

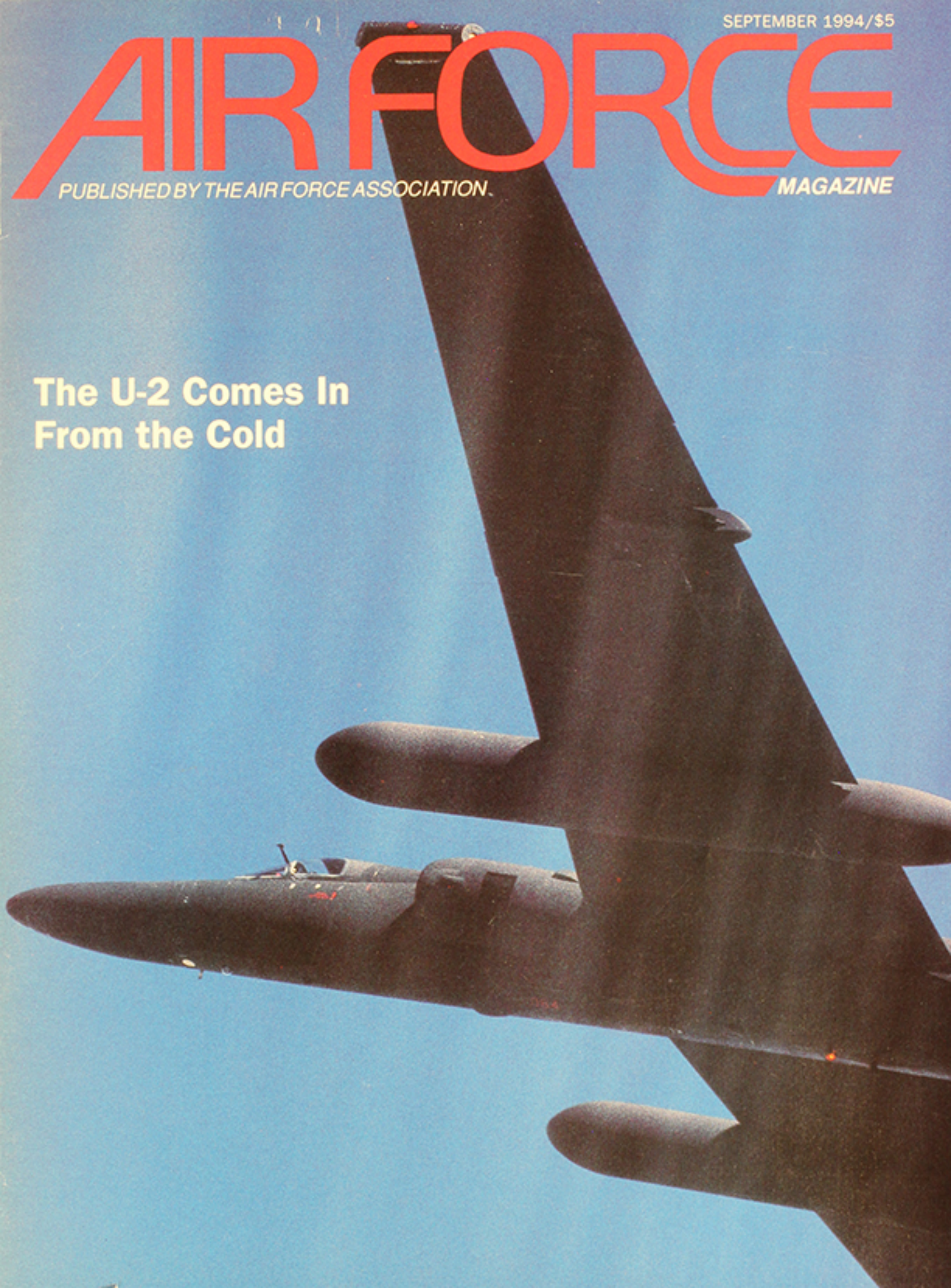
SEPTEMBER 1994/\$5

AIR FORCE

PUBLISHED BY THE AIR FORCE ASSOCIATION.

MAGAZINE

**The U-2 Comes In
From the Cold**





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About the Cover: A U-2R from the 1st Reconnaissance Squadron, 9th Reconnaissance Wing, Beale AFB, Calif., climbs into the sky above northern California. See "The U-2 Comes In From the Cold," p. 44. Staff photo by Guy Aceto.

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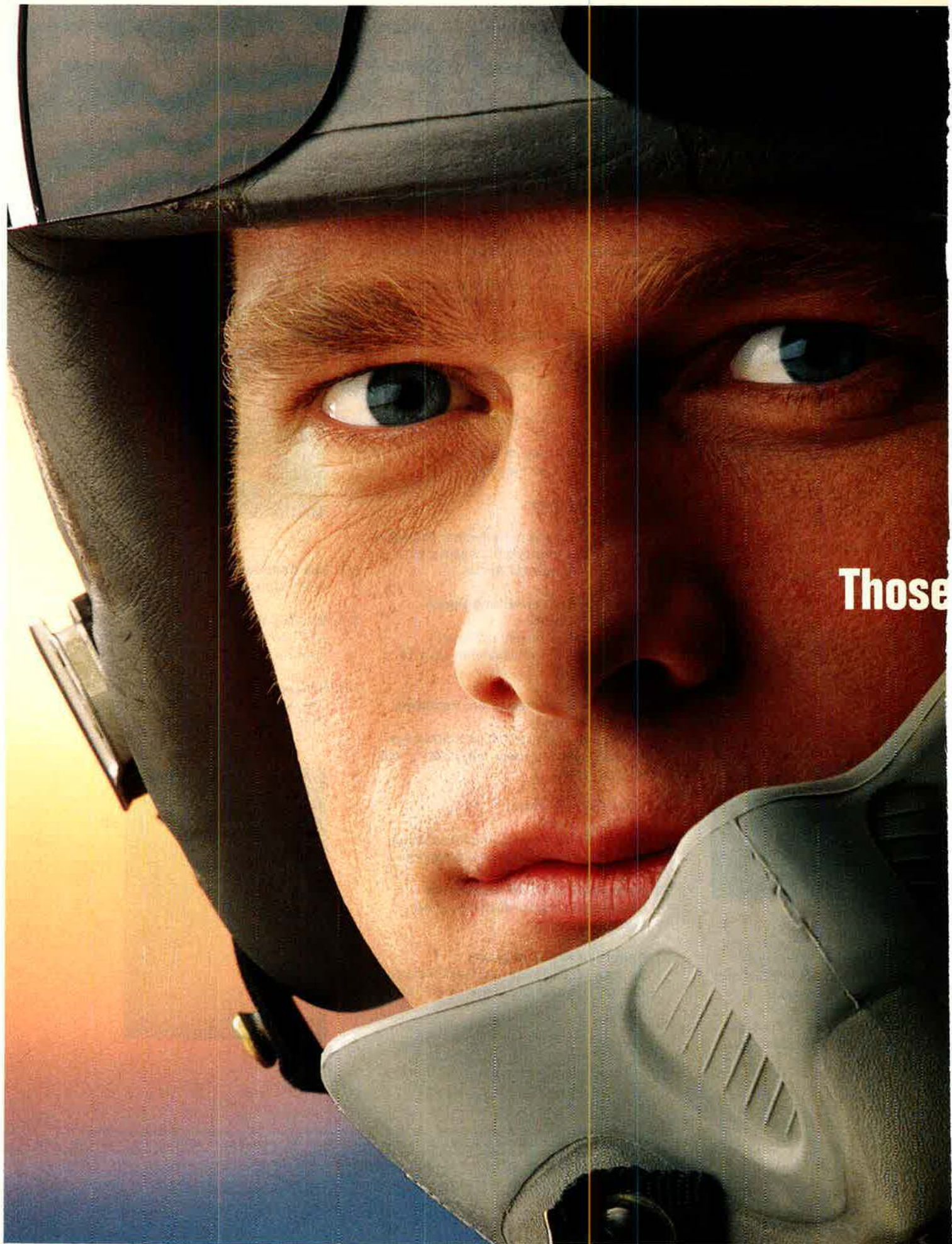
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By John T. Correll, Editor in Chief

Revelations and Moonshine

SECRETARY of Defense William J. Perry has dropped the pretense—which the Clinton Administration had been pushing for the past year—that the United States is ready to fight two major regional conflicts, nearly simultaneously. Testifying to the Senate July 12, Mr. Perry admitted that the Pentagon cannot handle two concurrent conflicts “with the force structure laid out right now,” even though that is the standard prescribed by the national defense strategy.

The only real news about Mr. Perry’s statement was that he said it. The inability of the armed forces to carry out the strategy has been an open secret for months. Nevertheless, Mr. Perry sought to temper his admission with several creative explanations.

The plan all along, he claimed, was to build toward a two-conflict capability by adding “enhancements” over time. No need to worry about capabilities that are missing now. The requirement was never regarded as immediate anyway, he said. The United States has several years to get its two-conflict strategy together, Mr. Perry said, and “we’re counting on that.”

With all due respect to Mr. Perry, that is not the way the story was told before, and it is not what the public was promised. Eighteen months ago, the Clinton Administration rashly cut the defense program without first calculating the consequences. When the options were priced out, it was obvious that the radical reductions had gone too far.

The preferred military posture was a capability to fight two major regional conflicts simultaneously. According to the strategists, however, that meant a force that included twenty-four Air Force fighter wings, twelve active Army divisions, and twelve aircraft carriers. Not affordable, the accountants said. The force cuts had to go lower to meet the predetermined budget ceiling.

Mr. Perry’s predecessor, Les Aspin, tried to bridge that gap with a bargain-basement concept called “Win-Hold-Win.” It provided for full

military response to only one regional contingency at a time. Mr. Aspin was unable to build any support for his proposal, and within weeks, the whole idea was blown away by criticism and ridicule. On June 24, 1993—without solving the basic problem of insufficient funding—the Pentagon

The Pentagon admits the forces can’t cover the strategy—and GAO says the budget is \$150 billion short of covering the forces.

promulgated the two-conflict strategy, which it now acknowledges it cannot fulfill. When Mr. Perry claims that “we never envisioned that we would get involved in two major regional contingencies,” he is skirting the position that Mr. Aspin found untenable in his Win-Hold-Win period.

