)—the computer at the heart of the fighter's EW suite.

It is impossible to achieve total integration of EW systems on present-day combat aircraft, most of which were designed around the computer and sensor technologies of yesteryear, without remodeling their electronic innards beyond belief. Short of that, though, much can be done.

The Air Force TEWS integration program for F-15s is a prime example. It may not turn the F-15 into an EW mas-

terpiece like the F-22 is expected to be, but it should be a big help to a plane that may need all the help it can get.

The Air Force undertook the TEWS program, which it described as the most complex internal EW integration of any of its tactical aircraft, to address a major problem. The F-15's jammer interfered with its radar warning receiver and deafened it to the radar signals of oncoming missiles. Confused by signals from the jammers, the RWRs sometimes heard nothing when there was actually something, or picked up what EW experts call "multiple symbols"—two or more missile radar signatures—when there were actually none.

On tactical aircraft, there is no way to keep the high-powered signals from the jammer transmitter antenna from overwhelming the neighboring RWR antenna. The only solution lies in coordinating the timing of jammer and RWR operations—and those of the ECM dispenser when under attack—for optimum effect on all counts.

### Linking the Black Boxes

This is no problem for the F-22, with its built-in central computer and high-speed data buses designed for just such coordination. The F-15 TEWS was something else again—a collection of black boxes, each with its own computer, making up what EW officials call a "federated"—as opposed to integrated—system. The goal of the TEWS integration program is to link those



**The Lockheed F-22 advanced tactical fighter will include an EW suite in which all elements are completely integrated by means of a central signal processor. Total EW Integration is impossible to achieve on existing combat aircraft.**

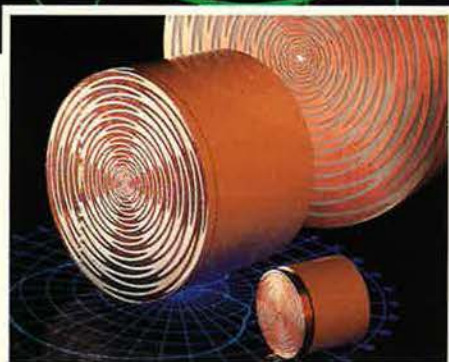


Photo depicts radiation patterns from a 2 inch Dual Linearly Polarized Sinuous Antenna

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Today's fast changing electronics defense environment demands a continuing focus on the development of advanced technologies. Loral Randtron Systems' tradition of excellence in microwave engineering and manufacturing is proven again with the availability of an antenna designed as a drop-in replacement for the single polarization spiral traditionally used in EW or ESM applications.

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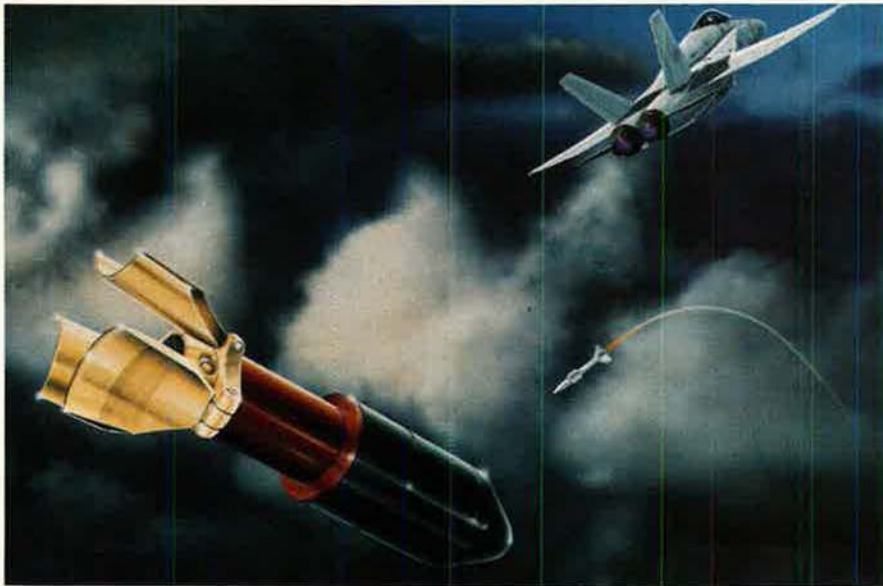
switched output for direct replacement of spiral elements.

Loral Randtron Systems' dual CP sinuous antenna applications include Radar Warning, ESM (interferometer), ECM repeater, Polarimeter and Compact Range usage. Loral Randtron's other antenna systems are improving performance on-board the F4, F15, F16, EF111A, Mirage V, E2C, C130 and P3.

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**LORAL**  
Randtron Systems





**A Texas Instruments generic expendable (GEN-X) decoy is in production for Navy and Marine Corps aircraft. On ejection, the decoy emits radar-like signals to lure attacking radar-guided missiles away from the plane. Such radar decoys will replace or complement chaff.**

computers much more closely and make them work more as a team. Advanced software and enhanced signal processing are the means. The computer in the Loral ALQ-56C RWR plays a major role in such integration. It houses the new software module that is the key to communications among black boxes in the TEWS.

"We are tying all those black boxes together," declares Lt. Col. Norman Matthews, chief of the electronic combat division in Air Force Materiel Command's F-15 System Program Office. "We won't have the jammer stepping on the RWR. We'll manage to have more jamming power and more [radar] listening sensitivity."

Over time, the new-look TEWS will be integrated with the F-15's fire-control radar, radar altimeter, and navigation radar. Developmental testing of the integrated TEWS began in June at the Air Force Development Test Center at Eglin AFB and is scheduled to end November 1. Operational testing will take place through the first half of next year. Operational F-15Es will begin receiving the system next July.

The means to alert tactical aircrews against heat-seeking and electro-optical missiles are also at hand. The Air Warfare Center undertook an evaluation of off-the-shelf missile approach warning systems more than a year before Iraq invaded Kuwait. AWC examined the technology of such systems already on "heavies" like the

B-52. Companies providing MAWS hardware for AWC to evaluate include General Electric, Lockheed Sanders, Loral, Westinghouse, and Cincinnati Electronics. AWC has tested the systems against air-to-air and surface-to-air missiles.

"We have done quite a bit of work with lots of companies," says General Corder. "We are satisfied that we have MAWS available to go on our fighters."

The Air Force began looking at MAWS for its tactical aircraft under pressure at the Defense Department level. In early 1990, the Defense Acquisition Board approved the service's controversial plan to assign the F/A-16 to the close air support (CAS) mission, on condition that the Air Force agree to install a MAWS on the new CAS fighters.

There are indications that the DoD pressure persists even as Air Force MAWS funding falters.

DoD's Mr. Grieco emphasizes that "our tactical aircraft have no warning at all of an IR shot. I'm convinced that missile approach warning systems are necessary adjuncts to our existing EW suites."

Shoulder-fired, heat-seeking missiles are expected to be the most abundant of all types of SAMs in the hands of potential US adversaries around the globe, Mr. Grieco says.

A MAWS does more than detect such missiles. It signals the aircrew that the time has come to release flares

to decoy the missiles away from the plane. Aircrews lacking MAWS on their planes sometimes put out flares as a precautionary measure, just in case. If there are no enemy IR missiles in the vicinity, the flares go to waste, and the crew may wind up wanting them back when the missiles do show up.

General Corder says aircrews "should put out flares only when they're under attack. If they use flares properly, they should be able to survive five or six missile attacks."

### Unused Flares

In the absence of MAWS, some crews never put out flares. They hoard them, in the hope that what they don't hear won't hurt them. "Airplanes that get shot down by IR missiles often have a full load of flares aboard," General Corder says.

In an integrated EW suite containing a MAWS, the flare dispenser would respond automatically to a MAWS alarm.

A MAWS would also alert an aircrew to dispense chaff against an oncoming radar-guided missile. Radar warning receivers serve that purpose on today's tactical fighters. "Missile warning systems make chaff and flares smart," General Corder declares.

The Air Force is working to keep its flares as up-to-date as the IR missiles they may have to face. "The flares we have to date do good work, but we're looking for new ones to take on the more advanced IR missiles like [American-made] advanced Stingers and some the Russians came up with."

Air Force Materiel Command's Aeronautical Systems Center, located at Wright-Patterson AFB, Ohio, has marshaled a half dozen or more companies in the search for super-sophisticated flares. "Each has a different idea of how to beat the missiles," General Corder says. Among them are flying flares with little nozzles for propulsion and tethered flares that sense when to cut loose and make missiles give chase.

"To make the flares work properly, we would have to have a missile warning system," General Corder declares.

Such a system will probably come along. Meanwhile, the Air Force seems to have EW pretty well under control. "We have good systems to take on this generation of SAMs and good programs to take on the next generation," General Corder asserts. "No one is going to beat us up." ■



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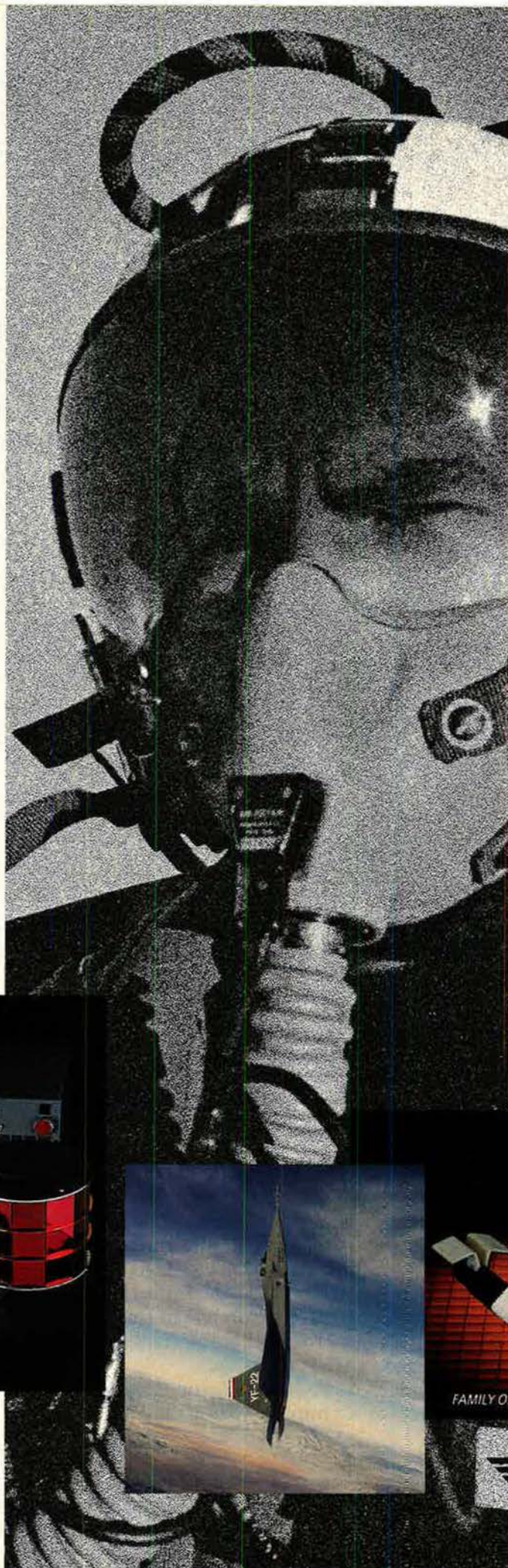
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40 miles,  
1500 closing.  
No missile  
threat."**



## **Lockheed leads.**

Today's pilots face a staggering array of deadly missiles—RF, IR or EO.

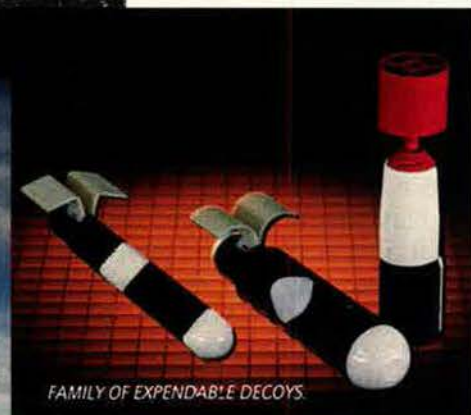
For forty years, Sanders has been building the systems that neutralize these threats. We've produced and delivered more electronic warfare systems than any other company in the world. Moreover, we continue to advance the state of the art, integrating the latest gallium arsenide circuitry into new expendables as well as proven jammers like the AN/ALQ-126B.

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# A Checklist of Major Electronic Systems

**Electronics work in progress at the Air Force's Major Program Offices, Electronic Systems Center, Hanscom AFB, Mass., and Rome Laboratory, Griffiss AFB, N. Y.**

## **Air Base Decision System Program Office**

### **Air Force Electronic Security Equipment Program**

Procurement of physical security equipment for deployment to seventy USAF bases and 210 sites overseas. **Contractor:** None. **Status:** Deployment.

### **Air Force Shelter Technology Office**

Program to provide program management and engineering support for shelter programs throughout the Air Force and to improve design, manufacturing techniques, and materials. **Contractors:** Spectrum 39, Advanced Composite Tech. **Status:** FSD.

### **Air Force Worldwide Military Command and Control System (WWMCCS) ADP Modernization**

Program to implement WAM system capabilities at designated Air Force sites. Objectives are to integrate workstations, implement a file transfer protocol capability, install a high-speed local area network, and connect various processors. **Contractors:** CEA, I-Net. **Status:** Deployment, production.

### **Air Logistics Centers Local Area Network**

Provides for development, installation, testing, and integration of a local communications system connecting the five ALCs. **Contractor:** TRW. **Status:** Deployment.

### **Automated Weather Distribution System**

Program to enhance the Air Weather Service's meteorological support for the Army and Air Force by using advanced computer technology and graphic presentation software. **Contractors:** Unisys, Contel, Federal Electric. **Status:** Production.

### **Automated Weather Distribution System P<sup>3</sup>**

Preplanned Product Improvement to AWDS, focused on improved graphics, interoperability, and communications. **Contractor:** None. **Status:** Concept definition.

### **Avionics Intermediate Shop Mobile Facility**

Program provides for developing shelter systems for F-15, F-16, A-10, and F/EF-111 avionics maintenance. **Contractor:** American Development Corp. **Status:** Production.

### **Battlefield Weather Observation and Forecast System/Tactical Decision Aids**

Program to provide decision aids in assessing weather effects on various weapon systems in specific battle situations. **Contractor:** None. **Status:** Conceptual.

### **Command Center Evaluation System**

Program to provide central facility to evaluate technologies that might meet needs of USAF command centers. **Contractor:** None. **Status:** Conceptual.

### **Computer Resource Management Technology**

Engineering development program to translate the software advances of industry, university, and laboratory into use in USAF weapon systems dependent on computer resources. **Contractor:** HH Aerospace. **Status:** FSD.

### **Deployable Strategic Mission Data Preparation Shelter**

Program to provide USAF capability to transport computer system able to create Mission Planning Data Transfer Unit Cartridges for B-52s, B-1s, B-2s, ALCMs, and ACMs. **Contractor:** Sacramento ALC. **Status:** FSD, production.

### **DoD Base and Installation Security System**

RDT&E program to develop physical security equipment for DoD sites worldwide. **Contractor:** None. **Status:** FSD.

## **DoD Software Engineering Institute**

Program to develop and disperse technology and means to improve quality of software in mission-critical computer systems. **Contractor:** Carnegie-Mellon University. **Status:** FSD.

## **Information Processing System**

Provides automated support for command-and-control functions at top AMC command echelons. **Contractor:** Computer Science Corp. **Status:** FSD, production.

## **Logistics Information Management System**

A program to produce logistics information architecture and recommendations for helping to keep USAF weapons in a high state of readiness. **Contractor:** Transportation System Center. **Status:** Conceptual.

## **Scope Shield Phase I**

Program to create a security police communications system that will replace radios currently used by USAF security police in air base defense, weapon system security, and law enforcement. **Contractor:** Magnavox. **Status:** Deployment.

## **Scope Shield Phase II**

Program to provide better communications for USAF security police and other forces. **Contractor:** To be determined (TBD). **Status:** Production.

## **Security Pro**

A security products program to design and develop secure computing systems able to meet war-planning, intelligence, and force-management requirements generated by STRATCOM. **Contractors:** Intermetrics Corp., Advanced Technology Inc. **Status:** FSD.

## **STARS**

Software Technology for Adaptable, Reliable Systems pursues DoD goal of dramatic improvements in weapon software quality while reducing costs. **Contractors:** Boeing, IBM, Unisys. **Status:** Deployment.

## **Survivable Base Communication System**

Program to dramatically reduce the time required to assess damage and direct efforts of air base recovery teams. Combines communications equipment and computers for effective command of recovery personnel. **Contractor:** Sumaria. **Status:** FSD.

## **UHF Satellite Terminal System**

Development of a deployable, multiple-access communications system based on a single UHF satellite channel for Air Force and DoD users. **Contractor:** Titan Linkabit. **Status:** FSD.

## **Unified Local Area Network Architecture Phase I**

Program to develop standard local area network components used to create data communications networks on USAF bases. **Contractors:** EDS, TRW. **Status:** Ongoing.

## **Weapons Storage and Security System**

Research effort to determine new ways to provide dispersed, unattended tactical weapons storage using hardened vaults beneath the floors of aircraft shelters. **Contractor:** Bechtel. **Status:** Production.

## **Airborne Warning and Control System Program Office**

### **Airborne Battlefield Command and Control Center III**

A C-130-based, automated, airborne command-and-control system for ACC use in forward battle areas and with special operations forces. **Contractor:** Unisys. **Status:** Production.



### **Airborne Warning and Control System (E-3)**

A major upgrade program for the AWACS surveillance and battle management aircraft. Includes additional sensors, antijam communications, and radar systems upgrades to keep the plane in service into the next century. **Contractors:** Boeing, Westinghouse. **Status:** Full-scale development (FSD), production.

### **NATO AWACS Program**

Development, production, and enhancement of NATO's eighteen AWACS Sentry planes. Installation of a major upgrade, Electronic Support Measures, to provide a passive sensor system as a complement to active radar sensors. **Contractor:** Boeing. **Status:** FSD, production.

### **Republic of France Have Quick A Nets**

Foreign military sales program to provide line replaceable units for installation into four French commercially procured AWACS E-3s. Plans call for four radios per aircraft. **Contractor:** Boeing. **Status:** Production.

### **Saudi Arabian AWACS**

Program to acquire and outfit five US-built AWACS E-3s for the Royal Saudi Air Force. **Contractor:** Boeing. **Status:** Deployment.

## **Airspace Management System Program Office**

### **Digital Brite**

System that will replace the existing Brite display system with more reliable equipment displaying alphanumeric beacon data. **Contractor:** Unisys. **Status:** Production, deployment.

### **FAA/Air Force Radar Replacement**

Joint effort to replace 1950s-vintage surveillance and height-finding radars with modern three-dimension radars. **Contractor:** Westinghouse. **Status:** Production.

### **Have Quick II/IIA**

An upgrade to the Have Quick antijam UHF voice communications radio. **Contractors:** Many. **Status:** Production.

### **Microwave Landing System**

A four-part DoD program to develop and produce landing systems to replace existing Instrument Landing System and Precision Approach Radars. **Contractors:** Many. **Status:** FSD.

### **National Airspace Systems**

Upgrade program to ensure compatibility of the DoD Air Traffic Control System with the FAA Capital Investment Plan through 2020. Replacement of analog systems with digital systems. **Contractor:** TBD. **Status:** Conceptual.

### **New Mobile Rapcon**

Program to acquire new approach-control radar systems to replace aging mobile AN/MPN-14 systems. **Contractors:** Unisys, Aydin Computer System. **Status:** Production, validation.

### **Tower Restoral Vehicle/Surveillance Restoral Vehicle**

Program to provide highly mobile, rapid restoral equipment for air traffic control towers and radar approach controls. **Contractor:** Airspace Technology Corp. **Status:** FSD.

## **Battle Management System Program Office**

### **Air Situation Display System**

Procurement of system composed of six operator display positions used at Allied Tactical Operations Center at Sembach AB, Germany. **Contractor:** COMPTTEK Research. **Status:** Production.

### **Caribbean Basin Radar Network**

Program to upgrade US air surveillance in the Caribbean via transmission of radar data via satellite and land links to US C<sup>3</sup> centers. **Contractor:** Westinghouse. **Status:** Production.

### **Combat Identification System/Indirect Subsystem**

Program to develop and deploy NATO-compatible system for accurate and timely target identification to battle commanders. **Contractor:** TBD. **Status:** Conceptual.

### **Digital European Backbone**

Incremental upgrade to portions of the European Defense Communications system from insecure analog systems to secure digital systems. **Contractors:** GTE, Gould, TRW. **Status:** Production, deployment.

### **EIFEL**

Program to develop follow-on telecommunications and automated data-processing capabilities to the EIFEL I system at the ATOC, Sembach AB, Germany, and at associated bases. Common undertaking of the US, Germany, Belgium, the Netherlands, and the UK. **Contractor:** Dornier Systems. **Status:** FSD.

### **Enhanced Mission Support Systems**

Program to explore long-range, evolutionary improvements to automated

support of mission planning and execution, to an open system architecture, and to modular software architecture as rapidly as feasible, to support core mission planning system. **Contractor:** TBD. **Status:** FSD.

### **Ground Mobile Forces SATCOM Terminals**

Program to produce highly mobile satellite communications terminals for the tactical air forces and others. **Contractors:** GE, Harris. **Status:** Production, deployment.

### **Mission Support Systems II Upgrade and Modification**

Program to provide near-term upgrade to keep pace with steadily growing requirements demanding greater processing speed and storage capacity. **Contractor:** TBD. **Status:** FSD, production.

### **Modular Control Equipment**

Development of a transportable, modular, automated air command-and-control system. **Contractor:** Litton Data Systems. **Status:** Production.

### **Modular Control Equipment P<sup>3</sup>**

Design development, fabrication, integration, and test of improvements to MCE components. **Contractor:** Litton Data Systems. **Status:** FSD.

### **NATO Air Base SATCOM Terminal Program**

Development of survivable terminals for wartime communications between NATO Air Operations Centers and allied airfields. **Contractors:** Harris, Loral, Western Development Labs. **Status:** Production.

### **Puerto Rico Operations Center**

Program to establish performance, integration, and verification requirements for Puerto Rico Operations Center, to be procured by the Puerto Rico ANG. **Contractor:** Litton Data Systems. **Status:** Production.

### **Seek Screen AN/TPS-75 Radar**

Development of modification kit to provide enhanced ECCM and performance for the AN/TPS-43E tactical radar. Kit will make it more resistant to enemy aircraft's jamming, increase its range and sensitivity, and make it more survivable. **Contractor:** Westinghouse. **Status:** Production.

### **Seek Screen Arm Decoy**

Program to build a decoy that would protect the AN/TPS-75 radar from destruction by incoming antiradiation missiles. **Contractor:** ITT Corp., Gilfillan Division. **Status:** FSD.

### **Special Operations Forces Planning and Rehearsal System**

Development, procurement, and deployment of a third-generation AMPS to replace minicamp hardware and to enhance existing minicamps. **Contractors:** Lockheed Sanders Inc., Logicon Strategic & Information Systems, Paramax Systems Corp. **Status:** FSD.

### **TRI-TAC AN/TRC-170**

Development and production of digital troposcatter radio terminals for use by tactical forces; provides secure transmission of messages; performs analog and digital voice transmission and transmission of digital data over a range of up to 200 miles. **Contractors:** Raytheon, Unisys. **Status:** Production, deployment.

## **Intelligence, C<sup>3</sup>CM Systems Program Office**

### **Automated Message Handling System**

Program to provide an intelligence analyst with capabilities for local electronic message handling and access to databases. **Contractor:** McDonnell Douglas Electronic Systems Co. **Status:** Production.

### **Cobra Dane System Modernization**

Upgrade to replace aging computers and software and improve processing of landbased, phased-array radar at Shemya AFB, Alaska. **Contractor:** Raytheon. **Status:** Production.

### **Comfy Sword**

Program to develop a jamming and deception system for training aircrews to operate in an electronic environment. **Contractor:** Tracor Flight Systems. **Status:** Deployment.

### **Constant Source**

Development of means to correlate and display intelligence information to unit-level forces. **Contractor:** None. **Status:** Conceptual.

### **Firestarter**

Initiative to provide computer and communications security to Air Force systems (manual or automatic), independently of the funding for the development or operation of the systems. **Contractor:** None. **Status:** Concept development.

### **High-Power Microwave**

Program to develop a tactical, point-defense, high-power microwave for protection of C<sup>3</sup>I assets. **Contractor:** MITRE. **Status:** Conceptual.

### **Intelligence Communications Architecture**

Program to support development of an intelligence communications architec-



ture and to monitor related efforts. **Contractors:** Many. **Status:** Concept, delivery.

#### **Intelligence Work Station**

Joint ESC/Rome Laboratory project to replace standard intelligence terminals with modular, stand-alone stations. **Contractor:** Contel Federal Systems. **Status:** Production.

#### **Intratheater Imagery Transmission System**

Program to develop a hard-copy image dissemination system to allow the tactical air forces to transmit photographs and other intelligence information swiftly by electronic means. **Contractor:** GE. **Status:** FSD, production.

#### **Joint Intelligence Center**

Program to develop and implement a wartime protected theater intelligence system to support unified and specified commands. **Contractor:** None. **Status:** Concept definition.

#### **Joint Services Imagery Processing System**

Development of a ground station to receive, process, and disseminate national, strategic, or tactical imagery to combat commanders. **Contractor:** E-Systems. **Status:** FSD.

#### **Networking Capabilities**

Program to provide wide-range support to various local area networks and network-associated systems. **Contractor:** Infotec Development, Inc. **Status:** Production.

#### **NORAD Tactical Intelligence Cell**

Project to establish an around-the-clock, all-source, antidrug Tactical Air Intelligence Fusion Center. **Contractor:** SAIC. **Status:** Deployment.

#### **PACAF Interim National Exploitation Segment**

Program aimed at providing an interim soft-copy exploitation capability. **Contractor:** Hughes. **Status:** Deployment, program management responsibility transfer.

#### **Red Mission Analysis**

Program to improve the scientific and technical intelligence base for computer modeling and simulation, in order to create digital models of various kinds of threats. **Contractor:** TBD. **Status:** Validation.

#### **Sentinel Aspen Expansion**

Program to provide three more classrooms' worth of hard-copy imagery workstations, single soft-copy workstation for Sentinel Aspen General Imagery Intelligence Training System, and soft-copy workstation system for US Army Intelligence Center & School. **Contractor:** Loral Defense Systems Division. **Status:** Production.

#### **Sentinel Aspen Phase I**

Fabrication of a general-imagery intelligence training system for ATC. The system uses computer-aided instruction in preparing imagery analysts for operational systems. **Contractor:** Loral. **Status:** FSD.

#### **Sentinel Aspen Phase II**

Program to modernize the Air Intelligence, Targeting Indications, and Warning and Fusion Training conducted by Goodfellow Training Center. **Contractor:** Network Solutions, Inc. **Status:** FSD, production.

#### **Sentinel Bright I**

Development and acquisition of a voice-processing training system with 460 workstations for the training of cryptologic linguists. **Contractor:** Engineering Research Assoc. **Status:** Deployment.

#### **Sentinel Bright II**

Design, development, and acquisition of a classified training system with 275 workstations and an unclassified training system with 113 workstations. Used to train operators, analysts, and maintenance technicians for modern crypto systems. **Contractor:** American Systems Corp. **Status:** FSD, production.

#### **Sentinel Byte**

Program to provide unit-level intelligence support system focused on automated use of data in tactical air forces units. **Contractors:** Many. **Status:** Production, deployment.

#### **Soft-Copy Exploitation System**

Development of a common family of workstations for exploitation of digital imagery; a DoD program managed by ESC. **Contractor:** Classified. **Status:** Production.

#### **Tactical Air Forces Linked Ops/Intel Centers, Europe**

Program to develop intelligence software application linked to other Contingency Tactical Air Control System Automated Planning System units. **Contractors:** Infotec Development, BTG, Planning Research Corp. **Status:** FSD.

#### **Tactical Digital Facsimile**

System to receive transmission of and reproduce photographs, maps, finger-

prints, and other forms of hard-copy images; compatible with standard modems. **Contractors:** Litton, Amecon. **Status:** Production, deployment.

### **International Systems Program Office**

#### **AWACS Interface System**

Program to provide Royal Saudi Air Force with interface to its E-3 AWACS Sentry aircraft. **Contractor:** Boeing. **Status:** Deployment.

#### **Base Air Defense Ground Environment**

Program to provide engineering technical support to the Japan ASDF for a BADGE upgrade. **Contractor:** MITRE. **Status:** Deployment.

#### **Canadian Patrol Frigate**

Program to provide software analysis and technical support to Canada in its development of software for a new warship. **Contractor:** MITRE. **Status:** Technical review and study.

#### **Computer-Aided Mission Planning at Air Base Level**

Program provides an automated mission planning system for European Participating Air Forces. **Contractor:** General Dynamics. **Status:** FSD.

#### **Egyptian E-2C/776 Interoperability**

Technical assistance to Egypt on how to coordinate the E-2C Hawkeye aircraft and the 776 Ground System. **Contractor:** Hughes. **Status:** Deployment.

#### **Egyptian Radar Repair and Upgrade**

Provides Egypt with capability to repair, reengineer, and refurbish air defense radars. **Contractor:** EG&G. **Status:** Production.

#### **Peace Panorama**

Program to provide to Colombia an air surveillance system to establish and maintain control of Colombian airspace, control military operations, and identify radar targets. **Contractor:** BDM. **Status:** FSD.

#### **Peace Shield**

Development and acquisition of a ground-based C<sup>3</sup> system for the Royal Saudi Air Force. Includes equipment, facilities, and support units that will link up with existing Saudi tactical radars, Saudi AWACS planes, and elements of other Saudi military forces. **Contractor:** Boeing. **Status:** FSD, production, deployment.

#### **Royal Thai Air Defense System**

Program aimed at upgrading and automating existing Royal Thai Air Defense System and expanding its long-haul communications network. **Contractor:** Unisys. **Status:** Deployment.

#### **TRI-TAC United Arab Emirates**

Program to modify and develop an AN/TRC-170 troposcatter radio set with support equipment for the UAE Hawk missile program. **Contractor:** Raytheon. **Status:** Production.

### **Joint STARS Systems Program Office**

#### **Joint Surveillance and Target Attack Radar System**

A joint USAF-Army program to develop the primary sensor needed to carry out the AirLand Battle Doctrine; integrates a sensitive, side-looking multimode radar into an E-8A platform to create a targeting system able to detect ground-based objects, whether stationary or moving. **Contractor:** Grumman. **Status:** FSD.

### **JTIDS Systems Program Office**

#### **Air Force JINTACCS**

USAF input to a program for joint interoperability of tactical command-and-control systems, designed to ensure that Air Force standards are included in the program. **Contractors:** JTC<sup>3</sup>A, Martin Marietta. **Status:** FSD.

#### **Joint Tactical Information Distribution System**

A program to develop a high-capacity, jam-resistant, secure digital information system that will permit the distribution of intelligence data among fighter aircraft, surveillance aircraft, ground air defense units, and naval vessels. **Contractors:** GEC, Rockwell/Collins. **Status:** FSD, low-rate initial production.

### **Milstar Terminals Systems Program Office**

#### **Milstar Satellite Terminals**

Development of reliable, antijam, and survivable EHF satellite communication terminals for strategic and tactical use among all services. **Contractor:** Raytheon. **Status:** FSD.

### **North Warning & North Atlantic Defense Systems Program Office**

#### **North Atlantic Defense System**

Program to provide four long-range radars to enhance ability of Air Forces Iceland to perform NATO missions. **Contractors:** GE, TechDyn Systems,



Hughes Aircraft, Whittaker Electronic Systems. **Status:** Deployment, USS-C Production.

#### North Warning System

A program to develop new long- and short-range radars that will replace the aging Distant Early Warning (DEW) Line and provide continuous coverage from the northern slopes of Alaska across Canada and down the east coast of Labrador. **Contractors:** Unisys, GE. **Status:** FSD, production.

### OTH-B Radar System Program Office

#### Over-the-Horizon Backscatter Radar

Program to develop and deploy a series of four radar systems for long-range detection, early warning, and attack assessment of bomber and cruise-missile threats. **Contractor:** GE. **Status:** FSD, production.

### Space & Missile Warning Systems Program Office

#### Acquisition Integration Office

Program to provide a "system of systems" quality assurance function. Responsibilities include engineering analysis for 800 series programs in Missile Warning, Atmospheric Warning, and Space Warning. **Contractor:** None. **Status:** Ongoing.

#### BMEWS Modernization Program

Program to upgrade the Ballistic Missile Early Warning System radars in Greenland and the UK, plus modernization of BMEWS radar in Alaska. **Contractor:** Raytheon. **Status:** FSD, production.

#### Cheyenne Mountain Upgrade Programs

Integrated management of five existing upgrades to Integrated Tactical Warning/Attack Assessment system of systems. **Contractors:** Many. **Status:** FSD, production.

#### Command Center Processing and Display System Replacement

A replacement system, part of the ballistic missile warning network, to receive warning information from sensors and produce integrated warning and attack assessment displays for Cheyenne Mountain AFB and STRATCOM headquarters. **Contractor:** TRW. **Status:** FSD, production.

#### Communications System Segment Replacement

A replacement system to improve the reliability, capacity, and flexibility of Cheyenne Mountain communications processing. **Contractor:** GTE. **Status:** FSD, production.

#### Granite Sentry

Program to replace the current NORAD computer system and modular display system and to upgrade command post, air defense operations center, battle staff support center, and weather support unit in Cheyenne Mountain. **Contractors:** AFSPACECOM & DEC. **Status:** FSD.

#### Integrated Tactical Warning and Assessment System

Acquisition of new systems and upgrade of existing systems of the Integrated Tactical Warning and Assessment System. **Contractor:** N/A. **Status:** N/A.

#### Pave Paws

A program to develop and deploy advanced, large-scale, phased-array radar systems to provide precise early warning and attack characterization of enemy sea-launched ballistic missiles from all directions. **Contractor:** Raytheon. **Status:** FSD, production.

#### Space Defense Operations Center

Program to develop new SPADOC at Cheyenne Mountain AFB; central C<sup>3</sup> element of the Space Defense Command and Control System to be used to collect and distribute information on space status and warning. **Contractor:** Loral Command & Control. **Status:** FSD.

#### Space Surveillance Network Improvement Program

SSNIP will evaluate Air Force Space Command's spacetrack capabilities for detecting and cataloging space objects. Recommendations for improving this global network of sensor sites, which detect, track, and identify satellites in Earth's orbit, will be planned for future upgrades in support of the space control mission. **Contractor:** TRW. **Status:** FSD.

#### Survivable Communications Integration System

Development of a multimedia management and control system for sending missile warning data between sensor sites and command authorities. **Contractor:** E-Systems. **Status:** FSD.

### Strategic C<sup>3</sup> System Program Office

#### Advanced VLF Receiver

Program to provide B-2 bomber force with highly survivable capability to receive NCA directives. **Contractor:** Rockwell. **Status:** FSD.

#### Conventional Mission Planning Preparation Software

Project to develop and provide software to Strategic Mission Data Preparation

System, which performs conventional mission planning for B-52 aircraft weapons. **Contractor:** Boeing. **Status:** FSD.

#### Dual-Frequency MEECN Receiver

Program to build receiver that will allow C<sup>3</sup> reception in VLF/LF band to strategic launch-control centers, despite high-altitude nuclear detonations. **Contractor:** Westinghouse. **Status:** FSD.

#### Ground Wave Emergency Network

C<sup>3</sup> program to provide US strategic forces with long-range communications that can continue to function in the presence of electromagnetic pulse. **Contractors:** GE, Contel. **Status:** On hold.

#### Miniature Receive Terminal

A program to develop survivable, low-frequency terminals to upgrade communications among NCA, STRATCOM, and ACC bombers; terminals will be designed to work even in a nuclear environment. **Contractor:** Rockwell. **Status:** Production.

#### Rapid Execution and Combat Targeting

Program to modify Minuteman and Peacekeeper launch-control centers. **Contractor:** GTE. **Status:** FSD.

#### Mission Data Preparation System

MDPS will develop, test, and acquire mission planning systems to support ACC aircraft while maintaining software for the currently fielded ACC mission planning system. **Contractor:** Boeing Military Airplanes. **Status:** FSD.

### Rome Laboratory

#### Advanced Terminal Technology

Program to reduce the overall weight, size, and power requirements of airborne terminal systems and to increase survivability of satellite communications. **Contractor:** None. **Status:** Ongoing.

#### Analog Fiber-Optic Links for RF Waveguide Replacement

Program to demonstrate a cost-effective, optical method to replace conventional RF antenna waveguide with analog fiber-optic links. **Contractors:** Many. **Status:** Ongoing.

#### B-52 Infrared Camera

Program to provide the bomber with the capability to passively detect, track, and identify advanced atmospheric and space-based threats, with sufficient fidelity to provide positive threat assessment. **Contractor:** None. **Status:** Ongoing.

#### Conformal Array Radar Demonstration

Development and integration of sensors operating at multiple frequencies to provide high-confidence detection, tracking, classification, and identification of low-observable threats. **Contractor:** Raytheon. **Status:** Ongoing.

#### Digital Beam-Forming (Mainbeam ECCM)

Program to develop sensor systems with sufficient stability, adaptability, and sensitivity to handle small targets in a severe ECM environment. **Contractor:** General Electric. **Status:** Ongoing.

#### Enhanced Software Life Cycle Support Environment

Joint ESC/Rome Laboratory project to produce and deploy a robust software engineering environment for use by the Air Force and DoD. **Contractor:** International Software Systems Inc. **Status:** FSD.

#### Integral C<sup>3</sup>I Optical Processor

Effort to develop a hybrid optoelectronic processor capable of achieving processing speeds of one tera-operation (10<sup>12</sup> single operations) per second. **Contractor:** None. **Status:** Ongoing.

#### Integrated C<sup>3</sup>I Optical Processor

Program to design and demonstrate a hybrid optoelectronic processor that integrates multiple C<sup>3</sup>I functions, such as surveillance, electronic support measures, communications, intelligence, and image processing to achieve a Multifunction Airborne Surveillance System with synergistic advantage. **Contractors:** Many. **Status:** Ongoing.

#### Knowledge-Based System Architecture Concept

Program to develop systems to support decision and analysis tasks in planning, intelligence, battle management, training, and logistics and to assist in the maintenance of these various AI-based systems. **Contractors:** Many. **Status:** Ongoing.

#### Natural Language

Program to investigate and develop advanced technology that will assist in the functional processes of an intelligence center and emulate the cooperation and interaction that occurs between expert, intelligent analysts. **Contractor:** None. **Status:** Ongoing.

#### NCTR Multisensor

Development of techniques to detect, store, and process unusual signals



across wide bandwidths at higher frequencies and under new transmission schemes. **Contractor:** None. **Status:** Conceptual.

#### **Optical Control of Phased Arrays for Multifrequency/Multibeam Systems**

Program to demonstrate a cost-effective, optical method to implement and control large, high-density, multibeam/multifrequency, shared-aperture, phased-array antennas. **Contractors:** Many. **Status:** Ongoing.

#### **Optical Processor for Jammer Cancellation**

Effort to develop an optically based signal processor for evaluation as a multiple parallel correlation canceler for radar multislidlobe multiscatter jammer rejection. **Contractors:** GE/Rockwell. **Status:** Ongoing.

#### **Requirements Engineering Workstation**

Program to integrate a suite of requirements analysis, specification, and validation tools on a Sun4/UNIX platform providing a uniform user interface style (Open Look) and common object manager database system. Initially, tools will support requirements analysis, user interface prototyping, performance modeling, executable specifications, and reusable components library. **Contractor:** International Software Systems Inc. **Status:** FSD.

#### **Secure Communications**

Program to design and develop interoperable, multiservice, survivable, and secure communications among geographically separate functional units. **Contractors:** Many. **Status:** Ongoing.

#### **Software Engineering Cooperative Research and Development Agreement**

Program to develop and provide advanced software engineering technology to identify and exploit parallelism for both current and future high-performance computers. **Contractors:** Many. **Status:** Ongoing.

#### **Software Life-Cycle Support Environment**

Program to develop software engineering tools, methods, and integrated software development/support capabilities that will replace or reduce today's labor-intensive techniques. **Contractor:** None. **Status:** Ongoing.

#### **Software Quality Technology Transfer Consortium**

CRDA effort between Rome Laboratory and defense industry to apply and validate Rome Laboratory Software Quality Technology on major defense system development projects. **Contractors:** Many. **Status:** Ongoing.

#### **Speakeasy**

Program to develop a joint service multiband programmable radio with the capability to be backward-compatible with existing fielded systems in addition to the capability to add new functionality through software. **Contractors:** Hazeltine, TRW, TI, Hughes, Sciteq, IBM. **Status:** Ongoing.

#### **Strategic Defense System Communications**

Program to develop lightweight/low-power EHF and laser communications technology for SDS space segment mission payloads, mission communications network technology, and ground terminal elements technology. **Contractors:** Many. **Status:** Ongoing.

#### **Survivable Adaptive Planning Experiment**

Seeks ways to improve the capability and timeliness of the current strategic nuclear C<sup>2</sup> planning and problem-solving system and to produce rapid responses to new threats and to relocatable targets. **Contractor:** McDonnell Douglas. **Status:** Ongoing.

#### **Survivable Tactical Communications**

Program to develop a single communications network that can integrate all multilevel-secure functions (voice, data, message) and reduce equipment requirements by fifty percent. **Contractor:** None. **Status:** Conceptual.

#### **System Engineering Concept Demonstration**

Program to demonstrate concepts and technology that can increase the productivity and effectiveness of systems and specialty engineers involved in development, maintenance, and enhancement of military computer-based systems. **Contractor:** Software Productivity Solutions Inc. **Status:** Conceptual.

#### **TACS Force Level Execution**

Program to provide Combat Operations Division personnel of the Tactical Air Program and Tactical Air Control Center the automated capability to monitor, assess, and replan deviations that occur in the execution of the Air Tasking Order. **Contractor:** Advanced Decisions System. **Status:** Ongoing.

#### **Tactical Infrared Communications**

Effort to develop and test a variety of optical communications concepts in order to evaluate performance relative to various mission applications. **Contractor:** None. **Status:** Conceptual.

#### **Tactical Optical Disk**

Program to develop an integrated optical processor, with special emphasis on optical memory and optical interconnections that will help achieve high processing speeds. **Contractor:** General Electric. **Status:** Ongoing.

## **Deputate for Engineering and Program Management**

#### **Get Price**

Program to reduce cost of USAF electronic C<sup>3</sup> systems via advanced manufacturing technologies. **Contractors:** Many. **Status:** Production.

## **Deputate for Plans and Advanced Programs**

#### **Advanced Air Traffic Control**

Program to examine emerging technologies that can be used to meet anticipated requirements for air traffic control. System concept would automate air traffic control for high sortie rates, decrease dependence on radar, and use secure data links. **Contractor:** Transportation Systems Center. **Status:** Conceptual.

#### **Air Defense Initiative**

Definition, development, and demonstration of new technologies required for future construction of comprehensive active air defense system. Emphasis is on technologies for surveillance, battle management, and C<sup>3</sup> against advanced air vehicles. **Contractors:** Many. **Status:** Concept definition.

#### **Automated Tactical Aircraft Launch and Recovery Systems**

Development of a system to automate air traffic control and to integrate aircraft systems. Would control independent landing locations and integrate the battle management systems. **Contractor:** Transportation Systems. **Status:** Concept definition.

#### **C<sup>3</sup> Concept for SOF Airlift Operations**

Program to assess C<sup>3</sup> requirements for SOF operations across a broad spectrum of potential uses. **Contractors:** MITRE, RJO. **Status:** Conceptual.

#### **First Order Cost Estimating Model for Radars**

Project to develop model able to predict acquisition costs of radars quickly during the conceptual phase, when little or no engineering design data are available. **Contractor:** Tecolote. **Status:** Conceptual.

#### **High-Frequency Master Acquisition Plan**

Project to examine and develop action plan for meeting the Air Force's near-term and long-term high-frequency modernization requirements. **Contractor:** MITRE. **Status:** Conceptual.

#### **International Cooperative Research & Development**

Focal point office for processing information on ESC activities that might be of broader international interest and for identifying emerging technologies in the US. **Contractor:** None. **Status:** Ongoing.

#### **Joint Service Antisatellite Program**

Project that calls on ESC to develop battle management/C<sup>3</sup> system to support antisatellite capability, provide a surveillance support network, and integrate these elements with current and future antisatellite weapons. **Contractor:** To be announced (TBA). **Status:** Conceptual.

#### **NATO ACCS/MCE Compatibility Study**

Program that supports USAF in its evaluation of the Modular Control Element for application in the NATO Air Command and Control System and to conduct engineering evaluation of the MCE. **Contractor:** MITRE. **Status:** Conceptual.

#### **Small Business Innovative Research**

Program to stimulate technological innovation in private research and technological firms. **Contractors:** Many. **Status:** Ongoing.

#### **Space-Based Wide-Area Surveillance**

Program in conjunction with Space Systems Division effort to develop landbased C<sup>3</sup> architectures to get space-based radar data to worldwide users. **Contractor:** TBA. **Status:** Conceptual.

#### **Strategic Defense Initiative Planning**

Analysis of and experimentation with promising concepts and technologies for C<sup>3</sup> and battle management of a future strategic defense system. An experimental version of Strategic Battle Manager will be used. **Contractor:** TBA. **Status:** Demonstration/validation.

#### **Ultrawideband Radar**

Program to develop improved surveillance sensor and communications for DoD and to permit "silent" radar surveillance and very-low-probability-of-intercept communications. **Contractor:** TBA. **Status:** Concept definition.