A year ago, AIR FORCE Magazine concluded that the Clinton defense budget would not fund the two-conflict strategy and said that it even looked too short to support a Win-Hold-Win posture. In recent months, estimates of the budget shortfall had ranged as high as \$100 billion. The latest estimate, delivered August 1 by the General Accounting Office, is that the defense program will be short by at least \$150 billion over the next five years. “If these projections are even half-way correct, they call into question our ability not only to provide a sound national defense but also to meet the Administration’s future deficit targets,”

said Rep. John R. Kasich of Ohio, ranking Republican on the House Budget Committee.

The Administration is running out of military considerations it can trade away to make this underfunded defense program work. An early decision was to cut force structure and force modernization severely in hopes of preserving readiness. That priority was purchased at a price. For example, the Air Force fighter force has been cut by half, the bomber force by a third. It is difficult to think of a force modernization program that has not been cancelled, curtailed, or postponed. As Mr. Perry explained, weapons modernization was chosen to serve as the “bill payer” for readiness. The selected sacrifices, however, were not enough. In May—early in its declared “Year of Readiness”—the Air Force ordered its major commands to cut their aircraft operating costs by twenty percent to meet budget demands that service leaders say cannot be ignored.

In June, a task force of former military officers reported that despite “some downward indicators,” general force readiness “is acceptable in most measurable areas.” The panel noted a number of specific problems (a growing backlog of deferred maintenance, for example, and a shortage of critical Air Force spare parts) and warned that the services remain vulnerable to slipping into a “hollow force” status. It was hardly a ringing endorsement in an area that the Defense Department had stripped its other accounts to shore up.

Many in this Administration and Congress will no doubt concur with GAO’s assessment that the \$150 billion shortfall is attributable to “overprogramming.” GAO blathers on about the “unaffordability” of C-17 airlifters and calls the F-22 fighter “a premature venture.” It does not dawn on these people, apparently, that the problem is not overprogramming but underfunding. The Administration stepped into the moonshine with its original make-believe budget in March 1993 and seems stubbornly determined not to learn from its mistake. ■

Letters

Long Live the C-17

I fly the C-17, and I know it's a great airlifter. I am a pilot in the 17th Airlift Squadron at Charleston AFB, S. C. Col. Harry P. Wilson, USAF (Ret.), is flat wrong in his suggestions for solving our nation's serious airlift shortfall [*"Kill the C-17," July 1994 "Letters," p. 8*].

My background as a C-141 pilot in crises and contingencies from Grenada to Operation Desert Storm tells me that any new airlifter must have the flexibility to get into and out of tight places quickly and with a minimum of support. Most of the "new world order" is made up of Third World countries with inadequate transportation infrastructure (roads, ports, airports). The ramp space needed for one C-5 can accommodate three C-17s, each carrying nearly the same cargo weight as a C-5, giving the C-17 a 2.7-to-one advantage in throughput. The C-5 is 1960s technology, with low reliability and high cost to operate and maintain.

Commercial aircraft, such as the 747, cannot haul the large, heavy, go-to-war equipment that the Army needs in order to fight and win quickly with a minimal loss of American lives. Those swing-up nose doors on the 747 are not big enough for outside Army fighting vehicles and require special cargo-handling equipment to reach the high cargo deck. Also, the floor can only support pallets, not rolling stock. The 747s don't have the drive-on, drive-off capability that is essential for real-world military airlift operations.

Only the C-17 meets the requirements of our customers, primarily the Army and Marine Corps. The C-17's design is capable and flexible, based on lessons learned from other great airlifters: the outsize, heavy-lift cargo capacity of the C-5, the short-field capability and ground maneuverability of the C-130, and the versatility of the C-141.

As for the range capabilities of the C-17, our squadron recently flew a C-17 from Fort Campbell, Ky., to RAF Mildenhall, UK, nonstop and without aerial refueling. Another C-17 flight

went from Mildenhall to Pope AFB, N. C., nonstop, unrefueled, bucking an eighty-five-knot headwind. The C-17's commercial engines produce almost as much thrust as a C-5's, with better fuel efficiency and a whole lot less noise.

The C-17 "problems" are old news. The big problems have been solved. The little problems are rapidly being fixed. I have found the C-17 reliable, easy to operate, and superbly suited to the military airlift mission. Our maintainers love it too. The 747 lost the competition to be the C-5 back in the 1960s. The C-17 design beat all the entries in the C-X competition. I want my tax dollars spent on the winner—120 or more C-17s!

Lt. Col. Larry Kudelka,
USAF
Charleston AFB, S. C.

Prominent by its omission from the catalogue of missing aircraft fleets projected for today at the close of the Reagan Administration in "Fighters for the Twenty-First Century" [*July 1994, p. 50*] was the C-17. Recall the requirement for 210, arbitrarily reduced to 120, and now capped at forty pending a review of contractor performance in 1995.

While our current generation of fighters can best any in the world, our airlift fleet continues its relentless decline.

Winning the air battle is critical, but geographers tend to record land ownership as the final determinant of victory in war. As the A-10 crews used to say, winning the air battle is

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not very interesting if you return to find the enemy tank commander eating lunch in your mess.

We urgently need to accelerate improvements to our mobility systems to match the demands of a complex world.

Col. Michael R. Gallagher,
USAF (Ret.)
Sacramento, Calif.

Still Hiring

In "Before the First Command" [*"Smarter Troops for a Smaller Force," July 1994, p. 38*], the fourth paragraph stated, "The Air Force wants to hire 65,000 new people next year," when, in fact, the correct number is 36,500 in Fiscal Year 1995.

The propensity to join the Air Force is down, and the recruiting mission is getting tougher. Therefore, we need everyone on active duty and retired to be a force-multiplier in getting the word out that the Air Force is still hiring.

Brig. Gen. John M. McBroom,
USAF
Commander, Air Force
Recruiting Service
Randolph AFB, Tex.

No Subsidies

In "Depots in Dispute" [*July 1994, p. 66*], Peter Grier quotes extensively from Ron Baty of Air Force Materiel Command headquarters. Mr. Baty is quoted as saying that "if depot work is shifted to the Lockheeds and Northrops of the world, it will be in essence a backdoor subsidy." His rationale is that such companies are original equipment manufacturers (OEMs), which have higher overhead costs than "firms that specialize in repair work."

Lockheed is a large corporation organized into companies that each have a market niche. Some are indeed OEMs, and they bear the cost structure necessary to support the capabilities that make them superior in their markets. Lockheed Aircraft Service Co. (LAS), however, is optimized for the performance of depot maintenance, modifications, upgrades, and logistics support.

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Letters

LAS has been performing depot work for the Air Force for many years. For example, many C-130 variants are maintained at our home base in Ontario, Calif., and the KC-10s receive their heavy maintenance at our Greenville, S. C., facility. . . .

LAS has not asked for any subsidies, "backdoor" or otherwise. We do ask for recognition of our capabilities and our competitive costs.

Arthur J. Schuetz
Lockheed Aircraft Service Co.
Ontario, Calif.

An Old Fight

I feel compelled to comment on "Let's You and Him Fight" [June 1994 "Editorial," p. 2].

The remarks made by Gen. Merrill A. McPeak at the AFA symposium were not, as insinuated by some members of the press, the first shot in a new battle between services. His comments merely added to the existing animosity between the Navy and Air Force, which has become as deeply ingrained as any tradition or ceremony.

The relationship has become so negative and childish, it's probably best described as "space-age feudalism," a term coined by authors James Coates and Michael Kilian. The extent to which each service is willing to trash the other is amply discussed in their book *Heavy Losses* in a chapter appropriately titled "A Brotherhood of Rivals."

A case in point is the USAF chronology of Operation Desert Storm, "Reaching Globally, Reaching Powerfully: the United States Air Force in the Gulf War." This publication might have been more accurately titled, "How the Air Force Single-Handedly Won the War." It reaches a new low in self-glorification and is indicative of the ridiculous lengths to which each branch is willing to go to discredit the other and claim credit for a mutual accomplishment.

The issue General McPeak addressed in his speech to the symposium—power projection—has been heavily scrutinized for more than forty years. The battle over funding the B-36 program and the USS *United States* in the 1940s is an excellent example. While both vehicles (long-range bombers and aircraft carriers) have advantages, the answer to this long-debated issue may be too obvious for Pentagon planners to see.

Projection of power using ICBMs is clearly superior to either, but because it's not a visible threat (until one detonates on target), it is a paper tiger, so

to speak. Likewise, bombers are for all practical purposes an invisible threat that can be ignored or rebuffed (until they, too, have demonstrated their capacity to destroy). On the other hand, aircraft carriers provide both physical and psychological force projection, thereby helping to avoid as well as prosecute a conflict and demonstrate the resolve of America.

The advantages of a B-2 over a *Nimitz*-class aircraft carrier are numerous, but to a Serb commander or a Somali warlord they are inconsequential. Basically, such a man fears what he sees, and he fears tactical (Navy strike) aircraft that can be on site quickly. The close air support/battlefield air interdiction role was developed and perfected by USAF, so it should be a USAF mission. But ferrying a squadron of F-16s from North America to eastern Europe or Africa is not a practical form of force projection. It takes time to get a carrier battle group on station, but when it is, results are achieved.

The Argentinian military laughed at the slowness of the British Royal Navy's trek across the Atlantic. But when it finally did arrive, the laughing stopped and ass was kicked.

Both the Navy and the Air Force have great individual strengths that the other cannot equal. It's sad, but neither service will admit such an obvious fact. Frustratingly, they refuse to acknowledge that they complement each other well.

Kirk J. McDaniel
Naval Surface Warfare Center
Crane, Ind.

Explaining the Third Pilots

I am responding to Col. Joseph Schreiber's letter, "Triple-Headed Monsters" [April 1994, p. 8].

As a member of the Air Mobility Command staff, I have been able to watch the Third Pilot Program since its inception. This program was the result of AMC Commander Gen. Ronald R. Fogleman's effort to relieve the navigator shortage in the KC-135 fleet and reduce the size of the pilot bank (by 200 pilots in Fiscal Years 1994 and 1995). A side benefit allows tanker navigators and banked pilots (choosing the Third Pilot Program) better career progression options.

Due to the shortage of navigators in the command's KC-135s, navigators were forced to stay in the cockpit while their contemporaries were moving to the staff or making other career-broadening moves needed for officer professional development.

Virtually the same thing will happen to our banked pilots as they mature. Yes, they are getting their staff tours done early, but when they are midlevel majors and need to go to the staff, they won't be able to as they'll need to continue to fly for gate time.

To clarify the program for Colonel Schreiber, the third pilots go to Castle AFB, Calif., for the copilot academic and simulator phases of the course (approximately thirty-five days). While there, they get a five-day course on navigator duties, to include radar usage, rendezvous procedures, and nav systems/emergency procedures. If the schedule permits, they get up to two flights at Castle occupying the navigator's seat. The remainder of their third pilot training will be done in-unit, on regular training sorties, resulting in the individual's being certified to fly without an instructor navigator. The goal is certification within ninety days.

Third pilots are viewed as limited-duty pilots and will be able to fly in place of the navigator on local training sorties (pattern rides, depot inputs/outputs, and single-ship air refuelings), thus relieving the navigators for missions that require a navigator (overwater and overseas

deployments). The third pilots will also get two takeoffs and two approaches a month while maintaining the simulator currency of a line copilot. These pilots will upgrade to full copilot status within two years of certification (quicker if the wing commander is short in copilot manning) and will do that training in-unit instead of at CCTS—saving training and TDY costs.

Granted, there is no requirement in the KC-135 for a third pilot. This program was an effort by AMC to relieve nav manning and reduce the bank while helping two groups of officers as they progress through the ranks.

Maj. Edward M. Breen,
USAF
O'Fallon, Ill.

The Four-Headed Monsters

As one of the first entrants in the Pilot-Aircraft Observer, Bombardment (Pilot-AOB) training program and having subsequently qualified as a B-47 lead crew aircraft commander, let me attempt to clarify Colonel Schreiber's background information in his letter "Triple-Headed Monsters."

First, several aircraft in existence and on the drawing board in the late

1940s were capable of long-range delivery of special weapons. Several of these aircraft would have been more effective if the crew could have navigated using radar and celestial techniques. For example, the B-47 was configured with two pilots in tandem and a radar observer position in the nose, from which celestial observations were difficult and sometimes impossible.

The basic requirement of the SAC B-47 mission called for the ability to navigate worldwide with accuracy independent of surface aids. Celestial observations by both pilots were key factors in establishing this capability. The B-47 and its three-man crew did the job, as I can testify, having participated in two intercontinental bomb wing TDY deployments and many long-range combat-training missions, accumulating almost 2,000 B-47 flying hours in the process.

Second, "Triple-Headed Monsters" is a misnomer of "monstrous" proportions—the correct appellation was "Four-Headed Monster." This title was derived from the aviation ratings originally bestowed on the program graduate—Pilot, Celestial Navigator, Radar Observer, and Visual Bombardier.

Third, SAC crews of B-29, B-50,

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and KC-97 units were not "mostly Reserve officer pilots." They were 100 percent active-duty types.

The criticism of General LeMay and his methods of building an effective deterrent to the Soviet threat is weak and an affront to his memory. By any reasonable evaluation, the effect of the combat-ready B-47 wings on the Cold War was more than significant. In my view, it was pivotal. The Pilot-AOB program was established by USAF, and training was accomplished by Air Training Command—not SAC. Further, the B-47 was brought into production under the supervision of Air Force Materiel Command based on specs established by the Air Staff and the Boeing Aircraft Co.

Certainly General LeMay and his staff had some input in all these matters, but to compare their actions to AMC's Third Pilot Program is totally ridiculous.

The AMC program as outlined looks like a timely and resource-saving method of handling an unbalanced personnel situation. However, Colonel Schreiber's suggestion to give the young pilots "quickie" courses in the navigation and radar skills required would, in my opinion, be very foolish. The standard navigation and radar training could be shortened to credit the aviation experience of the young pilots, but they should be given a sound foundation in these skills.

Lt. Col. John S. Early,
USAF (Ret.)
Hemet, Calif.

Gliders Over Normandy

I eagerly awaited the June issue of AIR FORCE Magazine and just as eagerly turned to "Airpower Over Normandy" [p. 66]. I read it with anticipation and then with great disappointment.

The article contained several pictures of fighters, medium and heavy bombers, and one of the beloved C-47 "Gooney Bird." However, like the seven-volume *The Army Air Forces in World War II*, which devoted fewer than three pages to combat gliders, you obviously felt that gliders and glider pilots didn't rate any coverage in a Normandy article.

If glider pilots are still "The Bastards Nobody Wanted," your article could have mentioned, for the sake of aviation history, that combat gliders were used by the US only once—in World War II. Since no other aircraft in the World War II inventory could air deliver vehicles and assembled artillery pieces plus special

engineering equipment, the glider was used almost exclusively for this purpose.

In December 1944, the gallant 101st Airborne Division was surrounded at Bastogne, Belgium, during the Battle of the Bulge. The division had almost exhausted its supply of small arms and artillery ammunition, and food and gasoline were in short supply. The Germans, in violation of the Geneva Convention, had captured and held prisoner the division's medical unit. The division was resupplied by Ninth Air Force combat gliders flown by pilots who had volunteered for this "suicide mission." They suffered thirty-five percent casualties. This mission, like other glider operations, was the best kept secret of the war.

You, like our wartime brass, must feel that unless you fly something with powerful engines, you aren't really a pilot. To this the World War II US glider pilot says, "Like hell." If you must be good to fly with engines, you have to be a hell of a lot better to fly without them. . . .

George F. Brennan
Albuquerque, N. M.

Life-Support Training

I found "Lifeline to the Sky" [March 1994, p. 52] very interesting and potentially informative. I must, however, question retired CMSgt. Ellie Handley's assertion that there were no technical schools for life-support training in the 1950s.

I was pipelined in May 1949 from Lackland AFB, Tex., to Chanute AFB, Ill., as a personal equipment trainee to attend a tech training program that had just been organized. This was one of the first classes in the personal equipment program.

The training was set up in nine-week courses and included sewing machine use, care, and minor maintenance; parachute packing; cargo and personnel with a test drop; pneumatic equipment; oxygen equipment; and survival kits. . . .

My first duty station was Castle AFB, Calif., in 1949. We made checklists and inspection procedures from current tech orders. I can't say that I was ever in the dark about what the job was or how to do it. This information was accessible in 1949. . . .

During the time that Chief Handley described, I was very well trained and informed regarding duties and procedures. We planned for routine missions and contingencies, ensuring the accessibility of the correct equipment.

Thank you for a great piece about

our specialty. Now everyone will know that we did more than issue and receive flight clothing.

MSgt. Richard Traufeld,
USAF (Ret.)
Orlando, Fla.

"Lifeline to the Sky" was an excellent article about life support in USAF. It is appropriate, well-deserved recognition for the people who are in the business of protecting aircrew lives. However, several inaccuracies deserve correction.

The Life Support Equipment Laboratory (real name: Life Sciences Laboratory) does not design and test new equipment. The Life Sciences Laboratory is a one-of-a-kind aircraft mishap investigation branch of the Systems Support Division at Kelly AFB, Tex. The Life Support Systems Division at Brooks AFB, Tex., is responsible for the development of such aircrew life support equipment as Combat Edge, Advanced Technology (not Tactical) Anti-G Suit, Night Vision System, Universal Water Activated Release System, Active Noise Reduction, and other programs in the early stage of formation. The Chemical Biological Defense Systems Division, also at Brooks AFB, fields the Aircrew (not Advanced) Eye/Respiratory Protection System. All of these offices are part of Human Systems Center at Brooks. Under the recent Integrated Weapon System Management (IWSM) philosophy, all of these related aircrew-centered systems reside under one boss, from cradle to grave.

I am writing to correct the minor inaccuracies in an otherwise superb and well-presented article.

Lt. Col. Martin J. Clement,
USAF
Brooks AFB, Tex.

"Lifeline to the Sky," although well written, is incomplete. For decades, aircrew life supporters have received credit for a job completed mostly behind the scenes by the survival equipment shops.

Survival equipment shops throughout the Air Force are made up of folks who initially build up those parachutes, life rafts, life preservers, and other equipment that the aircrews rely on so heavily. The same life-sustaining equipment is periodically inspected for serviceability and repacked by the survival equipment shops, not the life supporters. The aircrew life supporters carry the equipment out to the aircraft or issue it to the crew members.



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A similar philosophy applies to anti-G suits, restraint harnesses, survival vests, antiexposure suits, and aircrew flight clothing. The life supporters deliver these items to the survival equipment shops whenever they need to be altered, modified, repaired, or tested.

For sixteen years, I have watched the life supporters receive credit for our work through countless newspaper and magazine articles. I have even known of instances where aircrews credited the life supporters with saving their lives (besides the example mentioned in the article) by showing them how to strap on and use their equipment. Isn't this like the bat boy getting credit for the home run? Wake up, folks! You would have a pretty hard time steering that parachute if it didn't open or sitting in that life raft if it failed to inflate.

SMSGt. Christopher D. Jones,
USAF
Dudley, N. C.

Bricks for BRAC

"More Base Closures Coming Up" [June 1994, p. 62] called the process "wrenching." Right on! Consider the following stupidity.

The Base Realignment and Closure (BRAC) Commission closed NAS Miramar near San Diego, Calif., and relocated aircraft to existing bases. Good decision. The cost of housing in San Diego was too high for sailors. The city of San Diego was happy. Miramar is desperately needed as a civilian airport for San Diego.

So far so good, but wait. The BRAC '93 Commission then decided to close MCAS El Toro, Calif. El Toro has on-base housing for 3,000 and better runways as a result of a \$1 billion upgrade program over the past eight years.

El Toro's mission will now move to NAS Miramar, which has no on-base housing, and it will require another \$1 billion to bring it up to El Toro's standards. El Toro is not needed by civilians.

Not many clear thinkers on the BRAC '93 Commission.

David Chigos
Point Loma, Calif.

The Spirit of Blackbird

"The Spirit of Missouri" [April 1994, p. 36] is reminiscent of the spirit of another "unique" aircraft program—the SR-71. The "Blackbirds" were also crewed by highly qualified aviators, chosen from a variety of flying backgrounds—hand-picked and physically screened—to fly the highly classified

aircraft. They also used the T-38 as a companion trainer to keep their flying skills sharp.