#### **Unmanned Aerial Vehicle**

Program to support DoD UAV Joint Program Office with data links, data distribution capability, mission planning, and ground stations. **Contractor:** MITRE. **Status:** Concept definition.

#### **USAF GUARD**

Program to develop a multilevel secure (MLS) communications interface between a Top Secret/Sensitive Compartmented (TS/SCI) Intelligence Data Handling System (IDHS) and the secret level unit support system. **Contractor:** Sterling; Network Solutions. **Status:** Operational. ■



**With things happening so fast,  
the damage control is only partially  
successful.**

# The Human Side of the Drawdown

By Bruce D. Callander

*1st Lt. Thomas Herring (in BDUs) listens to a preflight brief of a B-1B crew. Lieutenant Herring was headed for bombers after graduating from UPT in August 1991. He is currently banked as the deputy chief of Public Affairs with the 319th Wing, Grand Forks AFB, N. D.*

**L**AST year, 2d Lt. Kevin Tolley was in flight training at Laughlin AFB, Tex., hoping to become a fighter pilot. A graduate of the United States Air Force Academy, with good class standing in undergraduate pilot training, he was a strong candidate.

When he graduated from UPT last September, Lieutenant Tolley was assigned to the 1st Fighter Wing at Langley AFB, Va.—not as a pilot but as a logistics officer. He is one of more than 500 recent flight school graduates whom the Air Force has “banked” in nonflying jobs to wait for cockpit openings.

If Lieutenant Tolley had graduated from the Academy a year later, he probably would not even have gotten into flight school. With the pilot training rate cut almost in half, recent graduates have been sent directly to ground jobs and told not to expect UPT openings for up to four years. The same has happened to some 900 officers commissioned out of ROTC in recent years.

Lieutenant Tolley said he was promised that he would get his fighter within three years, perhaps within eighteen months. He keeps his hopes alive by hitching rides in the backseats of F-15s, but he admitted to occasional doubts

that he will ever get to fly one. “I’m putting a lot of faith in the Air Force,” he said. “I’m hoping that somebody won’t come along and say, ‘Let’s cut our losses with these guys and send them away.’”

Pentagon officials can give Lieutenant Tolley and others like him only conditional reassurance. “We made the commitment to the banked pilots,” explained one, “and, based on all the information we have available today, we can make good on it. We’re going to do everything we can to make it happen, but nobody can make an iron-clad promise in today’s environment.”

While they sweat it out, the banked Air Force officers are getting a backstage look at the Air Force that most young pilots do not have until they are well into their careers. This was Lieutenant Tolley’s first chance to interact with ground crews and enlisted technicians, and he believed the early exposure would help when he returned to flying.

## Understanding the Business

Lt. Col. John Gunselman, Jr., commander of Langley’s 1st Supply Squadron, agreed. Colonel Gunselman has a banked pilot in his unit. “I’ve sent him

to supply school, and I rotate him from job to job to get a taste of everything,” the Colonel said. “The way I see it, if he gets hacked off at supply now, then ten or fifteen years from now, when he’s in a command position, he’ll still be hacked off at supply. I need him to understand this end of the business.”

What’s happening in supply and elsewhere at the moment is hardly business as usual. The Air Force is not only shrinking but undergoing major internal changes as well.

After forty years of gearing up mainly to meet the well-defined threat posed by the Soviet Union, US armed forces must now prepare for a variety of less predictable problems and dangers. In a sense, they have been issued the military equivalent of a “John Doe warrant,” with names and places to be filled in when the bad guys are identified.

Under this to-whom-it-may-concern approach, the Air Force has begun reshaping its structure and rethinking some of its fundamental ideas. For example, the Tactical Air Command that Lieutenant Tolley joined last fall disappeared on June 1. Its assets went to the newly formed Air Combat Command.





At lower echelons, numbered air forces are being rebuilt to emphasize rapid deployment. All nineteen air divisions have been scrapped to eliminate a layer of middle management. To fill the gap, beefed-up wings will assume responsibilities formerly assigned to higher echelons and functions previously scattered over various support agencies.

The Air Reserve Component, already supplying more than forty percent of USAF's fighter forces and more than half its airlift forces, will take on more chores in the future. Unlike the reserves of the other services, which are taking large cuts, the Air Force Reserve will lose only about 800 people, and the Air National Guard actually will gain a few.

Even as it redraws its organizational tables, however, the Air Force continues its personnel drawdown. Barring further cuts, the force should level off at about 429,000 active-duty members by the end of Fiscal 1995. Getting there amid the base closures and unit overhauls involves a juggling act that would impress Barnum & Bailey, but it all seems to be taking place.

The Air Force got a jump on the other services in making end-strength

cuts. In 1986, it reduced recruiting, accelerated retirements, and encouraged voluntary separations. When the Pentagon ordered a faster drawdown, Gen. Merrill A. McPeak, USAF Chief of Staff, said he still hoped to meet it with voluntary separations and avoid an actual involuntary reduction in force (RIF) at least through 1992.

So far, General McPeak has gotten his wish, in a technical sense. The Air Force has refused to permit reenlistment of unpromoted E-4s and has used boards to pick officers for early retirement. To those who have exited the service under these circumstances, the separations may not seem entirely voluntary, but they are not, strictly speaking, RIFs.

### Carrots and Sticks

The Air Force's campaign to avoid a real RIF hinged largely on a carrot-and-stick separation program it launched last January.

Under this program, the first phase of which officially expired on April 15, the service offered noncommissioned officers and officers in the less critical skills quick cash to leave quietly. They could choose from two options: the Special Separation Ben-

efit (SSB), which was a lump-sum payment, or the Voluntary Separation Incentive, an annuity paid over a number of years. A major with fifteen years of service, for example, could take a one-time bonus of almost \$100,000 or take his payments over thirty years and wind up with roughly four times that amount.

To encourage members to take the money and run, the Air Force warned its personnel that, if it did not get enough volunteers by April 15, it would have to RIF some people in overstocked skill areas. The severance pay would be one-third less than what was available under the SSB program.

The Air Force extended the program to May 29, and USAF officials concluded that the two programs would probably entice a sufficient number of enlisted troops. As a result, they predicted, there would probably be no enlisted RIF in Fiscal 1992 or Fiscal 1993, which begins this October 1.

In the case of officers, however, the situation was markedly different. When the deadline passed, the program had netted less than half of the 7,500 officer separations that the Air Force said it had to have. The deadline was extended to May 29, but



officials said the machinery of an officer RIF probably would begin operating in the summer, though actual separations would not begin until December.

All departing members will receive various forms of transition assistance. Three-day seminars have been established to provide help in writing résumés, preparing for interviews, and hunting for jobs.

The Air Force concedes that early efforts in this area earned only low marks, but the program has been overhauled, and feedback indicates that it is going better. USAF is helping ease the transition of members by continuing to provide such benefits as health care for up to four months after exit from the force and commissary and exchange privileges for up to two years.

Even with cash incentives and transition assistance, most members do not want to leave. Fear of being forced out has taken its toll. "I'm seeing morale drop," reported one officer at Langley. "People aren't excited about their jobs because they think they might get cut tomorrow."

### **The Denial Phase**

Capt. Melvin Musser, a Langley personnel officer, said that people in his office didn't even discuss the cuts. "We're the ones who do all the out-processing, and our own shop is in the high target area for RIFs," said the Captain, "but it's like the pilot's attitude toward air crashes. You know it's out there, but you don't want to talk about it."

The Department of Defense tries to ease the worries with periodic briefings and follow-up messages of reassurance, but, with things happening so fast, the damage control is only partially successful.

In a recent appearance before the Senate Appropriations Committee, Lt. Gen. Billy J. Boles, Air Force deputy chief of staff for Personnel, summed up the situation in these words: "The anxiety factor for our people is almost off the chart. It increases with each announcement of another 'personnel action' taken to hit what they perceive to be moving end-strength targets. Add to this the often-expressed perception of an erosion of benefits, and it is easy to understand why morale is down."

The problem, General Boles said, is that today's services are made up entirely of volunteers, most of whom

want to stay for full careers. "To some extent," he said, "we are victims of our own success. We have worked hard to improve retention by making the Air Force an attractive way of life. These very efforts . . . now are complicating efforts to draw down the force."

**"We are victims of our own success. We have worked hard to improve retention by making the Air Force an attractive way of life."**

At a time when it is paying some members bonuses to leave, the Air Force is offering others big cash incentives to stay. It still pays selective reenlistment bonuses in critical enlisted skills and makes special payments to health professionals. The biggest outlays are in Aviation Career Incentive Pay for experienced pilots, who represent USAF's most critical retention problem.

Normally, pilots nearing the end of their initial service commitments would have until September to sign new contracts and claim the bonuses. This year, the Air Force moved the deadline to May 1 to force these pilots to make early career decisions.

Those who agreed to the added commitment will continue to get their choice of flying assignments. Those who didn't may be moved to nonflying jobs to free cockpit seats for pilots who will be around longer.

Next year, another group of pilots will be wooed with the same incentive, and some doubtless will take it. The long-range outlook, however, is not good. By coincidence, record numbers of airline pilots are reaching mandatory retirement age, and the civilian carriers are looking for replace-

ments. These well-paying private-sector jobs have always been tempting to military pilots, and they may look even more attractive amid today's uncertainties.

The Air Force needs to achieve a sixty percent retention rate to meet its long-term requirements, but in recent years it has managed to retain only about forty percent. Unless there is a dramatic improvement, DoD predicted, the Air Force will have a shortage of some 3,000 pilots by Fiscal 1997.

"The fact is, force structure cuts only delay the day when low retention will take its inevitable toll," said General Boles.

Today's banked pilots and the officers still waiting for training eventually will fill part of the pilot deficit. Even that prospect is iffy in some cases. While they wait, some of these officers could become physically disqualified to fly, and others may lose patience and leave the service.

### **Missing the Gate**

In the case of the banked pilots, an added worry exists. Under the present Air Force "gate" system, they must spend a high percentage of their early service in the cockpit to maintain flight status. Pentagon officials say the clock began running when the banked pilots graduated from UPT—they will have to begin flying soon to offset their time in ground jobs.

Although the Air Force has some power to waive gate requirements, there are limits to how long such pilots can wait to begin their flying years.

DoD considered using some surplus trainer aircraft to set up a proficiency flying program for banked pilots. That option proved too expensive. The plan now is to wait for the pilots to be "unbanked" and then send them through a short refresher course and on to training in the aircraft for which they are earmarked.

Yet to be answered is the question of where and when the transition to operational aircraft will take place.

General McPeak has dubbed 1992 "The Year of Training" and called for a "wall-to-wall" review of the programs for grooming members for their jobs. Among the questions he raised is whether pilots should be trained in such fighters as the F-16 by the combatant commands (such as Air Combat Command) or by Air Training



Command, which has professional instructors and an established learning environment.

The wide-ranging assessment also will look at such matters as the mix of formal schooling and on-the-job training and the amount of professional military education that Air Force members are getting. The study groups will report this summer, and major training changes will begin by the end of the year. Some predict that the changes will include greater emphasis on formal courses designed to ease the training burden on operational units.

### Tailored Skills

In a separate but related effort, the Air Force is taking a closer look at individual skills, particularly those on the enlisted side. The question is how they will fit the new force structures.

MSgt. Daryl Waldrop, superintendent of classification at the Air Force Military Personnel Center, Randolph AFB, Tex., said, "We're looking at how people are doing their jobs in each career field to see if we need to consolidate or merge skills or leave them alone."

Maintenance skills were broadened some time ago and were tailored to specific commands and aircraft types. Sergeant Waldrop says those specialties are being looked at again to see if they will work in the restructured force. Civil engineering is already being reworked, and some personnel and administration skills may be candidates for merging. Other skill classifications may have to be reworked as wings are reorganized, the mix of Stateside and overseas forces changes, and the Air Force has to find jobs for enlisted troops who specialized on weapons now being scrapped.

In the end, Sergeant Waldrop said, it may turn out that the smaller force needs more broadly trained members and fewer narrowly focused specialists, but MPC is not working with that aim in mind at the moment. Rather, it is trying to see what combination of skills will work best in the new Air Force.

For all the turbulence, however, the Air Force has managed to maintain a surprising degree of normality in some areas.

Promotions, for example, have held up fairly well, particularly for the enlisted ranks, where the personnel cuts have been spread fairly evenly. "In a given cycle, we may have a small

select rate," said one Pentagon official, "but, overall, over the next several years, we don't see a significant problem."

The Air Force has made one change that will pare the NCO ranks. Until recently, enlisted members entered grade E-4 as senior airmen, proved

### **USAF may get the funds to complete the drawdown only to be caught short of O&M money to support the remaining force.**

their leadership abilities, and were appointed sergeants in the same pay grade.

Now, USAF has eliminated this so-called "buck sergeant" rank, and senior airmen will not become NCOs until they make staff sergeant. "Because of the drawdown and the smaller force, more and more E-4s were finding themselves in technician jobs and not in supervisory positions," says an Air Force personnel officer. "We were not doing them a favor by calling them NCOs and then requiring them to do airmen's work."

On the officer side, promotions have slowed a bit, particularly promotions to the grade of major. Large groups of officers moving through the eleven- and twelve-year window have caused a slowdown in that grade, say Pentagon officials. The promotion opportunity rate has been lowered from ninety percent to eighty percent.

Military pay is not an immediate worry, but some in the Air Force would like to see improvements in such areas as quarters allowances. With housing prices and rental costs on the rise, the Pentagon is considering a plan to review and adjust the Variable Housing Allowance (VHA) more often. There also is talk of combining the VHA, payable in high-cost areas, with the basic allowance for quarters, but that would require new funding.

Finding funds for that or any other new initiatives may be getting tougher, officials concede. The idea of cutting defense and producing a quick "peace dividend" is politically attractive, but the thought of plowing some of the savings back into improved forces is not.

In fact, the process of reducing the forces is very expensive in the short run. Eventually, the Air Force will save the money it would have spent on salaries and retired pay for the members who leave early. However, it will be years before such savings offset the cost of inducing these persons to leave. Closing bases, reshuffling people, buying out weapons contracts, and restructuring the force also increase the short-term expense of scaling down.

One of the Air Force's biggest concerns is that it may get the funds to complete the drawdown only to be caught short of the operations and maintenance money to support the remaining force. "Our O&M budget request represents the minimum funding necessary for readiness," General McPeak told Congress. "Please understand that this is not arm-waving; your support to sustain our O&M funding is critical."

Such rhetoric is familiar on Capitol Hill, but this time the warning may be more urgent. Since 1986, the Air Force has taken a strength cut of twenty percent. An even bigger percentage has been chopped from the O&M account. If future budgets are cut further, the Air Force may indeed face what General McPeak has called "a downward spiral in readiness." ■

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**It will be ten years before new aircraft enter service. Until then, the Air Force will work on improving the current systems.**

# Upgrading the Fighter Fleet

By Frank Oliveri, Associate Editor

**T**HE F-22 fighter, Multirole Fighter, and Advanced Strike Aircraft won't enter service in large numbers until beyond 2000, and existing fighters will have to carry the load for some time. With the Air Force deploying a smaller combat fleet in the 1990s, more versatility in each aircraft will be needed.

For these two reasons, the process of upgrading the Air Force's fighter fleet, always an important task, has taken on heightened significance.

"We have always tried to do this," notes Lt. Gen. Thomas R. Ferguson, commander of Air Force Materiel Command's Aeronautical Systems Center at Wright-Patterson AFB, Ohio, "but the circumstances we face today . . . make the consideration of modifications more likely."

No one expects full implementation of every upgrade now under consideration. Some will prove unnecessary, unworkable, or unaffordable. However, contracts have been let, studies launched, and agreements signed in a drive to develop and produce new and better means to upgrade various aircraft.

■ For its fleet of F-15s, the Air Force will conduct upgrade work in

Fiscal 1993 worth \$304 million, a sum destined to grow. USAF wants the F-15E strike fighter variant to pick up part of the Suppression of Enemy Air Defense (SEAD) mission handled by F-4Gs and F-16s. The F-15E would be modified to carry AGM-88 HARMs (high-speed anti-radiation missiles). Separately, the Air Force also will seek greater integration of the F-15 jammer and missile warning system.

■ Some multirole F-16 aircraft may receive a substantial upgrade to enhance their close air support and battle-field air interdiction (CAS/BAI) capability. Other proposed upgrades would give the jet an advanced reconnaissance capability. The Air Force's budget includes some \$275 million for F-16 upgrade initiatives in 1993.

■ On the F-117 Stealth attack aircraft, forward-looking infrared and downward-looking infrared systems will be upgraded to increase the aircraft's recognition range and overall system reliability. The Air Force is putting up \$25 million in seed money this year.

■ A-10 program officers are studying an enhanced Automatic Target Handoff System (ATHS) that would

*The service life of US fighters has increased and their preeminence in the world has been maintained, a clear result of the Air Force's emphasis on upgrades. F-15s, here undergoing substantial upgrades, will be the top air-superiority fighters in the world until the F-22 comes into the force.*







be added to the plane and integrated with the Global Positioning System (GPS) satellite network. Plans call for spending \$8 million to start concept work this year. The idea is to enhance the A-10's recently installed Low-Altitude Safety and Targeting Enhancement (LASTE) system.

■ The Air Force will spend \$9 million in 1993 on plans for EF-111 upgrade work. It is studying ways to give the Raven more powerful processors, transmitters, and excitors. (The exciter determines what wave form will be transmitted to jam or confuse enemy radar.) USAF needs these items to guarantee its ability to jam and confuse future enemy radar threats.

Overall, General Ferguson reports, "what we'll really be going after are . . . things that will allow us to get firepower on target very quickly while minimizing that additional support that might be required in a strike package." He cited precision weapons delivery, mission planning, and command and control as examples.

More generalized upgrading is in store for key aircraft. The F-16A and B models soon will undergo previously planned midlife updates that include the development, production, and installation of avionics retrofit kits. The F-15 program office also is planning a multistage improvement program (MSIP), one that would upgrade all F-15A, B, C, and D models with new avionics.

Also fueling the move to upgrades, says General Ferguson, is the downfall of the old Soviet Union. "The Soviets were investing to such a degree [and] they were putting in a new generation [of combat systems] at such a frequency that a modification would not keep pace with the threat." This is no longer the case.

As the fighter force shrinks, the Air Force will be looking for more versatility and will view it as a way to save operation and support costs. "If we can operate with fewer types of aircraft, we can more efficiently manage the logistics tail and, with the smaller resource base, operate a more totally effective fleet of aircraft," says General Ferguson.

Much of the upgrade effort is focusing on the workhorse F-15. Current plans call for the Air Force to begin MSIP work on 172 of its 744 F-15A, B, C, and D fighters. These air-superiority aircraft will receive updated avionics through MSIP.

Older, obsolete F-15 parts will be redesigned to make them easier to produce and buy. The parts themselves are not suspect, says Col. R. T. Kadish, director of the F-15 System Program Office at ASC, but it is becoming harder and more expensive to replace parts that industry no longer routinely produces. "This airplane has been in production for over twenty years," says the Colonel. "The price of technology passes parts by. That problem will only get larger as the plane gets older."

For software-laden aircraft like the F-15, explain program officials, the greatest need is to install high-speed computers with tremendous growth potential. The Air Force will satisfy that need by retrofitting the F-15 fleet with computers using very-high-speed integrated circuit (VHSIC) semiconductors, says Colonel Kadish. These VHSIC-based computers are expected to increase the F-15's processing speed and power dramatically, compared to the jet's existing system. The new computers also will make maintenance easier and provide growth potential.

### A Midlife Update

When it comes to the F-16 fleet, the Air Force is turning to a midlife update for A and B models flown by the Air National Guard.

This work is to be carried out under a program developed by an international consortium comprising industrial concerns of the US, Belgium, Denmark, Norway, and the Netherlands. These were the nations involved in the original production of the F-16. All field substantial numbers of the fighter.

Maj. Jim Pollard, the program manager for the F-16A/B midlife update, says the objective is to extend through 2010 the current relative levels of F-16 combat capability. This F-16 upgrade would cover 533 aircraft from the consortium nations. Roughly 130 of them would be US Air Force fighters.

The planned overhaul will be thorough, say Air Force officers, and will turn older F-16s into substantially different aircraft. The work is expected to include installation of a modular mission computer, a digital terrain-tracking system, an improved modem for sending and receiving data, the array of Block 50 F-16 cockpit upgrades, a GPS receiver, an APG-66 radar upgrade, a daytime-only helmet-mounted display, and provision for a military microwave landing system.

Plans call for the helmet-mounted display to show head-up display (HUD) symbology and allow for off-boresight targeting. It is being developed under the CAS/BAI F-16 upgrade program and will not include a night capability. Cockpit upgrades will convert dials and switches to glass displays and will include installation of a sidestick.

Program costs are to be shared among consortium members. The Air



Two F-16 CAS/BAI demonstrators fly a test mission. USAF is studying options to convert 300 Block 30 F-16Cs and Ds to a CAS/BAI variant. The variant would have a night attack system with head-steered infrared and a helmet-mounted display.



Force's share is \$103 million in development funding and \$535 million in production funding. The Air Force recently issued a study notice to General Dynamics to develop a proposal for production.

Flight testing will begin in 1995. The Air Force expects to receive the first kit in October 1996, with the installment of the last kit planned for 2002.

Major Pollard says that the Air Force's European partners may require an F-16 structural upgrade.

### New Missions for Old Planes

With many older RF-4C, F-4G Wild Weasel, and A-10 aircraft leaving the active force, the Air Force is looking to make major additions to the mission complements of the F-15E and the C and D models of the F-16.

Already, the F-16C/D operates as an attack aircraft, air-combat fighter, and defense suppression aircraft. Lt. Col. Richard Garr, chief of the Advanced Program Division within the F-16 System Program Office, Wright-Patterson AFB, Ohio, says the F-16 may perform two new missions.

Colonel Garr explains that the Air Force is studying options to modify about 300 Block 30 F-16Cs and Ds for the CAS/BAI mission and an additional 150 of the same aircraft type to perform the tactical reconnaissance mission now handled by the RF-4C.

The proposed CAS/BAI F-16 upgrade is one of the largest aircraft modifications currently being stud-



Photo © Geoffrey Pearce / Aviagraphics

*The 174th Fighter Wing of the New York ANG flies F-16As modified with a 30-mm gun pod. Although the unit saw action in Operation Desert Storm, its fighters bear little similarity to what USAF envisions for the Block 30 CAS/BAI F-16s.*

ied. Included is the basic Block 30 baseline retrofit, consisting of a modular mission computer, a ring-laser gyro inertial navigation system (INS), and a GPS receiver.

The CAS/BAI F-16 would be upgraded with a night attack system that includes a head-steered infrared system and a helmet-mounted display. Maj. John Jannezo, the F-16 CAS program manager, says the helmet is "the heart and soul" of the new night attack capability. The helmet will allow for off-boresight targeting and will con-

trol the head-steered infrared systems, which greatly increase the field of view at night.

Major Jannezo says this collection of equipment will give the F-16 "far greater capability than the LANTIRN [Low-Altitude Navigation and Targeting Infrared for Night] system." LANTIRN only permits on-boresight targeting.

The F/A-16 would be outfitted with a digital terrain system, which includes terrain reference navigation, a ground collision avoidance system, database terrain following, and obstacle warning and cuing.

It would also have a centerline GPU-5A 30-mm gun pod, an advanced Pave Penny Laser Spot Tracker, very-high-frequency antijam radio with alternate VHF antenna, an upgraded programmable display generator, hydraulic flow-sensing shutoff valves, an ALE-47 chaff and flare dispenser, an ALQ-56M radar warning receiver, a missile warning system, and a tactical situation display.

The F-16s will get structural modifications sufficient to meet the 8,000-hour service life goal.

The Air Force's share of the total cost is some \$3 billion, and Major Jannezo reports that the program will get heavy scrutiny in Congress and the Pentagon. Colonel Garr stresses that the numbers are subject to change.

With the retirement of the RF-4C reconnaissance aircraft, the Air Force is looking to the F-16 to replace it.



USAF photo by TSgt. Lee Schading

*Workers perform multistage improvement program (MSIP) work on an F-15 at Warner Robins Air Logistics Center, Robins AFB, Ga. The MSIP will give 172 F-15A, B, C, and D models new avionics suites.*



With the addition of the Advanced Tactical Air Reconnaissance System (ATARS) and its subsystems and the electro-optic long-range oblique sensor, the F-16R would greatly increase the Air Force's reconnaissance capability. The F-16R would perform day/night, under-the-weather, low-level reconnaissance.

"ATARS is a digitized imaging system to take the place of the film-based cameras that are currently used on many aircraft all around the world," says Lt. Col. Michael Michaelson, the ATARS deputy program director. He notes that the ATARS has three main sensors: a low-altitude electro-optical sensor, a medium-altitude electro-optical sensor, and an infrared line scanner.

The ATARS pod would be carried on the centerline of the aircraft, says Colonel Michaelson. The pod cannot be jettisoned, but it can be removed to allow the F-16 to perform other missions. The sensor information can be recorded and edited on board the fighter and then transmitted over a data link to a ground station, where it can be reviewed.

Some additional switching functions would be added to the aircraft, allowing the pilot to control the system. However, it may also be used automatically. It can operate in conjunction with the GPS and INS of the F-16 and be preprogrammed to turn on when the aircraft is in a target area.

The Air Force hopes to prepare 150 F-16s for the reconnaissance mission

but plans to purchase only 108 ATARS units. The first ATARS-equipped aircraft could be delivered in 1998, with the final aircraft delivered in 2004. Estimated cost of the program: \$900 million.

### F-15s for SEAD

Modifying the F-15 for the SEAD mission will pay many dividends. An F-15E with SEAD capability, observes Colonel Kadish, "opens up a lot of doors for our tacticians."

This modification would include installation of the HARM carriage and targeting systems. Colonel Kadish says the total cost of this upgrade fleet-wide would be \$700 million to \$800 million. Development would begin in 1994, with full operational capability in 2000. McDonnell Douglas would handle the integration of the system into the F-15E.

Some F-16s have a HARM capability. The SEAD-capable F-15E would have a greater range and, unlike the HARM-equipped F-16s, would be able to locate enemy radar threats.

The F-15E soon will be given an autonomous landing capability, achieved by using a software program that integrates information from on-board systems.

Electronic warfare systems, so effective in the desert war, will also be modernized [see "Electronics for the 'Rainbow Threat,'" p. 24]. The EW upgrades will run into billions of dollars.

Another example of upgrades now being considered is the on-board EW simulator, which would allow a pilot to train in real time while flying the aircraft. As a result of preplanning a program on the ground, a number of threats would appear on the aircraft monitor, and the pilot could respond in flight. The aircraft system would then record the pilot's actions for review on the ground.

Colonel Kadish says that USAF is considering the integration of GPS receivers in the F-15E, but the service has not yet issued an official directive.

The F-117 Stealth fighter also is in line to receive new equipment to improve its combat performance. Maj. Glen Kuller, the F-117 director of projects at Wright-Patterson, says the downward-looking infrared and the original FLIR systems will be rebuilt to make them much more supportable and powerful.

This new system will be of the "form, fit, and function" variety, meaning that technicians can "take it all apart, put in new parts, and put it right back in the airplane," Major Kuller says. The retrofit will increase the F-117's target-recognition range and provide a more detailed image of the target. In addition, Major Kuller says, the new system will be twice as reliable and twice as easy to fix.

The Air Force is waiting for a proposal from Texas Instruments for the program, which is likely to cost about \$100 million. Flight testing will begin this summer, and the fleet should be outfitted by the middle of 1996.

The Air Force also plans to replace the existing F-117 INS, which was first developed for the B-52 bomber years ago. "It's very accurate," Major Kuller says. "The bad news is, it's a bear to fix. Therefore, the logistics costs are eating us."

The Air Force wants to install the Ring-Laser Gyro Navigation Improvement Program. With an additional \$42 million appropriated by Congress in 1992, the Air Force will integrate GPS with that system. At the same time, says Major Kuller, the Air Force plans to upgrade its mission computers with faster processors and more memory.

The F-117 is probably in line for additional upgrades. Major Kuller says the Air Force is now studying the feasibility of inserting capability to launch GPS-aided munitions. Also under consideration is a new mission support planning system.

USAF photo by Russ Pollanen



USAF plans to make the F-15E, already a formidable platform, SEAD-capable by adding HARM carriage and targeting systems. Development of the program would begin in 1994, with full operational capability in 2000.





*The Air Force is looking to spread the SEAD mission out over its force to fill gaps left by departing F-4G Wild Weasel aircraft. Some Wild Weasels (like this one, newly transferred to Idaho) are going to the Air National Guard.*

### Making More of LASTE

The A-10 attack plane, another stellar performer in Operation Desert Storm and winner of Gunsmoke '91, may soon boast greater capabilities. The LASTE system has already increased the precision bombing capability of the A-10. The Air Force wants to enhance the payoff of that system even further.

Col. Chris Russo, A-10 program manager at Sacramento Air Logistics Center, McClellan AFB, Calif., says the Air Force wants to make A-10s resemble the CAS F-16 aircraft in capability, with nearly identical systems.

His office is studying integrating the GPS receiver and the Improved Data Modem System (IDMS), a follow-on to the ATHS, into A-10 systems. The plan is to install these systems in the late 1990s. Draper Laboratory of Boston is in charge of program studies.

"LASTE has so revolutionized the weapons delivery system on the A-10, it has almost made it a totally different airplane," Colonel Russo says. "You take that computational capability and roll it into the inherent navigation . . . accuracy of a GPS, and you've enhanced the LASTE system even further."

The IDMS will allow the A-10 to receive bursts of target information data from the ground or other airborne systems. All the new mission information would be received digitally and displayed on the HUD.

Under congressional direction, the A-10 program office has asked Grumman to modify two A-10s for the night attack mission, using night vision goggles and a FLIR system. The A-10 can conduct night operations at present only by using the nighttime vision capabilities of its infrared-guided Maverick missile.

The Air Force is also looking at upgrades for another aging warbird, the EF-111 area and escort jammer. While the aircraft performed well in the Persian Gulf War, the technolo-

gies of its jamming systems are of 1970s vintage.

Lt. Col. Ronald Matsumura, the EF-111 deputy program manager at Wright-Patterson, says that the Air Force is conducting a multifaceted study. One part of the upgrade study aims to improve the power and throughput of the aircraft processor, which would allow for the installation of a new, more effective exciter.

Program Integration Engineer Pat Grebinski says the exciter "provides the music that is played by the transmitter, and that music changes depending on what type of threat you're looking at." This program is in the engineering and manufacturing development phase. Production is some years away.

EF-111 program workers are looking to replace the band nine transmitter, while prototyping the band four transmitter of the EF-111. The hope is to improve the capabilities of band nine, while increasing the reliability of band four. Band four has a mean time between failures of only 100 hours. "They're in a tough environment," says Colonel Matsumura. "A lot of power is created in a small environment. That creates a lot of heat."

The Air Force may have more good options for upgrades than it will have money with which to execute them. In the view of General Ferguson, "these decisions will become excruciatingly difficult with fewer resources." ■



*After the A-10 failed to crack the top ten in Gunsmoke '89, the Air Force installed the Low-Altitude Safety and Targeting Enhancement (LASTE) system. Three Warthog units finished in the top ten of Gunsmoke '91—including first place.*



## Unfurling the New Flags

**T**HE Air Force set June 1, 1992, for official activation of Air Combat Command (ACC) at Langley AFB, Va., and Air Mobility Command (AMC) at Scott AFB, Ill. The Defense Department activated on that day US Strategic Command (STRATCOM) at Offutt AFB, Neb. Simultaneously deactivating were Tactical Air Command (TAC) at Langley, Military Airlift Command (MAC) at Scott, and Strategic Air Command (SAC) at Offutt.

*Gen. Merrill A. McPeak, the Air Force Chief of Staff, delivered the following addresses at Langley, Scott, and Offutt, respectively. This verbatim text refers to Dick Cheney, Secretary of Defense; Donald B. Rice, Secretary of the Air Force; Gen. Colin L. Powell, Chairman of the Joint Chiefs of Staff; and Adm. Frank B. Kelso II, Chief of Naval Operations. JSTPS is the acronym for the Joint Strategic Target Planning Staff.*

### Air Combat Command

**G**ood morning. It's wonderful to be back here at Langley, at this beautiful spot. This is a great day for the Air Force. We are making history today. We are present at the creation of a new and better Air Force.

Going on fifty years ago, at the outset of the Cold War, we organized and equipped an air force to fight the Soviets. We called this a "strategic" air force. It was and is a fine air force and because we were so well prepared to use it, we never had to. Looking back, we can measure its success in terms of awful things that could have happened, but didn't.

Meanwhile, we were involved in some actual fighting and our experience, particularly in Korea and Vietnam, made it obvious that we also needed an air force to fight limited wars. So, over the years, we built up a separate, very good air force, specifically to fight limited wars. We called this a "tactical" air force.

But, our intuition tells us—and our experience confirms this—that most of the capabilities needed to fight either general or limited war are complementary. In fact, we have often found that the principal problem for the air commander is to blend these capabilities, to integrate them at the point of contact. We have never fought a pure bomber war or a pure fighter war. Every minute of actual combat experience teaches us that we have to meld the complementary capabilities of our air systems into a cohesive fighting force. We have worked hard on doing this and can rightly point to Desert Storm as showing that, given time and the freedom to organize properly, we can integrate air capabilities to good effect. Yet, until today, we have kept these two air forces apart, have kept separate "strategic" and "tactical" organizations.

Make no mistake, we must have as a first priority an Air Force capable of defending against a modern, industrialized, major power in a general war. But, our division of air capabilities into strategic and tactical categories has served, in recent years, only to confuse a fundamental truth: much the same kind of Air Force is needed for both jobs. And, when put to the test of combat, such an Air Force is likely to be needed at

once. In brief, we should organize our air combat forces in peacetime in the configuration we know will be needed for immediate use.

The idea of a single command to handle air combat forces goes all the way back to General Headquarters Air Force, which became operational in 1935. In fact, we had an Air Force Combat Command from 1941 to '43, controlling our stateside training and operational units. So, in some ways, the idea of an Air Combat Command is visionary, but in other ways, you could call it reactionary—back to the future—a return to a better way of organizing ourselves. It's taken a while, but today we are re-integrating air power into a cohesive whole.

I want to thank Secretary Rice for his leadership in the reorganization. History will say that his turn at bat was a high point for our service. I also want to thank all the people who have worked hard in the last year to make the TAC-ACC transition work. I especially want to congratulate Gen. Mike Loh, TAC's final flight lead and ACC's first commander. As he knows as well as anyone, there is work still to be done. But we are instituting basic change here, not just tinkering at the margins.

We do not lightly retire the colors of Tactical Air Command. TAC was one of the original Air Force major commands. It has a rich, a wonderful heritage, and just to say the names of its former commanders—Quesada, Lee, Barcus, Cannon, Weyland, Everest, Sweeney, Disosway, Momyer, Dixon, Creech, O'Malley, Russ—is to read a roll call of the great. But Air Combat Command will add new luster to this heritage and it will grow even richer.

What's more important, Air Combat Command gives us the right structure in peacetime for integrated employment in combat. Air Combat Command prepares us better to protect American lives and values in an uncertain world. It makes us a more operational, more capable Air Force. The idea has been with us since we first began to realize air power's potential. Today, it is an idea whose time has come. ■



## Air Mobility Command

**G**OOD afternoon. It's a great pleasure to be here at Scott to stand up the Air Force's newest organization, Air Mobility Command. It's only slightly newer than Air Combat Command, which we just activated this morning at Langley. Together, AMC and ACC move this nation into a new era—that of air power integration.

We all understand that airlift has had a revolutionary impact on us and our world. Within less than a century of man's first powered flight, we now look to the skies for rapid, economical movement of people and goods. This is an almost incredible development, when you think about it. But, we have become an air-faring nation to such a degree that most of us don't think much about it.

From time to time, the importance of airlift has been illustrated in a way that catches the eye. Flying supplies over The Hump from India to China in World War II was an example; the Berlin Airlift another. But, over the years, Military Airlift Command has performed so well, so often, has hit so many home runs, that the remarkable has come to seem quite commonplace.

Make no mistake, military professionals everywhere understand how important airlift has been—how central it is in providing the American capacity to influence events around the globe.

By activating this new command today we show that our thinking about airlift has moved to a higher level. We now understand that the real requirement is for mobility—that is, deployability and sustainability in combination—and that such mobility will often require a contribution from both the airlift and the air refueling communities.

The importance of this kind of mobility was highlighted by Desert Storm. MAC moved the ton-mile equivalent of the Berlin Airlift every six weeks, eventually transporting something like the population of Oklahoma City halfway around the world; moved it, then helped sustain it. Meanwhile, we had at times nearly a hundred SAC tankers forming an air bridge

across the North Atlantic, providing deployability for both airlifters and shooters. Let me put it this way: no tankers, no airlift, no Desert Storm.

This kind of mobility is sure to be even more important to the nation in the future. For most of the Air Force's existence as a separate service, our strategic position in the world was fairly static, with forces stationed forward at places where our interests were most clearly engaged. Now, many of these overseas forces are coming home. While I hope we will maintain a serious forward presence, it is obvious that to a much greater degree, our security will rely on US-based forces configured for expeditionary use. Deploying and sustaining these forces will increase the demand for mobility. AMC, the combination of airlift and tankers, is the Air Force's answer to this requirement for enhanced mobility.

Today, we close a glorious chapter in Air Force history. The MAC shield is covered with honors. To get some feeling for this, go back to the early days of the Military Air Transport Service, and read the names of the airlift commanders. Larry Kuter, Joe Smith, Bill Tunner, Joe Kelly, Howell Estes, Jack Catton, P. K. Carlton, Bill Moore, Dutch Huyser, Jim Allen, Tommy Ryan, Duane Cassidy. Like this wonderful command, these are men who carried the nation's precious cargo.

I would like to thank Gen. H. T. Johnson, MAC's final crew chief and AMC's first commander. He and MAC have turned in a magnificent performance and his staff has done fine work in setting up the new command. I also want to thank Secretary Rice for his leadership in the reorganization of the Air Force. I believe his tenure as secretary will be remembered as one of the most constructive in Air Force history.

In the end, this is a great day because Air Mobility Command will make us more responsive to our security needs in an uncertain world. It will make us a more agile, more cohesive Air Force. It provides the newest, best instrument giving global reach for America. ■

## US Strategic Command

**G**OOD afternoon. General Powell, we're honored to have you officiate today. This is a big day for the Air Force—a day we retire the colors of our most famous command and take a big step toward integrated air power. I know that for those who have served Strategic Air Command so well for so long, this is a difficult moment. But SAC's warriors did not sign on for the purpose of being in SAC—they signed up to serve the nation. For the nation, deterrence is not an Air Force mission, requiring an Air Force command. For the nation, deterrence is a joint mission, requiring a joint command. So for all of us, this is a day of progress and promise.

SAC's role in keeping the peace over the last half century was central to the nation's security. After World War II, for the first time in history, nations could utterly devastate each other on short notice. We depended on SAC to protect our freedom and our very lives. And, because global nuclear war would be a catastrophe for the whole world, it wasn't just Americans but all the planet's inhabitants who relied on SAC to do its job with care and competence.

Those were the hallmarks of SAC. Alert duty was and is lonely, unglamorous work, but no task was more fundamental to our security. Since 1946, SAC has had to get it right every hour of every day.

SAC was in many ways the creation of Gen. Curtis LeMay, and it came to embody his spirit. Some may wonder what LeMay would say if he were here today. But we don't need to speculate. LeMay's own words tell the story.

In 1957, General LeMay proposed combining SAC and TAC into a single air offensive command. He put it like this:

"whether we choose to recognize it or not, SAC and TAC are bedfellows. . . . They must deter together through their ability to defeat enemy air power together." Having a single command would allow the Air Force, in LeMay's words, to achieve "unified control of all air offensive forces . . . under a single air commander." Today, thirty-five years later, we have at last realized LeMay's vision with the activation of Air Combat Command.

The list of SAC's commanders over the years reads like a who's who of great airmen. Kenney, LeMay, Power, Ryan, Nazzaro, Holloway, Meyer, Dougherty, Ellis, Davis, Welch, Chain. Like SAC, these were and are men to rely on.

I want especially to thank the present SAC commander, Gen. Lee Butler, for his leadership in preparing for this day. His support of needed change has been uncompromising and courageous. He was the obvious selection to be Strategic Command's first commander.

General Powell was a driving force behind STRATCOM. His intelligence and his willingness to look at tough issues with a fresh eye gave us a command structure better suited to the nation's security needs. Secretary Cheney and Adm. Frank Kelso also deserve great credit for recognizing the value of the STRATCOM idea and making it a reality. The SAC staff and the JSTPS worked wonders in getting the new command organized.

But, most of all, I want to thank the men and women of SAC for their professionalism and their performance over the long years of the Cold War. The heritage you built goes with you into Air Combat Command and Air Mobility Command and will be with the Air Force forever. Thank you. ■



**Air Logistics Centers, now streamlined and competing for work, are becoming more like industry.**

# The Other Industrial Base

By Peter Grier

**T**HE United States Air Force's web of air logistics centers might well be called "the other defense industrial base." Like commercial defense contractors, the ALCs employ tens of thousands of skilled workers to help keep the flying commands in business. They, too, are centers of technical expertise.

The similarities do not end there. Just like their commercial counterparts, ALCs are coming up against stiffer competition for a dwindling amount of work. Both face a future where management efficiency will be critical.

Some logistics officers, in fact, worry that Washington is forcing the logistics centers to become *too* much like commercial industry. In the past, they note, the depot network served as a national insurance policy, providing excess capacity that could be used for rapid expansion of repair and production. Budget pressure, however, now threatens to squeeze out the excess. ALCs are becoming leaner to compete in what shapes up to be a fiercely competitive repair and support "marketplace." They risk losing what little remains of the capability for a wartime "surge."

Gen. Charles C. McDonald, the newly retired commander of Air Force Logistics Command at Wright-Patterson AFB, Ohio, warned Congress this spring. "As we downsize, we need to maintain that critical element of our industrial base called Air Force Air Logistics Centers."

## "Bomber Country"

ALCs have long been among the largest single-location industrial employers in the US. Today there are five: Ogden ALC, Hill AFB, Utah; Oklahoma City ALC, Tinker AFB, Okla.; San Antonio ALC, Kelly AFB, Tex.; Warner Robins ALC, Robins AFB, Ga.; and Sacramento ALC, McClellan AFB, Calif.

Each provides worldwide logistics support for a different list of Air Force systems. Sacramento ALC is largely oriented toward attack aircraft, with the responsibility for A-10s, F-117As, and the numerous variants of the F-111. Oklahoma City ALC calls itself "bomber country" and works on the B-1B, B-2, and the B-52 as well as a variety of missiles and engines. Maintenance for the F-15 is the responsibility of Warner Robins; the F-16 goes to Ogden ALC.

It's clear that changes in the flying organizations of the Air Force have a direct and major effect on what goes on at ALCs. In recent years, the watchword has been "downsizing," with the active aircraft inventory having shrunk by twenty-one percent and flying hours having dropped by twenty-five percent. The ALC maintenance requirement has dropped correspondingly.

F-4s and other airplanes requiring labor-intensive upkeep have gone out of service, so there is also less and less demand for the traditional blue-collar maintenance skills—sheet-metal working, hydraulics repair, and the like—that the depots have come to represent. Such new systems as the F-16 and future systems, such as the C-17 transport and F-22 fighter, are designed to need less depot-level work. They contain more electronics and are feeding a demand for more workers skilled in software development and composite material handling.

AFLC leaders say they do not want to close any ALCs as the command cuts back to fit budget reality. (AFLC assets, along with those of Air Force Systems Command [AFSC], moved to the new Air Force Materiel Command [AFMC] July 1.) Instead, each ALC will shrink fifteen to thirty percent over five years. The new and smaller depot maintenance infrastructure will fit into a streamlined Air Force support bureaucracy.

One big change this new environment holds for the depots is that they'll be part of a cradle-to-grave concept of system management. Under the old ways, the flying Air Force had to contact AFLC on logistics and maintenance matters and AFSC for everything having to do with research, development, or acquisition.

Now units will be able to contact AFMC for just about everything concerning aircraft materiel support. It sounds easy, but it will be a long time before all Air Force systems really have a seamless AFMC organization.

"There's a great deal of work to be done," said General McDonald shortly



before he retired. "It will be two, three years before all the issues are sorted out."

A 1,000-worker team is pulling together a new concept—Integrated Weapon System Management (IWSM). Twenty-one systems have been chosen as IWSM models. They represent everything from mature aircraft, such as the F-15, to new electronic hardware, such as the Global Positioning System. The "master templates" produced by integrating these programs will then be applied to the other 450 or so major Air Force programs, according to General McDonald.

Older IWSM candidates probably will be handled by the part of AFMC most familiar with logistics—the depots. Newer systems will be run by more development-oriented managers. The F-15's IWSM single program manager, for instance, will be based at Warner Robins ALC. The IWSM manager for the developmental E-8 Joint Surveillance and Target Attack Radar System, however, will be based at AFMC's Electronic Systems Center at Hanscom AFB, Mass.

### Culture Shock

The ALCs are facing a big cultural change as AFMC comes on line.

In the past, financial life was relatively simple for the ALCs. They received individual appropriations for each of their activities. Now they will have to operate increasingly like private defense contractors as the Defense Department continues to implement recommendations from the 1989 Defense Management Report.