The heart of SR-71 training and crew proficiency was also the simulator. After flying an operational mission in the simulator, crews emerged exhausted after four hours of emergency procedures and "what if" scenarios. Likewise, our simulator recorded every parameter and action the crew took, to be reviewed later at debriefing. SR-71 training was nine months long.

The SR-71 wrote the book on stealth and low-observable technology in 1964, using composite materials for much of the plane's exterior. The SR-71 had an extremely small radar cross section flying at Mach 3 and 80,000 feet. Cruising there, the aircraft had few SAM threats to contend with and no air-to-air threats.

Like the B-2, the SR-71 recorded all of its parameters in a system called DAFICS, allowing maintenance to review and diagnose problems that developed in flight. Similarly, scratch the SR-71's titanium with the wrong tool, and you could end up with a stress crack.

I hope Brig. Gen. Ronald C. Marcotte realizes that he commands a unique outfit in every sense of the word and reminds his troops daily that they are special. In spite of attempts to change it, the character of the SR-71 program remained unique over its twenty-one-year history because of the attitudes of those who maintained it, flew it, and led it.

During the B-2's lifetime, I'm sure there will be similar attempts to mainstream the program.

Col. Richard H. Graham,
USAF (Ret.)
Plano, Tex.

The Decisive Infantry

I agree with William V. Kennedy ["Land War's Decisive Element," May 1994 "Letters," p. 6] that the vertical factor of the modern battlefield (i.e., the tank-destroying helicopter armed with rocketry) has rendered such weapons as the Bradley Fighting Vehicle (the mobile death trap) and the main battle tank obsolescent and perhaps obsolete.

We must acknowledge the service he performs in making this point patent, but Army Aviation is not "the decisive element of land warfare." It is a catalyst in the successful pursuit of land warfare. The poor bloody infantry—the human element—remains the decisive factor in land warfare, as do airmen and seamen in their forms

of warfare. The Air Cavalry is also infantry. . . .

James L. Ballance
San Francisco, Calif.

Developing the Globemaster

I enjoyed your April issue, but I have to comment on "Checklist of Air Force Test and Training Programs" [p. 74]. You managed to omit one of only two large test efforts now under way at the Flight Test Center: the C-17A Globemaster III. The C-17A Combined Test Force has nearly 1,000 people, and we fly our six test aircraft in a very fast-paced, high-stakes program. Testing is running concurrently with initial squadron operations at Charleston AFB, S. C., which keeps the pressure on flight test to meet milestones for capability release. We try to stay out of the headlines, but we should have made your list.

Capt. John B. Norton,
USAF
Edwards AFB, Calif.

The Cost of Health Care

"Shakedown on Veterans Benefits" [July 1994, p. 70] stated the following about VA health care: "most people agree that the best thing about it is the price. It is free for those who get through the waiting lines."

VA health care is not free for those with nonservice-connected disabilities and whose incomes are above a certain level. The charge is \$36 per outpatient visit. For hospital care, the patient must, in general, pay an amount equal to the Medicare fee.

In other words, many military retirees under the age of sixty-five do not qualify for free care at VA health facilities as one would be led to believe by reading this article.

Maj. George F. Fisher,
USAF (Ret.)
Chelmsford, Mass.

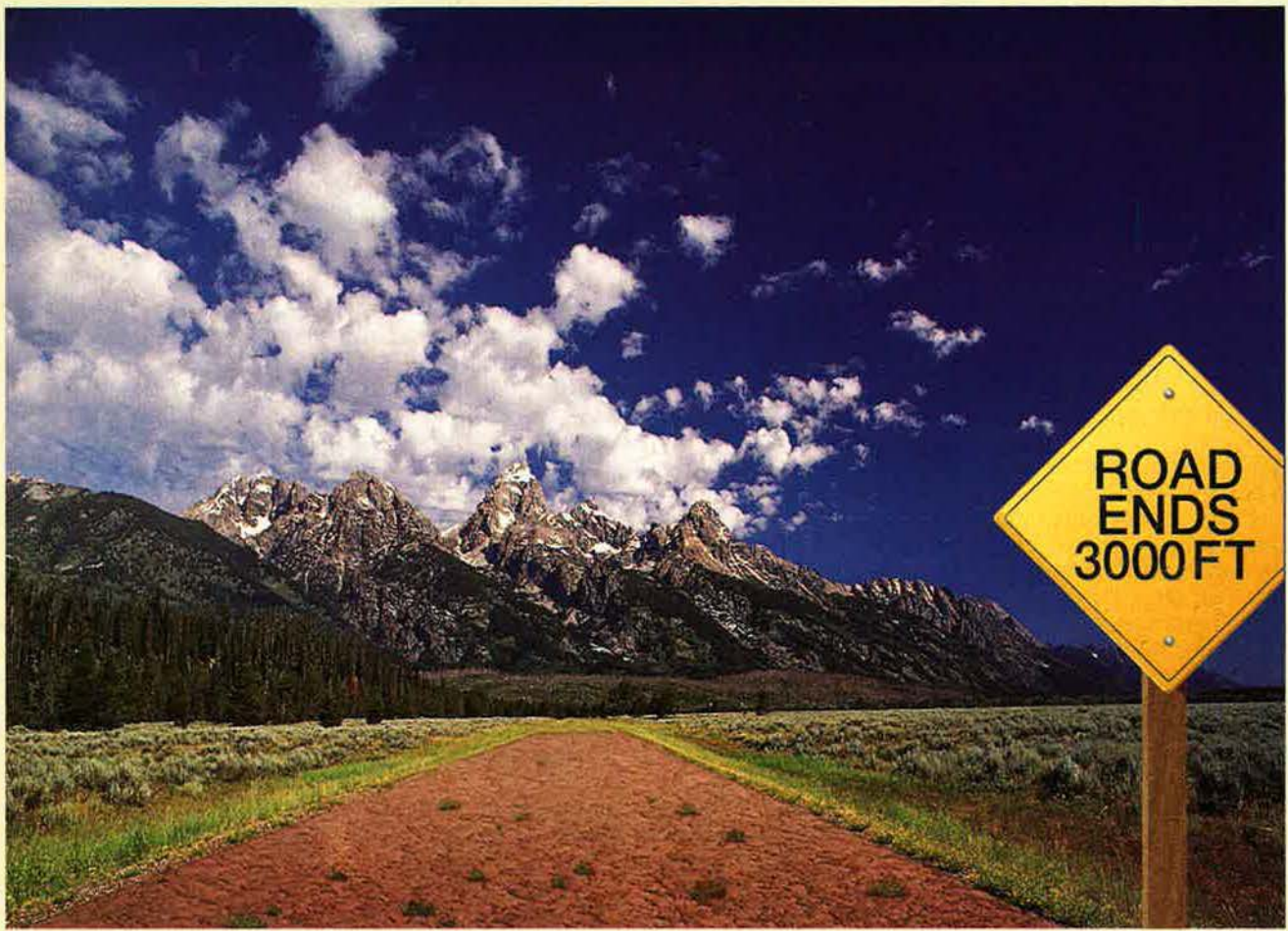
One Man's Weed

The July 1994 issue contains a photograph of the T-3A Firefly pilot screener airplane used to "weed out" trainees ["Smarter Troops for a Smaller Force," p. 38].

In 1944, I soloed in five hours and had 101 landings, but I turned out to be a better navigator, although I qualified for bombardier training as well. I flew thirty-one missions (a number of them as lead navigator) before being shot down and taken prisoner of war.

I didn't feel like a weed in 1944 and still don't!

Capt. Jack C. Curtis,
USAF (Ret.)
Battle Creek, Mich.



There's less land in our landing.

The C-17 has just landed and it's no big deal. Which is not to say the airlifter is anything shy of noteworthy. But one of the reasons it is so remarkable is that it requires so little distance to land – only 3,000 feet.

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Performance Above and Beyond.

By Brian Green, Congressional Editor

"Downward Indicators" on Readiness

Current readiness is high, but Defense Secretary Perry worries about morale and the "medium-term" future.

In testimony before a key Senate panel, Defense Secretary William J. Perry committed himself to improving the quality of life for military men and women. He had decided to take that step, he told senators, because he is concerned that poor morale could hurt military readiness. "We are heading for problems because of the deteriorating quality of life and potential morale problems in the future," Mr. Perry told the Senate Appropriations Committee's Defense Subcommittee July 12.

Mr. Perry's comments reflected the basic conclusions of the Readiness Task Force chaired by retired Gen. Edward C. Meyer, Army Chief of Staff from 1979 to 1983, when that service was beset by readiness problems. (General Meyer coined the term "holow force" to describe the Army of the period.) The Meyer panel noted "downward indicators" in readiness and warned that without new Pentagon and congressional attention, "the armed forces could slip into a 'hollow' status."

Several panel members agreed with the concerns expressed by the Secretary and the task force. Sen. Daniel K. Inouye (D-Hawaii), the subcommittee's chairman, maintained that readiness is the key to avoiding large-scale US casualties in a conflict. "In [World War II, the Korean War, and the Vietnam War] we entered unprepared, untrained, unequipped," he said, adding that studies have shown that the first 10,000 US casualties in the Korean War could have been half that number "if we had sent men who were properly equipped and trained."

In the end, said Senator Inouye, "I will see to it that we provide ourselves with the largest amount for readiness so that our forces can go into battle, if need be, whether it be in Haiti or Korea or Iraq, with odds that are overwhelmingly in our fa-

vor. In my mind, a ten percent casualty [rate] is not acceptable."

Sen. Ted Stevens (R-Alaska), the panel's ranking minority member, noted, "Food stamps are coming through the commissaries, and . . . we now find that they are increasing all over the country." He also worried that growth in federal entitlement spending would eventually hurt military readiness by siphoning off funds. The Fiscal 1995 appropriations bill, he said, did not have enough money to finance pay raises "that are essential to prevent more and more military people from going on food stamps." He suggested deferring spending on environmental restoration.

Sen. Pete Domenici (R-N.M.) warned that readiness was underfunded and that any savings derived from weapon program cuts might have to be spent on readiness—a statement with which the Defense Secretary agreed. Senator Domenici also argued that cuts approved in this year's budget resolution have raised questions about the adequacy of future defense spending levels.