For instance, the revolving funds that formerly went to AFLC are being taken over by the Defense Business Operating Fund, though implementation will be phased in during the next few years. Management of the checkbook that pays for support has gone to the level of the Office of the Secretary of Defense. As a result, ALC customers—the flying commands—will have a greater say in money spent for repairs and maintenance, according to Air Force officials.

General McDonald said that, in Fiscal 1993, logistic support centers will have to "sell" their work to customers and receive a "fee" in return. These fees will provide the funds that support daily operations.

This represents a significant change in ALC financial accounts. "I don't think we understand all the implica-

tions of it yet," warned General McDonald, though he pointed out that "we have managed revolving funds for many years, and we know how those operate."

Under this new business system, the stock fund will provide the money that pays for repair of depot-level exchangeable items, buys most spare parts, and pays for managing ALC operations. Money will not be routinely allocated to AFMC in the annual defense budget process.

In an even more radical change, flying commands will have the authority to get needed repair work accomplished however they choose. If the "price" that the ALCs charge is not to their liking, if work cannot be done quickly enough, or if it is not up to standards, flying commands may opt to do some jobs in-house. They may pick a private contractor—or even a Navy or Army repair organization.

Out of necessity, ALCs are going to have to cut costs and be more responsive to customer concerns to keep their business—just as commercial contractors do.

This more competitive atmosphere is driving the goals for shrinking individual ALCs by up to thirty percent over the next five years. Air Force officials say facilities at some ALCs will be sold off, though they hope to mothball some idled capacity against the day when it might come in handy. They say that the cost of completely shutting an ALC would be prohibitive.

### Down to Ten Days

General McDonald conceded that he had "some concerns" about the effect of new businesslike practices on capabilities of the ALCs, but he also claimed that the ALCs have made real progress in becoming more competitive. He cited Ogden ALC, where turn time for fixing wheels and brakes in landing gear has been cut from thirty days to ten days, on average.

The Air Force has emphasized reductions of overhead in the ALC blue-collar work force. The old ratio of one supervisor to every eight workers has been increased to one to eleven, said General McDonald. Based on the 1993 budget, manpower paid for by direct operations and maintenance funding will be cut by 8,300 positions over the next five years.

AFLC shaved \$58 million off depot maintenance operating costs in Fiscal

1991, according to General McDonald, though the goal had been only \$6 million. The goal is \$150 million in savings during Fiscal 1992, which ends September 30.

General McDonald admitted that the ability of the ALCs to surge for crisis production "becomes more difficult as the manpower base gets smaller." Officers add that surging is not a hypothetical matter applicable only in some implausible World War III-type conflict. They note that, in the Persian Gulf War, AFLC surged the repair of 96,000 parts.

In the future, said General McDonald, the system will be able to conduct a surge of some proportion, but it will be as a result of worker versatility. "The majority of our blue-collar workers have multiple skills," said the General. "That's how we can surge—with overtime, and sometimes turning to industry."

Stock funds and fee-for-service plans are not the only changes moving the ALCs further from their national insurance function and closer to operations in the commercial mold. They are under specific orders to save money by putting up part of their normal work load for competition.

The impetus for this move comes from Defense Management Report Decision 908, which has subsequently been incorporated in congressional legislation. In general, DMRD 908 directs that ALCs be used at near 100 percent capacity. The work load greater than a core necessary to maintain an ALC's infrastructure should be open for competition to other services and to the commercial sector.

For Fiscal 1992 and 1993, the Air Force by law may put no more than four percent of its current depot maintenance work up for grabs, but service officials expect this figure to rise in 1994 and beyond. "There will be substantial work loads offered up," says Robert S. Hancock, director of contracting at Oklahoma City ALC.

Last year, AFLC put up for competition five work packages worth a total of \$11 million. ALCs won two of these—the TRC-97A ground radio, won by Sacramento ALC, and the ARC-186 UHF radio, won by Warner Robins ALC.

### Lost Contracts

However, the commercial sector snagged the other three. Chromalloy won the right to work on TF33 engine



vanes and shrouds. Logicon won the F-16 software contract. Standard Aero won a contract for work on the T56 engine gearbox.

General McDonald said that even though the private sector took home more awards, he was encouraged by the ALCs' competitive performance. One of the contracts was lost not because of price but because of technical judgment.

"This is the first year we had to gear up our business offices, getting people used to responding to [requests for proposal]," he said. "We're used to writing them, not getting them."

One of the first problems ALCs faced in this regard was avoiding the appearance of conflicts of interest, says Mr. Hancock. Firm organizational boundaries had to be set up to ensure that the people preparing business proposals would have no exchange with the people evaluating those proposals. The danger was real because an ALC's contracting office is responsible for awarding the contract.

Not surprisingly, commercial firms do not entirely trust this process, their won-lost record notwithstanding. "They see all kinds of things wrong with the customer selling to himself," says Mr. Hancock.

Another problem has been to figure out exactly how to price ALC bids. As large enterprises, formerly driven by congressional appropriations, the ALCs have no set ways of charging for overhead, facility depreciation, or labor. The Air Force is developing an extensive cost comparability handbook, but it may be some time before all these questions are nailed down, according to Mr. Hancock.

Commercial firms have inherent advantages over ALCs when it comes to competition, say Air Force officials. Because those firms are smaller than the Air Force, they are typically more flexible, with the ability to build plants and hire and train people faster than the military can. Further, it is easier for commercial firms to control their labor costs. With labor a major cost driver, many companies can structure layoffs and subsequent hirings so their youngest and most productive employees can be kept, sometimes at the expense of older and higher-paid workers.

"We do just the opposite," says Mr. Hancock. "Our system is based on seniority. We're going to keep the

older, higher-salaried people around. While our bosses want us to act like the private sector, in that one regard we can't."

By the end of Fiscal 1992, AFLC will have put up for competition ten work loads, with a total annual value of \$126 million. The jobs range from C-141 center wing box replacement, a Warner Robins project worth \$34 million, to \$7 million in Minuteman III software from Ogden, to \$5 million for C-18 programmed depot maintenance in Oklahoma City.

### Vanishing Capabilities

These competitions are relatively small, measured against the sixty percent of AFLC's total work load that is done in-house at the ALCs. Over time, however, more competition may diminish ALC capabilities, according to Air Force officials.

"What it costs you is manpower," says Mr. Hancock. The TF33 vane program, lost this year by Oklahoma City ALC, was worth \$7 million, he points out. "We would have liked to have had it organically. There were hard feelings because we didn't get it."

The depots are still feeling their way along with the competition, trying to sort out complexities they had not foreseen. For instance, what happens if the Navy decides to bid on a contract, loses, and wants to protest? Commercial firms have a protest structure established within the General Accounting Office, but no such mechanism exists to sort out interservice disputes.

What about problems inherent in the administration of contracts by contract personnel attached to an ALC, even if the work stays in-house? That could pit one office of the ALC against another in a newly contentious relationship.

"I can see our contracting officer going in and shutting down the main line because he thinks there's something wrong with quality," says one ALC official. "He'll probably have to wear a gun."

Overall, the five competitions run last year saved AFLC about eighteen percent on the work done. The real benefit from competition, said Gen-

eral McDonald, will come from application of the business lessons learned to ALC programs across the board.

Under some circumstances, competition might also result in increases in depot contracts. Ogden ALC is angling to win a big Navy award for F/A-18 depot maintenance that is coming up for bid. They believe the work would fit nicely with the extensive F-16 work load they already have.

"We are good at fighter work load here," said Gene L. Mortensen, director of financial management at Ogden.

The Air Force hopes such approaches will bring large savings. If they don't, the ALCs could face a money crunch. The Air Force budget has projected a \$1.7 billion savings through 1997, based on depots adopting Defense Management Report initiatives. Saving that much money through competition alone would probably require the ALCs to put sixty percent of their current work load on the competition auction block, according to the Air Force.

This kind of up-front pressure provokes concern and objections from some in the Air Force. Beyond being pushed to become more like commercial firms, the ALCs are losing some departments to central Defense Department control. For example, some ALC supply depots are being brought under Defense Logistics Agency management. DLA now has responsibility for stocking approximately 436,000 Air Force items formerly distributed by AFLC.

Some in the Air Force maintain that Operation Desert Storm proved the ALCs are just the right kind of insurance policy for today's military in today's world. Along with their subtler light manufacturing contractors, the ALCs provided a quick surge of items needed in a regional crisis—food, spare parts, unforeseen equipment modifications.

The challenge ahead is to make ALCs more efficient without damaging their traditional capabilities—a tall order by anyone's calculation. As General McDonald told Congress not long ago, "We risk reducing our organic capabilities to the extent that the defense 'insurance policy' may not be effective when needed." ■

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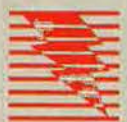
*Peter Grier is the Washington defense correspondent for the Christian Science Monitor and a regular contributor to AIR FORCE Magazine. His most recent article, "The Year of Training," appeared in the April 1992 issue.*





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# Gallery of NATO Airpower

By John W. R. Taylor and Paul Jackson

Together with the "Gallery of USAF Weapons" in the May 1992 issue of *Air Force Magazine*, this Gallery gives information on all first-line aircraft and missiles in service with NATO air forces. The French Air Force is also included, as France remains a member of NATO although it withdrew from NATO military command in 1966.

## Bombers and Maritime

### Mirage IV-P

Twenty-eight years after the original Mirage IV-A achieved initial operational capability, two squadrons remain in first-line service with the French Air Force in updated form. The basic mission of the 62 IV-As was high-altitude strategic bombing, with 45 minutes at Mach 1.7, as the quick-reaction manned component of the French nuclear deterrent. Combat radius could be extended by in-flight refueling from Boeing C-135F tankers. This became even more important from 1967, when the role was changed to low-level penetration, carrying an AN 22 parachute-retarded 60-70kT nuclear free-fall weapon. Twelve of the bombers were modified to carry a 2,200 lb CT 52 reconnaissance pod instead of the AN 22.

It was intended to retire the Mirage bomber force by 1985. Instead, 18 of the aircraft were upgraded in 1985-87 to Mirage IV-P (for Penetration) standard as carriers for the far more potent ASMP supersonic thermonuclear missile. A nineteenth was ordered subsequently as an attrition replacement. Navigation and targeting capabilities are improved by installation of a Thomson-CSF Arcana pulse-Doppler radar and dual inertial systems. Upgraded EW equipment includes, typically, a Thomson-CSF TMV 015 Barem self-protection jamming pod and a Bofors BOZ-103 chaff/flare pod on underwing pylons, plus two 436- or 660-gallon external fuel tanks. Thomson-CSF Servat radar warning receivers are standard. The Mirage IV-P became operational with Squadron 1/91 *Gascogne* at Mont-de-Marsan (with a detachment at Orange) on May 1, 1986, followed by 2/92 *Bretagne* (each now with 7 aircraft). The OCU CIFAS 328 *Aquitaine* disbanded at Bordeaux on June 30, 1992, and crew training is now undertaken in-house by 91 Wing. The underground Hq of the bomber force is at Taverny, near Paris. Reserve war Hqs are located inside Mont Verdun, near Lyon, and at Evreux. **Contractor:** Dassault Aviation, France.

**Power Plant:** two SNECMA Atar 9K-14 afterburning turbojets; each 14,840 lb st. Provision for 12 JATO rockets; total 11,000 lb st.

**Dimensions:** span 38 ft 10½ in, length 76 ft 5½ in, height 17 ft 8½ in.

**Weights (approx):** empty 31,965 lb, gross 72,750 lb. **Performance:** max speed Mach 2 at high altitude, 745 mph IAS at low altitude, service ceiling 54,100 ft, radius of action 930 miles unrefueled.

**Accommodation:** crew of two.

**Armament:** one 150-300kT ASMP thermonuclear missile.

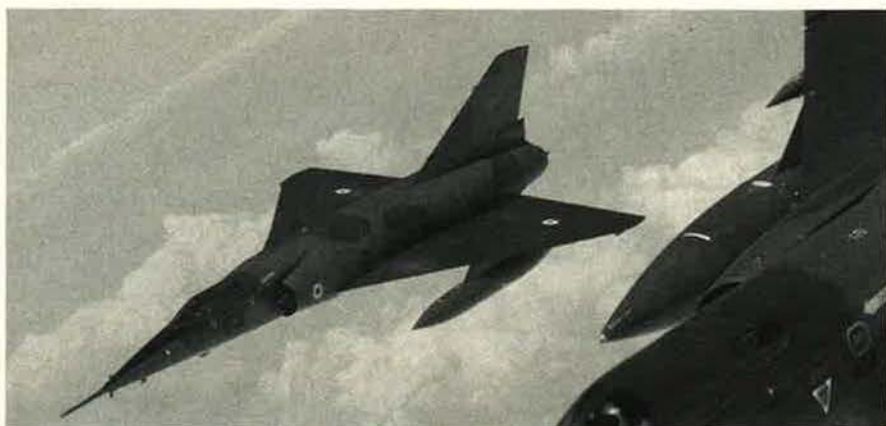
### Albatross (HU-16B)

This antisubmarine version of the HU-16B transport amphibian was developed by Grumman in 1961, with a nose radome, retractable MAD tail "sting," ECM equipment on the wing, an underwing searchlight, and provision for carrying depth charges. The Hellenic (Greek) Air Force acquired 12 from Norway in 1969 and refurbished them from 1986 for continued service. Four of the eight surviving HU-16Bs remain airworthy with No. 353 antisubmarine warfare squadron. Systems operators are provided by the Hellenic Navy.

**Contractor:** Grumman Aircraft Engineering Corporation, US.

**Power Plant:** two Wright R-1820-76A piston engines; each 1,425 hp.

**Dimensions:** span 96 ft 8 in, length 62 ft 10 in, height 25 ft 10 in.



Mirage IV-Ps, French Air Force (Sirpa "Air")



Atlantic, Italian Air Force (Paul Jackson)



D.3B Aviocar, Spanish Air Force (Paul Jackson)

**Weight:** gross 37,500 lb.

**Performance:** max speed 236 mph at S/L, service ceiling 21,500 ft, max range 2,850 miles.

**Accommodation:** crew of five.

**Armament and Operational Equipment:** four underwing pylons for torpedoes, rockets, depth charges, and other stores; sonobuoys, marine markers, and depth charges in fuselage.

### Atlantic

Winner of a NATO design competition to replace the Lockheed Neptune, Breguet's Br 1150 Atlantic antisubmarine aircraft was manufactured by companies in six European nations, with some avionics from the US and UK. Most production aircraft were delivered for naval duties and are not eligible for inclusion in this air force Gallery. The 18 purchased by Italy are operated by the 86th and 88th *Gruppi* of the Italian Air Force, based at Cagliari/Elmas and Catania/Fontanarossa, respectively, with Italian Navy personnel making up half of the crews. Instead of ordering additional aircraft, the Italian government authorized an extensive upgrade of the 18 Atlantics in 1986, under Dassault-Breguet management. New equipment includes a GEC Avionics AQS-902C sonobuoy processing system and Litton INS, together with Thomson-CSF Iguane radar

and other features of the French Navy's much-improved Atlantique 2. The first upgraded Italian Atlantic flew in July 1987, at Toulouse. The remainder, modified by Aeronavali in Venice, will be returned to service by October of this year.

Antisubmarine equipment standard on all Atlantics, in addition to the retractable radar, includes an MAD tailboom and an Arar ESM pod at the tip of the tailfin. The entire upper and lower rear fuselage provides storage for sonobuoys and marker flares.

**Contractor:** SECBAT international consortium, under Dassault-Breguet (French) direction.

**Power Plant:** two Rolls-Royce Tyne RTy 20 Mk 21 turboprops; each 6,106 ehp.

**Dimensions:** span 119 ft 1 in, length 104 ft 2 in, height 37 ft 2 in.

**Weights:** empty 52,900 lb, gross 95,900 lb.

**Performance:** max speed 409 mph at height, service ceiling 32,800 ft, range 5,590 miles.

**Accommodation:** crew of 12, comprising two pilots, flight engineer, three observers, radio navigator, ESM/ECM/MAD operator, radar/IFF operator, tactical coordinator, and two acoustic sensor operators. Provision for 12 relief crew.

**Armament:** internal weapons bay accommodates all standard NATO bombs, mines, 385 lb depth charges, four homing or nine acoustic torpedoes, or two Exocet missiles. Underwing pylons for two AS 30 or Martel missiles.

### Aviocar (C-212)

Specially equipped versions of the CASA C-212 Aviocar STOL utility transport have been delivered for military duties. Nine Srs 100/200s were ordered by the Spanish Air Force for search-and-rescue missions (Spanish designation D.3B), three by the Spanish Ministry of Finance, one ASW version by the Swedish Navy, four for maritime patrol (with SLAR and IR/UV search equipment) by the Swedish Coast Guard, and 20 others by Mexico, Sudan, and Venezuela. Operational equipment can include a nose-mounted AN/APS-128 search radar with 270° scan, searchlight, FLIR, smoke markers, and camera in the maritime patrol version; and an underfuselage radar with 360° scan, ESM, sonobuoy processing system, OTPI, MAD, tactical processing system, IFF/SIF transponder, sonobuoy and smoke marker launcher, and weapons in the ASW version. (*Data for Srs 200.*)

**Contractor:** Construcciones Aeronauticas SA, Spain. **Power Plant:** two Garrett TPE331-10R-511C turboprops; each 900 shp.

**Dimensions:** span 62 ft 4 in, length 49 ft 8½ in, height 20 ft 8 in.

**Weight (ASW version):** gross 18,519 lb.

**Performance:** max cruising speed 219 mph, loiter speed 121 mph at 1,500 ft, service ceiling 24,000 ft, range 1,898 miles.

**Accommodation:** crew of five (ASW and maritime patrol versions).

**Armament:** provisions for carrying torpedoes such as Mk 46 and Sting Ray, unguided rockets, and air-to-surface missiles such as Sea Skua and AS 15TT.



## Buccaneer

The heavily area-ruled Buccaneer began life as a naval aircraft, designed to exploit the vulnerable gap beneath hostile radar defenses by delivering nuclear weapons at speeds around Mach 0.9 at extremely low altitude. The Royal Navy lost its Buccaneers when its last big carrier was retired in 1978. Today, 33 Buccaneer S. Mk 2Bs remain in service with Nos. 12 and 208 Squadrons of the Royal Air Force. Based at Lossiemouth, Scotland, they are able to carry four Martel antiradiation missiles, or Sea Eagle antiship missiles, on underwing pylons in the maritime strike/attack role. Range was enhanced before delivery by the addition of a 510-gallon fuel tank in the rotating weapons bay door. In 1987-90, British Aerospace updated them with Ferranti FIN 1063 INS and Tracor AN/ALE-40 chaff/flare dispensers, plus enhancements to existing Ferranti AIRPASS III Blue Parrot radar and ARI 18228 RWR, the latter to Guardian 200 standard. The introduction of AN/AVQ-23E Pavé Spike laser designators and Paveway laser-guided bombs on the Buccaneers of 208 Squadron was to prove especially rewarding. When, during the Persian Gulf War in 1991, Tornado attack aircraft switched from low-level attack with JP233s to medium-height use of Paveways, Buccaneers were dispatched speedily to designate targets for them, which they did with great success. The original intention had been to enhance accuracy during maritime operations and on the Central Front in Europe. These will continue to be their designated roles until the two Squadrons are replaced by Tornados adapted for the maritime antisurface warfare task in October 1993 and April 1994.

**Contractor:** Hawker Siddeley Aviation Ltd, UK.

**Power Plant:** two Rolls-Royce RB168 Spey Mk 101 turbofans; each 11,100 lb st.

**Dimensions:** span 44 ft 0 in, length 63 ft 5 in, height 16 ft 3 in.

**Weights:** empty 33,000 lb, gross 59,000 lb.

**Performance:** max speed 668 mph at S/L, service ceiling above 40,000 ft, tactical radius 500-600 miles on hi-lo-hi mission.

**Accommodation:** crew of two, in tandem.

**Armament:** max weapon load 16,000 lb, inside ventral bomb bay and on underwing pylons, including WE177 nuclear bombs, AS 37 Martel and Sea Eagle missiles, Paveway laser-guided bombs, 1,000 lb conventional bombs, one AIM-9G Sidewinder missile, and an AN/ALQ-101(V)-10 ECM jammer pod.

## F27 Maritime

Canary Islands Air Command (MACAN) is a miniature air force, separated by more than 800 miles of Atlantic Ocean from the three domestic regional commands of the Spanish Air Force. Its three squadrons, based at Gando, Las Palmas, include No. 802 Maritime Surveillance and Search-and-Rescue Squadron, equipped with four Super Puma helicopters and three F27 Maritimes (Spanish designation D.2). The F27 Maritime is generally similar to the basic F27 twin-turboprop transport (which see). Unarmed, it carries a crew of up to six persons and has a Litton 360° search radar in a ventral radome. Its standard fuel gives it an endurance of 10-12 hours or a range of up to 3,107 miles.

Two F27 Maritimes of the Royal Netherlands Air Force are assigned to non-NATO duties in the Netherlands Antilles.

**Contractor:** Fokker BV, Netherlands.

## Gulfstream SMA-3

It was not easy to find off-the-shelf aircraft capable of meeting the requirements of Denmark's fishery protection mission. Zones to be patrolled cover an area of more than 212,000 sq miles around Greenland and 112,700 sq miles around the Faeroe Islands. Bad weather can prevent landing in either region, necessitating a 920-mile diversion to an alternate. With limited defense funding available, the Royal Danish Air Force looked for an aircraft that could also be used for airdrop, medevac (including airborne surgery), search and rescue, tactical air transport, and VIP transportation for members of the nation's royal family. Eventual choice was the SMA-3 special missions derivative of the Gulfstream III executive transport, with a cargo door on the starboard side, forward of the wing; Texas Instruments APS-127 sea surveillance radar; and Litton 72R INS. The three SMA-3s delivered in 1982 are operated by No. 721 Squadron from Vaerlose, near Copenhagen, and detach in rotation for duty at Narsarsuaq, Greenland. Two standard Gulfstream IIIs form part of the equipment of No. 306 Special Transport Squadron of the Italian Air Force, based at Rome/Ciampino. No. 1 Support Wing of the Irish Air Corps has a VIP Gulfstream IV.

**Contractor:** Gulfstream Aerospace Corporation, US.

**Power Plant:** two Rolls-Royce Spey Mk 511-8 turbofans, each 11,400 lb st.

**Dimensions:** span 77 ft 10 in, length 83 ft 1 in, height 24 ft 4 1/2 in.

**Weights:** empty 36,173 lb, gross 69,700 lb.

**Performance:** max cruising speed Mach 0.85, service ceiling 45,000 ft, range with VFR reserves 4,537 miles.

**Accommodation:** crew of seven.

**Armament:** none.

## Nimrod MR. Mk 2P

Although the Royal Air Force began taking delivery of 46 Nimrod MR. Mk 1 maritime patrol aircraft in 1969, their airframes were based substantially on that of



**Buccaneer S. Mk 2B, Royal Air Force**  
(Paul Jackson)



**Gulfstream SMA-3, Royal Danish Air Force**



**CP-140 Aurora, Canadian Forces**  
(Paul Jackson)

Britain's pioneer Comet 4C jet airliner of the 1950s. Thirty-five were upgraded to MR. Mk 2 operational standard, with Thorn EMI Searchwave long-range surface vessel detection radar, GEC Avionics AQS 901 acoustics processing system compatible with a wide range of passive and active sonobuoys, and Loral 1017 Yellow Gate EWSM in wingtip pods. An in-flight refueling probe and provision for Sidewinder and Harpoon missiles were added as a result of experience in the Falklands campaign in 1982, changing the designation to Mk 2P (for Probe).

Nimrod MR. 2Ps currently equip Nos. 120, 201, and 206 Squadrons of No. 18 Group of RAF Strike Command at Kinloss, Scotland. A fourth squadron (No. 42) will disband at St Mawgan, England, on September 31, 1992, and will be replaced by a detachment from Kinloss. At the same time, the established strength of the Nimrod force will be reduced from 33 to 26 aircraft. They provided effective support for coalition forces blockading Iraq during the Persian Gulf War last year.

**Contractor:** British Aerospace pic, UK.

**Power Plant:** four Rolls-Royce RB168-20 Spey Mk 250 turbofans; each 12,140 lb st.

**Dimensions:** span 114 ft 10 in, length with refueling probe 129 ft 1 in, height 29 ft 8 1/2 in.

**Weights (approx):** empty 86,000 lb, normal gross 177,500 lb.

**Performance:** max speed 575 mph, typical low-level patrol speed 230 mph, service ceiling 42,000 ft, typical endurance 12 hours.

**Accommodation:** crew of 12.

**Armament:** up to nine torpedoes, Harpoon missiles, mines, or bombs in weapons bay; two underwing pylons for Sidewinder missiles.

## Orion (P-3), Aurora (CP-140), and Arcturus (CP-140A)

The P-3 completes 30 years as the US Navy's standard shore-based antisubmarine and maritime patrol aircraft in 1992; it also flies in the insignia of the Canadian, Norwegian, Portuguese, and Spanish air forces and the Royal Netherlands Navy. The airframe of the original P-3A Orion was based on that of the Electra airliner, with 4,500 ehp Allison T56-A-10W turboprops, APS-80 radar, ASQ-10 MAD in a tailboom, and an ASR-3 sensor to sniff the exhaust of submerged diesel-powered submarines. Mines, nuclear or conventional depth bombs, and torpedoes were carried in a weapons bay forward of the wings. Ten underwing pylons could carry more torpedoes, mines, or rockets, as well as a searchlight. Sonobuoys and acoustic devices were launched from the cabin.

No. 221 Squadron of the Spanish Air Force, at Jerez, has two P-3As and five of the seven P-3Bs (Spanish designation P-3) that were operated formerly by No. 333 Squadron of the Royal Norwegian Air Force. Funds for their upgrading were reduced in early 1992, with the result that sonics systems will remain unmodified and only the APS-80 radar is to be improved for surface surveillance tasks. Norway now flies four of the latest Update III P-3Cs for its primary task of detecting CIS submarines leaving Northern Fleet bases in the Murmansk area from its base at Andøya, in the far north of Norway. These aircraft have much-improved avionics, including an IBM Proteus acoustic processor to analyze signals picked up from the sea, and a new sonobuoy receiver, as well as a Texas Instruments AAS-36 undernose IR detection set and Harpoon missile capability. The two remaining RNoAF P-3Bs have been assigned to Coast Guard duties, with the designation P-3N.

The Portuguese Air Force has six ex-RAAF P-3Bs, on which crew operational training began in September 1988 after the first had received a major retrofit and detection sensors upgrade by Lockheed. The remaining five have been modified similarly to P-3P standard, with an expanded processing capability able to accommodate Data Link 11, ALR-66(V)3 ESM, and interactive displays for the tactical coordinator and pilot. A new AN/APS-134 radar, dual AQA-7V9 sonar processor, IRDS, and Harpoon capability make the P-3Ps comparable to a P-3C Update II.5. They are operated by No. 601 Squadron at Montijo. The 18 CP-140 Auroras operated by the Canadian Forces since 1980 combine the P-3C airframe with the avionics and data-processing system of the US Navy's S-3A Viking, including APS-116 search radar, ASQ-501 MAD, and AYK-10 computer. They have been supplemented by the last three production P-3Cs for operation as unarmed economic zone patrol aircraft under the designation CP-140A Arcturus. Greece is expected to acquire six ex-USN P-3s. (Data for P-3C.)

**Contractor:** Lockheed Aeronautical Systems Company, US.

**Power Plant:** four Allison T56-A-14 turboprops; each 4,910 ehp.

**Dimensions:** span 99 ft 8 in, length 116 ft 10 in, height 33 ft 8 1/2 in.

**Weights:** empty 61,491 lb, normal gross 135,000 lb.

**Performance:** max speed at 15,000 ft 473 mph, patrol speed at 1,500 ft 237 mph, service ceiling 28,300 ft, mission radius (3 hours on station) 1,550 miles.

**Accommodation:** crew of ten.

**Armament:** max expendable load of 20,000 lb, including 500/1,000/2,000 lb mines, Mk 54/57 depth bombs, Mk 101 nuclear depth bombs, Mk 43/44/46 torpedoes, Harpoon missiles, sonobuoys, marine markers, acoustic sensors, and parachute flares.

## Tracker (S-2)

Forty years after it was first flown in XS2F-1 prototype form, the piston-engine Tracker continues to be responsible for Turkey's shore-based maritime patrol duties. About 20 S-2A/Es operated by No. 103 Squadron from Topel on the Black Sea are assigned to the Turkish Navy and manned by Naval systems operators, but they have Air Force pilots. They are being supplemented and/or replaced by 18 more ex-USN S-2Es, which are being refurbished by Grumman before delivery. (Data for S-2E.)

**Prime Contractor:** Grumman Corporation, US.

**Power Plant:** two Wright R-1820-82WA piston engines; each 1,525 hp.

**Dimensions:** span 72 ft 7 in, length 43 ft 6 in, height 16 ft 7 1/2 in.

**Weights:** empty 18,750 lb, gross 29,150 lb.

**Performance:** max speed 253 mph, search speed 161 mph, service ceiling 22,000 ft, range 1,150 miles.

**Accommodation:** crew of three or four.

**Armament:** 2.75 in rocket packs, torpedoes, depth bombs, and bombs.



# Fighters

## F-4 Phantom II

By the end of 1992, only three NATO air forces in Europe will continue to deploy the Phantom II as first-line combat equipment.

The German Air Force has eight squadrons of F-4Fs in one fighter-bomber wing (JBG 35) and three air defense wings (JG 71, 72, and 74). Nos. 35 and 72 wings are scheduled to move to bases in the former East Germany by 1993. Beginning this year, 107 defensively tasked aircraft are undergoing an upgrade to give them look-down/shoot-down capability against multiple targets. MBB is prime contractor for the program, known as ICE (Improved Combat Effectiveness), which replaces the existing Westinghouse APQ-120 radar with an all-digital multimode Hughes APG-65 embodying advanced ECCM. The cockpit is being updated. New equipment includes a Litef digital fire-control computer, Honeywell laser INS, GEC-Marconi digital air data computer, improved IFF, and provisions for four AMRAAMs. First AMRAAM firings were conducted in November 1991. A further 40 F-4Fs, serving in the fighter-bomber role, have undergone partial update.

The other two Phantom operators have F-4Es, of which three squadrons (337, 338, and 339) serve with the Hellenic Air Force, and seven squadrons (111, 112, 131, 132, 171, 172, and 173) with the Turkish Air Force. Both countries are receiving additional aircraft from USAF surplus.

The Royal Air Force will disband its last Phantom FGR. Mk 2 squadron in October. Some interest in the FGR. Mk 2 has been shown by Greece, but the British Phantom has nonstandard avionics and Rolls-Royce Spey engines, thus complicating support. (Data for F-4E.)

**Contractor:** McDonnell Douglas Corporation, US.

**Power Plant:** two General Electric J79-GE-17 afterburning turbojets; each 17,900 lb st.

**Dimensions:** span 38 ft 4 1/4 in, length 63 ft 0 in, height 16 ft 5 in.

**Weights:** empty 31,000 lb, gross 61,800 lb.

**Performance:** max speed at 36,000 ft Mach 2.16; service ceiling 58,750 ft; combat radius 520 miles.

**Accommodation:** crew of two, in tandem.

**Armament:** one 20-mm M61 multibarrel gun internally; four Sparrows or AMRAAMs and four Sidewinders. Provision for eleven 1,000 lb bombs, SNEB rockets, and 370- and (centerline only) 600-gallon external fuel tanks.

## F-5 and CF-5

Single-seat F-5As and two-seat F-5Bs, in various forms, are still assigned to fighter ground-attack duties by three non-US NATO air forces. On NATO's southern flank, they are flown by Squadrons 341, 343, and part of 349 of the Hellenic Air Force and Squadrons 133, 151, 152, and 153 of the Turkish Air Force. These two nations have absorbed many surplus F-5s from elsewhere. The two squadrons of CASA-built SF-5As (A.9s) and SF-5Bs (AE.9s) operated by the Spanish Air Force (Nos. 211 and 212 Squadrons) have had a proposed upgrade canceled but will continue in service. The Royal Netherlands Air Force withdrew its last NF-5s from service on May 1, 1991.

CF-18s have replaced Canadair-built CF-5s (single-seat CF-116As and two-seat CF-116Ds) in Canadian operational squadrons, but the CF-5s continue in use as fighter lead-in trainers. Bristol Aerospace is fitting CF-18-type cockpit instrumentation and controls in 13 of the As and 33 Bs for operation by 419 Squadron at Cold Lake, beginning this year. Similarly, Norway's No. 336 Squadron operates as an advanced training unit for its four squadrons of F-16s, although its F-5As and F-5Bs have received improved avionics and self-protection systems for wartime air defense duties with AIM-9L Sidewinders or ECM support with external jamming pods. Seven of the F-5As and eight Bs are currently returning to service after being fitted with F-16 avionics by Sierra in the US. (Data for F-5A.)

**Contractor:** Northrop Corporation, US.

**Power Plant:** two General Electric J85-GE-13 afterburning turbojets; each 4,080 lb st.

**Dimensions:** span over tip tanks 25 ft 10 in, length 47 ft 2 in, height 13 ft 2 in.

**Weights:** empty 7,860 lb, gross 20,040 lb.

**Performance:** max speed at 36,000 ft Mach 1.4, service ceiling over 50,000 ft, max range 1,750 miles, range with max weapons 368 miles.

**Accommodation:** pilot only.

**Armament:** two 20-mm M39A2 guns in nose; Sidewinder missile on each wingtip; centerline pylon and two under each wing for about 4,400 lb of air-to-air or air-to-surface missiles, rocket packs, gun pods, bombs, or 275-gallon fuel tanks.

## F-16 Fighting Falcon

The last of 221 F-16s assembled in Belgium by SABCA was delivered in October 1991, and the last of 300 assembled by Fokker in the Netherlands on February 27, 1992. This completed a program that began on June 7, 1975, when the governments of four European NATO nations announced their selection of the F-16 to replace their F-104s. Components, avionics, and equipment for the two assembly lines were supplied by about 30 European companies. All of the aircraft produced are similar to basic USAF F-16As and Bs, with some equipment changes. Belgian F-16s are being fitted with Dassault Carapace passive ECM in an extended fin root fairing; those for Norway and the Netherlands have a brake-chute in this location.

In total, the Belgian Air Force received 160 F-16s, the Royal Danish Air Force 70, the Royal Netherlands Air Force 213, and the Royal Norwegian Air Force 74. All early models have a Pratt & Whitney F100-PW-200 afterburning turbojet, replaced by a 23,450 lb st F100-PW-220 in late production aircraft; a Westinghouse APG-66 radar is standard. Currently, these aircraft equip Squadrons 1, 2, 23, 31, 349, and 350 of the BAF; 723, 726, 727, and 730 of the RDAF; 311, 312, 313, 314, 315, 316, 322, and 323 of the RNLAF; and 331, 332, 334, and 338 of the RNoAF.

When Turkey and Greece joined the list of F-16 operators, they both opted for the updated F-16C/D versions, with a General Electric F110-GE-100 engine and APG-68 radar. Deliveries of the 40 Greek aircraft started in November 1988, to 111 Wing at Nea Anklialos, where 330 and 346 Squadrons have been formed. Eight US-built aircraft were supplied to Turkey in 1987; the remaining 192 (plus 40 options) are being built in Turkey by Tusas Aerospace Industries, and the first two (Nos. 141 and 142) of eight planned squadrons formed in 1989-90, followed by 161 and 162. Portugal will receive 17 F-16As and three F-16Bs to reform No. 201 Squadron at Monte Real. (Data for Greek/Turkish F-16C.)

**Contractor:** General Dynamics Corporation, US.

**Power Plant:** one General Electric F110-GE-100 afterburning turbofan; 27,600 lb st.

**Dimensions:** span over missiles 32 ft 9 3/4 in, length 49 ft 4 in, height 16 ft 8 1/2 in.

**Weights:** empty 19,020 lb, gross 42,300 lb.

**Performance:** max speed at 40,000 ft above Mach 2, service ceiling above 50,000 ft, radius of action more than 575 miles.

**Accommodation:** pilot only.

**Armament:** one 20-mm M61A1 multibarrel gun in port side wing/body fairing; Sidewinder missile on each wingtip; centerline hardpoint and three under each wing for total 12,000 lb of stores, including air-to-surface missiles (Penguin Mk 3 on Norwegian aircraft), single or cluster bombs, rocket packs, ECM packs, and fuel tanks. Internal chaff/flare dispensers.

## F/A-18 Hornet

Two non-US NATO air forces decided to reequip with the twin-engined F/A-18 rather than the single-engined F-16. Canada was first, in April 1980, and eventually received 98 single-seat CF-18As and 40 two-seat CF-18Bs. By comparison with US Navy versions, these CF-18s have a different ILS and an added spotlight on the port side of the fuselage for night identification of other aircraft in flight. Unique is the canopy shape painted on the underside of the front fuselage, which is intended to confuse hostile pilots during combat maneuvers. The number of CF-18 squadrons constituting No. 1 Canadian Air Division, based at Söllingen, Germany, has been reduced from three to two (Nos. 421 and 439); these will be withdrawn in 1993-94. Four further squadrons of CF-18s (Nos. 416, 425, 433, and 441), plus an OCU (No. 410), have replaced CF-5s and the CF-101F Voodoos that contributed to northern European attack reinforcement and North American air defense. Two of them (416 and 433) are allocated to support Canada's NATO force in central Europe in an emergency.

The Spanish Air Force ordered 72 EF-18s in May 1983, designating the single-seaters C.15 and the two-seaters CE.15. Deliveries to equip two squadrons of 15 Group, at Zaragoza AB, began in 1986. The two former Phantom squadrons of 12 Wing, at Torrejon AB, also converted to EF-18s by mid-1990. (Data for CF-18A.)

**Contractor:** McDonnell Douglas Corporation, US.

**Power Plant:** two General Electric F404-GE-400 augmented turbofans; each 16,000 lb st.

**Dimensions:** span over missiles 40 ft 4 1/4 in, length 56 ft 0 in, height 15 ft 3 1/2 in.

**Weights:** empty 23,050 lb, gross (fighter escort mission) 37,175 lb.

**Performance:** max speed Mach 1.8, combat ceiling approx 50,000 ft, combat radius 660 miles.

**Accommodation:** pilot only.

**Armament:** one 20-mm M61 multibarrel gun in nose; Sidewinder missile on each wingtip; centerline pylon, two on engine trunks, and two under each wing for Sparrow air-to-air missiles, CRV-7 rocket packs, bombs, BL755 cluster bombs, ECM pods, etc. (HARMS and Harpoon missiles on EF-18.) Max external stores load 17,000 lb.

## F-104 Starfighter

Greece and Turkey have maintained large inventories of F-104s by acquiring surplus aircraft from other NATO air forces that have reequipped. The Hellenic Air Force has two fighter-bomber squadrons of F-104Gs with 116 Wing at Araxos, plus considerable reserves. The Turkish Air Force has five squadrons of F-104Gs and two-seat TF-104s (Nos. 163, 181, 182, 192, and 193), plus one air defense squadron of F-104Ss (No. 191) bought from Italy. The S model was the final version of the Starfighter, developed by Aeritalia (now Alenia) for the Italian Air Force, which bought 205. These now equip, partly or completely, eight squadrons with its Nos. 4, 5, 9, 36, 37, 51, and 53 Wings. Around 155 remaining Italian Air Force F-104s have undergone a major weapon system update since 1986, bringing them up to F-104S ASA (*Aggiornamento Sistemi d'Arma*) standard. This includes installation of an FIAR R21G/M1 Setter look-down/shoot-down radar, advanced ECM, improved IFF and altitude reporting system, improved electrical generation and distribution, an armament computer and time delay unit for improved weapons delivery, and a new automatic pitch control computer. Alenia's Aspide medium-range air-to-air missile is now standard, as an alternative to the very similar Sparrows, which accounted for the "S" in the aircraft's designation. (Data for F-104S.)

**Contractor:** Alenia (formerly Aeritalia SpA), Italy, under license from Lockheed.

**Power Plant:** one General Electric J79-GE-19 afterburning turbojet; 17,900 lb st.

**Dimensions:** span without tip tanks 21 ft 11 in, length 54 ft 9 in, height 13 ft 6 in.

**Weights:** empty 14,900 lb, gross 31,000 lb.

**Performance:** max speed at 36,000 ft Mach 2.2, at S/L Mach 1.2; service ceiling 58,000 ft; max combat radius 775 miles.

**Accommodation:** pilot only.

**Armament:** AIM-9L Sidewinder on each wingtip; seven pylons under fuselage and wings for bombs, rocket packs, fuel tanks, and air-to-air missiles, including two Aspides or Sparrow IIIs. Max external stores load 7,500 lb.

## Hawk T. Mk 1A

Eighty-nine Hawk jet trainers of two Royal Air Force advanced flying schools, and of its Red Arrows aero-



**Phantom FGR. Mk 2, Royal Air Force**  
(Paul Jackson)



**CF-18A Hornets, Canadian Forces**  
(Paul Jackson)



**F-104S ASA Starfighter, Italian Air Force**  
(Paul Jackson)



batic team, have been wired for carriage of two AIM-9L Sidewinder air-to-air missiles on their inboard underwing pylons and for optional activation of the previously unused outer wing hardpoints. Seventy-two of these redesignated Hawk T. Mk 1As are declared to NATO for point defense and participation in the RAF's Mixed Fighter Force, in which they would accompany radar-equipped Tornado ADVs on medium-range air defense sorties. They retain their underfuselage 30-mm Aden gun pod.

**Contractor:** British Aerospace plc, UK.

**Power Plant:** one Rolls-Royce Turbomeca RT172-06-11 Adour 151 turbofan; 5,340 lb st.

**Dimensions:** span 30 ft 9 3/4 in, length, excluding probe, 36 ft 7 3/4 in, height 13 ft 5 in.

**Weights:** empty 8,040 lb, gross 17,097 lb.

**Performance:** max speed approx 560 mph, service ceiling 48,000 ft, max range with external tanks 1,923 miles.

**Accommodation:** basically, crew of two in tandem. Pilot only in combat role.

**Armament:** one 30-mm Aden gun pack under fuselage; AIM-9L Sidewinder air-to-air missile on each inboard underwing pylon.

#### MiG-29 (NATO "Fulcrum")

NATO has become an operator of Soviet-built MiG-29 fighters since Germany again became a single nation on October 3, 1990. Twenty single-seat Fulcrum-As (MiG-29-711 and -712 versions) and four Fulcrum-B (MiG-29UB) two-seat trainers of the former East German No. 3 Fighter Wing at Preschen have been retained by the German Air Force for air defense duties in the eastern part of Germany. Their armament now consists of R-27 (AA-10 Alamo) and R-73A (AA-11 Archer) air-to-air missiles and the installed 30-mm GSh-30 gun. R-60 (AA-8 Aphid) missiles have been deleted from the inventory. Further information on the MiG-29 can be found in the "Gallery of Aircraft of the Commonwealth of Former Soviet Republics" in the March 1992 issue of Air Force Magazine. (Data for Fulcrum-A follow.)

**Contractor:** Mikoyan OKB, Russia.

**Power Plant:** two Klimov/Sarkisov RD-33 turbofans, each 18,300 lb st with afterburning. Internal fuel capacity 1,153 gallons. Provision for two external tanks under wings and one under fuselage.

**Dimensions:** span 37 ft 3/4 in, length 56 ft 10 in, height 15 ft 6 1/4 in.

**Weights:** empty 24,030 lb, gross 33,600-40,785 lb.

**Performance:** max speed at height Mach 2.35, at S/L Mach 1.06, service ceiling 60,700 ft, takeoff run 790 ft, landing run 1,970 ft, range 932 miles on internal fuel, 1,550 miles with external tanks.

**Accommodation:** pilot only (two seats in tandem in Fulcrum-B).

**Armament:** six medium-range radar/IR homing AA-10 (Alamo-A/B) and/or close-range AA-11 (Archer) air-to-air missiles on three pylons under each wing. Able to carry bombs; 57-mm, 80-mm, and 240-mm rockets; and other stores in attack role. One 30-mm GSh-30 gun in port wingroot leading-edge extension, with 150 rds.

#### Mirage III

First flown in prototype form on November 17, 1956, the Mirage III delta-wing fighter remains in first-line service with the air forces of France and Spain. The Mirage IIIIE, operated by Squadrons 1/3 Navarre and 3/3 Ardennes of the French Tactical Air Force (FATAC), originated as an all-weather low-altitude attack fighter with CSF Cyrano II fire-control and ground-mapping radar, Marconi Doppler, and navigation and bombing computers but is equally effective for interception of Mach 2 targets in all weathers. Mirage IIIIEE (C.11) interceptors are flown by 11 Wing of the Spanish Air Force from Manises AB. They were to have been updated locally with an in-flight refueling probe, APQ-159 radar, AYK-1 mission computer, and other avionics, including INS, RWR, and head-up and head-down displays; but this program was canceled, and withdrawal is now likely. (Data for Mirage IIIIE.)

**Contractor:** Dassault Aviation, France.

**Power Plant:** one SNECMA Atar 9C afterburning turbojet, 13,670 lb st.

**Dimensions:** span 27 ft 0 in, length 49 ft 3 1/2 in, height 13 ft 11 1/2 in.

**Weights:** empty 15,540 lb, gross 29,760 lb.

**Performance:** max speed at 40,000 ft Mach 2.1, at S/L Mach 1.14; service ceiling 55,775 ft; combat radius (lo-lo-lo) 305 miles.

**Accommodation:** pilot only.

**Armament:** two 30-mm DEFA 552 guns in fuselage, and one Martel antiradar missile on centerline pylon. Options include one Matra R.530 air-to-air missile under fuselage, and two Matra Magic missiles under wings, for interception missions; bombs or rocket packs underwing, for ground-attack missions.



Mirage IIIIE (C.11), Spanish Air Force



Mirage 2000C, French Air Force



Tornado F. Mk 3, Royal Air Force  
(Crown copyright)

#### Mirage F1

After a series of highly successful delta-wing Mirages, the switch to swept wings for the Mirage F1 came as a surprise. Its fuselage and weapon systems remained generally similar to those of the Mirage IIIIE, but high-lift devices and an uprated turbojet helped to ensure good takeoff performance and rate of climb and a stabilized ceiling of 52,500 ft at supersonic speed. Automatic leading-edge flaps enhanced maneuverability in the primary air combat role, matched by great stability at high speeds close to the ground during visual ground attack missions. Standard equipment on the basic F1-C, first ordered for the French Air Force in May 1969, included a HUD and Cyrano IV-M multifunction radar, with a high degree of resistance to ECM. Later, many F1-Cs were fitted with an in-flight refueling probe and redesignated F1-C-200. Squadrons now flying F1-Cs are 2/12 Picardie and 3/12 Cornouaille at Cambrai and 1/30 Valois and 2/30 Normandie Niemen at Reims. One further squadron, 4/30 Vexin, is based in Djibouti, and there are a few F1-Cs with the two-seat F1-Bs of 3/30 Lorraine, the OCU at Reims. Fifty-five Mirage F1-C-200s replaced in the air defense role by Mirage 2000s are being converted to F1-CT standard for attack duties, with upgraded radar, HUD, and INS, plus laser rangefinder, F10M ejection seat, RWR, and air-to-surface weapons. The first was handed over to Squadron 1/13 Artois at Colmar in February of this year; 3/13 Auvergne will follow in 1993; deliveries will be completed in 1995.

The Hellenic Air Force has two squadrons of Mirage F1-CGs, Nos. 334 Thalios and 342 Sparta, currently at Agrinos and Tanagra. No. 14 Wing of the Spanish Air Force at Albacete AB has two squadrons of F1-CEs (known as C.14As). In addition, a single squadron of multirole Mirage F1-EEs (C.14Bs), with INS, nav/attack computer, and HUD, serves with No. 46 Wing of Canary Command (MACAN) at Gando AB, Las Palmas. (Data for Mirage F1-E.)

**Contractor:** Dassault Aviation, France.

**Power Plant:** one SNECMA Atar 9K-50 afterburning turbojet; 15,873 lb st.

**Dimensions:** span over missiles 30 ft 6 1/4 in, length 50 ft 2 1/2 in, height 14 ft 9 in.

**Weights:** empty 16,314 lb, gross 35,715 lb.

**Performance:** max speed at height Mach 2.2, at S/L Mach 1.2; service ceiling 65,600 ft; combat air patrol endurance 2 h 15 min; attack radius, depending on flight profile and weapon load, 265-863 miles.

**Accommodation:** pilot only.

**Armament:** two 30-mm DEFA 553 guns (F1-CT, one) in fuselage; seven hardpoints for practical external load of 8,818 lb; two Matra Super 530 air-to-air missiles, a Matra Magic or Sidewinder missile on each wingtip, and chaff/flare dispensers for interception mission; or fourteen 250 kg bombs, 30 anti-runway bombs, 144 rockets, an ARMAT antiradar missile, AM39 Exocet antiship missile, or laser-guided weapons and designator pod for ground-attack missions.

#### Mirage 2000

The Mirage 2000 was selected on December 18, 1975, as the primary combat aircraft of the French Air Force from the mid-1980s. Under French government contract, it was developed initially as an interceptor and air-superiority fighter, powered by a single 19,850 lb st SNECMA M53-5 turbofan and with Thomson-CSF RDM multimode Doppler radar. However, it is equally suitable for reconnaissance, close support, and low-altitude attack missions in areas to the rear of a battlefield. The French Air Force funded 146 air-superiority Mirage 2000Cs and 22 Mirage 2000B two-seat trainers up to 1991, but further planned financing of 22 Cs and one B was then abandoned for financial reasons. A strike/attack version, the Mirage 2000N, is described separately.

From airframe No. 38, Mirage 2000Cs have a more powerful M53-P2 engine and RDI pulse-Doppler radar. Deliveries of initial production M53-5/RDM aircraft began in 1983, to Squadrons 1/2 Cigognes, 2/2 Côte d'Or, and 3/2 Alsace at Dijon. Squadrons 1/5 Vendée, 2/5 Ile de France, and 3/5 Comtat Venaissin at Orange have Mirage 2000Cs with M53-P2 and RDI, as does 1/12 Cambresis, which launched conversion of Cambrai-based 12 Wing from Mirage F1-Cs in early 1992. The designation 2000DA (Défense Aérienne) is used frequently in collective reference to Mirage 2000Cs and two-seat 2000Bs.

RDI radar has an operating range of 62 miles. Other equipment on the Mirage 2000C includes Sagem Uliss 52 INS, Thomson-CSF head-up and head-down displays, chaff/flare dispenser, and Thomson-CSF Serval radar warning receivers. Control is fly-by-wire. The standard detachable in-flight refueling probe enabled two Mirage 2000s of 2 Wing to fly nonstop more than 3,400 miles from Djibouti to Dijon on February 6, 1988, in 6 h 40 min, each refueled three times by a C-135FR tanker. Performance in air defense configuration includes the ability to attain a speed of Mach 2.26 at a height of 39,350 ft within 2 1/2 min of leaving the runway. Minimum speed in stable flight is 115 mph.

Delivery to 114 Wing (331 and 332 Squadrons) of the Hellenic Air Force, at Tanagra, of 36 multirole Mirage 2000EGs, plus four 2000BG two-seaters, took place in 1988-92. These aircraft have enhanced ECM, including self-protection jammers and Matra Spirale automatic chaff/flare dispensers. (Data for Mirage 2000C.)

**Contractor:** Dassault Aviation, France.

**Power Plant:** one SNECMA M53-P2 afterburning turbofan; 21,385 lb st.

**Dimensions:** span 29 ft 11 1/2 in, length 47 ft 1 1/4 in, height 17 ft 0 3/4 in.

**Weights:** empty 16,534 lb, gross 37,480 lb.

**Performance:** max speed at height Mach 2.26, service ceiling 59,000 ft, range with four 250 kg bombs more than 920 miles.

**Accommodation:** pilot only.

**Armament:** two 30-mm DEFA 554 guns in fuselage; five hardpoints under fuselage and two under each wing for max external stores load of 13,890 lb. Two Matra Super 530 and two Matra Magic air-to-air missiles for interceptor mission. Ground attack weapons include eighteen 250 kg retarded bombs or BAP 100 antirunway bombs, 16 Durandal penetration bombs, two 1,000 kg laser-guided bombs, six Belouga cluster bombs, two AS 30L or AM39 Exocet air-to-surface missiles, two ARMAT antiradar missiles, four packs of eighteen 68-mm rockets, two packs of 100-mm rockets, or a twin 30-mm gun pod.

#### Tornado ADV

Development of this Tornado air defense variant (ADV) from the basic IDS airframe involved an increase in fuselage length forward of the front cockpit, to house the longer radome of the Marconi AI.24 Foxhunter multimode pulse-Doppler radar, and a small "stretch" aft of the rear cockpit to allow four Sky Flash missiles to be carried in tandem pairs under the fuselage. After the first of three prototypes flew on October 27, 1979, it was found that, together with an increase in wingroot chord, these changes reduced drag, especially at supersonic speed. They also allowed a 10 percent increase in internal fuel capacity.

Of 170 production Tornado ADVs ordered for the Royal Air Force, the first 18 were built as F. Mk 2s with 16,920 lb st RB199 Mk 103 engines. Most of these are stored until required, when they will be upgraded to F. Mk 2A standard, equivalent to F. Mk 3 but retaining their Mk 103 engines. All subsequent ADVs are to F. Mk



3 standard, with uprated RB199 Mk 104 turbofans, a retractable in-flight refueling probe, added head-down display for the pilot, a second INS, new IFF, automatic wingsweep, and other changes. One of the two guns of the IDS is deleted from the ADV, and RAF aircraft use only the two inboard underwing pylons.

The first F. Mk 3 flew on November 20, 1985, and deliveries to No. 229 OCU (No. 65 Squadron) at RAF Coningsby began in July 1986. Other units now include Nos. 5 and 29 Squadrons at Coningsby, Nos. 11, 23, and 25 at Leeming, and Nos. 43 and 111 at Leuchars. One further unit, No. 1435 Flight, is forming this month for defense of the Falkland Islands. Under the latest procurement plans, chaff/flare defense systems are to be added to all ADVs. (Data for F. Mk 3.)

**Contractor:** Panavia Aircraft GmbH, a UK/German/Italian consortium.

**Power Plant:** two Turbo-Union RB199 Mk 104 afterburning turbofans; each 16,520 lb st.

**Dimensions:** span 45 ft 7½ in spread, 28 ft 2½ in swept; length 61 ft 3½ in, height 19 ft 6¼ in.

**Weights:** empty 31,970 lb, gross 61,700 lb.

**Performance:** max speed at height (clean) Mach 2.2, service ceiling 70,000 ft, intercept radius more than 345 miles supersonic, 1,150 miles subsonic.

**Accommodation:** crew of two in tandem.

**Armament:** one 27-mm Iwka-Mauser gun in fuselage; four Sky Flash air-to-air missiles under fuselage, four AIM-9L Sidewinders under wings. Two 594-gallon tanks underwing.

## Attack Aircraft

### Alpha Jet

A total of 175 close support variants of the Alpha Jet were delivered to the German Air Force in 1979-83, in parallel with production of advanced trainer/light attack versions for the French and other air forces. They equipped six squadrons within JBG 41, 43, and 49, plus a weapons training unit detached to Portugal. Retrofit replaced the original Larzac 04-C6 turbofans with more powerful 04-C20s. An update program was planned for 1989-92 but was curtailed as a result of defense economies that followed German reunification. Instead, the first Alpha Jet squadron was disbanded in April 1992, and all but 30 or 40 aircraft will be withdrawn by 1993. Those to be retained will provide "Europeanization" flying for German pilots trained in the US. France will buy 30 of the others for weapons instruction. Portugal hopes to acquire 50 or more.

**Contractors:** Avions Marcel Dassault-Breguet Aviation, France, and Dornier GmbH, Germany.

**Power Plant:** two SNECMA/Turbomeca Larzac 04-C20 turbofans; each 3,175 lb st.

**Dimensions:** span 29 ft 10¼ in, length 43 ft 5 in, height 13 ft 9 in.

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

**Performance:** max speed Mach 0.86, service ceiling 48,000 ft, max mission radius, hi-lo-hi 668 miles.

**Accommodation:** basically, crew of two in tandem. Pilot only in combat role.

**Armament:** hardpoint under fuselage and two under each wing for up to 5,510 lb of stores, including centerline 27-mm gun pod, four BL755 cluster bombs, and 82- or 119-gallon tanks. Bombs and rocket packs optional.

### AMX

This close support, battlefield interdiction, and reconnaissance aircraft was developed jointly by Aeritalia (now Alenia) and Aeromacchi of Italy in partnership with Embraer of Brazil. The first of seven prototypes flew in Italy on May 15, 1984, and the first Italian production AMX on May 11, 1988. Despite the distance between participating countries, there is no dual-sourcing of components.

Italy's original requirement for 187 single-seat AMXs to reequip eight squadrons has been scaled down to 136, of which 110 have been ordered to date. First to receive AMXs was 103 Squadron, which left its G91Rs at San Angelo on January 1, 1989, and transferred to Istrana to reequip with the new aircraft as part of 51 Wing. No. 132 Squadron/3 Wing at Villafranca received its first AMX in October 1990, and 14 Squadron/2 Wing followed in July 1991. Some others may have an upgraded version of the AMX with Grifo radar, for which Aeritalia (Alenia), Aeromacchi, and FIAR signed a joint venture agreement in 1990. The two-seat AMX-T, of which 26 have been funded by Italy from up to 51 required, is to be delivered initially in training configuration, but it may be adapted for other roles requiring two crew. As a G91T replacement, it will be operated by No. 60 Wing at Foggia for advanced training.

**Contractor:** AMX International (Alenia, Aeromacchi, Embraer).

**Power Plant:** one Rolls-Royce Spey Mk 807 turbofan; 11,030 lb st.

**Dimensions:** span 32 ft 8½ in (over missiles), length 43 ft 5 in, height 14 ft 11¼ in.

**Weights:** empty 14,771 lb, gross 28,660 lb.

**Performance:** max speed Mach 0.86, service ceiling 42,650 ft, combat radius 328 miles lo-lo-lo with 6,000 lb of external stores.

**Accommodation:** pilot only.

**Armament:** one 20-mm M61 multibarrel gun; twin centerline pylon and four underwing pylons for bombs, cluster bombs, air-to-surface guided missiles, and rocket pods; and two wingtip Sidewinder rails. Max external stores load 8,377 lb. Internal bay for reconnaissance or ECM pallets.

### Corsair II (A-7H and A-7P)

Sixty landbased A-7H Corsair IIs were delivered to the Hellenic Air Force in 1975-77 to replace F-84F Thunderstreaks for tactical support of maritime operations. Equipping No. 347 Squadron at Lárisa, and Nos. 340 and 345 at Soúda, they retain the folding wings and 15,000 lb st nonafterburning Allison TF41 (Spey) turbofan of the US Navy's A-7E on which they are based, but they have no in-flight refueling capability. They were followed by five two-seat TA-7Hs, and a further 36 ex-USN A-7/TA-7s have been offered by the US after rework at Jacksonville.

The 43 A-7Ps delivered to the Portuguese Air Force since 1981 are refurbished USN A-7As, with TF30-P-408 engine, a mix of A-7D and A-7E standard avionics, AIM-9P Sidewinders for the secondary role of air defense, and a Westinghouse ALQ-131 (Block II) ECM pod. They equip Nos. 302 and 304 Squadrons for maritime and ground-attack missions from Monte Real and maintain a detachment in the Azores. Six TA-7Ps were also supplied. (Data for A-7P.)

**Contractor:** Vought Corporation, US.

**Power Plant:** one Pratt & Whitney TF30-P-408 non-afterburning turbofan; 13,400 lb st.

**Dimensions:** span 38 ft 9 in, length 46 ft 1½ in, height 16 ft 0¼ in.

**Weights:** empty 16,175 lb, gross 42,000 lb.

**Performance:** max speed at S/L 697 mph, service ceiling 41,000 ft, combat radius 675 miles.

**Accommodation:** pilot only.

**Armament:** two 20-mm Mk 12 guns; two pylons under fuselage and three under each wing for up to 15,000 lb of Sidewinder air-to-air missiles, Maverick and

Shrike air-to-surface missiles, bombs, rocket packs, mines, 30-mm Mk 4 gun pods, ECM pods, sonobuoys, and flares.

### Draken (F-35)

In 1968-69, the Danish Defense Ministry ordered for the Royal Danish Air Force a total of 46 Saab 35XDs, comprising 20 fighter-bombers which it designated F-35, 20 RF-35 reconnaissance fighters, and six TF-35 fighter trainers. The number of TF-35s was increased subsequently to 11. Externally, the 35XD was similar to the Swedish Air Force's J35F supersonic all-weather fighter, but with greatly increased attack capability. Its then-unique double-delta configuration and afterburning Avon turbojet enabled it to take off in 4,030 ft carrying nine 1,000 lb bombs. An update program in the first half of the 1980s added a Lear Siegler nav/attack computer, Singer Kearfott INS, Ferranti laser ranger, improved gunsight, and head-up display, giving the Danish Drakens an attack capability equal to that of the F-16A. The F-35s equipped No. 725 Squadron at Karup, in a dual air defense/attack role, alongside the RF-35s of 729 Squadron, until December 31, 1991, when 725 disbanded. No. 729 is now a dual-role attack/reconnaissance squadron, with a diminished complement of F-35s and RF-35s.

**Contractor:** Saab-Scania Aktiebolag, Sweden.

**Power Plant:** one Volvo Flygmotor (Rolls-Royce) RM6C (Avon 300-series) afterburning turbojet; 17,650 lb st.

**Dimensions:** span 30 ft 10 in, length 50 ft 4 in, height 12 ft 9 in.

**Weight:** gross 33,070 lb.

**Performance:** max speed at Mach 2, service ceiling 65,000 ft, combat radius (hi-lo-hi) with two 1,000 lb bombs and two drop tanks 623 miles.

**Accommodation:** pilot only.

**Armament:** nine hardpoints under wings and fuselage for four Sidewinder air-to-air missiles, or up to 9,000 lb of bombs, rockets, and fuel tanks.

### G91R and G91Y

The first-generation G91R is a dual attack/reconnaissance aircraft, powered by a single Orpheus 803 turbojet and with three Vinten 70-mm cameras in a glass paneled nosecone. The last official flight by an Italian Air Force G91R/1 took place on October 14 last year. Many of the G91R/3s and 4s built for the German Air Force were transferred to the Portuguese Air Force between 1965 and 1980. The R/3s now equip attack Squadron 301 at Montijo, with limited interception capability since they were retrofitted with a Saab RGS 2 sighting system and Sidewinder air-to-air missiles. Ex-German Alpha Jets have been requested as replacements. Germany retains 24 G91R/3s and two-seat G91Ts for target towing.

A version known as the G91Y, with the larger wing of the G91T trainer, and two 4,080 lb st General Electric J85 afterburning turbojets replacing the single Orpheus, flew for the first time on December 27, 1966. Over the next ten years, 20 preseries and 45 production G91Ys were built for the Italian Air Force. They currently equip Squadrons 101 and 13, the latter with a primary antishipping role from Brindisi. All Italian G91s are being replaced by the AMX. (Data for G91R/3.)

**Contractors:** Fiat SpA, Italy, and ARGE-91 consortium, Germany.

**Power Plant:** one Fiat-built Orpheus 803 nonafterburning turbojet; 5,000 lb st.

**Dimensions:** span 28 ft 1 in, length 33 ft 9½ in, height 13 ft 1½ in.

**Weights:** empty 8,130 lb, gross 12,125 lb.

**Performance:** max speed 650 mph, service ceiling 40,000 ft, combat radius 196 miles.

**Accommodation:** pilot only.

**Armament:** two 30-mm DEFA 552 guns in fuselage; four underwing pylons for up to 1,000 lb of bombs, rocket packs, or Sidewinder missiles.

### Harrier GR. Mk 3

The world's first operational fixed-wing V/STOL combat aircraft, the original Harrier, now equips only the Royal Air Force's No. 233 OCU at Wittering, UK, and No. 1417 Flight in Belize, Central America. All aircraft are to GR. Mk 3 standard, with a single Pegasus 103 vectored-thrust turbofan for both lift and forward thrust—the simple key to the Harrier's unique success where so many other V/STOL techniques failed. Equipment includes a Ferranti FE 541 inertial navigation and attack system, Cossor IFF, Smiths electronic head-up display, Marconi radar warning receiver, a weapon aiming computer, and a Ferranti ARI 23231 laser ranger and marked target seeker in a lengthened nosecone.

**Contractor:** British Aerospace plc, UK.

**Power Plant:** one Rolls-Royce Pegasus Mk 103 vectored-thrust turbofan; 21,500 lb st.

**Dimensions:** span 25 ft 3 in, length 46 ft 10 in, height 11 ft 11 in.

**Weights:** empty 13,535 lb, gross 25,200 lb.

**Performance:** max speed in a dive at height Mach 1.3, in level flight at S/L 730 mph; service ceiling 51,200



Alpha Jet, German Air Force (Paul Jackson)



AMX, Italian Air Force (Paul Jackson)



G91Y, Italian Air Force (Paul Jackson)





**Harrier GR. Mk 7, Royal Air Force**

ft; range with 4,400 lb external load, hi-lo-hi 414 miles, lo-lo-lo 230 miles.

**Accommodation:** pilot only.

**Armament:** typical load comprises two 30-mm Aden gun pods under fuselage; 120-gallon combat tank or 1,000 lb bomb on each inboard underwing hardpoint; Hunting BL755 cluster bomb or Matra 155 rocket pod on each outboard pylon. Some aircraft carry Sidewinder air-to-air missiles and a Tracor ALE-40 internal chaff/flare dispenser or Phimat chaff dispenser pod.

#### Harrier GR. Mk 5/7

To meet US Marine Corps requirements for an improved version of the Harrier, which USMC had operated under the designations AV-8A/C, McDonnell Douglas and British Aerospace developed jointly the AV-8B Harrier II. This retains the basic Harrier/AV-8A fuselage, but with a raised cockpit similar to that of the Royal Navy's Sea Harrier, and with lift improvement devices under the fuselage. The wing has a supercritical section and is made largely of carbonfiber and other composites. Compared with the wing of the original Harrier/AV-8A, it has greater span and area and 10° less sweep. There are six underwing pylons, and the AV-8B can lift an external load of 9,200 lb at its max STOL weight. Equipment includes a Hughes Angle Rate Bombing Set with TV/laser target seeker/tracker, working in conjunction with a mission computer. RAF aircraft have an extra pair of wing pylons for AIM-9L Sidewinder missiles.

Two AV-8As were modified as YAV-8B aerodynamic prototypes. The first of four genuine full-scale development AV-8Bs flew on November 5, 1981, by which time it had already been decided to put the aircraft into production for the Marines and the Royal Air Force. McDonnell Douglas manufactures all wings; sections of the fuselage and other components are produced by one or other of the British and US contractors, with an assembly line in each country. Delivery of the 94 production single-seat Harrier IIs ordered for the RAF, with the initial designation GR. Mk 5, began in May 1987, the first unit being No. 233 OCU at Wittering, which then had a mix of GR. 3s and GR. 5s. No. 1 Squadron was redeclared to NATO with GR. 5s in October 1989, followed by No. 3 in Germany during 1990. The last 34 RAF aircraft were built to "night attack" standard, with the designation GR. Mk 7. Their equipment includes GEC Avionics FLIR, Smiths head-up and head-down displays, and cockpits compatible with night vision goggles. GR.7 deliveries began in September 1990 to No. 4 Squadron in Germany; No. 3 began upgrading to Mk 7 three months later, followed by the OCU in the spring of 1992. No. 1 Squadron begins conversion of Mk 7 in October 1992 and will be the first RAF Harrier unit to use the night avionics operationally. All Mk 5s are being modified to Mk 7 under a contract awarded in November 1990. (Data for Harrier GR. Mk 5.)

**Contractors:** British Aerospace plc, UK, and McDonnell Douglas Corporation, US.

**Power Plant:** one Rolls-Royce Pegasus Mk 105 vectored-thrust turbofan; 21,750 lb st.

**Dimensions:** span 30 ft 4 in, length 46 ft 4 in, height 11 ft 7 7/8 in.

**Weights:** empty 13,984 lb; gross for VTO 18,950 lb, for STO 31,000 lb.

**Performance:** max speed at height Mach 0.91, at S/L 661 mph; STOL T-O run 1,330 ft; combat radius (hi-lo-hi) with 4,000 lb weapon load 553 miles.

**Accommodation:** pilot only.

**Armament:** two 25-mm gun pods under fuselage; four hardpoints under each wing, plus centerline position, for two Sidewinder air-to-air missiles, seven BL755 cluster bombs, or five 1,000 lb bombs. Alter-



**Jaguar GR. Mk 1A, Royal Air Force (Alex Hay Porteous)**



**Tornado GR. Mk 1, Royal Air Force (Geoff Lee)**

natively, 500 lb bombs, Matra 155 rocket pods, and 300-gallon tanks. Marconi Zeus internal ECM and Plessey MAW missile warning radar in tailcone.

#### Jaguar

During the 1991 Persian Gulf War, Jaguars of the Royal Air Force and the French Air Force flew 1,227 missions without loss. All had been delivered between 1973 and 1981, with Adour Mk 102 afterburning turbofans, but RAF Jaguars were retrofitted with 7,900 lb st Adour Mk 104s in 1978-84. The 69 single-seaters and 22 two-seaters remaining in service with Nos. 6 and 54 Squadrons at Coltishall are mostly to GR. Mk 1A and T. Mk 2A standard, respectively, with the more compact and capable Ferranti FIN 1064 INS instead of their original NAVWASS nav/attack equipment. They will continue in tactical support and ground-attack roles until the second half of the 1990s; many other Jaguar squadrons have already been converted to Tornados.

The French Air Force still has four squadrons of single-seat Jaguar As in No. 7 Wing at St Dizier and No. 11 Wing at Toul, plus a mix of Jaguar As and two-seat Es in Squadron 2/7, the OCU. No. 11 Wing is intended primarily for close support duties in Europe and for rapid deployment overseas. No. 7 Wing reverted to conventional attack after withdrawal of its AN 52 nuclear bombs on August 31, 1991. Before fighting Iraq, French Jaguar As had already seen action in Mauritania and Chad and had crossed the Atlantic with the aid of in-flight refueling to participate in Red Flag training at Nellis AFB, Nev. (Data for Jaguar A.)

**Contractor:** SEPECAT Consortium, France and UK.

**Power Plant:** two Rolls-Royce Turbomeca Adour Mk 102 afterburning turbofans; each 7,305 lb st.

**Dimensions:** span 28 ft 6 in, length 55 ft 2 1/2 in, height 15 ft 9 1/2 in.

**Weights:** empty 15,432 lb, gross 34,612 lb.

**Performance:** max speed at height Mach 1.3, at S/L Mach 1.1; service ceiling 45,000 ft; typical attack radius, hi-lo-hi 875 miles, lo-lo-lo 570 miles.

**Accommodation:** pilot only.

**Armament:** two 30-mm DEFA 553 guns in fuselage; centerline pylon and two under each wing for 10,000 lb of stores, including AS 30L laser-guided missiles, BGL 400 laser-guided bombs, 550 and 880 lb bombs, Belouga cluster bombs, BAP 100 area denial bombs, BAT 120 antirunway bomblets, F1 rocket pods; Magic 2 air-to-air missiles, Barracuda electronic emission detectors, Barem or CT 51J jamming pods, Phimat chaff/flare pods; 317-gallon tanks.

#### Mirage 5

Twenty years after entering service with the French Air Force, the Mirage 5F is operational with Squadrons 2/13 Alpes and 3/13 Auvergne, although the latter will soon convert to Mirage F1-CTs. The basic airframe, power plant, and gross weight are identical with those of the Mirage III. By simplifying the avionics and other systems and deleting the radar, Dassault was able to increase the internal fuel capacity by 132 gallons, and the external stores load to 8,820 lb on seven wing and fuselage hardpoints. Belgium acquired 106 Mirage 5s, comprising 63 5BAs with comprehensive avionics, 16 5BD two-seat trainers, and 27 5BRs for reconnaissance. Following their partial replacement by F-16s, Belgium is upgrading 15 BAs and five BDs for continued service with No. 42 Squadron, now at Bierset but transferring to Florennes from 1993. (Data for Mirage 5F.)

**Armament:** 550 and 880 lb bombs, JL100 rocket and fuel pods, and Belouga cluster bombs, plus Phimat chaff/flare pods, Magic missiles for self-defense, and 317-gallon tanks.

**Performance:** combat radius with 2,000 lb bomb load 808 miles hi-lo-hi or 404 miles lo-lo-lo.

#### Mirage 2000N and 2000D

France's Mirage 2000N two-seat nuclear strike aircraft has been in service in Squadron 1/4 Dauphiné at Luxeuil since July 1, 1988, and with 2/4 Lafayette and 3/4 Limousin (detached to Istres) since 1989-90. All three squadrons were transferred from Tactical Command (FATAC) to the Strategic Air Force (FAS) on September 1, 1991. By comparison with the Mirage 2000C, the 2000N has a strengthened airframe for flight at a typical 690 mph at 200 ft above the terrain. Its primary weapon, like the Mirage IV-P strategic bomber, is the ASMP medium-range air-to-surface nuclear missile. Equipment includes ESD Antelope 5 terrain-following radar, two Sagem inertial platforms, two improved TRT AHV-12 radio altimeters, Thomson-CSF color CRT, and Omera vertical camera. Self-defense aids comprise two Magic air-to-air missiles and an integrated countermeasures suite comprising Servat RWR, Sabre electronic jammers, and Spirale automatic chaff/flare dispensers. The first 31 aircraft, with only ASMP capability, are designated 2000N-K1; 2000N-K2s, built since 1990, also have conventional attack capability. The last of 75 aircraft is being delivered this year to complete a fourth squadron (2/3 Champagne), which was commissioned at Nancy on September 1, 1991, and uses only nonnuclear armament.

Definitive conventional attack version is the Mirage 2000D, of which 75 have been funded; plans for 30 more were abandoned in the 1992 budget. Deliveries are scheduled to begin next year, to complete the equipment of 3 Wing at Nancy. Minor differences from the 2000N include the addition of GPS and deletion of the ASMP interface. Both versions can carry two 528-gallon drop tanks, but the 2000D offers a wider choice of weapons, including laser-guided AS 30L air-to-surface missiles and BGL bombs, Apache standoff weapon dispensers, Exocet antiship missiles, bombs, and rockets, as well as several types of sensor pod. Specification is generally similar to that of the Mirage 2000C, except for a length of 47 ft 9 in.

#### Tornado IDS

Tornado interdiction/strike (IDS) aircraft of the Royal Air Force and the Italian and Saudi Air Forces took part in the Persian Gulf War in 1991, the RAF aircraft alone flying some 1,650 combat sorties. They included low-altitude runway-denial attacks with JP 233 dispenser weapons; medium-altitude attacks with laser-guided Paveway IIs, some self-designated with TIALD pods; attacks on hostile radars with new ALARM air-to-surface missiles; and delivery of about 5,200 conventional 1,000 lb bombs (including 950 laser-guided). Results were outstanding, for the loss of six aircraft in combat.

Operational since June 1982, Tornado GR. Mk 1s currently equip Nos. 27 and 617 Squadrons of RAF Strike Command at Marham, UK, and Nos. 9, 14, 17, and 31 with RAF Germany at Brüggen. Their equipment includes a Texas Instruments multimode ground-mapping and terrain-following radar, Ferranti FIN 1010 digital INS, Decca Doppler, HUD, and laser rangefinder and marked target seeker in an undernose pod. Weapons include nuclear bombs.



RAF GR. Mk 1s are undergoing a midlife update, involving Marconi Hermes RWR and Sky Shadow EW jamming systems (already used in the Gulf War), GEC Avionics Spartan terrain-referenced navigation/terrain-following system, an updated weapons control system, new Ferranti HUD, and Smiths color CRT head-down display. The first upgraded aircraft, designated Tornado GR. Mk 4, is expected to fly this year. In 1993, No. 617 Squadron and the Buccaneer-equipped No. 12 will be reequipped with GR. Mk 1s modified for the antisurface unit warfare (ASUW) role. Armed with Sea Eagle antiship missiles, they will be based at Lossiemouth, Scotland.

German Air Force Tornados equip seven squadrons, two each with JBG 31, 33, and 34, and one with JBG 32, plus an OCU. The IDS version also equips Nos. 154, 155, and 156 Squadrons of the Italian Air Force, which, like German squadrons, can carry MW-1 anti-airfield bomblet dispensers.

Current IDS development includes full integration of HARM, ALARM, Kormoran, and Maverick missiles, TIALD laser designation, and a night vision FLIR system. A total of 732 IDS Tornados have been ordered by four air forces and the German Navy. Production has been completed in Germany and Italy.

**Contractor:** Panavia Aircraft GmbH (BAe, UK; MBB, Germany; Alenia, Italy).

**Power Plant:** two Turbo-Union RB199 Mk 103 afterburning turbofans; each 16,075 lb st.

**Dimensions:** as Tornado ADV, except length 54 ft 10 1/4 in.

**Weights:** empty 31,065 lb, gross more than 61,730 lb.

**Performance:** max speed at height Mach 2.2 clean, Mach 0.92 with external stores; radius of action, hi-lo 863 miles.

**Accommodation:** crew of two in tandem.

**Armament:** two 27-mm LWKA-Mauser guns in fuselage; seven fuselage and wing hardpoints for 19,840 lb of external stores, including air-to-air, air-to-surface, and anti-radiation missiles; cluster bombs, napalm; "smart," retarded, and conventional bombs; rocket packs; flare bombs; jamming/deception and chaff/flare ECM pods; and fuel tanks.

## Reconnaissance and Special Mission Aircraft

### Andover C. Mk 1(PR) and E. Mk 3

Two Andover C. Mk 1 transport/communications aircraft of the RAF returned to service in 1990 after conversion to C. Mk 1(PR) standard, with vertical cameras in the fuselage and with the port forward door sealed. These aircraft were used within the Berlin corridors and control zone, replacing two Pembroke C(PR). Mk 1s, until their mission was made unnecessary by German reunification. One has since flown Russian VIPs on a demonstration of "Open Skies" verification procedures.

The seven Andover E. Mk 3s of No. 115 Squadron are C. Mk 1s modified for navigation aids calibration and wartime radio relay. (Data generally as for Andover C. Mk 1 transport.)

### Aviocar (C-212)

Two EC-212 Aviocars are operated by No. 502 Squadron of the Portuguese Air Force for electronic intelligence/ECM duties. They carry equipment, including a blunt nose radome and fin tip pod, for automatic signal interception, classification, and identification in dense signal environments, data enabling a map to be drawn plotting the position and characteristics of hostile radars. Jamming emitters are also carried. The unit has a further C-212 fitted with a magnetometer for surveying.

Three C-212s similar to the Portuguese EC-212s serve with No. 408 Flight of the Spanish Air Force for ECM duties, under the designation TR.12D. Both the Spanish and Portuguese Air Forces also have a few Aviocars fitted with Wild RC-10 cameras for survey work. (Data generally as for C-212 transport.)

### Boeing 707

Boeing 707s serve in military roles with four NATO air forces besides USAF. Five aircraft of the Canadian Forces, designated CC-137, include two tanker/transports that were modified to support CF-5s and now support CF-18s. They have been relieved of scheduled transport operations to extend their service lives to 1996. Spain bases two similar tankers at Zaragoza to refuel its EF-18 Hornets. Four 707s handle VIP and

support flights with the German Air Force's Special Missions Squadron at Köln/Bonn, but these will also be converted to tankers. Dornier of Germany headed a team that modified three 707-320Cs as trainer cargo aircraft (TCA), with cockpit similar to that of the E-3A, for training NATO AWACS flight crews and to provide NATO with air transport capability. These aircraft have an in-flight refueling system installed. Italy has converted four ex-airline 707s to tankers, the first of which was delivered on May 14, 1992. They will be operated by 14 Wing at Pratica di Mare.

### C-135FR

Like the KC-135 Stratotankers of USAF, the eleven C-135FRs of the French Air Force have had their lower wing skin renewed to make possible another 25,000 flying hours. This justified reengining them with CFM56 turbofans, and the last updated aircraft rejoined the three squadrons of the 93d Refueling Wing in April 1988. C-135FRs have a standard USAF-type flying boom. Until recently, this terminated in a drogue for compatibility with the probe-equipped aircraft of the French Air Force. However, in 1991, work began on fitting two FRL Mk 32 hose-drum units under the wings to free the boom for receptacle refueling of E-3F AWACS aircraft. Radar warning receivers have also been fitted.

Range of the C-135FRs is nearly 3,400 miles. In their other role, as transports, each can carry 75 fully equipped troops on sidewall seating, or 77,000 lb of freight over a range of 2,235 miles, or 44 stretchers and 54 other persons in a medevac mission.

**Contractor:** Boeing Military Airplanes, US.

**Power Plant:** four CFM56-2 turbofans; each 22,000 lb st.

**Dimensions:** span 130 ft 10 in, length 136 ft 3 in, height 42 ft 0 in.

**Weights:** empty 110,230 lb, gross 319,665 lb.

**Performance:** max speed 560 mph, service ceiling 50,000 ft.

**Accommodation:** crew of four.

### Canberra

Five Canberra PR. Mk 9s of No. 1 PRU, with cameras and infrared linescan in their belly, form the only dedicated strategic photoreconnaissance unit in the RAF.

Eleven bulbous-nosed Canberra T. Mk 17s of 360



Andover C. Mk 1(PR), Royal Air Force (Paul Jackson)



C-135FR, French Air Force (Sirpa "Air")



Canberra T. Mk 17, Royal Air Force (Paul Jackson)

Squadron provide specialized electronic countermeasures training by transmitting radio interference and using jammers and wingtip chaff dispensers. Five have AN/ALQ-167 jammers and GTE Dragonfly jamming management systems. No. 360 also has two Canberra PR. Mk 7s used for laying chaff and an E. Mk 15 used for specialized radar calibration.

Canberra TT. Mk 18 target tugs were withdrawn in December 1991 and have been replaced with Hawks. (Data for Canberra PR. Mk 9.)

**Contractor:** English Electric Co Ltd/Short Brothers and Harland, Ltd, UK.

**Power Plant:** two Rolls-Royce Avon 206 turbojets; each 11,250 lb st.

**Dimensions:** span 67 ft 10 in, length 66 ft 8 in, height 15 ft 7 in.

**Weight:** gross 57,500 lb.

**Performance:** max speed Mach 0.83, service ceiling 50,000 ft, max range 4,000 miles.

**Accommodation:** crew of two.

**Armament:** none.

### Challenger (EW Versions)

Three Canadair Challenger 600s are employed on electronic support and training missions by No. 414 Squadron of the Canadian Forces. Equipment includes an ALQ-502 radar jammer, ALE-502 chaff dispenser, spectrum analyzer, and communications jammers. Another was delivered to the Aeronautical Engineering and Test Establishment at Cold Lake, Alberta, as a test-bed for developing such future military applications as maritime reconnaissance. Canadian Forces designation is EC-144A.

**Contractor:** Canadair Inc, Canada.

**Power Plant:** two Textron Lycoming ALF 502L turbofans; each 7,500 lb st.

**Dimensions:** span 61 ft 10 in, length 68 ft 5 in, height 20 ft 8 in.

**Weights:** empty approx 23,300 lb, gross 41,100 lb.

**Performance:** max cruising speed 529 mph, service ceiling 41,000 ft, range 3,220 miles.

**Accommodation:** crew of four and up to 12 passengers in transport role.

### CL-215

Greece and Spain are subject to severe forest fires and rely on their air forces for aerial firefighting duties. The Hellenic Air Force has taken delivery of 16 CL-215 amphibian water-bombers for this purpose, and the Spanish Air Force has received 30, under the designation UD.13, 15 of which are being converted to CL-215T standard with two 2,380 shp PW123AF turboprops. All are capable of other tasks, and eight of the Spanish aircraft are equipped for search and rescue and coastal patrol. Each air force has lost several aircraft during firefighting operations, but results have been impressive. Single CL-215s have frequently made more than 100 drops, totaling more than 141,230 gallons, in one day. Full loads of water have been scooped up from the Mediterranean by the amphibians in wave heights up to 6 ft.

**Contractor:** Canadair, Bombardier Inc, Canada.

**Power Plant:** two Pratt & Whitney R-2800-CA3 piston engines; each 2,100 hp.

**Dimensions:** span 93 ft 10 in, length 65 ft 0 1/4 in, height 29 ft 5 1/2 in.

**Weights:** empty 28,082 lb, gross 43,500 lb.

**Performance:** max cruising speed 181 mph, max range 1,301 miles.

**Accommodation:** crew of two; payload of 12,000 lb for water-bomber, 8,518 lb for utility version. Crew of six in patrol and SAR versions, with provision for additional seats and stretchers.

### DHC-8 Dash 8M (CT-142)

The Canadian Department of National Defence operates four Dash 8M-100s with No. 402 Squadron at Winnipeg, as CT-142 navigation trainers with an extended nose. Basically similar to the standard Dash 8 transport, these aircraft have long-range fuel tanks, rough-field landing gear, high-strength floors, and mission-related avionics.

**Contractor:** De Havilland Inc, Canada.

**Power Plant:** two Pratt & Whitney Canada PW120A turboprops; each 2,000 shp.

**Dimensions:** span 85 ft 0 in, length 73 ft 0 in, height 24 ft 7 in.

**Weights:** empty 22,000 lb, gross 34,700 lb.

**Performance:** max speed 310 mph, service ceiling 25,000 ft, range 575 miles.

**Accommodation:** crew of two; four students and two instructor navigators.

### Draken (RF-35)

Since January 1992, No. 729 Squadron of the Royal Danish Air Force has operated a mixed fleet of Drakens, consisting of F-35 single-seat fighter-bombers in addition to its former RF-35 (Saab S-35XD) reconnaissance aircraft. The RF-35s were equipped initially with cameras in the nose for daylight-only missions. They



have been able to operate round-the-clock since 1975, when Red Baron infrared pods were bought from Sweden. (Data as for F-35 Draken.)

### E-3A/D/F Sentry

NATO's 18 airborne warning and control system (AWACS) aircraft are the only operational military type to bear the insignia of Luxembourg. They were equipped initially to the original standard of USAF E-3A Sentry Nos. 26 to 34. Much of the avionics was produced in Germany, with Dornier as systems integrator. NATO funded a third HF radio, to cover the maritime environment; a new data analysis and programming group; underwing hardpoints on which operational ECM pods could be attached; and a radio teletype to link the aircraft with NATO maritime forces and commands. The 18 aircraft were delivered between January 1982 and April 1985. Subsequent updating has included the addition of AN/AYR-1 ESM in canoe-shaped pods on each side of the forward fuselage, with which the aircraft first became operational in October 1991.

Main operating base for the NATO E-3As is at Geilenkirchen in Germany. Forward operating bases are at Oerland, Norway; Konya, Turkey; Preveza, Greece; and Trapani, Italy.

Seven E-3s were ordered for the Royal Air Force and four for the French Air Force, all with CFM56 turbofans. Deliveries to both air forces took place in 1990-92. The RAF aircraft became operational with No. 8 Squadron at Waddington July 1, 1991, under the designation E-3D Sentry AEW. Mk 1. The French E-3Fs are assigned to *Escadre de Détection Aéroportée 36* at Avord. Both the E-3D and E-3F have an in-flight refueling probe and USAF-style receptacle. On March 3, 1992, an RAF E-3D refueled via each system in turn on a single sortie. RAF aircraft are fitted additionally with wingtip Loral 1017 Yellow Gate ESM pods. (Data for NATO E-3A.)

**Contractor:** Boeing Aerospace, US.

**Power Plant:** four Pratt & Whitney TF33-PW-100/100A turbofans; each 21,000 lb st.

**Dimensions:** span 145 ft 9 in, length 152 ft 11 in, height 41 ft 9 in.

**Weight:** gross 335,000 lb.

**Performance:** max speed 530 mph, service ceiling over 29,000 ft, max unrefueled endurance more than 11 hours.

**Accommodation:** basic crew of 17, including 13 AWACS specialists.

**Armament:** none.

### F-16A(R) Fighting Falcon

The aircraft of No. 306 Squadron of the Royal Netherlands Air Force are assigned to reconnaissance duties, with the designation F-16A(R). They are fitted with a radar altimeter and carry on their centerline pylon an Oude Delft Orpheus pod. This contains a fan of three TA-8 cameras, plus one panoramic F.415 and infrared linescan. (Data as for F-16.)

### G222GE and G222RM

The Italian Air Force has two G222GEs for electronic warfare duties with the 71st Squadron (*Guerra Elettronica*) at Pratica di Mare. Carrying a pilot, copilot, and up to ten systems operators, this version has a modified cabin fitted with racks and consoles for detection, signal processing, and data recording equipment, with an electrical system providing up to 40kW of power for its operation. It is externally distinguishable by a small thimble radome beneath the nose and a larger "doughnut" radome at the tip of the tailfin. Four G222RMs are used by No. 8 Squadron, also at Pratica, for in-flight calibration of ground radio nav/com facilities. Equipment includes a nose-mounted spotlight. (Data as for G222 transport.)

### Hansa Jet

No. 3 Squadron of JBG 32 Tornado Wing of the German Air Force operates seven sweptforward-wing Hansa Jets for ECM training. Features include a cylindrical nose radome and a boat-shaped fairing under the rear fuselage.

**Contractor:** Messerschmitt-Bölkow-Blöhm GmbH, Germany.

**Power Plant:** two General Electric CJ610-9 turbojets; each 3,100 lb st.

**Dimensions:** span 47 ft 6 in, length (excl radome) 54 ft 6 in, height 16 ft 2 in.

**Weight:** gross 20,280 lb.

**Performance:** max speed at 25,000 ft 513 mph, service ceiling 40,000 ft, range 1,472 miles.

### Hercules C. Mk 1 Elint

Five Royal Air Force Hercules (four C. Mk 1(K) tankers and a C. Mk 1) have been fitted with Orange Blossom elint equipment, which includes wingtip pods, each with three radomes. They operate normally from Mount Pleasant in the Falkland Islands, where additional duties include maritime surveillance.

### Jaguar GR. Mk 1A (Reconnaissance)

The Jaguar GR. Mk 1As of No. 41 Squadron of RAF Strike Command at Coltishall, UK, are assigned to tactical reconnaissance missions. Standard equipment is a 1,230 lb centerline pod containing five cameras and a Vinten 401 infrared linescan system. In 1990, for Operations Desert Shield and Desert Storm, a VICON 18 Srs 600 long-range oblique photography pod was introduced as an alternative fit.

### Mirage 5BR

No. 42 Squadron of the Belgian Air Force is a combined attack/tactical reconnaissance unit, equipped with license-built Mirage 5BR aircraft. Except for their five-camera nose, these are similar to the Mirage 5 fighter.