Several senators expressed concern about the cost of peacekeeping and other contingency operations—also a prominent concern of the Readiness Task Force. DoD, the task force argued, "should work with Congress in developing and institutionalizing a contingency funding system" that does not "divert, delay, or disrupt the flow of funds needed to maintain readiness of forces not engaged in such operations."

Mr. Perry said the most pressing problems concerned "medium-term readiness," several years away. "Current readiness is at a high level," he testified, adding that the principal factors that will determine the readiness of the force in three or four years will be "the capability, the quality, the morale of the military personnel." The services, he said, have focused on near-term readiness but have been "skimping" on funding that could improve quality of life for the troops.

He thus is focused on measures he can take today that will improve

the situation in the future. He said the Fiscal 1996 budget, to be unveiled next January, will exceed even the Fiscal 1995 budget in its heavy emphasis on readiness. Mr. Perry's testimony, however, suggested that funding all DoD's priorities would continue to be a difficult problem. Reductions in weapons modernization programs, which have provided much of funding needed to support near-term readiness, have gone too far, he said, and an increase will be needed in a couple of years. In the interim, protection of the industrial base is an imperative—"so that when we do begin building these weapons again we have that capability in place." At the same time, he said, "I think we have to maintain the force structure" while supporting readiness.

Mr. Perry is counting on a larger defense budget in the late 1990s and savings from acquisition reform and base closures to provide the necessary resources. Many in Congress remain skeptical that increases or savings will be forthcoming. Some senators suggested going back to the use of a budget "firewall" that would prevent money cut from defense from being spent on domestic programs. "It's pretty obvious that any Secretary of Defense would find that a useful tool," Mr. Perry observed.

In his appearance before the Senate appropriators, the Defense Secretary restated his unconditional opposition to Senate moves to provide additional funding for B-2 Stealth bombers. The Senate supports a measure to sustain the B-2 industrial base, and substantial backing for such a measure exists in the House as well. Mr. Perry put his opposition squarely in the context of readiness worries.

"Every time I look at this budget and look at the readiness problems we have and look at the force structure problems we have, I can't conceive of how we can . . . support building another ten or twenty of those B-2 bombers," he said. "I think they would be desirable to have but unaffordable." ■

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Result: a quality aircraft from a company with a successful history of managing total programs from start to finish. The Vought Pampa 2000 is the low risk JPATS option—ready today—to handle the training requirements of the 21st century.



The Chart Page

Edited by Tamar A. Mehuron, Associate Editor

The Away-From-Home Air Force

USAF Troops on Overseas TDY

Percent of Total Active Force

September 30, 1988

4,197

0.7 percent

September 30, 1989

3,635

0.6 percent

September 30, 1990

31,607

6.0 percent

September 30, 1991

8,483

1.7 percent

September 30, 1992

7,216

1.5 percent

September 30, 1993

9,856

2.2 percent

July 1, 1994

13,577

3.2 percent

September 30, 1995

17,000*

4.3 percent*

Individual deployability—the readiness of each USAF member to pack up, move out, and set up for combat anywhere in the world—is critical to power projection. The number of troops sent overseas on temporary duty has been rising steadily even as the number permanently stationed abroad has dropped. Overseas TDY began rising with the start of Operation Desert Shield in August 1990. It peaked during the Persian Gulf War in February 1991 with 55,000 deployed. It then tapered off, but it remains at historically high levels. Overseas TDY is on the rise once again, causing concern about stress on Air Force families.

Source: Lt. Gen. Billy J. Boles, deputy chief of staff, Personnel, USAF. Statement before the Subcommittee on Military Forces and Personnel of the House Armed Services Committee.

*Derived projections

Photo © Randy Jolly / Arms Communications

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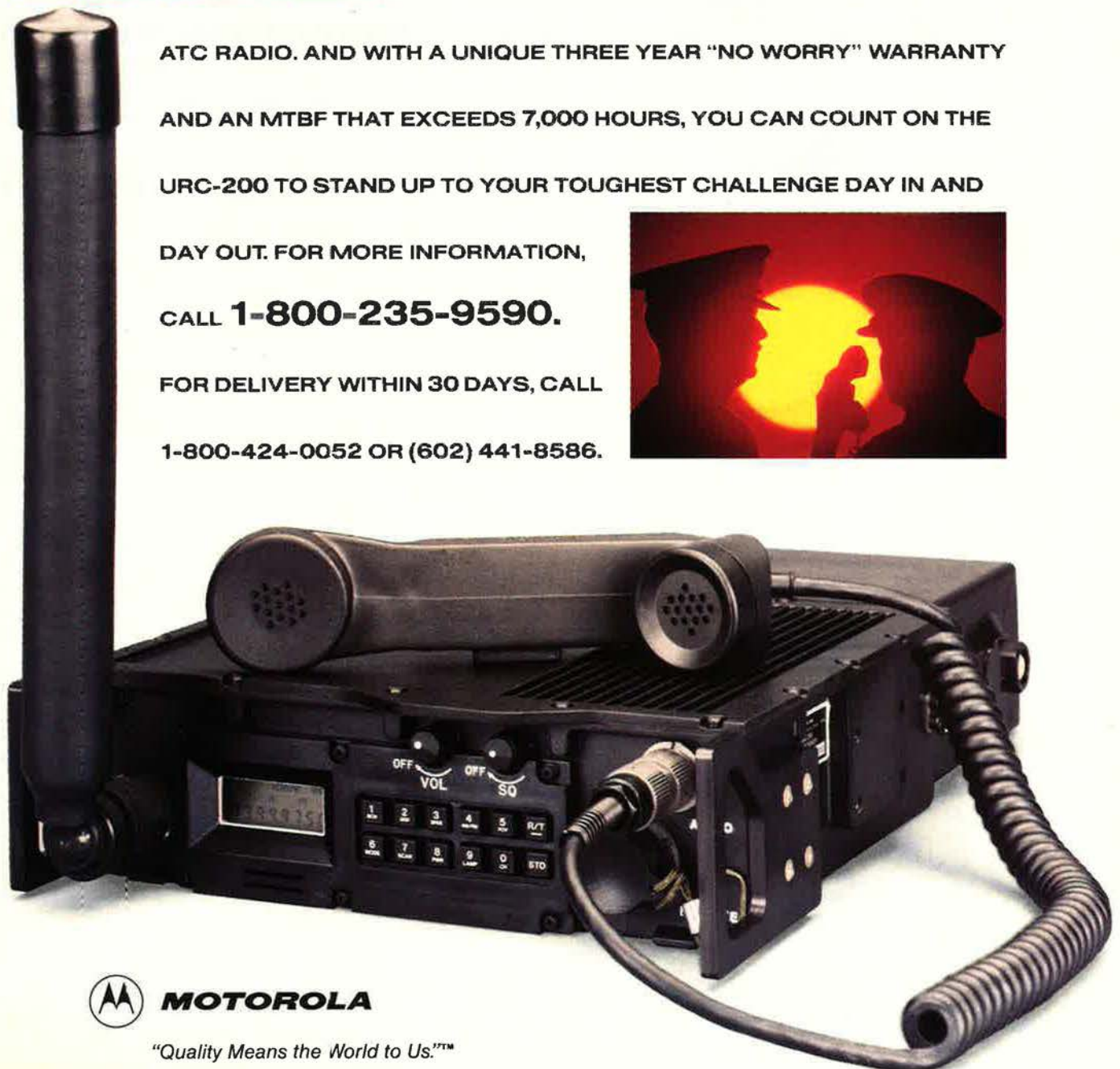
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THE F-15E.
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MEASURES SYSTEM IS ONBOARD EVERY
F-15E IN THE USAF FLEET.



THE F-5.
AS THE ORIGINAL MANUFACTURER, WE'VE
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AEROSTRUCTURE UPGRADES.



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LOCATE AND DESTROY TARGETS.

**OUR COMPANY IS ONLY
MONTHS OLD. YET WE
ACCOMPLISHED QUITE**

**FOUR
WE ALREADY
A BIT.**

**FOUR MONTHS AGO, WE FORGED A PARTNERSHIP
WHICH BROUGHT TOGETHER TWO OF THE
WORLD'S MOST STORIED AEROSPACE COM-
PANIES, NORTHROP AND GRUMMAN.**

**YOU ALREADY KNOW EACH COMPANY HAS A LONG
LIST OF ACCOMPLISHMENTS. BUT EVEN
MORE IMPRESSIVE THAN THE PROGRAMS
DEPICTED HERE IS WHAT WE'VE CREATED
IN THE PAST FOUR MONTHS:**

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EXACT CAPABILITIES THAT DEFENSE
EXPERTS SAY WILL PROVE INDISPENSABLE
IN THE UNCERTAIN CLIMATE OF THE POST-
COLD WAR WORLD.**

**A NEW COMPANY WITH STEALTH AND STANDOFF
COMPETENCIES, CREATING PLATFORMS
CAPABLE OF STRIKING TARGETS WITH
UTMOST PRECISION WHILE REMAINING
VIRTUALLY UNDETECTED.**

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LANCE AND BATTLEFIELD MANAGEMENT
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THE KEY TECHNOLOGIES TO MEET THE
CHALLENGES OF THIS CHANGED WORLD
CAN BE FOUND IN ONE PLACE.**

**BECAUSE NORTHROP AND GRUMMAN ARE NOW
NORTHROP GRUMMAN.**

NORTHROP GRUMMAN



Airborne drug smugglers will find it more difficult to hide from the customs service thanks to the advanced radar and infrared sensor systems on board U.S. Customs patrol aircraft. With the aid of Hughes Aircraft Company's APG-63 radar, coordinates of the suspected drug smugglers are relayed to customs service tracker aircraft, which guide "Bust Crews" in helicopters to meet the would-be drug traffickers when they land. Hughes integrated the radar with a new navigation system, an air data computer, and an infrared detection system using a new Sensor Integration Package, which has recorded numerous mission days of operations with no failures. The APG-63 radar system was originally designed and built by Hughes for the U.S. Air Force F-15 fighter aircraft.

A new method of extracting power in semiconductor lasers will boost applications requiring both high brightness and high average power. The Surface Emitting Distributed Feedback (SEDFB) laser uses a grating instead of mirrors, eliminating the optical damage and beam divergence of reflector-type semiconductor lasers. The SEDFB laser allows for "large area" emitting surfaces without the use of facets, which are a primary cause of failure in conventional diode technology. Developed by Hughes, this new technology will enable advancements in medical laser systems, materials processing, laser igniters, laser radar, and military opto-electronic countermeasures.

Switzerland's Air Force will train pilots in take offs and landings, realistic air-to-air and air-to-ground combat environments, electronic countermeasures and emergency procedures with the help of a dual-seat dome simulator. Hughes will build a 40-foot dome F/A-18D Weapons Tactics Trainer (WTT) simulator, which will provide pilots with a fully functional replica of the F/A-18D cockpit and a 360 degree field-of-view. The out-the-window visual system will encompass the entire country of Switzerland and will be coupled with threat aircraft, in-flight missiles, and gun fire. A day/night head tracked area-of-interest display system and high resolution target imagery will be provided by Hughes' laser target projector system. Training will be further enhanced by the simulation of sustained aerodynamic g-forces to the pilot by using a g-seat/buffet system and an active g-suit.

Aircraft pilots will be able to read their gauges more easily, even in sharp sunlight, with an advanced cockpit display. Developed by Hughes for military airborne applications, this compact, lightweight, multi-function cockpit display unit offers improved performance and reliability. The new display incorporates a cathode ray tube display and electronics elements in a single package weighing less than 14 pounds. Compatible with Hughes' AN/AAQ-16B helicopter night vision systems, this high resolution display has a maximum brightness and can be read easily in all conditions.

An in-flight, duty free shopping program is now available for passengers aboard Northwest Airlines' 747 aircraft. As an extension of Hughes' interactive video system, called Worldlink™ by Northwest, passengers have access to view the complete Inflight Duty Free Shop selection of products through an individual screen and control unit at each seat. Passengers are able to place orders from the comfort of their seats and select their preferred method of payment — cash when the flight attendant delivers the order or credit card, using a built-in magnetic card reader. With the wide variety of entertainment, business, communications, and tourist information offered by Worldlink, passengers have control over their in-flight experience.

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By Frank Oliveri, Associate Editor

Behind the Black Hawk Tragedy

The lethal, seemingly inexplicable F-15C attack on two US Army UH-60 Black Hawk helicopters in the sky over Iraq was caused by a series of human errors and procedural failures, apparently not by faulty equipment, the Defense Department reported on July 13.

The Pentagon released results of a probe into the April 14 attack, which killed fifteen Americans and eleven foreign nationals—all helicopter passengers. Defense Secretary William J. Perry called it "a tragedy that never should have happened." He said that the Pentagon would take corrective action and would attempt to fix individual blame.

According to the report, breakdowns began when the Combined Task Force gave unclear guidance to component organizations, causing a poor understanding of individual responsibilities. The Pentagon's findings, in brief, follow.

AWACS mistakes. Crew members of the E-3 AWACS aircraft monitoring the tactical area of responsibility (TAOR) made critical errors. The mission crew commander, who had flown only one sortie in the previous three months, was not currently qualified in accordance with Air Force regulations.

AWACS weapons controllers, supervised by the mission crew commander, did not clearly understand their responsibility to support helicopters functioning in the TAOR. It was the common view of the AWACS crews and the Combined Forces Air Component airborne command element officer that helicopter activities were not an integral part of air operations.

Some AWACS crew members were aware that two US helicopters were proceeding east into the TAOR, but the F-15 pilots were not. When the fighters informed the AWACS operators of unknown radar contacts in the area of the helicopters, the E-3 failed to inform the pilots of the location and identity of the Black Hawks.

F-15 miscues. The F-15 pilots tried to identify the contacts electronically by using identification, friend or foe (IFF) Mode 1 and Mode 4 codes. The

Chronology of a Tragedy

Maj. Gen. James G. Andrus, USAF, commander of 3d Air Force, briefed reporters on the sequence of events that led to the downing of two Black Hawk helicopters on April 14. (All times are local Iraqi time.)

8:36 a.m. E-3 AWACS departs Incirlik as the first of fifty-two coalition sorties scheduled for that day.

9:22 Two UH-60 Black Hawks depart Diyarbakir, Turkey, en route to Zaku, Iraq. AWACS makes radar and radio contact and detects the Black Hawks' IFF Mode 1 and Mode 2 signals.

10:27 The Black Hawks land at Zaku.

10:35 Two F-15s depart Incirlik. Shortly after takeoff, AWACS establishes radar and IFF contact.

10:54 Black Hawks take off from Zaku, contact AWACS, and report they are en route to Irbil, Iraq. AWACS acknowledges call and begins tracking Black Hawks again on radar and IFF.

11:11 Black Hawks fly into mountainous area, and their radar and IFF contacts fade from AWACS scopes.

11:20 F-15s enter area and notify AWACS, which passes on no information about presence of Black Hawks.

11:21 AWACS controller, assuming helicopters have landed, drops Black Hawks' track designation symbol from radar scope.

11:22 F-15 lead detects and locks on to Black Hawks' radar contact, checks IFF Modes 1 and 4. F-15 lead receives a momentary Mode 4 indication but nothing more. F-15s inform AWACS, which responds, "Clean there," meaning no returns in that area.

11:26 Steady IFF returns and intermittent radar returns from the Black Hawks appear on AWACS radar scopes. F-15s not advised of the presence of IFF data in the target area.

11:27 AWACS controller attempts IFF procedures, but F-15s and Black Hawks are too close for AWACS to make a reading.

11:28 Lead F-15 reports to AWACS a visual ID of a helicopter, misidentifies it, and radios "Hind—no, Hip." F-15 wingman does not make a positive identification but does not report this.

11:30 F-15 lead attempts final IFF Mode 1 check, receives no reply, and fires one missile at trailing helicopter, causing it to crash. F-15 wingman fires one missile at the remaining helicopter, destroying it.

helicopter crew members apparently were not aware of the Mode 1 code specified for use in the TAOR and instead had an incorrect code, so the F-15s did not receive a correct response. Using the Mode 4 code, an F-15 pilot received a momentary correct response but nothing on the next two attempts. His wingman also failed to get a response.

The fighter pilots then tried to identify the aircraft visually. The lead pilot, however, made passes at speeds and altitudes that made it unlikely he could have identified a helicopter's markings. Neither pilot had received recent and adequate visual recognition training. The lead pilot identified

the helicopters as Russian-made Mi-24 "Hinds," not recognizing the differences between Black Hawks with wing-mounted tanks and Hinds with wing-mounted weapons.

The wingman was asked to identify the aircraft but called out no identification and failed to indicate that he could not make one; thus the engagement continued. The flight lead fired a radar-guided AIM-120 Advanced Medium-Range Air-to-Air Missile, destroying the trailing helicopter. The wingman fired an AIM-9 missile, which destroyed the lead Black Hawk.

See the box above for a chronology of the incident.

Enlisted Spacefarers?

For the first time, Air Force enlisted troops may apply to become mission specialists on the space shuttle, the Air Force said in June. The next astronaut selection board is expected to convene in May 1995. First applications will be accepted in November.

NASA officials have not determined how many candidates will be considered. Those interested must meet basic requirements: a bachelor's degree in engineering, biological science, physical science, or mathematics; ability to pass a NASA Class II space physical similar to a military or civilian Class II flight physical; and height of at least fifty-eight and a half inches and no more than seventy-six inches.

F-16 Save Wins Kolligian Trophy

Maj. Bob Harvey's greatest concern was making it home in one piece and, if possible, getting his disabled F-16 home too. With the help of some friends, he succeeded on both counts and, as a result, won the Koren Kolligian, Jr., Trophy.

The trophy, given for outstanding performance in an in-flight emergency, was awarded in June.

Major Harvey, of the 52d Operations Support Squadron, Spangdahlem AB, Germany, was on his last training mission of a three-week deployment to Incirlik AB, Turkey, as part of Operation Provide Comfort. He was flying his F-16C on April 27,



Boeing Defense & Space Group completed assembly of the outboard wing sections for the Air Force's twenty-first B-2 bomber (including the prototype) in May. The sixty-five-foot sections are believed to be the largest structural aircraft parts ever made from composite materials.

1993, when his engine flamed out at 18,000 ft.

Major Harvey recalled hearing a loud rumble about ten minutes after takeoff. His fighter shook suddenly as it suffered a catastrophic engine failure. Major Harvey worked frantically to restart the engine and succeeded, but the engine merely sputtered and ultimately flamed out again.

"As soon as I realized I wasn't getting any thrust, I reached up and

tightened my seat belt," he said. "I was ready to punch out, but I didn't because I knew I had plenty of time to deal with the problem."

Major Harvey began running calculations in his head as he turned his gliding aircraft toward Adana, Turkey. At this point, support from other pilots became crucial. "Your mental capacity is stretched to its limits," he said. "You just can't think."

Cpts. Merrill Fink, Dennis Prokopowicz, and Dan Tippet talked Major Harvey through critical action procedures and other steps needed to land safely. "I know I wouldn't have been able to make it without their help. I would have made a mistake or omitted something."

Major Harvey made a dead-stick landing at Adana International Airport. Afterward, he attributed his success to teamwork, luck, and timing. As he eased himself from the cockpit and patted the F-16's nose, the left main landing gear burst into flames.

"That's when I got worried," said the major. "My squadron commander would have killed me if I burned his plane." The landing-gear fire was quickly doused.

Damaged B-1B Turned Quickly

A B-1B bomber from the 9th Bomb Squadron, 7th Wing, Dyess AFB, Tex., was forced to make an emergency landing at Rhein-Main AB, Germany, in June with its wings fully swept to the rear. Despite some damage, the B-1 was serviced and flown out only



USAF photo by TSgt. Alan Brown

The 155th Air Refueling Group, Nebraska ANG, simulates emergency war operations while under enemy attack. The ability to survive and operate (ATSO) exercise is a yearly Guard requirement. Here, medics in nuclear-biological-chemical warfare suits treat a "wounded" airman.