RF-35 Draken, Royal Danish Air Force



E-3A Sentry, NATO (Paul Jackson)



Hansa Jet, German Air Force (Paul Jackson)



Mirage F1-CR-200, French Air Force, with Jaguar A



Reims-Cessna FTB 337 G, Portuguese Air Force (Paul Jackson)

### Mirage F1-CR-200

All three tactical reconnaissance squadrons of the French Air Force (1/33 *Belfort*, 2/33 *Savoie*, and 3/33 *Moselle*) are equipped with Mirage F1-CRs. Full designation of these aircraft is F1-CR-200, implying that they have a fixed in-flight refueling probe. They differ from the basic F1-C fighter in being fitted with Cyrano IVMR radar (with additional ground mapping, contour mapping, air-to-ground ranging, and blind let-down modes), a Sagem Uliss 47 inertial platform, and ESD 182 navigation computer. An SAT SCM2400 Super Cyclope infrared linescan reconnaissance system replaces the starboard gun, and an undernose bay houses either a 75-mm Omera 40 panoramic camera or a 150-mm Omera 33 vertical camera. F1-CR-200s have a secondary ground-attack role and can also carry a centerline podded sensor in the form of a Thomson Raphaël TH SLAR or a Thomson-CSF Astac electronic reconnaissance system for detecting ground radars. ECM pods can be carried underwing, together with two Magic air-to-air missiles for self-defense. (Data as for Mirage F1-C, except length 50 ft 2 1/2 in.)

### Mystère-Falcon 20

The French, Norwegian, and Portuguese air forces all use small numbers of Mystère-Falcon twin-jet transports modified for ECM training and combat area duties. The Norwegian aircraft are equipped for radar and communications intelligence and jamming duties. The Mystère-Falcons of the French *Centre d'Instruction Tactique 339* at Luxeuil are fitted with the combat radar and navigation systems of various Mirage types for training interceptor, strike, and reconnaissance pilots. France and Spain also have Mystère-Falcon calibration aircraft in service.

**Contractor:** Avions Marcel Dassault-Breguet Aviation, France.

**Power Plant:** two General Electric CF700-2D2 turbofans; each 4,500 lb st.

**Dimensions:** span 53 ft 6 in, length 56 ft 3 in, height 17 ft 6 1/4 in.

**Weights:** empty 16,600 lb, gross 28,660 lb.

**Performance:** max cruising speed 490 mph at 40,000 ft, service ceiling 42,000 ft, range 2,180 miles.

**Accommodation:** flight crew of two; up to ten other persons or 3,750 lb of equipment or cargo, according to role.

### Nimrod R. Mk 1P

Three Nimrod R. Mk 1s, delivered to No. 51 Squadron of RAF Strike Command at RAF Wyton, are specially equipped for electronic intelligence missions, carrying four flight crew and 24 systems operators. They can be identified by the short tailcone that replaces the MR. Mk 2's MAD boom and by modifications to the wing leading-edge pods. All three were fitted with in-flight refueling probes between 1982 and 1988, so becoming Mk 1Ps. BOZ-107 chaff/flare dispenser pods, modified with AN/AAR-47 missile approach warning systems, were added under the wings in 1990. (Data generally as for Nimrod MR. Mk 2.)

### PD-808ECM and RM

Together with its PD-808VIP and TA light jet transports, the Italian Air Force acquired six PD-808ECMs for electronic warfare training, and four PD-808RMs for naval calibration and other duties, in the 1970s. Recent conversion of some of the transports increased these totals to eight ECMs with No. 71 Squadron and seven RMs with No. 8 Squadron, both at Pratica di Mare. Except for their specialized role equipment, they are similar to the PD-808TA, for which data follow.

**Contractor:** Rinaldo Piaggio SpA, Italy.

**Power Plant:** two Rolls-Royce Viper Mk 526 turbojets; each 3,360 lb st.

**Dimensions:** span over tip tanks 43 ft 3 1/2 in, length 42 ft 2 in, height 15 ft 9 in.

**Weights:** empty 10,650 lb, gross 18,000 lb.

**Performance:** max speed at 19,500 ft 529 mph, service ceiling 45,000 ft, range 1,322 miles.

**Accommodation:** flight crew of two; up to nine other persons or 1,600 lb of equipment, according to role.

### Reims-Cessna FTB 337 G

FTB 337 G militarized versions of Cessna's "push and pull" twin-engine light aircraft are used by No. 701 Squadron of the Portuguese Air Force for army cooperation, photographic reconnaissance/survey, training, and utility duties. They embody STOL modifications in the form of high-lift flaps. Many of them are able to carry gun pods, rocket launchers, or bombs on underwing pylons for counterinsurgency missions, but this option is no longer employed.

**Contractor:** Reims Aviation SA, France.

**Power Plant:** two Continental TSO-360-D turbocharged piston engines; each 225 hp.

**Dimensions:** span 39 ft 8 1/2 in, length 29 ft 9 in, height 9 ft 4 in.

**Weights:** empty 3,206 lb, gross 4,630 lb.

**Performance:** max speed 236 mph, service ceiling 23,950 ft, range 1,325 miles.



**Accommodation:** pilot and up to five passengers, two stretchers, or cargo.

#### RF-4 Phantom II

Four NATO air forces in Europe continue to operate reconnaissance versions of the Phantom II. The German Air Force has four squadrons of RF-4Es in AG 51 and 52 Wings at Bremgarten and Leck, respectively, but these are scheduled to disband next year. The Hellenic Air Force operates a few similar aircraft alongside the F-4Es of 110 Wing. The Turkish Air Force also has RF-4Es in No. 113 Squadron, and planned to supplement them with 35 ex-German RF-4Es when they became available, but the transfer fell foul of diplomatic problems in early 1992. Eight ex-USAF RF-4Cs (CR.12s) serve in 12 Wing of the Spanish Air Force. (Data generally as for F-4 Phantom II.)

#### RF-5A

No. 184 Squadron of the Turkish Air Force is the largest NATO operator of reconnaissance RF-5As, with up to 20 aircraft at Diyarbakir. The Hellenic Air Force has about eight in No. 349 Squadron. Spain has 13 (designated AR.9) alongside the F-5As of Nos. 211 and 212 Squadrons in 21 Wing. Original standard equipment of the RF-5A comprised four KS-92 cameras in a modified nosecone. (Data generally as for F-5A.)

#### RF-104G Starfighter

The 3d Reconnaissance Fighter Wing of the Italian Air Force, based at Villafranca/Verona, includes No. 28 Squadron with RF-104Gs. They will be replaced soon by AMXs.

#### Tornado (Reconnaissance)

Six Tornado GR. Mk 1A cameraless reconnaissance aircraft, from Nos. 2 and 13 Squadrons of the RAF, flew 135 low-level missions during the Persian Gulf War. No. 2 had been first to form in January 1989, followed by No. 13 a year later. They will be based together, at Marham, UK, next year. The GR. Mk 1A has a Vinten sideways-looking IR system, Vinten Linescan 4000 IR surveillance system, and Computing Devices signal processing and video recording system. It is identifiable by the small underbelly blister fairing to the rear of its laser rangefinder pod. Full attack capability is retained, except for the normal guns.

Germany and Italy have jointly developed a reconnaissance pod to equip Tornados of the first squadron of MFG 2 of the German Navy and No. 155 Squadron of the Italian Air Force. Hung from the centerline pylon, the pod contains two Zeiss cameras, TV sensors, and Texas Instruments RS-710 infrared linescan.

The German Air Force has 35 specially developed Tornado ECR (electronic combat and reconnaissance) versions of the Tornado IDS in single squadrons within JBG 32 and JBG 38. Retaining an air-to-surface role, except for the removal of guns, the ECR is fitted with a ground emitter locator; a Honeywell/Sondertechnik IR linescan; FLIR; on-board systems for processing, storing, and transmitting reconnaissance data; and advanced tactical displays for the pilot and weapons officer. It is normally configured to carry two HARMs, two Sidewinders, an active ECM pod, chaff/flare dispenser pod, and two underwing 396-gallon fuel tanks. A Mk 105 version of the RB199 engine provides about 10 percent more thrust than the IDS's Mk 103.

Italy intends to convert 16 of its existing Tornado IDSs to ECR configuration, with equipment similar to that of Germany except for a Honeywell/Elettronica infrared imaging system (IIS) instead of linescan and addition of advanced radar warning equipment. A prototype was completed in March 1992. The Italian Air Force expects its ECR force to have Suppression of Enemy Air Defense capability by next year and full ECR capability by 1995.

In a further program, Germany is seeking a new reconnaissance system for some 40 Tornado IDSs which will be transferred from the Navy to the Air Force in 1993. These aircraft will be based at Schleswig/Jagel with No. 51 Wing after its RF-4E Phantoms have gone. (Data generally as for Tornado IDS.)

#### Transall Astarté and Gabriel

Four of the second-series Transall C-160s built for the French Air Force are equipped as communications relay aircraft on behalf of the nation's nuclear deterrent forces. Designated Astarté (*Avion STATION Relais de Transmissions Exceptionnelles*) and operated under the Ramses (*Réseau Amont Maillé Stratégique Et de Survie*) program, each is equipped with a Collins VLF system of the kind fitted to US Navy TACAMO aircraft. To ensure maximum survivability and effectiveness in a nuclear combat environment, they are able to operate as in-flight refueling tanker/receivers. Operating unit is No. 59 Squadron at Evreux.

Two other Transalls, delivered to No. 54 Squadron at Metz in February 1989, are equipped as elint/ESM



**RF-4C Phantom II (CR.12), Spanish Air Force**



**TriStar K. Mk 1, Royal Air Force (Paul Jackson)**



**VC10 K. Mk 2, Royal Air Force (Paul Jackson)**



**Victor K. Mk 2, Royal Air Force (Paul Jackson)**

aircraft and are designated Gabriel. Also equipped as tanker/receivers, they have a row of large blade antennas above the forward fuselage, a retractable ventral Thomson-CSF radome, and slender wingtip pods with UHF/DF blade antennas. (Data as for Transall C-160 transport.)

#### TriStar Tankers

Six Lockheed L-1011-500 TriStar airliners purchased by the Royal Air Force from British Airways are operated as dual-role tanker/transport by No. 216 Squadron from Brize Norton, UK. Two of them were modified by Marshall of Cambridge to TriStar K. Mk 1 standard, with an increased max takeoff weight of 540,000 lb. Each has twin Flight Refuelling Ltd Mk 17T hose drums (one a reserve) in the fuselage, and seven tanks in the baggage compartments, raising total fuel capacity to 313,300 lb. Features include a refueling receiver probe over the flight deck, optional seating for 187 passengers, and closed-circuit TV to monitor all refueling operations. The other four aircraft were converted by Marshall to KC. Mk 1 tanker/freighter configuration, with a large cargo door, strengthened cabin floor, and cargo handling system. Fuel capacity is as for the K. Mk 1, but optional seating can accommodate 196-266 passengers, and the KC. Mk 1's refueling probe was removed in late 1991. Plans to fit both versions with underwing refueling pods have been abandoned, as have intentions to convert the RAF's TriStar C. Mk 2 passenger transports into dual-role tanker/transport. **Contractor:** Lockheed Aircraft Corporation, US. **Power Plant:** three Rolls-Royce RB211-254B4 turbofans; each 50,000 lb st.

**Dimensions:** span 164 ft 6 in, length 164 ft 2½ in, height 55 ft 4 in.

**Weights:** empty 242,864 lb, gross 540,000 lb.

**Performance:** max speed 545 mph at 30,000 ft, service ceiling 43,500 ft, range with max payload 4,310 miles.

**Accommodation:** crew of three.

#### VC10 Tankers

No. 101 Squadron of the Royal Air Force has five VC10 K. Mk 2 in-flight refueling tankers, converted by British Aerospace from ex-BOAC Model 1101s, and four VC10 K. Mk 3s converted from East African Airways Super VC10 Model 1154s. Each has a Flight Refuelling Ltd Mk 17B hose drum in the rear fuselage, a Mk 32 pod under each wing, a receiver probe on its nose, and closed-circuit TV to monitor refueling operations. Fuel tanks in the cabin give the K. Mk 2 a total capacity of 24,470 gallons and the K. Mk 3 a capacity of 26,455 gallons.

A further five ex-British Airways Super VC10s are being converted to VC10 K. Mk 4 standard. Although having a fuselage-mounted Mk 17B hose drum unit and a Mk 32 pod under each wing, they will have no extra fuel tanks in the fuselage. To supplement this 14-aircraft fleet, all 13 of the VC10 C. Mk 1 strategic transports serving with No. 10 Squadron are being converted to C. Mk 1(K)s with only two wing pods and no additional fuel, thereby retaining full passenger/freight capability.

Data are generally as for the VC10 C. Mk 1 transport, except that the K. Mk 2 is 166 ft 1 in long and the K. Mk 3 is 179 ft 1 in long.

**Weights:** gross (K. Mk 2) 313,933 lb, (K. Mk 3) 334,875 lb.

#### Victor K. Mk 2

Eight remaining Victor K. Mk 2 in-flight refueling tankers of No. 55 Squadron of the Royal Air Force were converted from operational B. Mk 2 strategic bombers and SR. Mk 2 strategic reconnaissance aircraft in the early 1970s. Fuel capacity is 18,960 gallons. Like the VC10s of 101 Squadron, they are able to refuel three small aircraft simultaneously. It is planned to retire the Victor tankers in October 1993.

**Contractor:** Handley Page Ltd, UK.

**Power Plant:** four Rolls-Royce Conway RCo 17 Mk 201 turbofans, each 20,600 lb st.

**Dimensions:** span 117 ft 0 in, length 114 ft 11 in, height 30 ft 1½ in.

**Weight:** gross 238,000 lb.

**Performance:** max speed over 600 mph at 40,000 ft, service ceiling over 60,000 ft, max range 4,600 miles.

**Accommodation:** crew of four.

## Tactical and Strategic Transports

#### Andover/HS 748

The Belgian Air Force has three HS 748 Srs 2A tactical transports, with side freight door, in its No. 21 Transport Squadron at Melsbroek, but these are to be sold because of funding cuts. Conventional Andover CC. Mk 2s, and C. Mk 1s with an upswept tail and rear loading ramp, continue in Royal Air Force use for a variety of tasks. The Andover E. Mk 3 and C. Mk 1 (PR) are listed under "Reconnaissance and Special Mission Aircraft." (Data for Andover C. Mk 1.)

**Contractor:** Hawker Siddeley Aviation Ltd, UK.

**Power Plant:** two Rolls-Royce Dart RDa 12 Mk 301 turboprops; each 3,245 ehp.

**Dimensions:** span 98 ft 3 in, length 78 ft 0 in, height 30 ft 1 in.

**Weights:** empty 27,709 lb, gross 50,000 lb.

**Performance:** max speed 302 mph, service ceiling 23,800 ft, range with 8,530 lb payload 1,158 miles.

**Accommodation:** crew of two or three; up to 44 troops, 18 stretchers and eight seated passengers, or 14,000 lb of freight.

#### Antonov An-26 (NATO "Curl")

A dozen former East German An-26s have been absorbed into the German Air Force, including one modified for elint operations, though not to full Curl-B standard. The aircraft are based at Dresden and wear the badge of their former operating unit, 24 Transport Squadron, which is now a detachment of 65 Transport Wing. Further details can be found in the "Gallery of Aircraft of the Commonwealth of Former Soviet Republics" in the March 1992 issue of Air Force Magazine.



**Contractor:** Antonov OKB, Ukraine.

**Power Plant:** two Ivchenko AI-24VT turboprops; each 2,820 ehp. One 1,765 lb st RU 19A-300 auxiliary turbojet in starboard nacelle for turboprop starting and to provide additional power for takeoff, climb, and cruising flight, as required.

**Dimensions:** span 95 ft 9½ in, length 78 ft 1 in, height 28 ft 1½ in.

**Weights:** empty 33,113 lb, gross 52,911 lb.

**Performance:** cruising speed 273 mph at 19,675 ft, service ceiling 24,600 ft, range 683 miles with max payload.

**Accommodation:** crew of five, plus station for load supervisor or dispatcher. Electrically powered mo-



**Antonov An-26, German Air Force (Peter Cooper)**



**Aviocar (C-212), Portuguese Air Force (Paul Jackson)**

bile hoist, capacity 4,409 lb, and conveyor to facilitate loading and airdropping. Provision for carrying 40 paratroops or 24 stretchers.

#### Aviocar (C-212)

More than 50 Aviocars equip No. 37 Transport Wing of the Spanish Air Force, one squadron of 35 Wing, and No. 461 Squadron of its Canarias Command, under the designations T.12B/C. Each aircraft can accommodate up to 18 troops, 15 paratroops and a jumpmaster, or 4,410 lb of freight, including light vehicles, loaded via the rear ramp. Two medevac conversions (D.3As) can each carry up to 18 stretcher patients. Squadrons 502 and 503 of the Portuguese Air Force fly standard C-212 tactical transports. Data are generally as for the maritime version, except for operational equipment.

#### Buffalo (CC-115)

Fifteen Buffalo medium transports were acquired for the Canadian Forces in 1967-68, for their ability to operate under all weather conditions in areas where short, rough, unprepared strips provide the only take-off and landing surface. About 11 are now assigned primarily to search-and-rescue missions, together with helicopters, in No. 442 Squadron at Comox on Canada's west coast, No. 413 at Summerside on the east coast, and No. 424 at Trenton, Ontario. Disposal of the fleet is planned.

**Contractor:** The de Havilland Aircraft of Canada Ltd, Canada.

**Power Plant:** two General Electric CT64-820-3 turboprops; each 3,060 shp.

**Dimensions:** span 96 ft 0 in, length 79 ft 0 in, height 28 ft 8 in.

**Weights:** empty 24,500 lb, gross 41,000 lb.

**Performance:** max cruising speed 260 mph, service ceiling 25,000 ft, range 1,400 miles.

**Accommodation:** crew of three; up to 41 troops, 24 stretchers and six seated persons, or freight.

#### C-130 Hercules

Except for Germany and the Netherlands, all NATO air forces operate transport versions of this classic aircraft, which first flew in prototype form 37 years ago. Canada has mainly C-130Es, with 4,050 ehp T56-A-7 engines, plus a few more powerful C-130Hs. Designated CC-130 by Canadian Forces, these 31 aircraft are used for strategic airlift, tactical airdrop/airlift, and search and rescue from Edmonton, Belgium, Denmark, Greece, Italy, Norway, Portugal, Spain, and Turkey all have small numbers of C-130Hs. Twelve C-130Hs were delivered to France in 1987-91, including nine "stretched" C-130H-30s. The Royal Air Force acquired 66 C-130Ks, basically Hs with UK equipment, as Hercules C. Mk 1s. Six were converted into C. Mk 1K in-flight refueling tanker/receivers by Marshall of Cambridge, with four fuel tanks and a hose drum unit in the



**CN-235 M (T.19), Spanish Air Force (Paul Jackson)**



**G222, Italian Air Force (Paul Jackson)**

hold. Thirty were lengthened to C-130H-30 standard, as Hercules C. Mk 3s, able to carry seven cargo pallets instead of five, four Land Rovers and trailers, 128 troops, 92 paratroops, or 97 stretcher patients. All have been fitted with an in-flight refueling probe, becoming C. Mk 1Ps and 3Ps. RAF Hercules equip Squadrons 24, 30, 47, and 70 of Strike Command and No. 1312 Flight in the Falkland Islands. (Data for C-130H.)

**Contractor:** Lockheed Aeronautical Systems Company, US.

**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 175,000 lb.

**Performance:** max cruising speed at 20,000 ft 374 mph, service ceiling 23,000 ft, range with max payload 2,356 miles.

**Accommodation:** crew of five; up to 92 troops, 64 paratroops, 74 stretcher patients, or five 463L freight pallets.

#### CN-235 M (T.19)

This twin-turboprop transport was developed, and is

being manufactured, as a joint program of CASA of Spain and IPTN of Indonesia, with a final assembly line in each country. The first NATO military operator was the Spanish Air Force, which acquired two as VIP transports under the designation T.19C. Deliveries are now in progress of 18 more (T.19Bs) for 35 Wing at Getafe. The French Air Force funded two in FY 1990 and six more in FY 1991; deliveries began in February 1991. Turkey has ordered 52 to replace veteran C-47s, 50 to be built locally by TUSAS following two delivered by CASA in early 1992.

**Contractor:** Aircraft Technology Industries (Airtech: CASA, Spain, and IPTN, Indonesia).

**Power Plant:** two General Electric CT7-9C turboprops; each 1,870 shp.

**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 25,000 ft, range with max payload 932 miles, with 7,935 lb payload 2,706 miles.

**Accommodation:** crew of three; up to 48 troops, 46 paratroops, 24 stretchers and four attendants, 13,227 lb of freight (loaded via rear ramp), or equipment for ASW/maritime patrol, EW or photographic duties.

#### F27 Friendship and F27M Troopship

The Royal Netherlands Air Force has only one transport squadron, No. 334 at Eindhoven, equipped with three standard F27-100 Friendships and nine F27M Troopships with a large parachuting door on each side in addition to the freight loading door. (Data for Troopship.)

**Contractor:** Royal Netherlands Aircraft Factories Fokker, Netherlands.

**Power Plant:** two Rolls-Royce Dart RDa. 7 Mk 532-7R turboprops; each 2,140 ehp.

**Dimensions:** span 95 ft 2 in, length 77 ft 3½ in, height 27 ft 11 in.

**Weight:** gross 45,000 lb.

**Performance:** cruising speed at 20,000 ft 298 mph, service ceiling 30,000 ft, max range with freight 2,727 miles.

**Accommodation:** crew of two or three; 45 paratroops, 24 stretchers and nine seated persons, or 13,283 lb of freight.

#### G222

The G222 equips two of the three transport squadrons of the Italian Air Force in its standard general-purpose form. Six quick-change kits are also held, for field conversion to aeromedical configuration. The Italian Air Force has eight of the G222SAA firefighting version of the aircraft, with a modular palletized pack carrying 1,585 gallons of water and retardant. These have been used extensively and successfully in many parts of Italy. The Air Force also operates five G222s ordered by the Italian Ministry for Civil Defense as a rapid intervention unit for firefighting, oil slick dispersal, medevac, and airlift of supplies to earthquake and other disaster areas. (Data for G222.)

**Contractor:** Alenia (Aeritalia SpA), Italy.

**Power Plant:** two General Electric T64-GE-P4D turboprops; each 3,400 shp.

**Dimensions:** span 94 ft 2 in, length 74 ft 5½ in, height 32 ft 1¾ in.

**Weights:** empty 33,950 lb, gross 61,730 lb.

**Performance:** max speed 336 mph, service ceiling 25,000 ft, range with max payload 852 miles.

**Accommodation:** crew of three; 53 troops, 40 paratroops, 36 stretchers and four attendants, or 19,840 lb of freight, vehicles, and guns.

#### Transall C-160

The French Air Force received 50, and the German Air Force 90, of the original C-160s, which ended production in 1972. A second series was authorized in 1977, with updated avionics and an optional center-section fuel tank. Of 29 built for the French Air Force, eight are standard transports, ten are equipped as probe-and-drogue in-flight refueling tankers, five others have provision for rapid conversion to tankers, and six are Astarte/Gabriel special missions aircraft (which see). All have an in-flight refueling receiver boom. Four squadrons of the French Air Force and six squadrons of the German Air Force fly C-160s, some of the French aircraft being on long-term loan to small units overseas. In addition, first-series C-160s equip No. 221 squadron of the Turkish Air Force.

**Contractor:** Arbeitsgemeinschaft Transall (Aerospatiale and MBB); France and Germany.

**Power Plant:** two Rolls-Royce Tyne RTy.20 Mk 22 turboprops; each 6,100 ehp.

**Dimensions:** span 131 ft 3 in, length, excluding probe, 106 ft 3½ in, height 38 ft 2¼ in.

**Weights:** empty 63,935 lb, gross 112,435 lb.

**Performance:** max speed at 16,000 ft 319 mph, service ceiling 27,000 ft, range with max payload 1,151 miles.

**Accommodation:** crew of three; 93 troops, 61-88



paratroops, 62 stretchers and four attendants, tanks, vehicles, or up to 35,275 lb of freight.

### TriStar C. Mk 2

In addition to the former British Airways TriStars that have been converted into tankers, the Royal Air Force purchased three similar passenger transports from Pan Am. These are operated by No. 216 Squadron as C. Mk 2 passenger aircraft with 267 seats. Their conversion to tankers will not now take place.

### VC10 C. Mk 1

No. 10 Squadron of the Royal Air Force has 13 VC10 transports for long-range strategic operations. Although dimensionally similar to the commercial standard VC10 airliner, these were built with updated engines, additional fuel tankage in the tailfin, a side freight door, reinforced cabin floor, rearward-facing seats, an optional in-flight refueling probe, an APU in the tailcone, and autoland blind-landing system. All are being adapted for dual-role transport/tanker use, under the designation C. Mk 1(K), as described on p. 63.

**Contractor:** British Aircraft Corporation, UK.

**Power Plant:** four Rolls-Royce Conway 301 turbofans; each 22,500 lb st.

**Dimensions:** span 146 ft 2 in, length excluding probe 158 ft 8 in, height 39 ft 6 in.

**Weights:** empty 146,000 lb, gross 323,000 lb.

**Performance:** max speed at 30,000 ft 580 mph, service ceiling 42,000 ft, range with 24,000 lb payload 5,370 miles.

**Accommodation:** crew of four; 150 passengers, 76 stretcher patients and six attendants, or 57,400 lb of freight.

## Helicopters

### Alouette III

The Alouette III was produced first with an Artouste turboshaft, as the SA 316B, and then with an Astazou, as the SA 319B. Both versions continue in NATO service, with the air forces of France, the Netherlands, Portugal, and Spain. Main uses are now light transport, search and rescue, and training, although a wide variety of armament could be carried. (Data for SA 319B.)

**Contractor:** SNI Aerospatiale, France.

**Power Plant:** one Turbomeca Astazou XIV turboshaft; derated to 600 shp.

**Dimensions:** rotor diameter 36 ft 1 3/4 in, length of fuselage 32 ft 10 3/4 in, height 9 ft 10 in.

**Weights:** empty 2,527 lb, gross 4,960 lb.

**Performance:** max speed 136 mph, range with max payload 375 miles.

**Accommodation:** pilot and six passengers or two stretchers and two attendants.

### BO 105 CB

The Royal Netherlands Army owns the BO 105 CB helicopters of No. 299 Squadron and the SA 316B Alouette IIIs of Nos. 298 and 300 Squadrons, but they are flown and maintained by the Royal Netherlands Air Force. Duties are light transport, observation, and forward air control on behalf of the Army. No armament is fitted, but the BO 105 CBs are equipped for operation at night and in adverse weather.

**Contractor:** Messerschmitt-Bölkow-Blohm GmbH, Germany.

**Power Plant:** two Allison 250-C20B turboshafts; each 420 shp.

**Dimensions:** rotor diameter 32 ft 3 1/2 in, length of fuselage 28 ft 1 in, height 9 ft 10 in.

**Weights:** empty 2,813 lb, gross 5,511 lb.

**Performance:** max cruising speed 150 mph, service ceiling 17,000 ft, range with max payload 408 miles.

**Accommodation:** up to five persons; rear bench seat removable to permit carriage of two stretcher patients or equivalent freight.

### CH-113 Labrador

Together with fixed-wing Buffalos, CH-113 Labrador helicopters form the mainstay of Canada's coastal and inland search-and-rescue units. Each has a 900-gallon fuel capacity for relatively long-range missions, an 11,000 lb cargo hook for external loads, a rear ramp for easy loading, a watertight hull for landing on water, a rescue hoist, a scoopnet for retrieving survivors from the water, and Stokes litters. Under an upgrade program, the entire fleet has been fitted with improved avionics and a high-powered searchlight. The CH-113s will continue to serve until replaced by EH-101s in the closing years of the decade.

**Contractor:** The Boeing Company, Vertol Division, US.

**Power Plant:** two General Electric T58-GE-8F turboshafts; each 1,350 shp.

**Dimensions:** rotor diameter each 50 ft 0 in, length of fuselage 44 ft 7 in, height 16 ft 10 in.

**Weights:** empty 11,532 lb, gross 21,400 lb.

**Performance:** max speed 170 mph, service ceiling 13,700 ft, range 690 miles.

**Accommodation:** crew of three; provision for up to 20 survivors.

### Chinook (CH-47)

The Royal Air Force's Chinook HC. Mk 1s have an autoflight control and stability augmentation system and operate at a much greater gross weight than contemporary US Army CH-47Cs, including 28,000 lb loads on a triple cargo hook. Instrument lighting is compatible with pilots' night vision goggles, and the helicopters are well protected by RWR, missile approach warning systems, and IR jammers. Squadrons 7, 18, and 78 are based in the UK, Germany, and the Falkland Islands, respectively. RAF Chinooks are being upgraded to HC. Mk 2 standard in the early 1990s, gaining all major features of the latest CH-47D. Similar CH-147s operated by No. 447 Squadron of the Canadian Forces are being withdrawn. (Data for Chinook HC. Mk 1.)

**Contractor:** Boeing Helicopters, US.

**Power Plant:** two Textron Lycoming T55-L-712 turboshafts; each 3,750 shp.

**Dimensions:** rotor diameter each 60 ft 0 in, length of fuselage 51 ft 0 in, height 18 ft 7 3/4 in.

**Weights:** empty 20,547 lb, gross 50,000 lb.

**Performance:** max speed 180 mph, service ceiling 15,000 ft, mission radius 115 miles with 14,728 lb payload.



**BO 105 CB, Royal Netherlands Army**  
(Paul Jackson)



**Chinook HC. Mk 1, Royal Air Force**  
(Paul Jackson)



**Ecureuil 2, French Air Force**  
(Paul Jackson)



**Gazelle HT. Mk 3, Royal Air Force**  
(Paul Jackson)

**Accommodation:** crew of four; up to 44 troops, or 24 stretcher patients, or internal or external freight.

**Armament:** one machine gun in forward hatchway.

### Ecureuil 2

The French Air Force is acquiring 52 of these twin-turbine light helicopters for surveillance of strategic military bases and other support duties. The first eight are AS 555F.s, as described below. The remainder, delivered from January 1990, are AS 555ANs, with 456 shp Turbomeca TM 319 turboshafts.

**Contractor:** Eurocopter International (Aerospatiale, France, and DASA, Germany).

**Power Plant:** two Allison 250-C20F turboshafts; each 420 shp.

**Dimensions:** rotor diameter 35 ft 0 3/4 in, length of fuselage 35 ft 9 1/2 in, height 10 ft 4 in.

**Weights:** empty 2,840 lb, gross 5,511 lb with slung load.

**Performance:** max cruising speed 143 mph, service ceiling 12,140 ft, range 447 miles.

**Accommodation:** pilot and up to five passengers.

**Armament:** provision for carrying 20-mm gun and Mistral missiles.

### Gazelle

The 34 Gazelles supplied to the Royal Air Force have been used mainly for training at No. 2 FTS and at the Central Flying School, under the designation HT. Mk 3. Four serve with No. 32 Communications Squadron. **Contractors:** Westland Helicopters Ltd, UK, and SNI Aerospatiale, France.

**Power Plant:** one Turbomeca Astazou IIIA turboshaft; 590 shp.

**Dimensions:** rotor diameter 34 ft 5 1/2 in, length of fuselage 31 ft 3 1/4 in, height 10 ft 2 3/4 in.

**Weights:** empty 1,874 lb, gross 3,970 lb.

**Performance:** max cruising speed 164 mph, service ceiling 16,400 ft, range 416 miles.

**Accommodation:** pilot and up to four other persons.

### HH-3F Pelican

Agusta of Italy began license production of this Sikorsky multipurpose search-and-rescue helicopter in 1974 and has since received orders for 35 for the Italian Air Force. The last 13 are being delivered with a new radar, Loran, FLIR, and navigation computer, which will be retrofitted in the remaining 19 of the original production series. They equip No. 15 Wing, with 85 Squadron at Ciampino (Rome Airport) and detachments at Trapani, Rimini-Miramare, and Brindisi. The Italian Air Force also has two similar AS-61A-4s for VIP transport.

**Contractor:** Agusta SpA, Italy.

**Power Plant:** two General Electric T58-GE-100 turboshafts; each 1,500 shp.

**Dimensions:** rotor diameter 62 ft 0 in, length of fuselage 57 ft 3 in, height 18 ft 1 in.

**Weights:** empty 13,255 lb, gross 22,050 lb.

**Performance:** max speed 162 mph, service ceiling 11,100 ft, range 886 miles.

**Accommodation:** crew of two or three; six stretchers and 10 seated persons, or 26 troops, or 15 stretchers and two attendants, or equivalent freight.

### Hughes 300

The Hellenic and Spanish air forces both utilize small numbers of Hughes 300C light helicopters for training. The two Greek aircraft were built under license in Italy by BredaNardi as NH-300Cs.

**Contractor:** Hughes Helicopters Inc, US.

**Power Plant:** one Avco Lycoming HIO-360-D1A piston engine; derated to 190 hp.

**Dimensions:** rotor diameter 26 ft 10 in, length overall 30 ft 10 in, height 8 ft 9 in.

**Weights:** empty 1,100 lb, gross 2,050 lb.

**Performance:** max cruising speed 94 mph, service ceiling 10,200 ft, range 232 miles.

**Accommodation:** pilot and two other persons.

### Kiowa and AB-206A

Seventy-four Bell COH-58As, generally similar to the US Army's OH-58A Kiowa, were delivered to the Canadian Forces to fill the roles of observation, reconnaissance, command and liaison, target acquisition, and fire adjustment. Known in Canada as CH-136s, they have been supplemented by 14 Bell 206B Jet-Ranger IIIs (CH-139s) for pilot training since 1981. The Hellenic Air Force uses two similar Agusta-Bell 206As for transport tasks. (Data for CH-136 Kiowa.)

**Contractor:** Bell Helicopter Company, US.

**Power Plant:** one Allison T63-A-700 turboshaft; 317 shp.

**Dimensions:** rotor diameter 35 ft 4 in, length of fuselage 32 ft 7 in, height 9 ft 6 1/2 in.

**Weights:** empty 1,797 lb, gross 3,000 lb.

**Performance:** max speed 140 mph, service ceiling 10,000 ft (restriction, as oxygen not available), range 230 miles.

**Accommodation:** crew of two.

**Armament:** one 7.62-mm Minigun, or 2.75 in rockets.



### MD 500

Delivery began in May 1990 of 50 MD 500 light helicopters, built under license as NH-500Es, to replace the aging Bell 47s of the Italian Air Force's helicopter school at Frosinone. Two NH-500MDs have also been acquired for development work.

**Contractor:** Agusta SPA, Italy.

**Power Plant:** one Allison 250-C20B turboshaft; 420 shp.

**Dimensions:** rotor diameter 26 ft 4 in, length of fuselage 23 ft 11 in, height 8 ft 2 in.

**Weights:** empty 1,441 lb, gross 3,550 lb.

**Performance:** max speed 160 mph, service ceiling 16,000 ft, range 320 miles.

**Accommodation:** pilot and six passengers.

### Mil Mi-2 (NATO "Hoplite")

The 3d Squadron of 65 Transport Wing of the German Air Force, at Briest, has 25 Polish-built Mi-2S light helicopters that were operated by former East German units. They are used principally for civilian tasks such as search and rescue and emergency medical evacuation.

**Contractor:** WSK-PZL Swidnik, Poland.

**Power Plant:** two Polish-built Isotov GTD-350 turboshafts, each 400 shp.

**Dimensions:** rotor diameter 47 ft 6 1/4 in, length of fuselage 37 ft 4 1/4 in, height 12 ft 3 1/2 in.

**Weights:** basic operating 5,213 lb, gross 8,157 lb.

**Performance:** max speed 130 mph at 1,640 ft, service ceiling 13,125 ft, range 360 miles with max fuel, 105 miles with max payload.

**Accommodation:** pilot and eight passengers, 1,543 lb of freight, or four stretchers and medical attendant.

### Mil Mi-8 (NATO "Hip")

Unified Germany took over 23 Mi-8S, 70 Mi-8T, and eight Mi-9 special communications versions of Hip in October 1990, mostly for Army use. However, ten are operated at Neuhardenberg by the former No. 44 Squadron, now part of the German Air Force's 65 Transport Wing.

**Contractor:** Mil OKB, Russia.

**Power Plant:** two Klimov (Isotov) TV2-117A turboshafts; each 1,700 shp.

**Dimensions:** rotor diameter 69 ft 10 1/4 in, length of fuselage 59 ft 7 1/4 in, height 18 ft 6 1/2 in.

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

**Performance:** max speed 161 mph at 3,280 ft, service ceiling 13,050 ft, range 311 miles as passenger transport.

**Accommodation:** crew of two or three; up to 32 passengers, but normal military configuration is for 24 combat-equipped troops on tip-up seats along cabin side walls; 8,820 lb of freight internally, 6,614 lb externally; or 12 stretchers and attendant.

### Puma

Pumas serve in Europe with the Royal Air Force and the air forces of France, Portugal, and Spain. The basic SA 330 was produced under a joint Anglo-French program that included the Gazelle and Lynx. French Air Force version, partly equipping four utility helicopter squadrons, is the SA 330Ba (equivalent to SA 330H); RAF version is the SA 330E. Both have Turmo IIC<sub>2</sub> engines. RAF Puma HC Mk 1 assault helicopters have a cargo hook as standard equipment; a rescue hoist is optional. They equip No. 33 Squadron in the UK, No. 230 with RAF Germany, and No. 1563 Flight in Belize. Under current upgrading, 40 Puma HC Mk 1s are receiving improved avionics and strengthened fuselage top decking around the main gearbox. The ten remaining Pumas of the Portuguese Air Force are SA 330S<sub>s</sub>, with Makila IA1 turboshafts; five are fitted with ORB-31 nose radar. They equip No. 751 Squadron in Portugal and No. 752 in the Azores, primarily for search and rescue. Spain's five Pumas are VIP transports.

**Contractors:** Westland Helicopters Ltd, UK, and SNI Aerospatiale, France.

**Power Plant:** two Turbomeca Turmo IIC<sub>2</sub> turboshafts; each 1,435 shp.

**Dimensions:** rotor diameter 49 ft 2 1/2 in, length of fuselage 46 ft 1 1/2 in, height 16 ft 10 1/2 in.

**Weights:** empty 7,403 lb, gross 14,110 lb.

**Performance:** max speed 174 mph, service ceiling 15,100 ft, range 390 miles.

**Accommodation:** crew of two; up to 16 troops, six stretchers and four seated persons, or internal or external freight.

**Armament:** two 7.62-mm machine guns; other weapons optional.

### Sea King

Based, under license, on Sikorsky's SH-3 helicopter, the Westland Sea King can undertake such roles as search and rescue, tactical troop transport, medevac, and cargo carrying, as well as the original naval anti-submarine mission. The Royal Air Force uses Sea King HAR. Mk 3s to equip Flights of No. 202 (SAR) Squad-

ron throughout the UK, and (with Chinooks) No. 78 Squadron in the Falklands. Equipment of the HAR. Mk 3 includes MEL radar and a Decca TANS F computer, accepting inputs from a Mk 19 Decca nav receiver and Type 71 Doppler. Six upgraded HAR. Mk 3s were ordered in early 1992 to replace most remaining Wessex HC. Mk 2s used on SAR duties.

Sea King Mk. 43 and 48 are similar SAR versions used by the Norwegian and Belgian air forces, respectively. Denmark has Sikorsky-built S-61As for search and rescue. Canadian Forces deploy CH-124As on board ships for ASW duties and for search and rescue, passenger transport, and carriage of slung loads. These are generally identical to the USN's SH-3A Sea Kings, with General Electric T58-GE-8D turboshafts, but have undergone progressive updating. From 1991, six Canadian Sea Kings are being converted to CH-124B standard, with a new tactical navigation system, acoustic processor, internal MAD, and passive (replacing active) sonar. (*Data for Sea King HAR. Mk 3.*)

**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, length of fuselage 55 ft 9 1/4 in, height 15 ft 11 in.

**Weights:** empty 13,672 lb, gross 21,400 lb.

**Performance:** max speed 131 mph, service ceiling 14,000 ft, range 690 miles.



**Puma HC. Mk 1, Royal Air Force**  
(Crown copyright)



**Sea King Mk 48, Belgian Air Force**



**Wessex HCC. Mk 4, Royal Air Force**  
(Paul Jackson)

**Accommodation:** crew of four; six stretchers, or two stretchers and 11 seated persons, or 19 passengers.

### Sikorsky S-76

Between 1991 and 1993, the Spanish Air Force is taking delivery of eight S-76C twin-turboshaft helicopters for IFR training by No. 783 Squadron of 78 Training Wing at Granada/Armilla. Equipment includes Honeywell SPZ-7600 EFIS/AFCS and a rescue hoist for secondary SAR duties.

**Contractor:** Sikorsky Aircraft, US.

**Power Plant:** two Turbomeca Arriel 1S1 turboshafts; each 723 shp.

**Dimensions:** rotor diameter 44 ft 0 in, length of fuselage 43 ft 4 1/2 in, height 14 ft 9 1/4 in.

**Weights:** empty 6,282 lb, gross 11,700 lb.

**Performance:** max speed 178 mph, service ceiling 11,800 ft, range with 30 min reserves 421 miles.

**Accommodation:** two pilots and 12-13 passengers.

### Super Puma

The French Air Force uses three of these AS 332 developments of the original Puma for support duties at nuclear test sites in the Pacific and two more to equip a VIP transport squadron at Villacoublay. The Spanish Air Force acquired ten for search-and-rescue missions from bases in Madrid, Seville, Gando in the Canaries, and Palma de Mallorca. Two more operate alongside Pumas on VIP duties with No. 402 Squadron from Cuatro Vientos Airport, Madrid. Spanish designations are HD.21 (SAR) and HT.21 (VIP).

**Contractor:** Aerospatiale SNI, France.

**Power Plant:** two Turbomeca Makila IA1 turboshafts; each 1,877 shp.

**Dimensions:** rotor diameter 51 ft 2 1/4 in, length of fuselage 50 ft 11 1/2 in, height 16 ft 1 3/4 in.

**Weights:** empty 9,458 lb, gross 19,841 lb.

**Performance:** cruising speed 163 mph, service ceiling 13,450 ft, range with standard fuel 384 miles.

**Accommodation:** crew of two or three; up to 21 passengers, or six stretchers and 11 seated persons, or nine stretchers and three seated or internal freight, or 9,920 lb slung load.

### UH-1 (single-engine)

Variants of the single-engine Bell UH-1 Iroquois serve with five non-US NATO air forces. Those operated by Canada and Turkey were built in the US; the German aircraft were manufactured under license by Dornier; those flown by Greece and Spain came from Agusta license production in Italy. Canada uses its CH-118s (UH-1Hs) for transport and base rescue. Germany's large force of UH-1Ds is intended for liaison and SAR, with four assigned to the German Air Force's special missions wing. Greece has Agusta-Bell 205As (UH-1D/H series) for light transport and SAR. Spain's AB-205s are assigned primarily to SAR but are being replaced by Sikorsky S-76Cs. The Turkish UH-1Hs are used for support, liaison, and training. (*Data for CH-118.*)

**Contractor:** Bell Helicopter Company, US.

**Power Plant:** one Avco Lycoming T53-L-13 turboshaft; 1,400 shp.

**Dimensions:** rotor diameter 48 ft 0 in, length of fuselage 41 ft 10 1/4 in, height 14 ft 8 in.

**Weights:** empty 4,800 lb, gross 9,620 lb.

**Performance:** max speed 140 mph, service ceiling 10,000 ft (restriction, as no oxygen available), range 360 miles.

**Accommodation:** two crew and 11 other persons, or up to 4,000 lb of slung cargo.

### UH-1 (twin-engine) and Models 212 and 412 Arapaho

The Bell Model 212 was developed as a twin-engine version of the Iroquois utilizing a Canadian-built power plant. Canada placed the first order, for 50, as CUH-1Ns. Now designated CH-135, they are combat area transports, able to carry 12 troops with weapons only, ten with packs in summer, eight with packs in winter, or six stretcher patients. Options include various types of armament or a rescue hoist for SAR operations. Italy uses Agusta-built AB-212s for SAR and communications/light transport. Greece has a few for transport duties; Norway has 18 of the developed Model 412SP Arapaho, with a new four-blade advanced technology rotor and improved performance. Seventeen of these were assembled in Norway, to replace UH-1Bs of Nos. 339 and 720 Squadrons of the Royal Norwegian Air Force. (*Data for 412SP.*)

**Contractor:** Bell Helicopter Textron, Canada.

**Power Plant:** one Pratt & Whitney Canada PT6T-3B-1 Turbo Twin Pac; 1,400 shp.

**Dimensions:** rotor diameter 46 ft 0 in, length of fuselage 42 ft 4 1/4 in, height 14 ft 2 1/4 in.

**Weights:** empty 6,470 lb, gross 11,900 lb.

**Performance:** max cruising speed 143 mph, service ceiling 16,300 ft, range with max payload 432 miles.

**Accommodation:** pilot and up to 14 passengers.

### Wessex

Three versions of this turbine-powered development of the Sikorsky S-58 remain in service with the Royal Air Force. Wessex HC. Mk 2 tactical transports equip No. 72 Squadron at Aldergrove, in support of the Northern Ireland garrison. No. 28 in Hong Kong, and No. 22 for SAR missions throughout the UK. Two Wessex HCC. Mk 4s wear the red and blue livery of the Queen's Flight. Ex-Royal Navy Wessex HC. Mk 5Cs of No. 84 Squadron provide SAR and occasional United Nations support from Akrotiri, Cyprus. Most SAR HC. Mk 2s will be replaced by new Sea King HAR. Mk 3s. (*Data for HC. Mk 2.*)

**Contractor:** Westland Aircraft Ltd, UK.

**Power Plant:** two coupled Rolls-Royce Bristol Gnome Mk 110/111 turboshafts; each 1,350 shp.

**Dimensions:** rotor diameter 56 ft 0 in, length of fuselage 48 ft 4 1/2 in, height 14 ft 5 in.

**Weights:** empty 8,304 lb, gross 13,500 lb.

**Performance:** max speed 132 mph, service ceiling 12,000 ft, range 478 miles.



**Accommodation:** crew of two or three; 16 troops, seven stretcher patients, or 4,000 lb of freight.  
**Armament:** provision for air-to-surface missiles, rocket packs, or machine guns.