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 **TEXAS**
INSTRUMENTS



Lockheed photo by John Rossino



Lockheed Aeronautical Systems Co. fuel tank sealers Charles Wages (left) and Kenneth Williams measure lower wing panels for a C-141B StarLifter under repair (background). The strategic airlifters developed wing weep hole problems in 1993; 200 of 244 C-141s have been returned to service.

twenty-two hours after the incident, the Air Force said.

Technicians on the scene and in the US determined that the left wing sweep gearbox assembly had failed internally. A Dyess maintenance crew, deployed to RAF Fairford, UK, for Coronet Pinto '94, packed up and headed to Rhein-Main to recover the aircraft. Fifteen maintainers and 3,300 pounds of equipment were flown to Germany, where crews worked under deadline to get the bomber flying. The airport would begin charging the US government runway closing fees at 6:00 a.m.

The crew arrived at the site at 3:00 a.m. and began work, replacing four flat tires on the big bomber so that it could be towed from the runway. The aircraft was clear of the runway by 5:57 a.m. The crew replaced all the bad tires, checked the brake system, repairing one, and spent six hours manually sweeping the wings forward. The aircraft took off from Rhein-Main at 6:00 p.m. and landed at RAF Fairford an hour and a half later.

Combat Challenge '94

The 5th Combat Communications Group, Robins AFB, Ga., won the overall large-unit award during Combat Challenge '94, USAF's largest command, control, communications, and computer meet. The competition was held at Tinker AFB, Okla., May 30 to June 3.

Twenty Air Force communications teams from four major commands,

Air Force Reserve, Air National Guard, and the Joint Communications Support Element participated in the five-day competition. Winners were chosen in three overall categories based on team size.

The medium-unit winner was the 1st Communications Squadron, Langley AFB, Va., and the small-unit award was won by the ANG's 118th Combat Communications Squadron, Badin, N. C.

Three special events were added to the regular Combat Challenge events. These categories and their winners: Air Weapons Control, 728th Air Control Squadron, Eglin AFB, Fla.; Air Traffic Control and Landing Systems, 5th Combat Communications Group; Joint Task Force/Joint Forces Air Component Commander, 612th Air Communications Squadron, Davis-Monthan AFB, Ariz.

Winners of the combat support events—which include pallet building, tent setup, camouflage, fitness run, and marksmanship—were the 3d Combat Communications Group, Tinker AFB (large unit); 16th Operations Support Squadron, Hurlburt Field, Fla. (medium unit); 438th Communications Group, McGuire AFB, N. J. (small unit).

B-52 Crash Kills Four

In late June, a B-52H bomber assigned to the 92d Bomb Wing, Fairchild AFB, Wash., crashed northeast of the base's air traffic control tower. All four crew members were killed.

Film taken at the accident scene showed the B-52 in an extreme left-hand bank at the moment of impact, when its left wing struck the ground. The aircraft exploded instantly.

Killed in the crash were Col. Robert E. Wolff, vice commander, 92d Bomb Wing, pilot; Lt. Col. Mark C. McGeehan, commander, 325th Bomb Squadron, instructor pilot; Lt. Col. Kenneth S. Huston, operations officer, 325th Bomb Squadron, instruc-



USAF photo by TSgt. Scott Stewart

Joint Communications Support Element personnel from MacDill AFB, Fla., set up equipment for a competition during Combat Challenge '94 at Tinker AFB, Okla. Combat Challenge is USAF's largest command, control, communications, and computer meet. Combat support events include pallet building and camouflage.

tor radar navigator; and Lt. Col. Arthur A. Holland, 92d Operations Group, instructor pilot.

The accident is under investigation.

Drawdown to Hit USAF Civilians

The Air Force will eliminate more than 28,000 civilian positions by Fiscal 2001, the service said in June.

The Pentagon decided that civilian employment levels across DoD were too high and that reductions had not been commensurate with the overall active-duty force reductions.

AFMC's Aeronautical Systems Center, Wright-Patterson AFB, Ohio, will be forced to eliminate 3,900 civilian positions over the next seven years, according to the Air Force. The cuts will affect nearly every major activity on base. The downsizing is a result of the National Performance Review and the Federal Work Force Restructuring Act of 1994.

The Air Force plans to use all the loss management and transition assistance programs available to achieve its drawdown goals. The Air Force will also aggressively use civilian separation incentives to encourage employees to consider early retirement, regular retirement, or resignation.

Aid to Rwandan Refugees

The Pentagon said in June that it had sponsored forty-one flights, both military and civilian contract, airlifting 846 tons of humanitarian relief supplies and equipment to refugees of the bloodletting in Rwanda.

The effort began on May 11, following the outbreak of massacres in the African nation. Some 446,000 refugees have fled to neighboring Tanzania, Burundi, Uganda, and Zaire.

Patricia L. Irvin, the deputy assistant secretary of defense for Humanitarian and Refugee Affairs, said that logistics and material support is continuing.

"We are doing everything within our capabilities and resources to respond to requests for assistance from the State Department, United Nations, International Committee of the Red Cross, and other relief groups," she said. "We've been working to speed humanitarian assistance to the Rwandan refugees."

Thirteen Air Force C-130s flew supplies from Nairobi, Kenya, to Bujumbura, Burundi, while contract flights carried supplies from Pisa, Italy, to Entebbe, Uganda. USAF C-141s flew supplies from Incirlik, Turkey, to Mwanza, Tanzania. Medical supplies were flown on civilian contract aircraft from Hartford, Conn., to Mwanza.



Air Mobility Command C-5 and C-141 aircraft airlifted armored personnel carriers to Uganda in July. The APCs were delivered to the UN Assistance Mission for Rwanda for use by peacekeeping forces evacuating civilians from the war-torn country. The airlift marked the first landing of a C-5 in Uganda.

The flights cost \$3.2 million, paid for by the Defense Emergency Response Fund.

51st FW Takes Colombian Trophy

For the second consecutive year, the 51st Fighter Wing, Osan AB, South Korea, has won the Colombian Trophy, given in recognition of the unit that chalks up USAF's best flying safety record.

From July 1, 1992, through September 30, 1993, the wing flew 11,190 sorties totaling 16,670 hours in the F-16, OA-10, UH-60, and C-12 aircraft without a Class A or Class B mishap. The wing also went seventy-nine months without a Class A mishap while flying 55,533 sorties totaling 92,778 hours. That is the longest a PACAF wing has gone without suffering such a mishap.

Class A mishaps involve the death or total disability of a person, damages of at least \$1 million, or damage beyond economical repair. Class B mishaps involve five or more persons requiring hospitalization or damage between \$200,000 and \$1 million. Osan is the fifth busiest air traffic area in the world. Air traffic controllers saw more than 188,000 radar approach control events and 81,000 tower events during the rating period.

Perry Acts to Reduce Milspecs

Defense Secretary Perry ordered in June another revision of the Pentagon's acquisition system, hoping to simplify how the military buys goods and key components for military systems.

Mr. Perry said DoD needs to have access to state-of-the-art commercial technology in order to obtain products and technology more rapidly and efficiently and to cut costs.

"Replacing, whenever and wherever we can, military-unique specifications—so-called 'milspecs'—with commercial and performance standards will accomplish these goals," Mr. Perry said, "as well as fitting in with the Administration's concepts of dual-use technology and support of our nation's industrial base by relying on the commercial marketplace."

The largest savings should come from purchases of technologically advanced components used in larger military weapons and related systems.

Mr. Perry also released in June DoD's report on military specifications and standards, "Blueprint for Change."

The eighty-eight recommendations in the report were developed by a Process Action Team chartered in August 1993 by Deputy Under Secretary of Defense for Acquisition Reform Colleen Preston to develop the plan to eliminate unnecessary and obsolete specifications, to use performance specifications, to use commercial standards where possible, to encourage industry to propose alternative solutions to military specifications and standards, and to cut paperwork.

"Troops to Teachers" Head Chosen

The Pentagon announced in June that Dr. John L. Stremple will admin-



A Lockheed quality inspector examines the first aft fuselage section for an FS-X flight test aircraft. Mitsubishi Heavy Industries, the Japanese prime contractor for the F-16 derivative, will assemble the aft section with other airframe components to complete the first prototype. First flight is scheduled for mid-1995.

ister the "Troops to Teachers" model program in California.

The Teacher and Teacher's Aide Placement Assistance Program will help finance teacher certification training for separated troops, terminated Defense Department and Energy Department civilians, and certain displaced defense contractor employees. [See "Troops to Teachers," June 1994 "Aerospace World," p. 16.]

Dr. Stremple was selected by Under Secretary of Defense for Personnel and Readiness Edwin Dorn. Dr. Stremple will run the program from McClellan AFB, Calif.

Dr. Stremple had been selected as the director of Education for the Department of Defense in 1992 to administer the DoD dependents' school system overseas and in the US, as well as the Continuing, Adult, and Postsecondary Education Program.

C-130s Battle Forest Fires

Three C-130 aircraft with about thirty Air Force Reservists from the 302d Airlift Wing's 731st and 302d Maintenance Squadrons, based at Peterson AFB, Colo., aided the US Forest Service in fighting fires in southern California in June.

Aircrews fought fires in a 2,000-acre area in the San Bernardino and Angeles National Forests, using the new Modular Airborne Firefighting System.

The MAFFS lets airmen quickly modify the C-130 into an airborne fire

truck. The reusable system deploys water and fire-retardant chemicals from aircraft in flight. It consists of seven airborne modules and an air compressor module. The system can be loaded on a C-130 in two hours and filled with retardant and compressed air in fifteen to twenty minutes. The entire load of retardant is discharged within eight seconds.

9th Air Force Wins Long Shot

Team 1 of 9th Air Force was named Top Long Shot Team at an awards banquet at Nellis AFB, Nev., in June, concluding the 1994 Long Shot competition. The team was a composite strike force of A-10s and F-16s from Shaw AFB, S. C., F-15s from Eglin AFB, Fla., F-16s from Moody AFB, Ga., and B-52s from Griffiss AFB, N. Y.

Long Shot is a short-notice, long-range conventional bombing competition, designed to incorporate many Air Combat Command fighter and bomber aircraft into a conventional combat strike force.

Team 1 from 12th Air Force took second place overall, and Team 1 from 8th Air Force took third. The Numbered Air Force Trophy went to 9th Air Force; 12th Air Force was second and 8th Air Force third.