## Strategic Missiles

### S3D (SSBS)

Second element of France's *Forces Aériennes Stratégiques* (FAS), after its Mirage IV-P bombers, is the 1st Strategic Missile Brigade of S3D *sol-sol ballistique stratégique* (SSBS) missiles based in hardened silos throughout 385 sq miles of the Plateau d'Albion, east of Avignon. Each of the two components of nine S3D second-generation missiles has its own fire-control center, with No. 1 PCT (*Poste Centrale de Tir*) at Auzat and No. 2 at Reilhannette. Reaction time for the S3D is reported to be about 3½ minutes. Its silo is claimed to be able to survive a nuclear first strike. (Data are provisional.)

**Contractor:** Aerospatiale SNI, Space and Strategic Systems Division, France.

**Propulsion:** first stage: SEP Type 902 solid-propellant motor; 99,200 lb thrust for 76 seconds. Second stage: SEP Rita II solid-propellant motor; 70,550 lb thrust for 52 seconds.

**Guidance:** inertial.

**Warhead:** thermonuclear (1.2 MT). Reentry vehicle is hardened against the effects of a high-altitude nuclear explosion by an ABM and carries penetration aids.

**Dimensions:** length overall 45 ft 11 in, diameter of first stage 5 ft 0 in.

**Weight:** 56,880 lb.

**Performance:** range over 2,175 miles.

## Air-Launched Missiles

### ALARM

ALARM (Air-Launched AntiRadiation Missile) was developed for use by Royal Air Force Tornado IDS aircraft against hostile gun and missile radars. Sufficiently small and lightweight to be carried also by aircraft as small as the Hawk and military helicopters, it has several operational modes. These include direct attack and a loiter mode in which the missile climbs to height and deploys a parachute, from which it remains suspended for several minutes until a suitable target has been identified. The parachute is then released, and the missile falls on the target. First users are Tornado GR. Mk 1s of No. 9 Squadron, which are assigned to a pathfinding role. Production deliveries were brought forward to allow about 120 ALARMS to be used during the Persian Gulf War in 1991.

**Contractor:** British Aerospace plc, UK.

**Propulsion:** Bayern Chemie solid-propellant rocket motor.

**Guidance:** passive homing, using Marconi seeker that homes on hostile radar emissions.

**Warhead:** high-explosive type, by MBB, with Thorn EMI laser proximity fuze.

**Dimensions:** length 14 ft 1½ in, body diameter 8¾ in, wingspan 2 ft 4½ in.

**Weight:** 590 lb.

**Performance:** range 28 miles.

### AS 12

The Turkish Air Force still has AS 12 air-to-surface missiles in its inventory. The armor-piercing version will penetrate more than 1½ inches of steel armor. Alternatives include an antitank shaped charge and a prefragmented antipersonnel type.

**Contractor:** Nord-Aviation/Aerospatiale, France.

**Propulsion:** two-stage solid-propellant rocket motor.

**Guidance:** wire-guided, under manual control.

**Warhead:** high-explosive type; weight 62.6 lb.

**Dimensions:** length 6 ft 2 in, body diameter 7 in, wingspan 2 ft 1½ in.

**Weight:** 170 lb.

**Performance:** speed at impact 210 mph, max range 3.7 miles.

### AS 30L

The AS 30L (for laser) supersonic air-to-surface missile is intended for use against hardened and heavily



ALARMS on Tornado (Paul Jackson)



HARMS on Tornado (Paul Jackson)

defended targets on land and at sea, normally in conjunction with a Thomson-CSF Atlas 2 target illuminating pod carried by the launch aircraft. The guidance system is claimed to provide the optimum standoff distance for direct target acquisition. The warhead's hard steel casing allows penetration of more than 6 ft of concrete before detonation, using a delayed fuze. The AS 30L replaced the earlier, radio-command AS 30 in production and is carried by French Air Force Jaguars. It has been exported to operators of the Mirage F1, and is compatible with such types as the Mirage 2000, AMX, Tornado, F-15, and F-16.

**Contractor:** Aerospatiale SNI, Division Engins tactiques, France.

**Propulsion:** two-stage solid-propellant rocket motor.

**Guidance:** inertial, followed by semiactive laser terminal homing using a Thomson-CSF Ariel seeker.

**Warhead:** high-explosive type; weight 529 lb.

**Dimensions:** length 11 ft 11¼ in, body diameter 1 ft 1½ in, wingspan 3 ft 3¼ in.

**Weight:** 1,146 lb.

**Performance:** speed at impact above Mach 1.32, range 1.8–6.2 miles.

### ASMP

The ASMP (*Air-Sol Moyenne Portée*) is primary armament of the French Air Force's Mirage IV-P strategic bomber and Mirage 2000N attack aircraft and Super Etendard fighters of the French Navy. It is powered in supersonic cruising flight by a kerosene-burning ramjet, supplied with air by a pair of two-dimensional side intakes that also provide lift. Intended targets are airfields, command communication centers, and other heavily defended sites, from standoff range.

**Contractor:** Aerospatiale SNI, Division Engins tactiques, France.

**Propulsion:** SNPE solid-propellant booster is integrated in the combustion chamber of a kerosene-burning ramjet, forming a two-stage rocket-ramjet.

**Guidance:** Sagem preprogrammed inertial system, with terrain-following capability.

**Warhead:** nuclear type; yield 150kT (TN80) or 300kT (TN81).

**Dimensions:** length 17 ft 8 in, body diameter 1 ft 3 in, finspan 3 ft 11¼ in.

**Weight:** estimated at 1,895 lb.

**Performance:** cruising speed Mach 2 at low altitude, Mach 3 at high altitude; range 50 miles after low-altitude launch, 155 miles after high-altitude launch.

### Aspide

Aspide is interchangeable with the externally similar Sparrow on F-104S ASA Starfighters of the Italian Air Force. It is an all-weather, all-aspect, air-to-air and surface-to-air weapon, suitable for air-launch at very low altitudes and offering multiple target engagement and resistance to advanced ECM. A version with active radar homing, known as Aspide Mk 2, has been funded by the Italian Air Force as insurance against rejection of AMRAAM for the EFA.

**Contractor:** Alenia, Italy.

**Propulsion:** single-stage solid-propellant rocket motor.

**Guidance:** semiactive CW radar guidance, employing monopulse techniques.

**Warhead:** high-explosive fragmentation type; weight 66 lb.

**Dimensions:** length 12 ft 1½ in, body diameter 8 in, wingspan 3 ft 3¼ in.

**Weight:** 485 lb.

**Performance:** cruising speed Mach 2 plus speed of launch platform, range 22–37 miles.

### Bullpup (AGM-12)

Developed originally for the US Navy, Bullpup began as a simple weapon built around a standard 250 lb bomb. The pilot steers it in flight by radio command, via a hand switch in the cockpit, using tracking flares above and below the rocket nozzle to keep Bullpup on a line-of-sight path to the target. License manufacture in Europe was undertaken by a consortium led by Kongsberg Vaapenfabrikk of Norway, whose production rounds are still available to the air forces of Denmark, Norway, and Turkey.

**Prime Contractor:** Kongsberg Vaapenfabrikk, Norway.

**Propulsion:** Thiokol LR58-2 storable liquid-propellant rocket motor; 12,000 lb st.

**Guidance:** radio command.

**Warhead:** high-explosive type; weight 250 lb.

**Dimensions:** length 10 ft 6 in, body diameter 1 ft 0 in, wingspan 3 ft 1½ in.

**Weight:** 569 lb.

**Performance:** cruising speed Mach 1.8, max range 4.35 miles.

### HARM (AGM-88)

The US's HARM (High-speed AntiRadiation Missile) has been ordered by the German and Italian air forces to equip their Tornados and by the Spanish Air Force for its EF-18 Hornets. It was developed on the basis of experience in Vietnam, where Soviet-built radars often detected approaching first-generation antiradiation weapons such as Shrike and shut down before the missile could home on their emissions. HARM offers both higher performance and coverage of a wide range of frequencies, through the use of programmable digital processors in the launch aircraft's avionics and the missile. It can be launched at heights from sea level to 40,000 ft. The USN and USAF used it against Libya in 1986 and in the Persian Gulf War in 1991.

**Contractor:** Texas Instruments, Inc, US.

**Propulsion:** Thiokol smokeless dual-thrust solid-propellant rocket motor. Hercules second source.

**Guidance:** passive homing, using seeker that homes on hostile radar emissions.

**Warhead:** high-explosive type; weight 145 lb.

**Dimensions:** length 13 ft 8½ in, body diameter 10 in, wingspan 3 ft 8½ in.

**Weight:** 807 lb.

**Performance:** cruising speed supersonic, range 15.5 miles.

### Harpoon (AGM-84A)

During the 1982 Falklands War, some Nimrod maritime patrol aircraft of the Royal Air Force were fitted with Sidewinder air-to-air missiles for self-defense and were given an attack capability with bombs and Harpoon antiship missiles similar to those carried by USAF B-52Gs. Retained for possible future use, the Harpoons are designed to follow a sea-skimming path after launch and can perform high-g maneuvers against fast maneuvering targets. ECCM features are installed.

**Contractor:** McDonnell Douglas Missile Systems, US.

**Propulsion:** Teledyne CAE J402-CA-400 turbojet; 660 lb st.

**Guidance:** inertial; active radar terminal homing.

**Warhead:** penetration high-explosive blast type; weight 488 lb.

**Dimensions:** length 12 ft 9½ in, body diameter 1 ft 1½ in, wingspan 3 ft 0 in.

**Weight:** 1,168 lb.

**Performance:** cruising speed high subsonic, range 75 miles.

### Kormoran

The basic Kormoran 1 version of this rail-launched sea-skimming antiship missile can be carried by any aircraft able to maintain a speed between Mach 0.6 and 0.95 during the attack and equipped with target acquisition radar and an autonomous navigation system such as an inertial platform. Launch information is received from the aircraft's radar and navigation system. The missile can be operated in range-and-bearing and bearing-only modes, the latter being used when firing optically without use of radar.

Operational with Tornados of the German Navy and Italian Air Force, the Kormoran 1 is designed for maximum effectiveness against ships up to destroyer size and is largely immune to all contemporary types of ECM. An improved Kormoran 2 has been ordered for German Navy Tornados, with a new radar seeker, a strapdown INS, and digital signal processing. Interchangeable with Kormoran 1 on the Tornado, it offers improved target engagement capability, advanced ECCM, a longer range (22 miles), better penetration capability, and increased warhead weight (485 lb.)

(Data for Kormoran 1.)



**Contractor:** Messerschmitt-Bölkow-Blohm GmbH, Germany.

**Propulsion:** two built-in boosters, and solid-propellant sustainer rocket motor.

**Guidance:** inertial midcourse guidance and active radar terminal homing.

**Warhead:** high-explosive type; weight 364 lb.

**Dimensions:** length 14 ft 5 in, body diameter 1 ft 1 1/2 in, wingspan 3 ft 3/4 in.

**Weight:** 1,320 lb.

**Performance:** cruising speed Mach 0.9, max range 18.5 miles.

#### Magic (R.550)

The initial version of this highly maneuverable short/medium-range dogfight missile can be launched at ranges between 1,640 ft and 4.35 miles in the hemisphere behind the target, is stressed for 50g maneuvers, and can be fired from an aircraft in a 7g turn, singly or at one-second intervals between rounds. There is no minimum launch speed; maximum is more than 805 mph IAS.

The Magic 2 all-sector version is operational on Mirage 2000 aircraft of the French and Hellenic air forces. It has a more sensitive infrared seeker with head-on capability and improved IRCCM, including flare rejection, and can be slaved to the launch aircraft's AI radar as an alternative to autonomous operation. It has been fired successfully from an F-16 flying at Mach 1.3 at 20,000 ft, during an 8.7g turn. About 10,000 Magics have been sold, 75 percent of them for export. They have been adapted to A-4 Skyhawk, Alpha Jet, F-5, F-8E (FN) Crusader, F-16, Jaguar, MB-339, MiG-21, MiG-23, Mirage III, Mirage 5, Mirage F1, Mirage 2000, Super Étendard, Sea Harrier, and other types. (Data for Magic 2.)

**Contractor:** SA Matra, France.

**Propulsion:** single-stage solid-propellant rocket motor.

**Guidance:** infrared homing.

**Warhead:** high-explosive type; weight 28.6 lb. Impact and RF proximity fuzes.

**Dimensions:** length 9 ft 0 1/4 in, body diameter 6 1/4 in, wingspan 2 ft 2 in.

**Weight:** 198 lb.

**Performance:** cruising speed above Mach 2, range 1,640 ft to 6.2 miles.

#### Martel (AS 37)

Martel (Missile AntiRadar and TELevision) was developed in two forms, as a joint Anglo-French program. The command guided AJ.168 has been superseded by Sea Eagle. The all-weather antiradiation AS 37 continues in use on Mirage IIIEs and Jaguars of the French Air Force and on Royal Air Force Buccaneers.

**Contractors:** SA Matra, France, and British Aerospace, UK.

**Propulsion:** solid-propellant rocket motors by Aero-spatiale and Hotchkiss-Brandt.

**Guidance:** AS 37 has passive seeker that homes on hostile radar emissions.

**Warhead:** high-explosive type; weight 330 lb. Radar proximity fuze.

**Dimensions:** length 13 ft 6 1/4 in, body diameter 1 ft 3 3/4 in, wingspan 3 ft 11 1/4 in.

**Weight:** 1,168 lb.

**Performance:** cruising speed subsonic, range 34 miles.

#### Maverick (AGM-65)

The air forces of Germany, Greece, and Spain are European operators of this launch-and-leave TV-guided air-to-surface missile. The version bought by Germany is the AGM-65B, with a "scene magnification" seeker that enables the pilot to identify and lock on to smaller or more distant targets than with the original AGM-65A. (Data for AGM-65B.)

**Contractor:** Hughes Missile Systems Group/Raytheon Company, US.

**Propulsion:** Thiokol TX-481 solid-propellant rocket motor.

**Guidance:** self-homing electro-optical system.

**Warhead:** high-explosive type, shaped charge; weight 125 lb. Impact fuze.

**Dimensions:** length 8 ft 2 in, body diameter 1 ft 0 in, wingspan 2 ft 4 1/2 in.

**Weight:** 462 lb.

**Performance:** range 0.6-14 miles.

#### Penguin

The air-launched Penguin Mk 3 antiship missile arms F-16s of the Royal Norwegian Air Force. It can be carried by aircraft flying at speeds up to Mach 1.2 and launched at any height between 150 and 30,000 ft. Target acquisition can be via the launch aircraft's radar or in a completely passive mode using the head-up display. It is claimed to be immune to ECM and able to discriminate between real targets and decoys.

**Contractor:** Norsk Forsvarsteknologi A/S, Norway.

**Propulsion:** two-stage solid-propellant rocket motor.

**Guidance:** programmed inertial midcourse guidance; infrared terminal homing.

**Warhead:** high-explosive semi-armor-piercing type; weight 265 lb.

**Dimensions:** length 10 ft 4 3/4 in, body diameter 11 in, wingspan 3 ft 3/4 in.

**Weight:** 820 lb.

**Performance:** cruising speed above Mach 0.9, range over 25 miles.

#### R-27 (NATO "Alamo")

Lt. Gen. Joerg Kuebart, Chief of Staff of the German Air Force, states that the R-27 has demonstrated the same capabilities as AMRAAM. Two versions have been retained for the MiG-29s now in German Air Force service:

**R-27R (AA-10A Alamo-A).** Short-burn semiactive radar homing version for use over medium ranges.

**R-27T (AA-10B Alamo-B).** Short-burn infrared homing version.

**Contractor:** unknown, Russia.

**Dimensions:** length 12 ft 11 1/2 in (A), 11 ft 10 1/2 in (B), body diameter 7 1/4 in, wingspan 2 ft 3 1/2 in.

**Weight:** 440 lb (A), 385 lb (B).

**Performance:** range 15.5 miles.

#### R-73A (NATO "Archer")

General Kuebart regards the R-73A as being equal to the AIM-9L Sidewinder. Four thrust-vectoring control vanes in the rocket efflux and complex control surfaces confer great maneuverability, particularly when the missile is launched at large off-boresight target angles. R-73As arm the German Air Force's MiG-29 fighters.

**Contractor:** unknown, Russia.

**Guidance:** infrared homing, with active radar fuze.

**Warhead:** HE fragmentation, approx 33 lb.

**Dimensions:** length 10 ft 0 in, body diameter 7 in, span of tailfins 1 ft 8 1/2 in.

**Weight:** 275 lb.

**Performance:** range 5 miles.



Martel (AS 37) on Atlantic (Paul Jackson)



Sky Flash and AIM-9L Sidewinder on Phantom FGR. Mk 2 (Paul Jackson)

#### R.530 and Super 530

The R.530 all-weather air-to-air missile was built in two forms, with alternative semiactive radar and infrared homing heads. Carried under the fuselage of Mirage III interceptors and Mirage F1s, it can be launched at any altitude between sea level and 69,000 ft. Operators include the French and Spanish air forces.

The Super 530 is an all-sector development of the R.530 able to attack targets flying 29,500 ft higher or lower than the launch aircraft. It is fitted with advanced ECM antijamming circuits. The basic Super 530 F is deployed under the wings of Mirage F1 interceptors. The Mirage 2000 is armed with the Super 530 D, compatible with its Doppler radar and able to attack targets flying at speeds up to Mach 3 and heights from sea level to 80,000 ft. (Data for Super 530 D.)

**Contractor:** SA Matra, France.

**Propulsion:** dual-thrust solid-propellant rocket motor, by Thomson-Brandt.

**Guidance:** semiactive pulse-Doppler radar homing, by Electronique Serge Dassault.

**Warhead:** fragmenting high-explosive type; weight 66 lb. Active radar proximity fuze.

**Dimensions:** length 12 ft 5 1/2 in, body diameter 10 1/4 in, wingspan 2 ft 1 1/4 in.

**Weight:** 585 lb.

**Performance:** cruising speed Mach 4.5, range more than 25 miles.

#### Sea Eagle

Sea Eagle is an all-weather, day and night, "fire and forget" antiship missile. Its turbojet engine gives it a longer range than that of the rocket powered AJ.168 Martel, which it replaced. Prior to launch, the on-board microprocessor is supplied with target positional information from the carrier aircraft. The computer controls the flight path of Sea Eagle until the target is acquired by the radar seeker during the final sea-skimming phase of attack. The missile can discriminate between several potential targets and is designed to destroy or disable targets protected by sophisticated ECM and decoys, including heavy cruisers and aircraft carriers. A helicopter-launched version has a small additional boost motor. Sea Eagle equips Royal Air Force Buccaneers and Tornados assigned to maritime roles.

**Contractor:** British Aerospace plc, UK.

**Propulsion:** Microturbo TRI-60 turbojet; 787 lb st.

**Guidance:** inertial navigation, with active radar terminal homing.

**Warhead:** high-explosive type; weight more than 507 lb.

**Dimensions:** length 13 ft 7 in, body diameter 1 ft 3 3/4 in, wingspan 3 ft 11 1/4 in.

**Weight:** 1,320 lb.

**Performance:** cruising speed Mach 0.85, range more than 68 miles.

#### Sidewinder (AIM-9)

This pioneer infrared homing air-to-air missile is used by all NATO air forces except that of France. Major current model in Europe is the third-generation AIM-9L, manufactured by a consortium of British, Italian, Norwegian, and German companies, under the leadership of Bodenseewerk. (Data for AIM-9L.)

**Contractor:** Bodenseewerk Gerätetechnik GmbH, Germany.

**Propulsion:** Mk 36 Mod 7/8 solid-propellant rocket motor.

**Guidance:** infrared homing, with AM/FM conical scan and active laser proximity fuze.

**Warhead:** annular blast fragmentation high-explosive; weight 21 lb.

**Dimensions:** length 9 ft 5 in, body diameter 5 in, finspan 2 ft 1 in.

**Weight:** 192 lb.

**Performance:** cruising speed above Mach 2, range 5 miles.

#### Sky Flash

The "boost and coast" Sky Flash all-weather air-to-air missile has the same general configuration and dimensions as the AIM-7E Sparrow but is fitted with a British semiactive radar homing head of inverse monopulse design. The advanced radar proximity fuze is claimed to offer a high single-shot kill capability against targets flying at subsonic and supersonic speeds, singly and in formation, at high, medium, and low (250 ft) altitudes, in severe ECM environments. Sky Flash is the primary weapon of the RAF's Tornado ADV.

**Contractor:** British Aerospace plc, UK.

**Propulsion:** Aerojet Mk 52 Mod 2 solid-propellant rocket motor.

**Guidance:** semiactive radar homing, by Marconi Defence Systems.

**Warhead:** high-explosive continuous rod type; weight 66 lb. Thorn EMI radar proximity fuze.

**Dimensions:** length 12 ft 0 in, body diameter 8 in, wingspan 3 ft 4 in.

**Weight:** 430 lb.

**Performance:** cruising speed above Mach 2, range 25 miles.

#### Sparrow (AIM-7)

Sparrow is in service with the air forces of Canada, Greece, Italy, Spain, Turkey, and the UK. Most widely used version is the AIM-7E, which was also manufactured in Italy by Selenia; but the Spanish Air Force has AIM-7Ds and Fs, and the latest AIM-7M serves with the Canadian and Hellenic Air Forces. (Data for AIM-7E.)

**Contractor:** Raytheon Company, US.

**Propulsion:** Rocketdyne Mk 38 Mod 2 solid-propellant rocket motor.

**Guidance:** semiactive CW radar homing.

**Warhead:** high-explosive type; weight 68 lb.

**Dimensions:** length 12 ft 0 in, body diameter 8 in, wingspan 3 ft 4 in.

**Weight:** 450 lb.

**Performance:** cruising speed above Mach 3.5, range 20 miles. ■



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**Their own world was collapsing, but Soviet generals still watched the Persian Gulf War intently.**

# Soviet View of the Storm

By Capt. Brian Collins, USAF

**T**HE Soviet Union may no longer exist, but its armed forces do, and their leaders still think along traditional Soviet lines. All signs are that the Soviet General Staff's views on airpower will influence successor forces, Russia's in particular.

In that respect, close examination of the Soviet analysis of Operation Desert Storm points toward an important conclusion: The Soviet high command remained generally unpersuaded, even skeptical, that airpower had achieved a new and dominant position in warfare.

Soviet analysts disputed the view that the US-led air offensive demonstrated airpower's decisive or near-decisive nature. They argued that, although airpower is vital in modern warfare, ground forces are still decisive. Although a few airpower advocates, such as Gen. Col. Peter Deynekin, Commander in Chief of the Soviet Air Forces (SAF), claimed that warfare had fundamentally changed, the mainstream backed the Army. For example, Gen. Col. Igor M. Maltsev, Chief of Staff of the Soviet Air Defense Forces (SADF), concluded, "Airpower can only be decisive in very limited military conflicts."

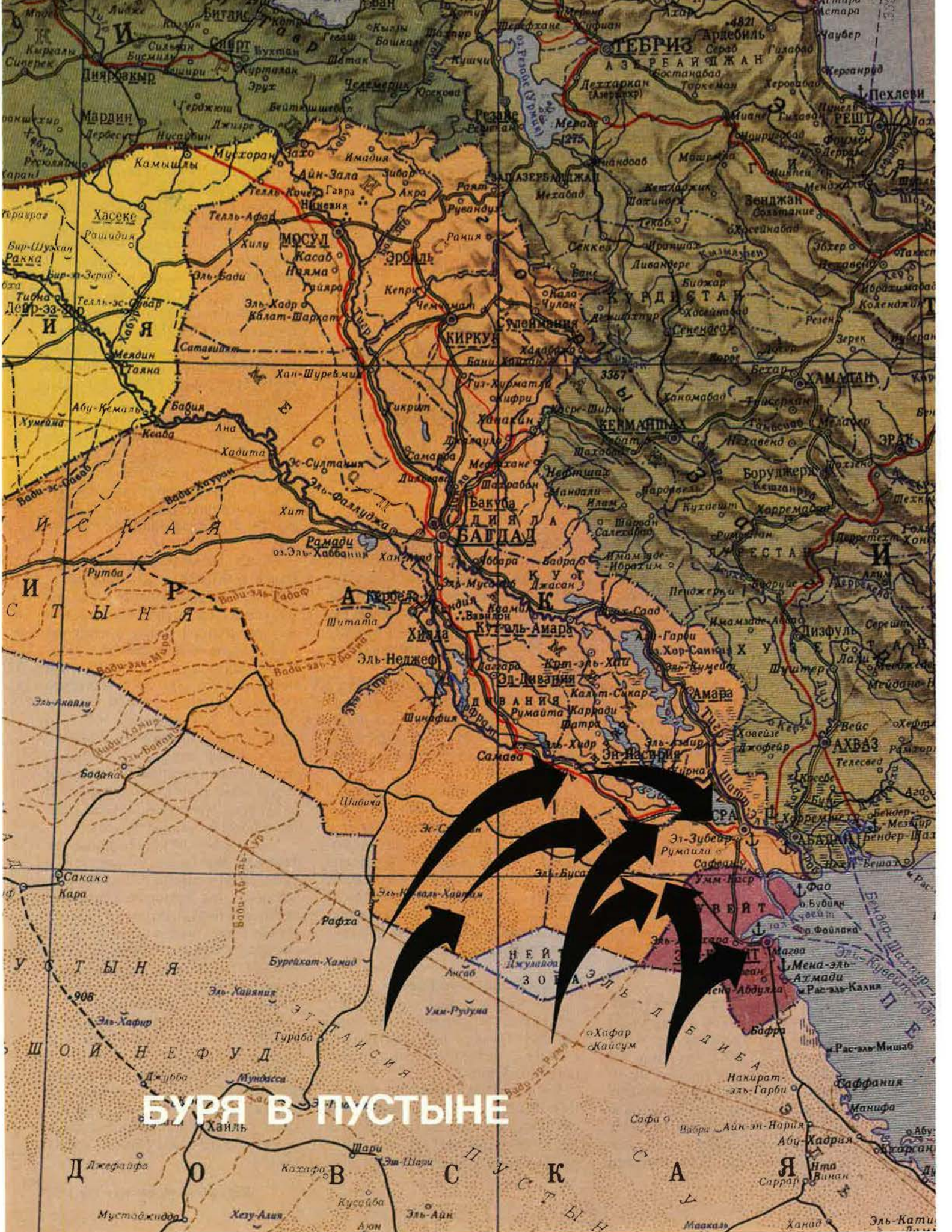
Soviet thinking on the subject underwent a dramatic shift during the war and its aftermath. At first, the hierarchy's view of the air war was bullish. Gen. Maj. V. Slipchenko of the prestigious General Staff Academy wrote that the war vindicated various expansive airpower theories.

In a paper presented at the National Defense University in early 1991 after the war ended, General Slipchenko issued this declaration: "The experience of the war in the Near East showed that, under modern conditions, not just the character of the offensive but the character of war itself is fundamentally changing."

However, that view was short-lived. Soviet officers soon advanced the notion that the impact of the war on Soviet forces would be not revolutionary but evolutionary at best.

They described the war as "local," without broader significance. The heart of the argument was that the performance of airpower in the Iraqi debacle had no direct applicability to Soviet forces, despite similarities in their equipment and the fact that Iraq had long been a client of the Kremlin. Soviet analysts drew a sharp distinction between the air and air defense





# БУРЯ В ПУСТЫНЕ

Д ЖЕФРА О Ш О И Н Е Ф У Д У С Т Ы Н Я С П У С Т Ы Н Я С А Я И Т Ы Н Я И С К А Я И Д Е Р Ж А В А И Р А К И Я И Р А Н И Я А З Е Р Б А Й Д Ж А Н Т У Р К М Е Н С Т А Н К И Р Г И З И С Т А Н П А К И С Т А Н И Н Д И Я



forces of Iraq, which indisputably had been thrashed, and the air units of the Soviet Union, which would presumably do better.

### Two Different Air Forces

Many papers cited the differences between Iraqi and Soviet air equipment. The Soviet military advanced the argument that the Iraqi Air Force

aircraft were considered, this ratio rose to thirteen to one.

The Soviets estimated that the number of Iraqi sorties fell from 116 in the first day of the air war to almost none after the first week. They noted that the air war quickly evolved into war between coalition air forces and Iraqi Air Defense Forces (IADF).

One SADF Staff colonel who con-

short-range systems, against which the US had developed comprehensive ECM packages. Iraq's use of SA-6s and SA-8s for point defense left ground forces without medium- and high-altitude air defenses. The result, said one report, was "an almost unhindered bombing of Iraqi positions from medium altitude."

General Shtepa contended that, since modern Soviet-made weapons made up such a small portion of the Iraqi inventory, any attempt to compare US and Soviet arms would be invalid.

Moreover, SADF officers proudly proclaimed that their air defenses had high degrees of automation in operations, targeting, and intelligence and that their system was complemented by ECM-resistant SAMs and radar systems.

The chief engineer of the Soviet Ground Forces' Air Defense Forces stated that the coalition won because Iraq did not possess defenses against "smart weapons" or advanced precision munitions—and quickly added that the Soviet Union most assuredly did.

Equally prominent in Soviet critiques were claims that vast doctrinal differences existed between Soviet and Iraqi air forces. Soviet officers generally condemned Iraq's operational employment of resources and vehemently argued that Iraqi doctrine and operational art bore no resemblance to Soviet practices.

Gen. Lt. A. I. Malyukov, Chief of Staff of the Soviet Air Forces, blamed Iraq's defeat directly on Saddam's inability to conceptualize warfare in terms other than his Iran-Iraq War experience, where airpower had minimal impact on ground combat.

Iraq seemed to be refighting the Iran-Iraq War when it went into a static defense after invading Kuwait. However, the Soviet conception of defense is neither static nor passive. Soviet forces would actively try to disrupt or repel an offensive. This would entail air strikes against enemy bases, destruction of enemy reconnaissance assets, and the like.

General Malyukov's conclusion: "It is difficult to comment on Iraqi aviation since it did so utterly little."

The combination of poor Iraqi leadership and problems in command and control and pilot training, said another commentator, rendered Iraq's modern Soviet-made planes virtually useless.

## Soviet analysts drew a sharp distinction between the air forces of Iraq and the air units of the Soviet Union.

was primarily Western, not Soviet, in orientation.

Gen. Lt. V. Shtepa, Deputy Chief of the General Staff Operational-Strategic Research Center, wrote that advanced Soviet arms accounted for only five to ten percent of Iraq's inventory.

Gen. Col. V. P. Mironov, Deputy Minister of Defense for Armaments, stated, "The small quantity of Soviet-produced modern combat equipment, such as the MiG-29 aircraft, could not have a significant effect on the outcome of the war."

A Soviet article on US Air Force preparation for the air war reported that, in the autumn of 1990, USAF changed its traditional "Red Flag" exercise at Nellis AFB, Nev., to "Desert Flag," providing specific training for combat against French-trained Iraqi pilots flying French Mirage fighters. The implication was that USAF considered the Iraqi Air Force's weapons to be primarily non-Soviet.

The claim that modern Soviet combat aircraft formed an insignificant part of the Iraqi inventory dovetailed nicely with the idea that Iraqi Air Force and air defense forces were insufficient in size and largely obsolete.

The Soviet General Staff estimated that, in combat aircraft, the coalition opened the war holding a 3.5 to one advantage over Iraq. If only modern

ducted operational-tactical research claimed that coalition air offense forces held a ten to one advantage over the IADF. In actual combat, he wrote, the survival rate of coalition fighters exceeded ninety-nine percent because of IADF's poor organization and control of resources.

The Soviets maintained that Iraq's poor showing could be traced to its failure to procure electronic countermeasures (ECM) and automated operational-strategic command-and-control gear.

One Soviet military specialist who served in Iraq in the late 1980s assessed the IADF's weakness this way: "With raid sizes of tens, or even hundreds, it is impossible to allocate targets between divisions without automation. . . . Absence of an automated control system alone reduced the Iraqi ADF firing capabilities by approximately forty percent."

### "Test-Range" Conditions

The upshot is that coalition jets outgunned, outnumbered, and overran the IADF in what the Soviets continually described as close to "test-range conditions."

Soviet analysts reported that Iraq's lack of modern strategic surface-to-air missiles forced the IADF to use SA-2, SA-6, and SA-8 systems to protect key points. Air defense rested on



The Soviet military was keen to make clear the distinction between military advisor and military specialist. There never were any Soviet military advisors in Iraq. The Soviet specialists did not advise on the placement or the employment of equipment, nor did they in any way assist in plans, C<sup>2</sup>, or operations.

In short, Iraq alone bears responsibility for the results of flawed doctrine and faulty use of Soviet equipment.

### Cultural Drawbacks

Several Soviet generals cited cultural differences as a major factor in Iraq's inability to use Soviet doctrine and equipment correctly. For example, Gen. Lt. Sergei Bogdanov cited "the passivity and indecision of the top Iraqi leadership and the poor training of the command personnel" as decisive factors.

General Mironov claimed that the most significant reason for the lightning-strike defeat of the Iraqi Army was not armament but rather the poor morale of personnel and their lack of desire to engage in combat with the multinational forces."

Finally, the Soviet consensus is that the geography and the buildup time made the Persian Gulf War air operation unique.

A Soviet military journal reported that Nellis ranges were outfitted with duplicates of many of the 1,400 ground targets in Iraq and Kuwait within six weeks of the USAF decision to change Red Flag to Desert Flag. Soviet officials claimed that the US Air Force established specific mock air bases with defenses, oil installations, missile launch sites, industrial targets, transportation nodes, and air defense systems in the Nevada desert.

However, the passivity of Iraq in the face of the five-month buildup is contrary to Soviet tendencies, and an attack against the Soviet Union would also face a much larger target list.

Though the IADF suffered a rout, SADF analysts saw some positive factors. Coalition losses of sixty-eight aircraft and twenty-nine helicopters, said one official, "show that it is possible to conduct combat operations through the skilled use of weapons, even if they are not the most modern."

One SADF colonel credits the ZSU-23-4 and SA-13 combination with downing one B-52 bomber (the plane that ditched in the Indian Ocean after

its mission was completed) and with forcing another B-52 to abort because of a SAM hit.

Gen. Maj. A. G. Luzan said that older Soviet short-range air defense systems in Iraq still performed well since the ZSU-23-4 and SA-8 systems were responsible for most losses. One Soviet ADF officer drew the conclusion that, "if Iraq had not possessed

## General Malyukov's conclusion: "It is difficult to comment on Iraqi aviation since it did so utterly little."

such an ADF, losses would have been much worse."

The General Staff appeared unimpressed with the coalition's "smart weapons." It concluded that the effectiveness of such weapons in combat did not exceed forty percent. Further, the Soviets said coalition airpower seemed to be unable to solve the problem of destroying Iraqi Scud launchers.

Gen. Col. V. I. Filatov, an ardent supporter of Iraq who visited Baghdad during the war, contended that Iraq won. He based his view on the following: At war's end, Saddam was in power, the Baath Party was in control, the Iraqi Air Force had "been preserved," and the army was still ready for combat against the Kurds and Shiites.

The upshot of all this, for Soviet military men, was obvious. Though the coalition had conducted a "classic offensive air operation," the setting and circumstances of the war were local and unique. Thus, the General Staff could not directly draw specific lessons from the air war.

### Keys to Success

Still, leaders of the Soviet armed forces found some events worthy of further study. Soviet officers drew up a list of the keys to the coalition's stunning air operation. Among the

more important topics of discussion:

**Space.** The General Staff underlined the direct role of space assets for the first time in a large combat operation. General Bogdanov concluded that, despite the lack of Iraqi countermeasures, the coalition's use of space assets in the war "is of definite interest to us." The Soviets implied that their investigation would focus on

effective countermeasures against the Western space system that would degrade its land, air, and sea combat capabilities.

**Reconnaissance and reconnaissance strike complexes.** The Soviets made clear that they were impressed with the coalition's ability to transmit space-provided information quickly to strike platforms. General Mironov was dismayed that much of the modern equipment that the Iraqis had hidden had been detected through space-based reconnaissance and destroyed by smart weapons. Another article pointed out that use of a space-based ballistic missile launch detection system to detect Scud missile launches quintupled the warning time for Patriot batteries.

The Soviets also paid close attention to the first operational employment of the E-8 Joint STARS aircraft. It formed the basis for Gen. Maj. I. Vorobev's claim that the "electronic-fire strike," or combination of massive jamming and destruction of the enemy by fire, was a new fundamental element of modern all-arms warfare.

**Smart weapons.** General Malyukov said that the video images shown on television made smart weapons seem effective, but he claimed that they had been fired under perfect conditions—good weather without enemy counter-



measures. The General's point was that, in a different situation, wherein both sides conducted intensive land and air operations and the ground was obscured by smoke and dust, it would be very difficult to employ smart weapons. Consequently, traditional aviation ordnance still has an important role in modern battle, he concluded. Nevertheless, he clearly saw the potential of smart weapons, especially in a preemptive attack, and warned that "we must not neglect this."

**Electronic warfare.** The intensity and importance of EW support was widely noted by Soviet analysts. In fact, General Malyukov argued that EW was no longer a supporting function but a component of armed combat. One SADF colonel was surprised to discover that, though EW aircraft jammed ground-based radars, strike aircraft still aborted if their chaff dispensers did not work. To him, this illustrated the significance USAF attached to EW, since multiple layers of EW protection were required.

For the Soviets, the value of suppression of air defenses through fire seemed to be a major lesson. The coalition launched some 130 AGM-88 HARMs and numerous cruise missiles in the initial strike to clear corridors for coalition aircraft. Although the Soviets claim their most modern SAMs can down cruise missiles, attacking launch platforms may still be the more effective counter to such systems, especially for HARMs.

**Tactical, operational, and strategic lines.** The Soviet General Staff viewed the widespread use of B-52 strategic bombers against targets at tactical and operational depths as evidence of the growing tendency to blur the distinction between employment of tactical and strategic aviation. General Malyukov conceded that the conditions of total air supremacy facilitated their use in this role, but denied that this use was unique to Desert Storm. "This element," he added, "duly requires an appraisal and consideration in the development of our aviation."

**Predictive failure.** Dr. Vitaly N. Tsygichko, director of the National Security and Strategic Stability Studies Center in Moscow, said that military models run prior to Desert Storm failed to predict the outcome accurately and grossly overestimated casualty figures. Soviet generals said

that the error sprang in part from the fact that they based estimates on classic AirLand Battle Doctrine, *i.e.*, massive air strikes lasting five to seven days followed by ground troop intervention. However, the dramatic increase of the air operation's duration changed the war. Soviet generals pointed out the obvious: "The conduct of air operations of such dura-

air war started, many Soviet generals said that "the war" had not yet begun, contending that the air operation was a sideshow of sorts—a warm-up for the real war on the ground to follow.

Some Soviet generals attempted to use the Iraqi rout as a reason to examine Soviet military dogmas. According to General Vorobev, it was not the

## **Gen. Col. V. I. Filatov, an ardent supporter of Iraq who visited Baghdad during the war, contended that Iraq won.**

tion against an enemy approximately equal in strength would have been impossible."

**Maskirovka.** Of all Iraq's capabilities, *maskirovka* was the one that the Soviets continually placed under the category of "meriting further study." The effectiveness of Iraqi camouflage techniques, in spite of the US space reconnaissance effort, drew positive remarks from several Soviet officers. The late Marshal Sergei Akhromeyev commented that Iraqi systems of decoy targets and decoy target groupings caused problems for coalition forces in the first weeks of the air war. General Maltsev speculated that up to fifty percent of the first coalition strikes were carried out on false targets because of Iraq's extensive deployment of sophisticated dummy air defense systems.

Despite the apparent success of the coalition air war, the historical dominance of ground forces in Soviet military theory will continue as a major factor in the development of doctrine.

For example, two weeks after the

weakness of the weapons and combat equipment but Iraqi leadership's dogmatism and refusal to explore other directions in the development of military art that contributed to the Iraqi defeat.

"This is an obvious lesson for everyone," he said.

However, to most Soviets, the Iraqi rout demonstrated that modern war begins with a massive air attack. If an attacking air force has a quantitative edge of 3.5 to one against the opposing aircraft and up to ten to one against opposing air defenses, as well as massive qualitative superiority, it should win. If this air force achieves surprise and quickly destroys opposing C<sup>2</sup> systems, the results will be dramatic. However, in a European scenario, with rough quantitative and qualitative parity in air forces and air defense systems and with enemy ground forces conducting an active defense (or even an offensive), such an offensive air operation would be stalemated.

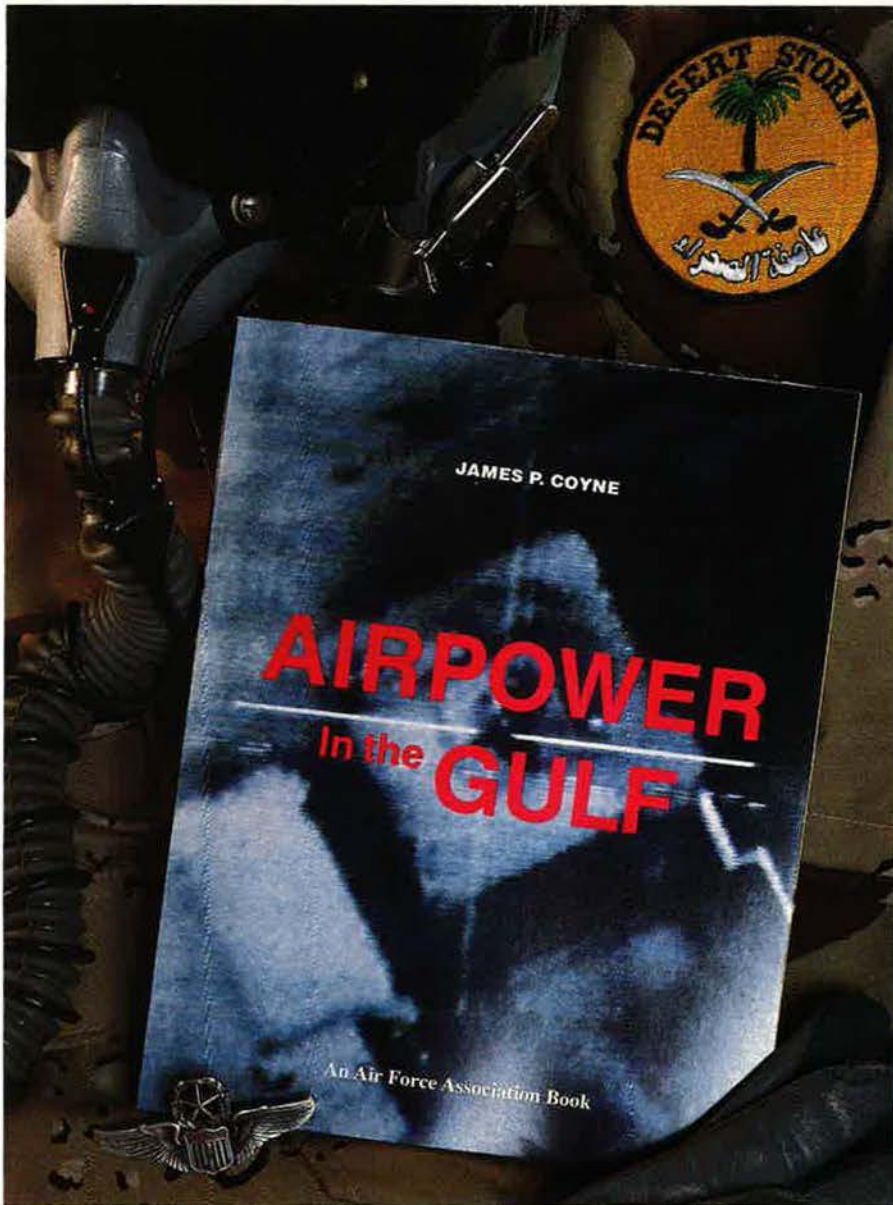
The final Soviet conclusion was that airpower would continue to be a critical, but supportive, part of Soviet combined-arms concepts. ■

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*Capt. Brian Collins, USAF, is the aerospace analyst in the Soviet (now CIS) Military Studies Group at Supreme Headquarters Allied Powers Europe in Belgium. This article, his first for AIR FORCE Magazine, is an excerpt from a longer paper, "Airpower in the Persian Gulf: Soviet Analysis."*



# A Bolt From the Blue!



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**The Air Force wants a stealthy multirole fighter that would enter service around 2015.**

# A Replacement for the F-16

By Frank Oliveri, Associate Editor

**T**HE Air Force has disclosed that it wants to develop and produce a brand-new, stealthy, Multirole Fighter (MRF) and start replacing the F-16 fleet with it around 2015. Plans call for the service to buy about 2,000 of the new lightweight aircraft.

The MRF would be USAF's third new-development, low-observable, combat aircraft program for future years. High-volume production would come after the peak of F-22 fighter procurement but would coincide with production of a new advanced interdictor based on the Navy's A-X carrier-based attack plane.

In addition, the service might pursue a relatively inexpensive "force sustainment" fighter or fighters later in this decade.

Gen. Merrill A. McPeak, the Air Force Chief of Staff, made public the basics of the program at a House Armed Services Committee hearing April 29. In the past, the Air Force tended to take the view that the MRF would be a derivative of an existing combat plane. However, General McPeak stated flatly, "When I use the term MRF, I mean an entirely new small fighter design."

General McPeak said that the Air



Staff photo by Guy Acello

*As the F-16 leaves the flight line, a new Multirole Fighter (on facing page, a generic MRF concept) will replace it, if Air Force Chief of Staff Gen. Merrill A. McPeak gets his way. The Air Force may also buy F-16s or a derivative late in the decade to sustain the MRF force.*



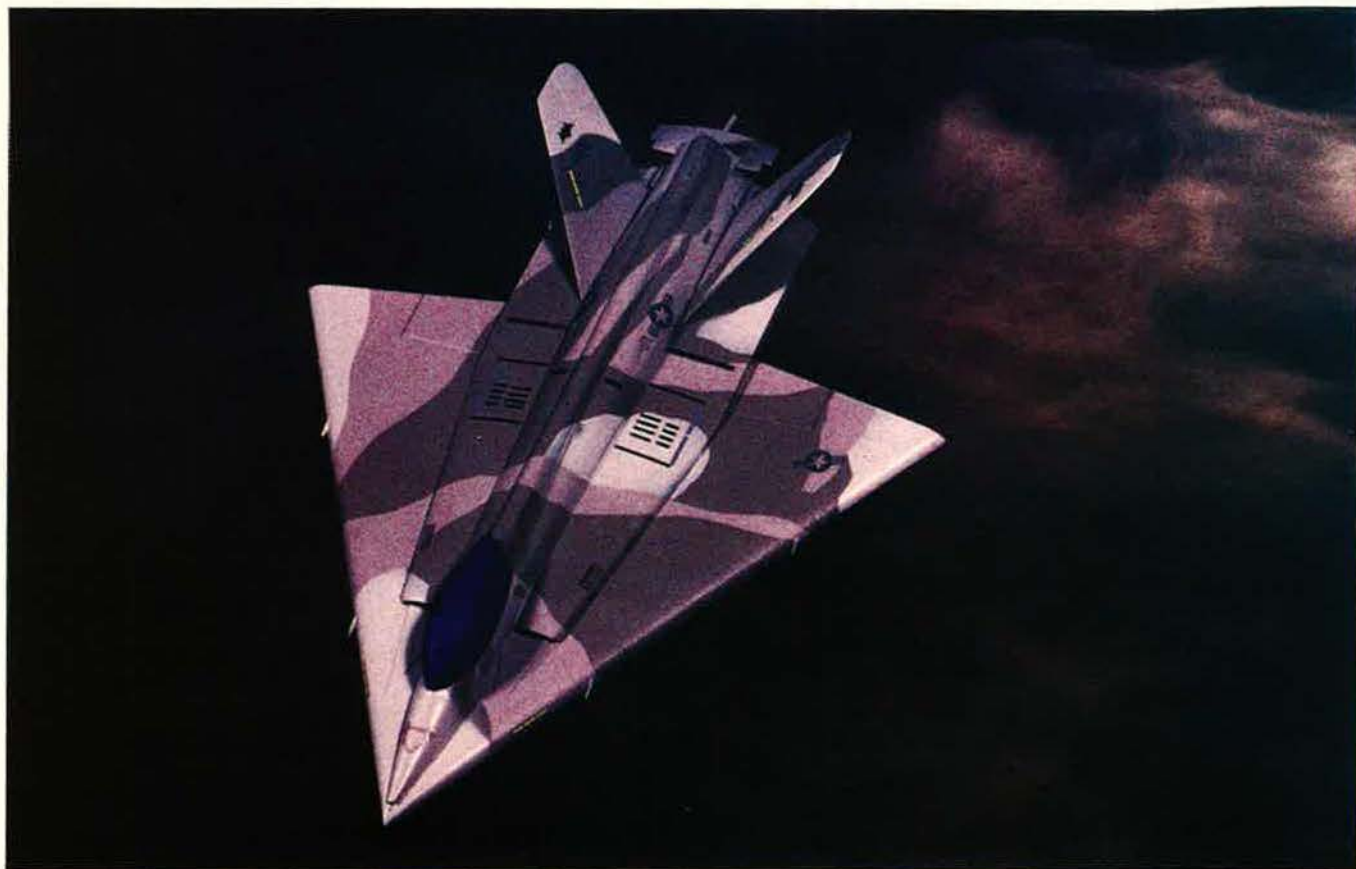


Photo by Erik Simonsen

Force has put aside \$15 billion to develop a new MRF. “[This] is a brand-new airplane,” he emphasized. “It is not a derivative of an existing airplane. It costs about \$15 billion to develop.”

He argued that it made little sense for the Air Force to buy a nonstealthy aircraft as its new MRF. He said that, if he had his way, USAF would never again develop a nonstealthy fighter.

General McPeak added that the service also needs a new MRF in large numbers. “Therefore,” he explained, “affordability is a very big consideration with this airplane.”

“If it’s not affordable, if we can’t replace the F-16 with it, then we’re going to go back to the drawing boards and design another one until we get it affordable,” he said.

Senior Air Force officials say there is widespread acceptance within the service for the Chief of Staff’s view on the MRF issue.

Having a stealthy MRF may impinge on the Air Force’s outyear budget plans, but there are possible solutions to that problem. One Air Force official said the MRF may not need full-aspect stealth. “An MRF may have stealth focused toward the front end

or wherever you think the main threat is, without going to the lengths you go in full stealth aircraft.”

General McPeak noted that the new MRF approach leaves a problem to solve. “F-16 availability begins to go south on us in the early 2000s,” he said, meaning the plane begins to “age out” of the force during those years. The Air Force must cover the shortfall until new MRFs begin to arrive.

On the assumption that the F-16 has an 8,000-hour service life, Block 50/52 F-16s begin to leave service in 2005, creating a shortfall within the 26.5-fighter-wing force. “There is a lag here in being able to sustain the size of the inventory of some time and some dimensions,” General McPeak said. “We don’t know how big that lag is. We think it’s about 500 aircraft.”

General McPeak added a new wrinkle to the service’s acquisition plans: the concept of a force sustainment fighter. This unspecified airplane or set of airplanes would supplement the F-16 fleet during the period of shortage.

General McPeak said the Air Force prefers to go with a “conservative” approach. “We laid some additional

money in our plan,” he said. “This is a force sustainment funding amount. It buys 500 F-16s for \$25 million apiece.”

He said that \$25 million exceeds the per-aircraft cost of today’s F-16s, but the Air Force might have to buy new F-16s in small, high-cost lots, or advanced models.

For \$25 million per copy, the force sustainment fighter might have to be the same F-16 the Air Force is buying today at very low production rates. The F-16’s 1993 fly-away cost is about \$22 million, according to the Air Force.

There are two other possible solutions to the fighter shortfall, said General McPeak. One would be to bring out of storage “perfectly good” F-15s and A-10s, “with a lot of airframe life on them,” and use them to cover for lost F-16 air-to-air and air-to-ground capabilities.

The other solution might come about automatically if the fighter force structure were further reduced in size. “If you drop this force level down some . . . the force sustainment problem goes away,” said the Chief of Staff, “and then the MRF comes along in time to solve the problem.” ■



**Tehran is determined to regain its stature as the preeminent power in the Middle East.**

# Iran Resurgent

By Richard Mackenzie

*Iran aims to upgrade its air arm, which was supplied extensively in the 1970s with US equipment. Here, aging US-built F-14, RF-4, and F-5 fighters (left to right) of the Iranian Air Force refuel from a modified Boeing 707 tanker.*

**O**N A Sunday morning in April, eight Iranian F-4 fighters streaked through the sky over Iran, crossed into Iraq's airspace, and zeroed in on the staging area of an Iranian rebel group that had been conducting cross-border raids with Baghdad's blessing. The jets swooped down, pounded the position, pulled up, and returned to base.

The strike had little permanent effect and would have been quickly forgotten had it not been part of a much bigger and more sobering picture. The event marked the Iranian Air Force's first attack of any kind since 1988 and was viewed around the Mideast as one more demonstration of Tehran's resurgence.

With historic political ambitions in the Middle East, and encouraged by the weakness of Iraqi rival Saddam Hussein, leaders in Tehran have quietly embarked on a campaign to restore the Islamic republic's strength and influence. CIA Director Robert Gates warns that Tehran "is determined to regain its former stature as the preeminent power in the Persian Gulf," a development that could spell new danger for US interests there.

The resurgence of Iran is evident in three developments.

Iran is in the midst of a substantial military buildup, the largest it has seen since the last years of the reign of Shah Mohammad Reza Pahlavi in the 1970s. Purchases include advanced fighters, front-line antiaircraft weapon systems, Soviet-built diesel attack submarines, and long-range Scud missiles. The CIA estimates that Iran is currently buying, on average, \$2 billion worth of weapons each year.

Second, Iran's leaders have launched an energetic, sophisticated diplomatic drive to break out of the international isolation to which the country has been subjected ever since the eruption of the hostage crisis at the US embassy in Tehran in November 1979. US and Western analysts report that Iranian diplomacy has been vigorous in the new, predominantly Islamic, central Asian republics of the former Soviet Union. Iran's new assertiveness is being watched carefully by Turkey, Saudi Arabia, and Pakistan.

Finally, and more speculatively, Tehran apparently is pursuing the wherewithal to build nuclear weapons. CIA and other US analysts say there are signs that Iran has initiated a nuclear development program and that, given the state of Iranian technical

expertise and the rate at which the program is moving, Iran could probably produce a nuclear bomb around the turn of the century. Iran denies it is pursuing a nuclear weapon, claiming all its atomic research is for peaceful purposes.

## **Influence and Intimidation**

Tehran is rebuilding not only to redress the military imbalance with Iraq but also to increase its ability to influence and intimidate neighbors, says Mr. Gates. The architect of Iran's new stance is Hojatolislam Hashemi Rafsanjani, elected president in 1989. He is an accomplished deal-maker and a pragmatic leader. One Bush Administration official who closely watches Iran calls Rafsanjani "a tough, smart, and clever politician," adding, "He is probably the most effective politician Iran has."

Iran's move to reestablish itself as a major regional military force dates to shortly after the death in June 1989 of Ayatollah Ruhollah Khomeini. President Rafsanjani has since maneuvered between conflicting pressures in Tehran and kept the rearmament program moving. Iran, with a gross domestic product of only





Photo by F. Arnaud / Sipa Press

\$59 billion in 1990, is estimated to have spent \$3.1 billion that year on its military. The next year, the defense budget reportedly rose to \$3.8 billion.

Mr. Gates says the CIA estimates that, by 1994, Iranian forces will have spent a five-year total of \$10 billion on new weapons, over and above expenditures on personnel, upkeep of old weapons, and training. Analysts note that the sum is vast, given the isolated condition of Iran and its incomplete recovery from the effects of the Islamic revolution and an eight-year war that devastated its economy and infrastructure.

The need, however, is great. Much of the Iranian armory is of US manufacture, but it was acquired during the reign of the Shah, which ended more than a decade ago. Moreover, international arms embargoes have stripped Iran of the ability to replenish and refurbish its equipment. The result is that much of the inventory is outdated or nonoperational.

Shortly after he took office, President Rafsanjani flew to Moscow to sign a \$15 billion deal for commercial and military goods. That military relationship has been enhanced rather than

hindered by the collapse of the Soviet Union. Hurting for cash, Russia is now willing to sell much more of its advanced weaponry to Iran than was the case at the time of the agreement.

Two of the last major Communist powers, China and North Korea, also have eagerly pursued a military supplier relationship with Tehran.

Iran, with a population of 55 million, maintains armed forces totaling about 500,000 regular troops and another 350,000 troops in reserve. Its most elite force, the Revolutionary Guard Corps, numbers 170,000. Most of the Guards are ground forces.

### The Air Force Tops the List

Though the military has been oriented toward the ground forces ever since the fall of the Shah, the principal aim in the current buying spree was to boost the combat power of the Iranian Air Force. Under the Shah, the Iranian air arm was the largest and most powerful in the Middle East, save Israel's. Moreover, the Iranian Air Force was undergoing an extensive buildup shortly before the Islamic revolution toppled the monarchy and its short-lived successor government in early 1979.

One of the first moves of the Khomeini regime was to declare null and void the nation's plan to purchase large numbers of the US-built F-16 multi-role fighter. Years before, the Shah had purchased eighty ground-based versions of the US F-14 carrier-based fighter. After the revolution, Iran was unable to get spare parts and was unable to fully maintain the Tomcats.

Ten years later, the new buildup began. In 1990, the USSR confirmed that it had sold fourteen front-line MiG-29 "Fulcrum" air-superiority fighters to Iran. That sale was apparently just the opening wedge in a larger aircraft and air defense development scheme.

Mr. Gates reported to Congress that Tehran has purchased large numbers of relatively advanced warplanes and anti-aircraft missiles from Russia and China. Tehran's inventory of MiG-29s now numbers at least twenty, and Moscow has promised to deliver another sixty of the advanced fighters in the next few years, say intelligence experts. Moreover, Russia has sold the Iranian Air Force twelve front-line Su-24 fighter-bombers.

China, meanwhile, has transferred to the Iranians less-sophisticated but



nevertheless serviceable F-7 fighters. An estimated 100 F-7s have been ordered for the Revolutionary Guard Air Forces.

As coalition attacks on Iraq intensified during Operation Desert Storm, Iraq sent an estimated 122 of its aircraft fleeing unannounced to sanctuary in Iran. They were immediately impounded by Iranian authorities. There is virtually no chance that President Rafsanjani will return these aircraft to Saddam, but Iran probably will be unable to get much use out of them. Many of the best aircraft—about twenty-four or so—are French-built Mirage fighters. Iran has neither the parts nor the training to keep them flying. However, the exodus to Iran also included some MiG-29s, a squadron of Su-24s, and thirty-five Su-22s, according to Iraq.

Current estimates are that the Iranian inventory also includes about forty F-4s, seventy-five F-5s, fifteen F-14s, sixteen F-6s, and eighteen F-7s.

Western analysts believe that the Iranian Air Force now deploys nine fighter squadrons, eight of which are dedicated to ground-attack missions, the other to interceptor operations. The Air Force is said to number about 35,000 troops.

### Subs in the Gulf?

Iran's 18,000-man Navy has been described by experts as "dilapidated," but it is being rebuilt. Until recently,



Photo by Eslami Raaf / Gamma Liaison

**In the eight-year Iran-Iraq war, Iran's ground forces, though ill-equipped, halted the Iraqi advance and went on the offensive, nearly topping Saddam Hussein. Now Tehran wants Soviet-made T-72 tanks and other modern systems.**

it had only two midget submarines. One was of Iranian design, and the other was built in North Korea. It also had two destroyers, five frigates, ten fast attack craft, and three Chinese gunboats.

Iran sealed a recent deal with Moscow to buy two *Kilo*-class attack submarines. In blue-water operations, such small diesel-electric powered attack boats would be no match for the US Navy's nuclear-powered SSN-688 attack submarines. However, there is

concern that such underwater weapons could play havoc with shipping or naval operations in the confined waters of the Gulf or the Strait of Hormuz.

Iran's Navy will continue to deploy about forty "speedboats," the little vessels that gained notoriety for attacks on shipping during the Iran-Iraq war and are a mainstay of the Revolutionary Guard at sea.

The Iranian Navy still possesses an estimated 150 Chinese-made *Silkworm* antiship missiles. Iran used both ship-launched and ground-launched versions of this weapon during the Iran-Iraq War. It is thought that Chinese deliveries are continuing.

Active Iranian Army manpower is approximately 305,000. Though Iraq suffered heavy losses in the Persian Gulf War, it still has about three times as many armored vehicles as Iran. Tehran, therefore, is attempting to purchase hundreds of tanks, such as T-72s, from Russia and from the Kremlin's former satellites in eastern Europe.

In pursuing the military buildup, President Rafsanjani realizes he has to walk a fine line. His principal objective is to reduce US involvement and influence in the region, says the CIA's Mr. Gates. As a result, Tehran's approach probably will be "to court Gulf states rather than bully them."

Extraordinary international changes have given Iran its opening to try to



Photo by Eslami Raaf / Gamma Liaison

**Two warships of the Iranian Navy get under way. Western experts say the Iranian flotilla, now small and "dilapidated," is being rebuilt. Tehran has struck a deal with Moscow to procure two used, Soviet-built attack submarines, a major threat to shipping in congested Persian Gulf waters.**



retrieve the role of regional heavy-weight.

First, Tehran looked on with satisfaction as the US-led coalition of forces decimated Iran's longtime enemy, Iraq, during Operation Desert Storm. When the shooting was over, Tehran saw that it had come closer to achieving military superiority over its arch-rival than it had in eight years of direct war.

Second, Iran benefited from the dissolution of the Soviet Union and withdrawal of the Kremlin's military, political, and economic influence from central Asia and the Middle East, leaving a vacuum into which Iranian diplomacy could surge.

US officials point out that Tehran is also trying to improve its relations with Arab states outside the Gulf, emphasizing Muslim solidarity and Islamic principles in such places as Somalia and Sudan.

"In countries with Islamic opposition movements," Mr. Gates says, "Iran hopes to increase its influence among local fundamentalists without damaging its relations with these governments."

He cited Algeria, where the government had banned the opposition Front for Islamic Salvation after it won elections there. Trying to have it both ways, Tehran wants to maintain ties with the existing government but continues political and financial support for the Front.

### The Palestinian Embrace

Iran also has expanded its support of some radical Palestinian groups, which Mr. Gates believes may bring Iran closer to such extremist Arab states as Libya. At the root of that, the CIA director explained, is Tehran's antipathy toward Israel, which it regards not only as a strategic threat but also as a Western beachhead in the Islamic world.

For these reasons, says Mr. Gates, the CIA expects Iran to continue to strongly oppose Middle East peace negotiations and to promote guerrilla operations aimed at undermining the talks. Tehran's surrogate in the Arab world, the Lebanese Shiite group Hezbollah, is the leading suspect in the recent bombing of the Israeli Embassy in Argentina, says Mr. Gates.

Increasing its influence in Sudan is also high on Iran's agenda. That poverty-stricken nation borders US



Russia has supplied Iran with twenty or so new Soviet-made MiG-29 fighters like this one. CIA Chief Robert Gates says Tehran "is determined to regain its former stature as the preeminent power in the Persian Gulf."

ally Egypt and lies just across the narrow Red Sea from Saudi Arabia, another US ally. The government in Khartoum contains many Muslim fundamentalists and has opened its doors to Iranian activists.

Iran is attempting to increase its influence in the new nations in central Asia. It offers its services as if it were a superpower, acting as a go-between in Azerbaijan's dispute with neighboring Armenia, for instance. Iran has sponsored several of these new nations for membership in various regional and international organizations.

"Tehran considers developments in the [central Asian republics] to be vital to its national interests," says Mr. Gates. "It wants to fill the void caused by the collapse of the Soviet Union and to prevent the United States and regional rivals, especially Turkey, from gaining dominant influence there. In addition, Tehran is trying to forge cultural and religious ties to the new republics."

While pursuing military reconstruction, President Rafsanjani is trying to create an image of responsibility and respectability. Tehran clearly wants to avoid giving the US a pretext for maintaining a significant military presence in Gulf nations.

### Rafsanjani's Opposition

Not everyone in Iran is pleased with the course of events. Some of President Rafsanjani's opponents hold to Khomeini's line that the Iranian government should keep the outside world, particularly the United States, at arm's length. They fear that doing business with such countries would open Iran to foreign domination.

Iran's ambitions will surely be constrained by its economic woes. Without links to the West, the Iranian economy is in a terrible state. The government admits to a 26.1 percent inflation rate, but Western diplomats in Tehran report the rate probably comes closer to fifty percent.

The nation earns \$12 billion a year from oil exports but has to pay in hard currency for food and other commodity imports that once were produced inside Iran.

Even so, Iran's military revival is stirring concern in Washington. Mr. Gates reminds his listeners that Iran's clerical leadership "has not abandoned the goal of one day leading the Islamic world and reversing the global dominance of Western culture and technology." The result might well be a clash of arms. ■

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*Richard Mackenzie, a free-lance writer in the Washington, D. C., area, was a war correspondent in Afghanistan from 1987 to 1990 and in the Persian Gulf War in 1991. His most recent article for AIR FORCE Magazine, "More Stormy Weather for the Airlines," appeared in the March 1992 issue.*



By John L. Frisbee, Contributing Editor

## Down in the Delta

The Air Force and Navy teamed up in one of the more dramatic rescues during the early months of the Vietnam War.

IT HAS been noted in earlier "Valor" stories that during the Vietnam War, USAF's Aerospace Rescue and Recovery Service saved more than 3,800 lives. Of that number, 2,800 were US military, including 680 Naval aviators. This is a story about the rescue of one Navy pilot, Lt. J.G. Larry Duthie, downed by enemy ground fire near Nam Dinh in the Red River delta about forty-five miles southeast of Hanoi, on July 18, 1967.

The Navy had its own air rescue system, using carrier-based helicopters. When Lieutenant Duthie bailed out of his burning aircraft, his wingman alerted the carrier on emergency frequency. A Navy helicopter was dispatched to locate and pick up the downed pilot.

Almost simultaneously, the Air Force launched a search-and-rescue (SAR) force of two HH-3E helicopters escorted by four A-1E "Sandys" as back-up to the Navy. The lead was flown by Maj. Glen York.

This was going to be a difficult and dangerous mission for all concerned. At the time, North Vietnam had about 7,000 AA guns and automatic weapons in the field, most of them in the north where Duthie had bailed out. There also were MiG fighter bases within seventy-five miles of the rescue site.

Navy pilots escorting their rescue helicopter located Lieutenant Duthie. As he was in reach of the rescue bird's forest penetrator, the helicopter took a burst of flak that killed one crew member, and the Navy rescuers had to pull out. In the meantime, Duthie's wingman, who had stayed in the area to cover his flight leader, was hit by ground fire and punched out a few miles from Duthie's position.

Now Sandys One and Two, who had arrived ahead of the HH-3Es, set about silencing enemy guns. A

MiG made one unsuccessful pass at the USAF on-site commander, Maj. Theodore Bronczyk (Sandy One). He jettisoned his bombs, rockets, and external fuel tanks in evasive action, then continued attacking the guns with his 20-mm cannons. With extensive battle damage and low on fuel, he and Sandy Two, flown by Capt. William Carr, were forced to depart.

After a pause to regroup the rescue force, Capt. Paul Sikorski, pilot of Sandy Three, assumed control of the rescue effort, with Capt. J.W. Kilbourne (Sandy Four) on his wing. Sikorski continued to lead Air Force and Navy planes in attacks on enemy gun positions, taking many hits but staying in the game. With enemy fire at least temporarily quieted, he called in Major York, who had been orbiting his HH-3E at 8,000 feet. York was well aware that he was flying into what the enemy troops believed would be his death trap. He knew

they were holding fire until his chopper hovered directly over their guns.

Major York broke his dive and slowed to thirty knots as he reared the hill where Duthie was hiding. The rescue force had lost voice contact with the Navy pilot, and as York circled the hill trying for a visual sighting, the enemy gunners zeroed in on his HH-3E. The huge Jolly Green, moving at a snail's pace just above the treetops, was a target that could not be missed. How much damage could it take?

As the seconds dragged toward what seemed imminent disaster, Major York's copilot, Lt. W. N. Privette, spotted Duthie through the jungle canopy. Enemy troops were only a few feet from him. York maneuvered the helicopter in a 180 degree turn and hovered over Duthie while the forest penetrator was lowered. As soon as Duthie was in the sling and clear of the trees, York moved out at full speed, using the terrain as cover.

At this point, Sandys Three and Four, critically low on fuel and with battle damage, had to head for home. Nevertheless, the rescue coordinator asked York to try for a pickup of the second Navy pilot. With unknown damage to his chopper and marginal fuel, York agreed. Escorted by Navy fighters, he flew into an even more hostile area, closer to Hanoi. The rescue force was driven off by the most intense fire they had seen that day. Major York headed for an emergency strip where he had to make an instrument approach in mountain terrain, homing on another aircraft. He landed with fuel lights on, a nose gear that would not extend, and a Navy pilot who would fly another day.

There were many heroes that day, when both Air Force and Navy men faced the concentrated enemy fire in Route Package Six-B. On the Air Force side, Major York was awarded the Air Force Cross. The other members of his crew and the four A-1E pilots all received the Silver Star for one of the most daring and dangerous deep-penetration missions flown in the early years of the Vietnam War. ■





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# Books

By Frank Oliveri, Associate Editor

*Airpower in the Gulf*, by James P. Coyne. Drawing upon nearly 200 interviews with those who fought in the Persian Gulf War—from the airmen and sergeants to the captains and generals—here is an authoritative account of what many consider the most impressive air campaign in history. The author, a veteran fighter pilot who prepared this book for AFA, opens with an account of the first air strikes by F-117 Stealth fighters and by a combined team of Army AH-64 Apache attack helicopters and Air Force MH-53J special operations helicopters in the early hours of January 17, 1991. From there, he traces in detail the buildup of forces in the fall and winter of 1990 and then the unprecedented use of airpower, right up to the support provided for the 100-hour ground war. *Airpower in the Gulf* includes an overview of behind-the-scenes planning that was the key to success in the war and a solid treatment of the weapons systems. Aerospace Education Foundation, 1501 Lee Highway, Arlington, VA 22209-1198. 1992. Including photos, maps, charts, a chronology of the air war, footnotes, bibliography, and index, 232 pages. \$21.00.

*Bouncing Back*, by Geoffrey Norman. Navy Lt. Cmdr. Al Stafford and various Air Force and Navy pilots managed to endure years of captivity as POWs in Vietnam and still maintain excellent mental health and high morale. The system they developed, simply called "Bouncing Back," was formally adopted by the US military in various training programs. 1990. Pocket Books, 1230 Avenue of the Americas, New York, NY 10020. 248 pages. \$4.99.

*Bull's Eye: The Assassination and Life of Supergun Inventor Gerald Bull*, by James Adams. The author, a correspondent for the *Sunday Times* of London, unravels the life of the mysterious Dr. Gerald Bull—artillery expert, CIA asset, and international gun smuggler. This piece of investigative journalism delves into political intrigue, intelligence, and the arms business. 1992. Times Books, 201 E. 50th St., New York, NY 10022. Including photos, bibliography, and index, 317 pages. \$23.00.

*European Terrorism: Today & Tomorrow*, edited by Yonah Alexander and Dennis A. Pluchinsky. The changes in the world, including the end of the cold war, have not diminished the threat of terrorism. The authors, well-known experts on the subject, study trends of future terrorism in Europe and examine ways to cope with the problem. 1991. Brassey's (US)

Inc., 8000 Westpark Dr., McLean, VA 22102. Including bibliography and index, 206 pages. \$30.00.

*Journey into Darkness*, by Col. Philip E. Smith and Peggy Herz. This is the story of how Colonel Smith, then a captain, was shot down and captured by Chinese Communists during the Vietnam War and what he endured during his seven-year ordeal. He was one of two US POWs to be held in China during that war. 1992. Pocket Books. 270 pages. \$4.99.

*Love and Duty*, by Ben and Anne Purcell. Captured by the North Vietnamese Army in 1968, Ben Purcell endured five and a half years of hunger, torture, and fear of death. He was listed as missing in action because his captors refused to notify the US government. 1992. St. Martin's Press, 175 Fifth Ave., New York, NY 10010. Including photos, 223 pages. \$17.95.

*Lucius D. Clay: An American Life*, by Jean Edwards Smith. General Clay, the Military Governor of Germany after World War II (1945-49), had a major role in laying the basis of today's democratic Germany. As a public servant, he was an influential player in some of the momentous events of this century. 1992. Henry Holt and Co., Inc., 115 W. 18th St., New York, NY 10011. Including photos, bibliography, and index, 835 pages. \$19.95.

*Mustang Ace: Memoirs of a P-51 Fighter Pilot*, by Robert J. Goebel. The author recounts his experiences as a P-51 Mustang pilot in the latter stages of World War II, where he scored eleven confirmed air-to-air victories. Mr. Goebel achieved this feat before he turned twenty-two. 1991. Pacifica Press, 1149 Grand Teton Dr., Pacifica, CA 94044. Including photos, 228 pages. \$24.95.

*A Nation of Fliers: German Aviation and the Popular Imagination*, by Peter Fritzsche. Germany's romance with the airplane took many forms, from the bright idealism of flight to the use of aircraft in warfare. The author documents the German fascination with flying and explores the relationship of modern technology and German National Socialism. 1992. Harvard University Press, 79 Garden St., Cambridge, MA 02138. Including photos, notes, bibliography, and index, 282 pages. \$27.95.

*Rethinking America's Security: Beyond Cold War to New World Order*, edited by Graham Allison and Gregory F. Treverton.

A group of highly regarded defense experts assesses the changing concept of national security in the 1990s and its implications for American policy at home and abroad. 1992. W. W. Norton & Co., Inc., 500 Fifth Ave., New York, NY 10110. Including notes, bibliography, and index, 479 pages. \$29.95.

*Vietnam Above the Treetops: A Forward Air Controller Reports*, by John F. Flanagan. This book, giving one man's perspective on life as a forward air controller, provides further insight into the Vietnam experience. Air strikes, team rescues, and failed attempts to save comrades are described in this eyewitness account. 1991. Praeger Publishers, One Madison Ave., New York, NY 10010. Including photos and index, 313 pages. \$24.95.

*The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration, 1933-1941*, by Jeffery S. Underwood. Mr. Underwood shows how leading officers in the Army Air Corps of the 1930s used their political skills to win the trust and support of their superiors. He makes the case that US leaders were not suddenly forced to accept the importance of airpower by the exigencies of war in Europe. 1991. Texas A&M University, College Station, TX 77843-4354. Including notes, bibliography, and index, 234 pages. \$39.50.

*The Winter War: The Soviet Attack on Finland, 1939-1940*, by Eloise Engle and Lauri Paananen. A little-noted conflict, this bitter, 105-day campaign saw Finland, vastly outnumbered by Soviet forces, finally succumb after initial successes. Though victorious, the Red Army suffered heavy losses. The authors claim the USSR lost nearly 1,000 planes, 2,300 tanks, and about one million lives. 1992. Stackpole Books, Cameron and Kelker Sts., P. O. Box 1831, Harrisburg, PA 17105. Including appendix, index, and photos, 176 pages. \$12.95.

## Other Titles of Note

*A Concise Dictionary of Military Biography: The Careers and Campaigns of 200 of the Most Important Military Leaders*, by Martin Windrow and Francis K. Mason. The careers of commanders from the Middle Ages through the 1980s. 1991. John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158-0012. 337 pages. \$15.95.

*Test Flying at Old Wright Field*. Test pilots' and engineers' experiences in the flying program. 1991. Wright-Patterson AFB Educational Fund, 4080 Beechwood Dr., Bellbrook, OH 45305. Including index, 222 pages. \$21.00. ■





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Edited by Daniel M. Sheehan, Assistant Managing Editor

## "An Era of Change"

AFA's Iron Gate (N. Y.) Chapter, a perennial fund-raising champion, passed the \$2 million mark at its twenty-ninth annual National Air Force Salute and, not content to rest there, immediately set about raising its third million. Seeking to spotlight the unprecedented organizational changes in the Air Force, the chapter took "An Era of Change" as its theme.

Chapter President Tom McKee presented four Aerospace Education Foundation Ira Eaker Fellowships to Air Force officers dedicated to implementing those changes: Gen. George Lee Butler, former commander in chief of SAC, now commander in chief of the new US Strategic Command; Gen. H. T. Johnson, former commander in chief of MAC, now commander of the new Air Mobility

Command; Gen. Charles C. McDonald, recently retired commander of Air Force Logistics Command; and Gen. Ronald W. Yates, former commander of Air Force Systems Command, now commander of the new Air Force Materiel Command. Gen. John Michael Loh, former commander of TAC, now commander of the new Air Combat Command, was unable to attend and will receive an Ira Eaker Fellowship at a later date.

The chapter reserved its highest honor, the Maxwell A. Kriendler Memorial Award (named for the chapter's founder), for the "principal architect" of these extensive changes, Chief of Staff Gen. Merrill A. McPeak. Saluting his "keen analysis and brilliant planning" that laid the foundation for the restructuring, the citation for the award also

praised his leadership in Operation Desert Storm. The value of airpower was "convincingly demonstrated with the overwhelming success of the air campaign that helped ensure the total victory," the citation stated.

The salute, an annual black-tie event, endows AEF, the Air Force Assistance Fund, Falcon Foundation, Air Force Historical Foundation, USAF Museum, National Aviation Hall of Fame, Civil Air Patrol and Air Force Academy flight awards, and the Soldiers', Sailors', and Airmen's Club, founded in 1919 to provide affordable food and lodging to transient military personnel.

Cabaret singer Karen Akers returned to entertain chapter members and guests for the second year. Next year's salute will take place in New York on April 3.

—James A. McDonnell, Jr.

Photo by Sid Birns



Taking part in the 1992 National Air Force Salute are (from left) Gen. James P. McCarthy, deputy commander in chief of US European Command; Gen. Ronald W. Yates, AFSC commander; Gen. Donald J. Kutyna, US Space Command commander in chief; Gen. H. T. Johnson, MAC commander in chief; Dorothy Flanagan, Salute Committee member; Gen. Merrill A. McPeak, USAF Chief of Staff; Dorothy Welker, Salute coordinator; Gen. Charles C. McDonald, AFLC commander; Gen. George Lee Butler, SAC commander in chief; Lt. Gen. Charles A. Horner, 9th Air Force commander; and Tom McKee, chapter president.



## AEF Rolls Out Gulf War Book

Air Force Secretary Donald B. Rice and General McPeak received the first copies of *Airpower in the Gulf* from author James P. Coyne during ceremonies at the Pentagon. Drawing on some 200 interviews, numerous policy studies and position papers, and hundreds of journalistic accounts and books, Mr. Coyne, a veteran Air Force fighter pilot and former Pentagon planner, has reconstructed the full story of what may be the most impressive air campaign in history.

Secretary Rice had high praise for the book. "To stay number one, you have to study what you did right . . . and what works against the other guy. Jim Coyne and the Aerospace Education Foundation have helped us do that." General McPeak agreed: "Having been a fighter pilot, Jim Coyne was able to write this book from the perspective of the cockpit."

From the buildup during Desert Shield to the 100-hour ground war, *Airpower in the Gulf* tells the entire story of the Gulf War. With authoritative detail, Mr. Coyne captures every facet of the air war, from weapons and tactics to the austere life of USAF and coalition forces in the desert.

Secretary Rice noted the enduring value of the book. "For years, historians, planners, and policymakers will refer to *Airpower in the Gulf* for insights into the war that sparked a new age for airpower."

AFA President O. R. Crawford, AEF President Gerald V. Hasler, AFA Chairman of the Board Jack C. Price, and Executive Director Monroe W. Hatch, Jr., also attended the Pentagon ceremonies.

The book is available directly from AEF to AFA members and Industrial Associates for \$21.85 per copy (including shipping and handling) and to non-members for \$23.95. Bulk discounts are also available. Write to AEF, 1501 Lee Highway, Arlington, VA 22209-1198 [see p. 75].

## A Remarkable Raid Recalled

AFA chapters on both coasts joined in commemorating the Doolittle Raid, which stunned the Japanese and heartened the US fifty years ago last April. The **General Doolittle/Los Angeles Area (Calif.) Chapter** cosponsored a salute at the Santa Monica Museum of Flying, and the **Columbia (S. C.) Chapter**, joined by **Billy Mitchell (Wis.) Chapter** President Charles W. Marotske, held ceremonies in conjunction with the raiders' fiftieth-anniversary reunion in Columbia, S. C.

In California, the Doolittle Chapter joined forces with the Pacific South-west Region of the Navy League and

the Aero Club of Southern California to mount a most impressive program. A host of dignitaries attended, including Commander of 15th Air Force Lt. Gen. Robert D. Beckel and Air Force Academy Superintendent Lt. Gen. Bradley C. Hosmer. The raiders were represented by Frank A. Kappeler, navigator of Crew 11; David W. Pohl, a gunner on Crew 8; and J. Royden Stork, copilot of Crew 10. Honorary raiders Tung-sheng Liu and Charles J. Graham, Jr., were there, as was Gen. James P. Mullins, USAF (Ret.), former commander of AFLC.

The program included a video, a speech by General Hosmer, dinner, and dancing to the music of the 15th Air Force Band. Perhaps most impressive was the booklet issued as a souvenir of the occasion. It contains messages from President Bush, General McPeak, and General Doolittle; a biography of Doolittle and a history of the Raid complete with dozens of vintage photographs; and a roster of all the raiders and their eventual fates (forty-one survive). Each of the 300 guests received a copy, and more were sent to South Carolina for the ceremonies there.

Chapter President Edward E. Reynolds, Jr., called the salute the "finest affair ever staged by our chapter" and pointed to the arrival of two beautifully restored B-25s as a highlight of the event.

Less than two weeks later, Columbia turned out in force to honor the raiders. National Vice President (Southeast Region) Stan Hood accompanied Raider Horace E. Crouch (navigator-bombardier of Crew 10) to the State Capitol, where he received the Order of the

Palmetto and a special proclamation from the state House of Representatives. Mitchell Chapter President Marotske mingled with a crowd that included Mr. Liu, General Doolittle's son John, Navy aviators Wade Campbell and Hank Miller, and authors C. V. Glines (who collaborated with General Doolittle on *I Could Never Be So Lucky Again*) and Stan Cohen (*Destination: Tokyo*). A crowd of 800 attended the Jimmy Doolittle Ball at the Carolina Coliseum, dancing to music of the 1940s.

The following day, the State Museum was the site of a B-25 dedication, attended by more than 1,500 people, including Sen. Strom Thurmond (R-S. C.), Lt. Gov. Nick A. Theodore, and Columbia mayor Robert Coble. F-16s from the 169th Fighter Group of the South Carolina ANG staged a flyover.

## Students, Teachers, and AFA

With the help of a \$400 grant from AEF, the **Gulf Coast (Fla.) Chapter** has taken an active role in informing local students about the virtues and benefits of an Air Force career. Chapter President Frank Kilcheski and Chapter Vice President (Aerospace Education) William A. Evans have organized several seminars for high school and middle school students. One, "How the Air Force Can Fit Into Your Life," was particularly successful. Representatives from the Air Force Academy, AFROTC, Patrick AFB, and MacDill AFB described the career options available in the Air Force, with a particular emphasis on training.

The three-hour program was videotaped and made available to AEF for



During Pentagon ceremonies, USAF Secretary Donald Rice (second from left) and Chief of Staff Gen. Merrill McPeak (second from right) accept copies of *Airpower in the Gulf* from (from left) AFA Chairman Jack Price, author James P. Coyne, National President O. R. Crawford, and AEF President Gerald Hasler.





Many of the surviving Doolittle raiders, their spouses, and widows of deceased raiders came to Columbia, S. C., to mark the Raid's anniversary. After numerous early US setbacks, the Raid was of incalculable benefit to US morale and a devastating loss of face to the defenders of Japan's "invincible" home islands.

future use as a recruiting tool. Mr. Kilcheski expressed thanks for the cooperation of Brig. Gen. Ben Nelson, commander of the 56th Fighter Wing at MacDill, who made it possible for three of the active-duty speakers to address the seminar.

In order to promote aerospace education, the **General Charles A. Gabriel (Va.) Chapter** has begun a program to honor outstanding local teachers. Modeled after AEF's national Christa McAuliffe Memorial Award, the Outstanding Educator of the Year Award goes to the local math-science teacher who has done the most to promote aerospace education. The award is accompanied by a plaque and a library/equipment grant. The first recipient of the award is Ronald Anderson, a science teacher from Thomas Jefferson High School in Alexandria, Va.

To make a viewing of the World War II film, "Attack from the Air," even more educational, members of the **Brandywine (Pa.) Chapter** supplemented it with a discussion of the P-47 and the Italian campaign. Chapter President Joe Dougherty, Phil Hardican, and Chapter Treasurer Joe Perlman—combat veterans all—told the eighth-grade class at St. Bernadette's School in Drexell Hill, Pa., about the Thunderbolt and their experiences during the war.

The **Colorado Springs/Lance Sijan (Colo.) Chapter** has been helping students at all levels achieve their goals. It continues its strong support of the Eagle Scholarships program. The most recent Community College of the Air Force graduates to receive the \$250 awards

are SrA. Linda Duffy, a contracting specialist at Peterson AFB, and SSgt. Jason F. Williams, a member of the 7625th Comptroller Squadron at the US Air Force Academy.

The chapter has jumped into the "Visions of Exploration: Past, Present, and Future" program. Students at twenty area elementary schools are now learning about space and space exploration through the work of the Sijan Chapter and *USA Today*.

The Sijan Chapter has also been busy at the high school level. Terri

Wang, a senior at Air Academy High School, received the first Jim Irwin Memorial Scholarship. She will apply the \$1,000 grant toward pursuing an engineering degree at Stanford. Katrina Byrd also received a \$1,000 scholarship. The Rampart High School senior will apply her grant toward an education in aerospace engineering at Colorado State. Two other area seniors, Robert Lee and Thomas Baumgardner, received \$500 awards.

Chapter President Don Dandurand took a novel approach to raising money for the National Bone Marrow Foundation. He organized a pretournament party, attended by more than 100 members and guests, on the night of the Air Force Academy's Wing Open Boxing Tournament. The evening netted \$1,000 for the foundation.

### Chapter News

The **Tacoma (Wash.) Chapter** staged a highly successful Spring Dinner Dance and Awards Program at the McChord AFB Enlisted Club. Gen. H. T. Johnson spoke and assisted with the awards. General Johnson praised the accomplishments of McChord's 62d Airlift Wing during Operations Just Cause, Desert Shield, Desert Storm, Fiery Vigil, and Provide Hope. He singled out Capt. Ralph T. Mead, Jr., of the 4th Military Airlift Squadron, citing his heroism during an airdrop over Panama as part of Just Cause. He also discussed the ramifications of restructuring and his new post as head of Air Mobility Command. The General was



Doing its part to foster strong NATO relations, the Tidewater (Va.) Chapter sent its president, Ralph Renfro (background) to greet Spanish Ambassador Jaime de Ojeda and Spanish Azalea Queen (the title rotates annually among NATO nations) Mathilda Herrero de Zuleta at the opening of the thirty-ninth Azalea Festival in Norfolk. Norfolk mayor Joseph A. Leaf (right) was also on hand.



introduced by Col. Edward G. Hoffman, vice commander of the 62d Airlift Wing, who also gave remarks.

After a moment of silence in honor of Former Prisoner of War Recognition Day, General Johnson, assisted by Lt. Col. Sandra Tooker, executive officer to the wing commander, presented the awards. AFJROTC Cadet Lt. Col. Teresa M. Hough and CAP Cadet Lt. Col. Alton S. White IV received \$300 scholarships, and \$200 awards were given to Capt. Anthony M. Butters, 8th Airlift Squadron; MSgt. Robert J. McLean and A1C Richard R. Seipert, Northwest Air Defense Sector; TSgt. Jeffrey B. Howard, 62d Security Police Squadron; and James J. Maine, civilian personnel officer.

A special presentation was made to David Gobeli, a student at Beachwood Elementary School in Fort Lewis (one of twenty-five schools taking part in this chapter's "Visions" program). Young Mr. Gobeli wrote the prize-winning essay for the "Visions" program and will attend US Space Camp/Space Academy in Huntsville, Ala., all expenses paid.

Dignitaries at the event included National Director Sherman T. Wilkins, Chapter President Tom Swarner, former Chapter and State President Edward V. Hudson, Tacoma mayor Karen Vialle, MAC Senior Enlisted Advisor CMSgt. David Campanelli, and Adm. James S. Russell, USN (Ret.).

The **Fort Worth (Tex.) Chapter** got some good coverage in the Fort Worth *Star-Telegram* for its Community Appreciation Banquet and Ball, at which Desert Storm air boss Lt. Gen. Charles A. Horner was the featured speaker. General Horner delivered a one-year-later assessment of the Gulf War. He strongly defended the coalition against charges that it left goals unmet. The paper reported the General's observation, "I think we showed . . . that an air campaign can be used to achieve the military goals with minimal loss of life on both sides." Col. Richard Szafranski, commander of the 7th Wing at Carswell

AFB; Ronnie W. Beezley, chapter president; and representatives from fourteen corporate sponsors also attended the banquet.

Patients at the Dallas VA Hospital will get their hot food a little faster, thanks to another effort by the Fort Worth Chapter. Mr. Beezley, Vice President (Community Partners) Vicky Cottingham, and Secretary Bob Copley turned over three new microwave ovens to Charlie Baker of the hospital staff.

Another AFA chapter benefited from an appearance by the well-traveled General Horner. He addressed the **Langley (Va.) Chapter's** Salute to the 1st Fighter Wing last March. This time his talk was geared to the restructuring of the force and easing the transition for active-duty personnel. He noted the "great uncertainty" faced by the troops and stressed the need to stay informed. General Horner then turned to force modernization, observing that history teaches that a future armed conflict is all but inevitable and that "we owe it" to the children of today "to continue to keep research, development, and modernization going." He presented awards to the 1st Civil Engineering Squadron (Best Support Squadron), 94th Fighter Squadron (Best Operational Squadron), and 1st Medical Group (Best Group).

Intent on preserving a piece of history, members of the **Central Indiana Chapter** have swung behind the effort to make the Atterbury-Bakalar Aviation Museum a reality. Chapter President Paul Gorman and Indiana Vice President (Government Relations) William Gommel saw their efforts rewarded at ground-breaking ceremonies at Columbus Municipal Airport. The 3,000-square-foot structure will house aircraft and other mementos from the base's Air Force service, first as Atterbury AFB, then (from 1954 until its closure in 1971) as Bakalar AFB. It opened in 1943, training all-black B-25 crews for the segregated Army Air Forces. The base subsequently trained glider pilots, C-

## Coming Events

July 10-11, **Kansas State Convention**, Wichita, Kan.; July 17-18, **Arkansas State Convention**, Little Rock, Ark.; July 17-18, **Colorado State Convention**, Lowry AFB, Colo.; July 17-19, **Georgia State Convention**, Savannah, Ga.; July 17-19, **Michigan State Convention**, Marquette, Mich.; July 17-19, **Pennsylvania State Convention**, Harrisburg, Pa.; July 17-19, **Texas State Convention**, San Angelo, Tex.; July 24-25, **Florida State Convention**, Panama City, Fla.; July 24-26, **Washington State Convention**, Tacoma, Wash.; July 31-August 1, **Arizona-Nevada (Combined) State Convention**, Las Vegas, Nev.; August 7-9, **California State Convention**, San Bernardino, Calif.; August 8, **Illinois State Convention**, Rosemont, Ill.; August 14-15, **Louisiana State Convention**, Bossier City, La.; August 22-23, **Indiana State Convention**, Kokomo, Ind.; August 28-29, **New Mexico State Convention**, Alamogordo, N. M.; September 14-16, **AFA National Convention and Aerospace Development Briefings and Displays**, Washington, D. C.

119 crews, and AC-119 crews. Formal dedication for the museum is slated for Veterans Day 1992.

The newly formed **West Kentucky Chapter** received its official charter from Chairman of the Board Jack C. Price during ceremonies at the Country Club of Paducah. National Vice President (Great Lakes Region) Cecil H. Hopper and Kentucky State President James Jenkins also saw the chapter's first president, James Long, receive the charter.

### Have AFA/AEF News?

Contributions to "AFA/AEF Report" should be sent to Dave Noerr, AFA National Headquarters, 1501 Lee Highway, Arlington, VA 22209-1198. ■

## Unit Reunions

### AACS Alumni

Veterans of the Airways and Air Communication Services will hold a reunion October 1-3, 1992, in Corpus Christi, Tex. **Contact:** Robert D. Leske, 4933 Kosarek St., Corpus Christi, TX 78415. Phone: (512) 855-6028.

### B-29 Anniversary Update

The following is a partial list of the organizations participating in the fiftieth-anniversary celebration of the B-29, August 14-16, 1992, in Seattle, Wash.: 58th Bomb Wing Association, along with the 40th, 444th, 462d, and 468th Bomb Group Associations;

73d Bomb Wing Association, which includes the 497th, 498th, 499th, and 500th Bomb Group Associations and 65th, 91st, 303d, and 330th Service Groups; 313th Bomb Wing Association, including the 6th, 9th, 504th, and 505th Bomb Group Associations and 509th Composite Group Association. **Contacts:** Paul S. Friedrich, P. O. Box 3999, M/S 17-28, Seattle, WA 98124-2499. Phone: (206) 773-7577 (Bob Moffatt) or (206) 655-2034 (Karl Croswhite).

### P-40 Warhawk Pilots

P-40 Warhawk Pilots will hold a reunion September

23-27, 1992, at the Hilton Hotel in Pensacola, Fla. **Contact:** Arthur Livingston, 2244 Clubhouse Dr., Lillian, AL 36549. Phone: (205) 962-4469.

### P-51 Mustang Pilots

**CORRECTION:** The reunion dates for the P-51 Mustang Pilots were incorrectly reported in the May 1992 issue. The reunion is scheduled for September 29-October 3, 1992, in Las Vegas, Nev. **Contact:** David D. Smith, 5052 E. Tahnee Dr., Las Vegas, NV 89122. Phone: (702) 454-4385.



## Unit Reunions

### Pararescue Ass'n

The Pararescue Association will hold a reunion September 10-12, 1992, in Fort Walton Beach, Fla. **Contact:** Bill Vargas, P. O. Box 13351, Albuquerque, NM 87192-3351. Phone: (505) 296-3557.

### Pilot Training Classes

World War II primary pilot training classes assigned at Douglas, Ga., will hold a reunion at the Holiday Inn in Jekyll Island, Ga. **Contact:** Harold E. Spangler, 495 E. Roseville Rd., Lancaster, PA 17601-6411. Phone: (717) 569-8366.

### RAAF/WAFB

Veterans who served at Roswell AAF/Walker AFB, N. M., will hold a reunion September 17-19, 1992, at the Roswell Inn in Roswell, N. M. **Contact:** TSgt. Lott W. Porter, USAF (Ret.), P. O. Box 2744, Roswell, NM 88202.

### Sampson AFB

Former permanent party personnel and students who had basic training at Sampson AFB, N. Y., will hold a reunion in October 1992. **Contact:** Walter W. Steesy, 2989 Lodi Rd., Interlaken, NY 14847. Phone: (607) 532-4997.

### Stallings AFB

Alumni of Serv-Air Aviation School, a former USAF contract flying school assigned to Stallings Field, N. C., will hold a reunion October 23-25, 1992, in Kinston, N. C. Former employees, students, and permanent party military personnel are invited. **Contacts:** Gil Woolard, 1607 Cambridge Dr., Kinston, NC 28501. Phone: (919) 527-0425. Col. Charles B. West, USAF (Ret.), 429 Edinburgh Dr., Fayetteville, NC 28303. Phone: (919) 864-2439.

### 1st Fighter Group

Veterans of the 1st Fighter Group will hold a reunion September 16-20, 1992, in San Antonio, Tex. All past and present members are welcome. **Contact:** Robert W. Spittler, 850 Oliver St., Fillmore, CA 93015-1816.

### 1st Motion Picture Unit

The 1st Motion Picture Unit, USAAF, will hold a fiftieth-anniversary reunion September 26, 1992, at the Sportsman's Lodge in Studio City, Calif. **Contact:** George J. Siegel, 17226 Weddington St., Encino, CA 91316. Phone: (818) 990-8087.

### 2d Air Division

Veterans of the 2d Air Division (World War II) will hold a reunion October 2-7, 1992, at the Riviera Hotel in Las Vegas, Nev. **Contact:** Evelyn Cohen, Apt. 06410 Delair Landing, Philadelphia, PA 19114.

### 5th Aircraft Repair Unit

Veterans of the 5th Aircraft Repair Unit (Floating) will hold a reunion September 18-20, 1992, at the Harley Hotel in Grand Rapids, Mich. **Contact:** John T. Fulbright, 9551 Ten Mile Rd., Rockford, MI 49341. Phone: (616) 874-7885.

### 6th Bomb Group

Veterans of the 6th Bomb Group who served on Tinian in 1944-45 will hold a reunion August 10-14, 1992, in Seattle, Wash. **Contact:** Virgil Morgan, 2719 Pacific Ave., Everett, WA 98201. Phone: (206) 252-4735.

### 7th Air Division

Veterans of the 7th Air Division (SAC), the 3910th Air Base Group, and the 4th AAA Battery unit who served as permanent party personnel at RAF Mildenhall, RAF Lakenheath, and RAF Upper Heyford between 1950 and 1953 will hold a reunion July 17-22, 1992, in Nashville, Tenn. **Contact:** Bill G. Parkhurst, P. O. Box 2881, Tulsa, OK 74101. Phone: (918) 446-6400.

### 7th Bomb Group

The 7th Bomb Group will hold a reunion September 3-6, 1992, in Dayton, Ohio. **Contact:** 7th Bomb

Group Historical Foundation, P. O. Box 12802, Tucson, AZ 85732. Phone: (602) 299-4572.

### 7th TDS/400th MMS

Veterans of the 7th Tactical Depot Squadron and 400th Munitions Maintenance Squadron will hold a reunion August 7-9, 1992, at the Quality Inn in Denver, Colo. **Contact:** Walter Buck, 531 Ursula St., Aurora, CO 80011. Phone: (303) 344-1319.

### 8th Photo Recon Squadron

The 8th Photo Reconnaissance Squadron will hold a reunion September 30-October 4, 1992, at the Sheraton Riverside Hotel in Riverside, Calif. **Contact:** Andy Kappel, 6406 Walnut St., Kansas City, MO 64113.

### 11th Bomb Group

The 11th Bomb Group will hold a reunion September 9-13, 1992, in Tulsa, Okla. **Contact:** Robert E. May, P. O. Box 637, Seffner, FL 33584. Phone: (813) 681-3544.

### 21st Air Depot Group

Veterans of the 21st Air Depot Group will hold a reunion September 4-5, 1992, at the Radisson Inn in Dayton, Ohio. **Contact:** James Campbell, 20 Chelsea St., Staten Island, NY 10307. Phone: (718) 984-2362.

### 22d Bomb Squadron

The 22d Bomb Squadron will hold a reunion September 17-19, 1992, in Rapid City, S. D. **Contact:** David K. Hayward, 6552 Crista Palma Dr., Huntington Beach, CA 92647.

### 33d Air Depot Group

The 33d Air Depot Group will hold a reunion October 1-4, 1992, in Warner Robins, Ga. **Contacts:** Herbert L. Cooper, 643 Reynosa Ct., Berea, OH 44017. Phone: (216) 234-9007. Robert W. Gochol, 10280 Pendery Dr., Cincinnati, OH 45242. Phone: (513) 891-7742.

### 34th Air Depot Group

Veterans of the 34th Air Depot Group will hold a fiftieth-anniversary reunion October 7-10, 1992, in San Bernardino, Calif. **Contact:** Joseph D. Myers, 2729 Ostrom Ave., Long Beach, CA 90815-1604. Phone: (310) 421-2166.

### 37th Fighter Squadron

Veterans of the 37th Fighter Squadron will hold a reunion October 4-8, 1992, at the Holiday Inn Market Square in San Antonio, Tex. **Contact:** Leslie E. Knapp, 9819 Gemini Dr., San Antonio, TX 78217. Phone: (512) 655-0908.

### 39th Fighter Squadron

Veterans of the 39th Fighter Squadron will hold a reunion September 30-October 2, 1992, at the Hilton Hotel in Dayton, Ohio. All 40th/41st Fighter Squadron and 561st Tactical Fighter Squadron personnel are welcome. **Contacts:** Nick Fallier, 1311 Piedmont Dr., Tallahassee, FL 32312. Phone: (904) 385-6037. Roy Seher, P. O. Box 352, Hydenville, CA 95547. Phone: (707) 768-3573.

### 39th Troop Carrier Squadron

The 39th Troop Carrier Squadron (World War II) will hold a reunion October 8-11, 1992, in San Antonio,

**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.**

**Tex. Contact:** Col. Russell E. Klingensmith, USAF (Ret.), 9121 Sundew Cir., Garden Ridge, TX 78266. Phone: (512) 651-6477.

### Class 42-D

Cadet Class 42-D (Stockton Field, Calif.) will hold a reunion September 22-24, 1992, on the *Delta King* riverboat in Sacramento, Calif. **Contact:** Bill Hartley, 5020 Winding Way, Sacramento, CA 95841. Phone: (916) 489-0294 or (916) 489-8742.

### Class 45-A

Members of Class 45-A (Enid Field, Okla.) will hold a reunion October 20-22, 1992, in San Antonio, Tex. **Contacts:** Frank Therrell, 3303 Shady Cove, Tyler, TX 75707. Phone: (903) 566-2616. Col. Jack Nuding, USAF (Ret.), 8617 Utica St., Lubbock, TX 79424. Phone: (806) 794-4377.

### 55th Strategic Recon Wing

The 55th Strategic Reconnaissance Wing will hold a reunion in conjunction with the fiftieth anniversary of the B-29 celebration on August 12-15, 1992, at the Westin Hotel in Seattle, Wash. **Contact:** Bruce M. Bailey, 1611 S. Aida Ave., Tucson, AZ 85710.

### Class 63-B

Members of Undergraduate Pilot Training Class 63-B (Moody AFB, Ga.) are planning to hold a thirtieth-anniversary reunion September 11-12, 1992, in Valdosta, Ga. Former students and instructors are invited. **Contact:** Lt. Col. Carl Hye-Knudsen, Jr., USAF (Ret.), P. O. Box 219, Kinsale, VA 22488. Phone: (804) 472-4223.

### 74th Tac Recon Group

The 74th Tactical Reconnaissance Group, including the 5th, 11th, 13th, and 22d Tactical Reconnaissance Squadrons, will hold a reunion October 16-18, 1992, at the Embassy Suites Hotel in Scottsdale, Ariz. **Contact:** Ed "Pappy" Hughes, 4310 E. St. Joseph Way, Phoenix, AZ 85018-1157. Phone: (602) 952-1320.

### 89th Troop Carrier Group

The 89th Troop Carrier Group will hold a reunion September 17-19, 1992, in Colorado Springs, Colo. **Contact:** Wayne Taylor, 5015 S. W. 20th Terrace, Topeka, KS 66604. Phone: (913) 272-2584.

### 95th Bomb Group

Veterans of the 95th Bomb Group (World War II) will hold a reunion September 15-19, 1992, in Boston, Mass. **Contact:** David Dorsey, 125 Clark St., Clarks Green, PA 18411. Phone: (717) 587-2290.

### 264th Combat Communications Squadron

Veterans of the 264th Combat Communications Squadron/318th Signal Company and the 106th Communications Squadron will hold a reunion October 16, 1992. **Contact:** MSgt. Irma Dobson, Illinois ANG, 264th Combat Communications Squadron, O'Hare International Airport, P. O. Box 66911, Chicago, IL 60666-0911. Phone: (312) 825-6958. DSN: 930-6958.

### 301st Veterans Ass'n

The 301st Veterans Association will hold a reunion September 17-20, 1992, in Spokane, Wash. **Contact:** Frank Madden, E. 10601 Nixon Ln., Spokane, WA 99206. Phone: (509) 924-6497.

### 312th Bomb Group

Veterans of the 312th Bomb Group will hold a reunion October 1-4, 1992, at the Westin Hotel-Williams Center in Tulsa, Okla. **Contact:** Ralph Trout, P. O. Box 542, Claremore, OK 74018. Phone: (918) 341-3231.

### 315th Bomb Wing

Veterans of the 315th Bomb Wing will hold a reunion August 12-15, 1992, in Seattle, Wash. **Contact:** Col. George E. Harrington, USAF (Ret.), 3165 N. Atlantic Ave., Cocoa Beach, FL 32931. Phone: (407) 784-0342.



### 318th Troop Carrier Squadron

Veterans of the 318th Troop Carrier and 343d Air-drome Squadrons will hold a reunion October 19-22, 1992, in Las Vegas, Nev. **Contact:** Robert C. Thompson, 608 St. Andrews Way, Lompoc, CA 93436.

### 319th Bomb Group

Veterans of the 319th Bomb Group will hold a fiftieth-anniversary reunion September 4-6, 1992, at the Airport Marriott Hotel in Long Beach, Calif. **Contact:** Joe Madrano, 8308 Springtown, Converse, TX 78109. Phone: (512) 659-4237.

### 325th Air Service Group

Veterans of the 325th Air Service Group, which included the 328th and 343d Air Service Squadrons, will hold a reunion September 25-26, 1992, in Wichita, Kan. **Contact:** John Watts, 4132 Jasmine Ct., Willow Bend, Wichita, KS 67226. Phone: (316) 636-2067.

### 348th Fighter Group

Veterans of the 348th Fighter Group, which included the 340th, 341st, 342d, and 460th Fighter Squadrons, 5th Air Force (World War II), will hold a reunion September 24-27, 1992, at the Menger Hotel in San Antonio, Tex. **Contact:** C. L. Osborn, Rte. 4, Box 4748, Lake Hill, TX 78063. Phone: (512) 751-2654.

### 375th Troop Carrier Group

Veterans of the 375th Troop Carrier Group, which included the 55th, 56th, 57th, and 58th Troop Carrier Squadrons (World War II), will hold a reunion October 1-4, 1992, at the Holiday Inn Downtown/Riverfront in St. Louis, Mo. **Contact:** Lt. Col. Eugene A. Diemand, USAF (Ret.), 625 S. Wheaton Ave., Wheaton, IL 60187. Phone: (708) 668-9575.

### 381st Bomb Group

Veterans of the 381st Bomb Group will hold a reunion September 8-13, 1992, in San Diego, Calif. **Contact:** Frank Sexton, 5232 Mount Alian Dr., San Diego, CA 92111. Phone: (619) 279-6724.

### 384th Bomb Group

Veterans of the 384th Bomb Group will hold a reunion September 10-13, 1992, in Irvine, Calif. **Contact:** Frederick Nowosad, P. O. Box 1021A, Rahway, NJ 07065.

### 437th Troop Carrier Group

Veterans of the 437th Troop Carrier Group will hold a reunion September 16-20, 1992, at the Stouffer Center Plaza Hotel in Dayton, Ohio. **Contact:** Bob Maycan, 360 Walker Ave., Greenacres City, FL 33463. Phone: (407) 965-1145.

### 451st Bomb Group

Veterans of the 451st Bomb Group are planning to hold a reunion September 16-20, 1992, in Irvine, Calif. **Contact:** Robert Karstensen, 1032 S. State St., Marengo, IL 60152. Phone: (815) 568-7766.

### 464th Bomb Group

The 464th Bomb Group, 15th Air Force, will hold a reunion August 12-16, 1992, in Duluth, Minn. **Contact:** Frank Rekucci, P. O. Box 174, Hill City, MN 55748. Phone: (218) 697-8331. Fax: (218) 697-8286.

### 465th Troop Carrier Wing

**CORRECTION:** The unit designation used in the April 1992 issue, 456th Troop Carrier Wing, was incorrect. The correct unit is the 465th Troop Carrier Wing, which included the 780th, 781st, and 782d Troop Carrier Squadrons. The reunion will be held as reported September 25-27, 1992, at the Elk Creek Lodge in Black Hills, S. D. **Contact:** Lt. Col. Gerald E. Teachout, USAF (Ret.), HCR 80, Box 766, Piedmont, SD 57769-9520. Phone: (605) 787-4560.

### 585th Bomb Squadron

Veterans of the 585th Bomb Squadron will hold a reunion September 23-27, 1992, at the Marc Plaza Hotel in Milwaukee, Wis. **Contact:** Tom O'Brien, 1907 Rio Vista Dr., Fort Pierce, FL 34949. Phone: (407) 465-7974.

### 1881st Engineer Aviation Battalion

The 1881st Engineer Aviation Battalion will hold a

reunion September 10-14, 1992, in St. Louis, Mo. **Contact:** Norman Johnson, 1944 Kinnard St., St. Paul, MN 55109. Phone: (612) 777-0158.

### 4412th WAF Squadron

Members of the 4412th WAF Squadron who served at Langley AFB, Va., between 1950 and 1952 will hold a reunion September 25-27, 1992, at Langley AFB, Va. **Contact:** Edith H. Garretson, 747 Black Stallion Rd., Clayton, DE 19938.

### 7330th Flying Training Wing

The 7330th Flying Training Wing stationed at

Fürstenfeldbruck AB, West Germany, will hold a reunion October 1-4, 1992, at the Handlery Hotel in San Diego, Calif. **Contact:** Father William L. Travers, American Embassy Bonn, Box 270, APO AE 09080.

### Class 42-G

Seeking members of Southeast Training Command Class 42-G interested in a reunion. **Contacts:** John T. Foster, 110 Arch St., Keene, NH 03431. Phone: (603) 352-5772. Dick Hurd, RD 2 Box 150, Plainfield, VT 05667. Phone: (801) 454-8335.

## Bulletin Board

Seeking contact with **George Smith**, who served with the 101st Airborne Division at Swindon, England, in 1939-45. **Contact:** S. G. Jones, 1 Isca Close, Tudor Park, Ross on Wye, Herefordshire HR9 5UH, England.

Seeking correspondence with personnel who participated in **Arc Lite** (September 1966 to 1970), **Bullet Shot II** (September 1972 to February 1973), and **Blue Straw/Blue Shield** (September to December 1965). **Contact:** Thomas W. Young, Sr., USAF (Ret.), 830 W. Amsden St., Denison, TX 75020-7929.

For a paper on aircraft armament from 1939 to 1955, I am seeking **armament personnel** who are familiar with the terms "headspace," "T-slot," and "overtravel," and are willing to answer a question-

naire. **Contact:** MSgt. Chuck Baisden, USAF (Ret.), 109 Wales Ct., Savannah, GA 31410-3410.

Seeking contact with **Sergeant Rogers**, who befriended a group of children from Barnardo's who were evacuated to Little Bardfield, North Essex, England, in 1941. After the war he became a priest. **Contact:** Charles Holden, Barnardo's Appeals Department, Tanners Ln., Barkingside, Ilford, Essex IG6 1QG, England.

Seeking nose art of any B-17 with the **305th Bomb Group**, 40th Combined Bomb Wing, 1st Bomb Division, that took part in Mission 115 to Schweinfurt, Germany, on October 14, 1943. I am also seeking information on a B-17 of the **43d Bomb Group** stationed at Dobodura, New Guinea, and piloted by Capt. Jay Zeamer, Jr., on a reconnaissance mission

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over Buka in the Solomon Islands, June 16, 1943. **Contact:** Jeff Handwerker, 2520 E. 7th St., #27, Stillwater, OK 74074.

Seeking contact with the following members of the 6901st Special Communications Group at Zweibrücken, Germany, in 1964-66: **David McMillan**, Elmira, N. Y.; **Hugh Boggs**, Peoria, Ill.; **Jerry Giles**, Scranton, Pa.; and **Norman Prather**, Iota, La. **Contact:** Val G. McIntire, 4987 N. 500 E., Marion, IN 46952.

Collector seeks used **US postage stamps**, both on and off paper. Surplus will be donated to VA Hospitals. **Contact:** Marvin Beisel, P. O. Box 433, Maiden, NC 28650.

Seeking information on **Charles Drew**, who was stationed with USAAF in Longview, Liverpool, England, in 1945 and whose last known address was in Philadelphia, Pa. **Contact:** Pat Wright, 14 Prestwood Crescent, Dovecot, Liverpool L14 2ED, England.

Seeking contact with **Sgt. Donald Davis** and other NCOs in the **2057th Radio Relay Squadron** stationed at Rothwesten Army Base, West Germany, in 1960-63. **Contact:** SSgt. William B. Lott, USAF (Ret.), 101 Valley Dr., Hattiesburg, MS 39402.

Collector seeks colored and subdued **patches** from SOS, ARRS, TACP, and PRS. **Contact:** Joel B. Paskauskas II, 40 Hapgood Rd., Worcester, MA 01605-3803.

Seeking contact with the following crew members from the 452d Bomb Group, 8th Air Force: copilot **2d Lt. Gerald D. Martini**, La Mesa, Calif.; navigator **2d Lt. John C. Duffey**, Philadelphia, Pa.; and bombardier **2d Lt. Donald Charbonneau**, Joliet, Ill. **Contact:** Larry H. Cogswell, P. O. Box 561, Farm Ln., West Newbury, MA 01985.

Collector seeks **patches** and color photos of F-16s, A-10s, and F-14s in various color schemes (especially aggressor squadron and "Lizard"). **Contact:** Doug Erasmus, P. O. Box 230, Pietermaritzburg 3200, South Africa.

Seeking models and photos of the **AGM-28 "Hound Dog" missile**. Also seeking photos of B-25 aircraft assigned to the Pilot School, Instrument, Barksdale AFB, La., in 1948-49. **Contact:** MSgt. Raymond K. Woodland, USAF (Ret.), 11318 Cotillion Dr., Dallas, TX 75228.

Seeking contact with **Sanroy or Eileen Lebert**, possibly from Louisiana. Sanroy was the radar officer for the 387th Bomb Group. They were married in Enfield, England, in 1944. **Contact:** Ted Rynard, 3505 69th St. W., Bradenton, FL 34209.

Seeking contact with **Sgt. James Clement** and his wife **Hazel**. They were stationed at RAF Sculthorpe, England, until 1956. **Contact:** Sandra M. (Heap) Bernhardt, Owers Hollow, Lakeside Close, Parson Drove, Wisbech, Cambridgeshire PE13 4LL, England.

Seeking contact with personnel from the **305th Bomb Wing**, Bunker Hill AFB, Ind., involved with B-58 bomber alert operations during the October 1962 Cuban missile crisis. **Contact:** Scott D. Sagan, Dept. of Political Science, Stanford University, Stanford, CA 94305.

Seeking information on the pilot of the P-47 **Hunter**, from Foggia, Italy. The plane had a large "40" on the fuselage behind the trailing edge of the wing. **Contact:** Col. Henry W. Brown, USAF (Ret.), 2389 Mt. Vernon Dr., Sumter, SC 29154.

Seeking two World War II jacket patches for the **4007th Bomb Squadron** and the **507th Parachute Infantry**. **Contact:** SMSgt. Larry Brooks, 1300 Military Rd., Lincoln, NE 68508-1090.

For a history of the **Air Force Flight Test Center** at Edwards AFB, Calif., I am seeking contact with former flight-test engineers and pilots. **Contact:** Steve Pace, 6501 E. I St., Tacoma, WA 98404.

Seeking contact with **Lt. W. "Bill" Adams**, who served with 630 Squadron of the Royal Air Force flying Lancasters in 1944-45. He was shot down in July 1944 on an operation to Stuttgart, Germany, but evaded capture and returned to England. **Contact:** Les "Jim" Ovens, 28 Abinger Close, Cann Hall, Clacton-on-Sea, Essex CO16 8FJ, England.

Seeking contact with members of B-26 crew 477 of the **440th Bomb Squadron**, 319th Bomb Group, 12th Air Force, serving in Sardinia and Corsica in World War II. The crew was formed in Shreveport, La. **Contact:** Jack H. Berger, 65 E. 80th St., New York, NY 10021.

The **Veterans of Underage Military Service** is trying to contact all who served in the US military for any length of time under the age of seventeen. A reunion will be held in Las Vegas, Nev., in October. **Contact:** Allan C. Stover, 3444 Walker Dr., Ellicott City, MD 21042.

Seeking information on the April 9, 1952, **crash of a JAL Martin 202** near Mount Mihara, Japan. All aboard were killed, including US pilots Charles Stewart and William Clevenger, employees of Transocean Air Control tower at Johnson AFB, Japan. **Contact:** Barbara E. Joe, 720 A St. S. E., Washington, DC 20003.

For possible publication, I am seeking contact with **World War II flight officers**. I am interested in your reactions to your appointment (positive or negative) and any effects on your military career. **Contact:** Martin L. Cook, 6010 2d St. N. W., Washington, DC 20011.

Seeking the whereabouts of **Earl Lucas Tate**, who was stationed with Det. 2, 6910th Security Wing, Camp Pieri, West Germany (near Wiesbaden), about 1966-68. **Contact:** Don Cork, 13491 Brighton Dam Rd., Clarksville, MD 21029.

The Oregon Parks and Recreation Department is preparing a history and would like to contact Air Force personnel who were stationed at **Fort Stevens**, near Hammond, Oregon. The 759th AC&W Squadron was there from 1948 to 1951, and a SAC radar bomb scoring unit was there from 1952 to 1965. **Contact:** Col. Joel B. Krausse, AFRES (Ret.), 1833 S. W. Laurel St., Portland, OR 97201.

Seeking contact with **Harold Peterson**, radar operator, and **Warren Thompson**, tail gunner, members of Bill Ground's B-29 crew of the 6th Bomb Group, who served on Tinian in 1944-45, were shot down March 28, 1945, and were known to survive

POW camp. **Contact:** Virgil Morgan, 2719 Pacific Ave., Everett, WA 98201.

Researcher seeks information, photos, and contact with personnel associated with the **Douglas C-133 Cargomaster**. **Contact:** Steve Tobey, 2604 Echo Point Dr., Fort Worth, TX 76123.

Seeking contact with **TSgt. James Avery** or any other personnel stationed at Thule AB, Greenland, between August 1955 and July 1956. **Contact:** Maj. William M. Sage, USAF (Ret.), 48 Shakerhouse Rd., Yarmouthport, MA 02675-1926.

Seeking a patch from the **38th Bomb Group**, 5th Air Force, World War II. **Contact:** Billy Ace Baker, 10819 Berryhill Rd., Pensacola, FL 32506.

Seeking contact with members of **Capt. Raymond L. Kuhlman's** WB-50 crew of the 57th Weather Reconnaissance Squadron. Also seeking a copy of *5-4-3-2-1 Pft*, by Col. William C. Anderson. **Contact:** SMSgt. Ira A. Van Orsdal, 1735 Black Ankle Rd., Cherrylog, GA 30522-9715.

Seeking information on **John E. Pross**, a B-25 pilot with the 77th Bomb Squadron, 11th Air Force, stationed on Attu, Aleutian Islands, from January to October 1945. He lived in Denver, Colo., after the war. **Contact:** Dale R. Luttmann, 1209 S. DeSpelder #5, Grand Haven, MI 49417.

Seeking contact with members of **bomber crews shot down over Czechoslovakia** on August 29, 1944: B-17s of the 20th Bomb Squadron, 2d Bomb Group, 5th Bomb Wing, 15th Air Force, based at Amendola, Italy; B-17s from the 429th and 49th Bomb Squadrons; and B-24s from the 454th Bomb Squadron. **Contact:** Michael Sisovsky, St. Hrozenkov 261, Okr. Uh. Hradiste 68774, Czechoslovakia.

Seeking contact with **SSgt. T. William McClery**, who served in Japan until 1949 or 1950 where he knew Kazuko Nishimura. He had a brother, James, who was killed in action in Europe during the war. **Contact:** Jimmy D. Nishimura, 24311 San Fernando Rd., Newhall, CA 91321.

Seeking information on the service career of **L. E. "Randy" Tolbirt** to provide documentation of service for his children and grandchildren. He trained at Bergstrom AFB, Tex., in 1944, flew C-47s in October 1944, the MC-109-E in May 1945, and B-25s in Europe in June 1945. **Contact:** Charlie and Billie Rankin, 500 Wichita #12, McAllen, TX 78503-3093.

Seeking contact with **Robert Kirwan**, who was stationed near Swindon, England, in 1942-44, where he knew the Gerlach family. **Contact:** Linda E. Duckhouse, 5 Meadway, Staines, Middlesex TW18 2PW, UK.

Author seeks photos and information on **nose art in the Vietnam War**—any unit, any aircraft type. **Contact:** Larry Davis, Squadron-Signal Publications, 4713 Cleveland Ave. N. W., Canton, OH 44709.

Seeking to trade USAF **patches and decals**. I am especially interested in memorabilia related to A-10s. **Contact:** Anthony G. Abbott, PSC 76 Box 6484, APO AP 96319-6484.

Seeking the whereabouts of **Larry Starlight** from Brooklyn, N. Y., who was at Irumagawa AAB, Japan, with Headquarters 5th Air Force from November 1945 to March 1946. **Contact:** John Winner, 1510 Garfield Ave., Dubuque, IA 52001.

Seeking contact with any World War II airmen, American or British, who had any connection with the **Mosquito**, RAF's fighter-bomber. An association has been formed to commemorate the Mosquito. **Contact:** Peter R. Gilliam, 82319 Cochran Dr., Indio, CA 92201.

**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 information on the whereabouts of **Richard F. Castell**, who served with Det. 2, 10th Consolidated Aircraft Maintenance Squadron, at Bruninhorpe, Leicestershire, England, in November 1959. **Contact:** Janet Whysall, 13 Westfield Rd., Kirkby in Ashfield, Nottinghamshire NG17 9DE, England.

Seeking posters of the following aircraft: F-4 Phantom, F-5 Tiger, F-14 Tomcat, F-15 Eagle, F-16 Falcon, F/A-18 Hornet, F-20 Tigershark, FB-111, F-117, AV-8, B-1, B-2, B-52, C-17, C-5 Galaxy, C-141 StarLifter, C-130 Hercules, and SR-71 Blackbird. **Contact:** Reynaldo J. Pagsanjan, St. Pelipe Subd. Neptune, St. Mojon, Malolos, Bulacan 3000, the Philippines.

Seeking contact with the following people who were at Hill AFB, Utah, in 1977-78: **1st Lt. Stephen K. Lechlopp**, **A1C Daniel Weldon**, **SSgt. Harold A. Busse**, and **Yvonne R. Day**. **Contacts:** Walter F. MacDonald, Jr., 1231 29th St. Rd., Apt. 110, Greeley, CO 80631 or c/o Bob Adams, 10 Ocean View Ave., Mattapoisett, MA 02739.

Seeking contact with **Maj. Francis K. Wood, Jr.**, from Taunton, Mass., former commander of the 2146th AAF Base Unit, Contract Primary School, Darr Aero Tech, Albany, Ga. He was in Class 41-E there, then commander from March 1943 to closing in January 1945. **Contact:** Gordon B. Wheeler, 105 Highgate Rd., Ithaca, NY 14850.

Seeking contact with personnel of the **61st Station Complement Squadron**, 466th Bomb Group, in England during World War II. **Contact:** Paul J. Gomez, 6129 Marshal Foch St., New Orleans, LA 70124.

Seeking contact with **Lt. Philip Osborne**, Class 43-1, Foster Field, Tex. He served in Hawaii in 1943-44, then with 13th Air Force at Guadalcanal. **Contact:** Joseph Bricola, 264 Mountain Way, Rutherford, NJ 07070.

Seeking whereabouts of members of **Bedford High School Class of 1967** who were dependents of Air Force personnel stationed at nearby Hanscom AFB, Mass. **Contact:** Marilyn (White) Cunningham, 209 School St., Acton, MA 01720-4432.

Seeking contact with **Gillian Cooke** and her husband **MSgt. Tommy Cooke**. Their last known address (in 1967-68) was in Sugarland, Tex. **Contact:** Jayne (Watson) Gilbert, Springfield, 1B Oak Tree Dr., Totteridge, London N20 8QJ, England.

Researcher seeks F-4C tail letters, nose art, and intake markings of the following **Phantoms that shot down MiG-21s** on these dates: April 26, 1966, **Maj. Paul Gilmore** and **Lt. William T. Smith**, 480th Tactical Fighter Squadron, 35th TFW; April 26, 1967, **Maj. Rolland W. Moore** and **1st Lt. James F. Sears**, 389th TFS, 366th TFW. **Contact:** John J. Maene, Jr., 46 Llewellyn Ave., Hawthorne, NJ 07506.

Seeking correspondence with personnel who participated in **Operation Blue Straw/Blue Shield**, especially those involved from September to December 1965, when CMSgt. Keith Knighton was the operations superintendent. **Contact:** Thomas W. Young, Sr., 830 W. Amsden St., Denison, TX 75020-7929.

Seeking contact with anyone who knew my father, **1st Lt. James F. Tostevin**, a pilot in the 14th Photoreconnaissance Squadron who was declared MIA January 15, 1945, and later reported KIA. **Contact:** Jim Tostevin V, P. O. Box 11766, Marina Del Rey, CA 90295.

Seeking contact with **Lt. H. Rogers**, forward air controller, and **Sgt. W. Brown**, both of the 6150th Tactical Control Squadron, directing air strikes on Old Baldy in 1951-52. **Contact:** Maj. John D. Murray, USAF (Ret.), P. O. Box 66, Jay, NY 12941.

Seeking information on these Americans who served in the Royal Air Force or Royal Canadian Air Force: **John H. Curry**, **Ripley O. Jones**, **John J. Lynch**, and **James E. Peck**. **Contact:** Robert H. Barnes, 35 Golden Ave. Apt. 22A, Battle Creek, MI 49015. ■

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**Expedited Claim Service:** Depending on the amount of coverage, a draft of up to \$5,000 can be issued immediately to the insured person's beneficiary on the same day as proof of death is received at AFA. Benefits beyond this initial draft amount will be issued in one of two forms: for remaining benefits of at least \$10,000, a Total Control Account checkbook will be issued to the beneficiary to enable him or her to have immediate access to the death benefit without the worry of having to find a secure haven for the funds. The account will bear an attractive rate of interest, accrued from the date of the insured's death, and no delay in payment of benefits will result from this approach. For remaining benefits of less than \$10,000, a traditional benefit draft will be provided promptly to the beneficiary.

**Disability Waiver Of Premium:** If, while insured and under the age of 60, you become totally disabled, coverage will be continued in force upon approval by MetLife. No further premium will be due for the duration of the disability, or until you reach the limiting age under the plan.

**Conversion Privilege:** At age 65, when coverage reduces, or at age 80, when it terminates, you may convert this insurance within 31 days of the then-current premium due date to any permanent plan of insurance then being offered by MetLife, regardless of your health at that time. The amount of your coverage may not be greater than the amount of your coverage under the group plan at the time of conversion.

**Limitation:** Benefits under this policy will not be effective if death results from intentionally self-inflicted injuries, whether the insured person is sane or insane, within one year from the date the insurance on that person becomes effective, or, with respect to increased amounts of insurance only, one year from the effective date of such increase. Additionally, the plan provides a reduced benefit (equal to 50 percent of the level term life insurance benefit in force) for members under age 35 who are killed in an aviation accident while operating the aircraft involved.

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### Premium Rate Schedule

Premiums shown are for each \$20,000 unit of coverage. Up to twelve (12) units of coverage may be requested.

Premium Rate Schedule (per \$20,000 unit of coverage)				
Attained Age	Monthly*	Quarterly	Semi-Annual	Annual
20-24	\$ 1.16	\$ 3.48	\$ 6.96	\$ 13.92
25-29	1.32	3.96	7.92	15.84
30-34	1.84	5.52	11.04	22.08
35-39	2.52	7.56	15.12	30.24
40-44	4.00	12.00	24.00	48.00
45-49	6.68	20.04	40.08	80.16
50-54	10.00	30.00	60.00	120.00
55-59	14.32	42.96	85.92	171.84
60-64	22.16	66.48	132.96	265.92
65-69	50.00	150.00	300.00	600.00
70-74	80.00	240.00	480.00	960.00
75-79	100.00	300.00	600.00	1,200.00



\*Only by government allotment or by automatic payments to an AFA/VISA or MasterCard account.





# Application for AFA

## AFA LEVEL TERM LIFE INSURANCE

Name (print) Last			First	Middle	<input type="checkbox"/> Male <input type="checkbox"/> Female	Group # <b>74571</b>	
Address		Street	City	State	Zip Code		
Date of Birth		Height	Weight	Social Security #	Daytime Phone #	Flying Status <input type="checkbox"/> Yes <input type="checkbox"/> No	
Mo.	Day	Year					
Primary Beneficiary (Name and Relationship) _____							
Contingent Beneficiary (Name and Relationship) _____							
Requested Amount of Coverage _____ (units) X \$20,000 = \$ _____ (amount of coverage)							
<b>Method and Amount of Payment</b>							
<input type="checkbox"/> <b>Monthly</b>							
<input type="checkbox"/> Governmental Allotment (check here but compute quarterly payment (below) and submit with application); Instructions for requesting allotment will be sent with [policy] certificate.							
<input type="checkbox"/> AFA/VISA/MASTERCARD credit card (Send no payment with application) Card # _____ Expire Date _____							
<input type="checkbox"/> Quarterly		}	\$	Using the Premium Rate Schedule, indicate the premium rate per unit of coverage based on your current age and requested frequency of payments.			}
<input type="checkbox"/> Semi-Annually							
<input type="checkbox"/> Annually							
_____ (units) X \$ _____ (premium rate per unit of coverage—see above) = \$ _____ (premium amount).							
1.	Have you been hospitalized during the preceding 90 days?					<input type="checkbox"/> Yes <input type="checkbox"/> No	
2.	In the past three years, have you received treatment or been told you had					<input type="checkbox"/> Yes <input type="checkbox"/> No	
	a) Cancer, Leukemia, Hodgkins Disease, or other associated malignancies?					<input type="checkbox"/> Yes <input type="checkbox"/> No	
	b) Heart Disease, stroke, or other related cardiovascular disease?					<input type="checkbox"/> Yes <input type="checkbox"/> No	
3.	Within the past two years, have you had persistent cough, pneumonia, chest discomfort, muscle weakness, unexplained weight loss of ten pounds or more, swollen glands, patches in mouth, visual disturbance, recurring diarrhea, fever, or infection?					<input type="checkbox"/> Yes <input type="checkbox"/> No	
4.	Has any application made by you for Life or Health insurance been declined, postponed, or issued other than as applied for?					<input type="checkbox"/> Yes <input type="checkbox"/> No	
5.	Are you receiving, entitled to receive or would be entitled to receive upon timely application any benefits due to sickness or injury (other than medical expense benefits) under any private policy or plan or governmental program whether insured or non-insured?					<input type="checkbox"/> Yes <input type="checkbox"/> No	
If you answered "Yes" to any of the above questions, please give details, dates, diagnosis, treatment, and name and address of the health care provider(s) and hospital(s). Use additional sheet of paper if necessary.							
Information in this application, a copy of which shall be attached to and made a part of my certificate when issued, is given to obtain the plan requested and is true and complete to the best of my knowledge and belief. I agree that no insurance will be effective until a certificate has been issued and the initial premium paid. I understand that coverage will not become effective until approved by MetLife.							
I understand that if on the Effective Date I am not eligible for such insurance by reason of (i) age or (ii) membership status, insurance will not become effective on my life.							
"Hospitalized" means inpatient confinement for: hospital care, hospice care or care in an intermediate or long term care facility. It also includes outpatient hospital care for chemotherapy, radiation therapy, or dialysis treatment.							
Authorization to Furnish Medical Information							
For underwriting and claim purposes, I hereby authorize any physician or other medical practitioner, hospital, clinic, other medically related facility, insurance company, or other organization to furnish MetLife, on my behalf, with information in his or its possession, including the findings, relating to medical, psychiatric or psychological care, or examination, or surgical treatment given to the undersigned. This authorization shall be valid for two years. A photocopy of this authorization shall be considered as effective and valid as the original.							
Member Signature						Date	
		Send application with remittance to: Insurance Division, AFA, 1501 Lee Highway, Arlington, Virginia, 22209-1198. 4571-G1-MetLife					

FORM 3922 GL APP. (Rev. 11/91)

7/92

**PLEASE RETAIN THIS MEDICAL INFORMATION FOR YOUR RECORDS**  
MetLife's Consumer Privacy Notice—Information Practices

**The Underwriting Process:** MetLife (hereinafter "we") will evaluate the information given by you on this enrollment form and tell you if we cannot give you the coverage you asked for. We will also tell you in general terms the reason for our decision. Upon written request, more specific reasons will be given to you.

**Information Collection:** This enrollment form is our main source of information. To properly evaluate your request for coverage, we obtain additional medical data from third parties about any person to be insured. For instance, we may ask physicians, hospitals, or medical care providers to confirm or add to the medical data you have given us.

**Information Disclosure:** In most cases, the information we have about you will be sent to third parties only if you authorize us to do so. In some cases where disclosure is required by law or necessary for the conduct of our business, we may send the information to third parties without your consent.

**Access and Correction Information:** Upon written request, we will make information we have about you available to you. You have certain access and correction rights with respect to the information about you in our files.

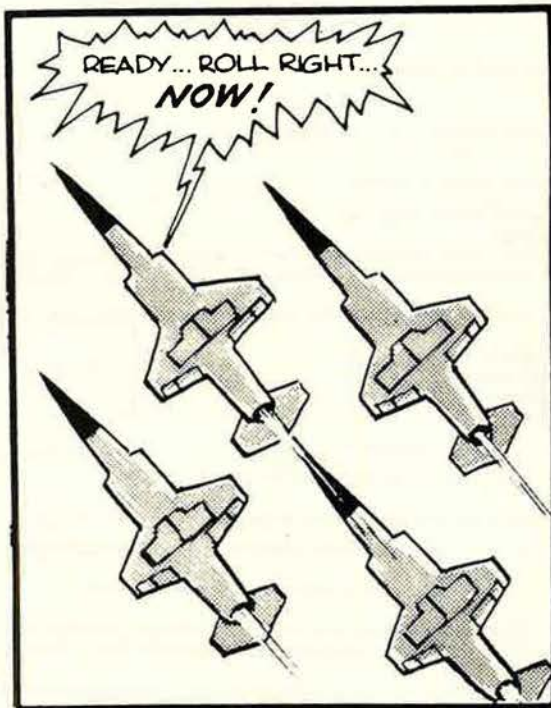
**Further Information About Our Practices:** Upon written request, we will send you more information about our underwriting process and your access and correction rights. Also, upon your written request, we will give you more information about the circumstances under which we will disclose the information about you to third parties without your authorization. Please write MetLife at the following address about these matters.



Bob Stevens'

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*Bob Stevens*





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AIWS fit check on F-15E

**AN EXPERIENCED, COMMITTED TEAM** TI is a recognized leader in designing and producing high volume, low cost tactical weapons. These systems were proven under fire, since a majority of the smart weapons employed during "Desert Storm" were developed and produced by TI.

The Texas Instruments team has combined resources and experience to offer U.S. Armed Forces a low risk, low cost Joint Standoff Weapon system – JSOW – program. This design meets the requirements for standoff, lethality, and aircraft survivability. And it exceeds the required performance specifications. The modular baseline design allows low risk growth to P3I, and maximizes supportability.

**BEST VALUE** JSOW adds a new dimension to Air Force, Navy and Marine Corps strike warfare capability by providing:

- Standoff outside point defenses
- All weather, day/night delivery capability
- Non-line-of-sight weapon delivery
- Target-hit accuracy beyond requirements
- Simplified mission planning

**LOW RISK, DEM/VAL TO PRODUCTION** The TI team has

been selected for the JSOW Engineering and Manufacturing Development. Extensive risk reduction efforts were conducted on all facets of the design. This includes free-flight, submunition dispensing, mission planning and wind tunnel.



JSOW Dynamic Submunition Dispense Test

Texas Instruments – leading the team for JSOW development and production.

 **TEXAS INSTRUMENTS**

01-JSW-922