Each numbered air force fielded two teams with eighteen aircraft apiece. Competing aircraft included the B-1B, A-10, F-15A/C, F-15E, F-16, B-52H, and F-111F. Air refueling and airborne command and con-

trol support was provided for each team by KC-135A/R, KC-10A, and E-3A AWACS aircraft. Marine F/A-18s served as adversary aircraft.

Team 1 from 9th Air Force captured 1,975 out of a possible 2,400 points or an 82.3 percent score. Team scores were based on the percentage of available points accumulated. Available points varied for the different strike packages. Team 1 from 12th Air Force earned 2,325 out of 3,000 points, giving it a score of 77.5 percent. Team 1 from 8th Air Force earned a score of 69.2 percent.

F-16 Wins Competition

The Republic of Singapore said it will purchase eighteen Lockheed F-16C/D fighters. The decision follows an intense competition that included the McDonnell Douglas F/A-18C/D.

The F-16 is the front-line fighter for eighteen nations. Including Singapore's order and forty aircraft ordered by Turkey in February, Lockheed has added fifty-eight new international F-16s to its backlog in 1994. The F-16 will be in the USAF inventory at least through 2020.

Ex-Airman Kills Four

A recently discharged USAF airman killed four people and wounded twenty-three others before being killed by a base Security Policeman in a June shootout at Fairchild AFB, Wash.

A1C Dean Mellberg was discharged from Cannon AFB, N. M., in May for personality and character disorders. He had been assigned to Fairchild in April 1993 and was reassigned to Cannon in March.

The shooting occurred at 3:15 p.m., when Mellberg entered the mental health clinic outside the base carrying an AK-47 assault rifle. He shot and killed two doctors and wounded several people before crossing the parking lot to the hospital. Once inside, Mellberg began shooting patients and staff members, killing one.

He then left the building and killed a fourth person in a grassy area near the hospital. He was gunned down by a bicycle-mounted policeman patrolling the area.

The shooting is under investigation.

Lockheed Discounts F-16C/Ds

Lockheed made an unsolicited offer to sell the Air Force additional F-16C aircraft at a price of \$20 million each. The offer will remain available for government action from Fiscal 1997 through Fiscal 2000.

Lockheed said that successful ef-

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 **Rockwell** Aerospace

North American Aircraft



A C-17 Globemaster III visited Vought Aircraft's Dallas, Tex., facility in July, where thousands of employees got their first look at the airlifter. Vought produces the engine nacelles, vertical and horizontal tail sections, and the aerial refueling receptacle for the aircraft.

forts to hold down manufacturing costs for the F-16 as production rates decline enabled it to make the offer. The cost of current F-16s is believed to be about \$25 million per copy.

The price quoted is a per-unit fly-away cost offered for production quantities of twelve to twenty-four aircraft a year. The Lockheed portion of the airplane cost is considered a firm price, calculated in Fiscal 1994 dollars.

Lockheed's new proposal is for the Block 50D F-16C—the version the Air Force currently buys. New F-16C purchases under Lockheed's offer could begin deliveries in early 1999. The last delivery from the proposed four-year purchase would occur in December 2002.

Flying Dolphins

In May, members of the 438th Airlift Wing, McGuire AFB, N. J., flew a C-141 two-ship mission to pick up and deliver eight Atlantic and four Pacific bottle-nosed dolphins and their trainer-caretakers from NAS North Island, Calif., to Hickam AFB, Hawaii.

Each dolphin was encased in a tank slightly larger than the dolphin itself. Before takeoff, trainers partially submerged the dolphins in the containers while litters were clamped to the tanks to hold the dolphins in place. Some delicate flying was required to keep the dolphins from being jostled.

The trainers calmed the dolphins by patting and stroking their skin and

kept them cool by pouring water over them. Crew members tried to keep the flight smooth.

Pilot Capt. Chris Von Thaden, 13th Airlift Squadron, said, "The dolphins were very excitable during the flight. They would periodically spray the area and kept their chirping up until we landed."

In Hawaii, the dolphins were assigned to USS *Juneau*, an amphibious landing ship. *Juneau*, along with

ships from the US, Australian, and Canadian navies, sailed to Hawaii as part of the Rim of the Pacific exercise. The dolphins' role in the exercise included locating foreign undersea objects and swimmers who could pose a threat to ships.

To learn to perform their duties, the dolphins went through ten to twelve years of extensive training.

Operation Sea Signal Begins

In June, the Air Force deployed an air transportable hospital and fifty-seven members of the 6th Medical Group, MacDill AFB, Fla., to Guantanamo Bay Naval Base, Cuba, to treat and process sick and wounded Haitian refugees.

The operation—called Sea Signal—was launched to provide a means for dealing with increasing numbers of Haitians fleeing their nation and attempting to enter the United States. An air transportable hospital is self-contained and mobile, with full laboratory, X-ray, and surgical capabilities, and can be rapidly sent anywhere in the world.

The hospital will be set up to screen migrant Haitians for communicable diseases, including the human immunodeficiency virus (HIV) associated with AIDS.

Lt. Col. Dave Kulow, 6th Medical Group chief of Public Health, said, "Our staff is concerned particularly with tuberculosis because it's airborne spread. We have special high-filtration masks to deal with this problem.



The Museum of Flight in Seattle, Wash., began exhibiting a rare Lockheed D-21 drone, reunited with its "mother ship," the A-12 "Blackbird," earlier this year. The drone was originally designed for CIA surveillance missions over hostile territory. It was capable of speeds approaching 3,000 miles per hour.

Photo by Brian Baum

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We also intend to be extra cautious with blood work to prevent the spread of HIV and hepatitis."

More than 400 other Air Force personnel have been attached to Joint Task Force 160-Deployed, a unit established to support President Clin-

ton's decision to use Guantanamo Bay as a transit processing center for Haitian refugees.

News Notes

■ In June, a south Chicago elementary school was renamed to honor

Maj. Robert H. Lawrence, Jr., the first African-American selected to be an astronaut. He was to have flown in the Gemini/Manned Orbiting Laboratory Program but died in the 1967 crash of an F-104D Starfighter at Edwards AFB, Calif., a few months

Senior Staff Changes

RETIREMENTS: B/G Peter C. Bellisario; B/G George P. Cole, Jr.; B/G Dennis K. Hummel; B/G Ben Nelson, Jr.; B/G David Oakes; B/G Hallie E. Robertson; M/G William A. Studer.

CHANGES: B/G (M/G selectee) Jerrold P. Allen, from Cmdr., 7th Wing, ACC, Dyess AFB, Tex., to Dir., Plans & Policy, J-5, Hq. USEUCOM, Stuttgart-Vaihingen, Germany, replacing M/G Charles D. Link . . . M/G George K. Anderson, from Cmdr., Human Sys. Ctr., AFMC, Brooks AFB, Tex., to Dep. Ass't Sec'y of Defense (Health Services Ops.), Washington, D. C. . . . B/G Robert P. Belihar, from Command Surgeon, Hq. AFMC, Wright-Patterson AFB, Ohio, to Cmdr., Human Sys. Ctr., AFMC, Brooks AFB, Tex., replacing M/G George K. Anderson . . . B/G Robert J. Boots, from Dir., P&P, Hq. AMC, Scott AFB, Ill., to Cmdr., 436th AW, AMC, Dover AFB, Del., replacing Col. William Welser III . . . M/G Hiram H. Burr, Jr., from Cmdr., 13th AF, PACAF, and Cmdr., Southwest Pacific Air Defense Region, PACOM, Andersen AFB, Guam, to Ass't Dep. Under Sec'y (International Affairs), Office of the Under Sec'y, OSAF, Washington, D. C., replacing M/G Joseph E. Hurd . . . B/G Paul K. Carlton, Jr., from Dir. of Medical Services and Training, Hq. AETC, Randolph AFB, Tex., to Cmdr., 59th Medical Wing, AETC, and Lead Agent, Region VI, DoD, Lackland AFB, Tex., replacing M/G (L/G selectee) Edgar R. Anderson, Jr. . . . B/G John P. Casciano, from Dir., P&R, ACS, Intel., Hq. USAF, Washington, D. C., to Dir., JEWIC, Jt. Staff, and Cmdr., AIA, Kelly AFB, Tex., replacing M/G Kenneth A. Minihan . . . B/G (M/G selectee) William J. Donahue, from Dir., Communications-Computer Systems, Hq. ACC, and Dep. Dir., Communications-Computer Systems, ACOS, Langley AFB, Va., to Dir., Comd. Control Sys. and Log., J-4/J-6, Hq. USSPACECOM, and Dir., Comd. Control Sys., NORAD, Peterson AFB, Colo., replacing M/G Phillip E. Bracher.

L/G James A. Fain, Jr., from Cmdr., ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, to Ass't Vice C/S, Hq. USAF, Washington, D. C., replacing L/G Thomas G. McInerney . . . B/G John H. Garrison, from US Defense and Air Attaché, People's Republic of China, DIA, USDAO, Beijing, China, to Dir., Intel., Hq. ACC, Langley AFB, Va. replacing Col. G. E. Reynolds . . . B/G Orin L. Godsey, from Dir., Command & Control, Combat Ops. Staff, and Dep. Dir., Ops. & Log., J-3/J-4, Hq. USSTRATCOM, Offutt AFB, Neb., to Chief of Safety, Hq. USAF, Washington, D. C., replacing M/G Ronald N. Running . . . B/G (M/G selectee) Edward F. Grillo, Jr., from Cmdr., 97th AMW, AETC, Altus AFB, Okla., to Vice Cmdr., 15th AF, AMC, Travis AFB, Calif., replacing retiring M/G Marvin S. Ervin . . . B/G John B. Hall, Jr., from Cmdr., 20th Fighter Wing, ACC, Shaw AFB, S. C., to Dir., East Asia Pacific Region, Office of the Ass't Sec'y of Defense for International Security Assistance, OSD, Washington, D. C. . . . B/G Marcelite J. Harris, from Dir., Technical Training, Hq. AETC, Randolph AFB, Tex., to Dir., Maintenance, DCS/Log., Hq. USAF, Washington, D. C., replacing retiring B/G Dennis K. Hummel . . . B/G Charles R. Henderson, from Cmdr., 384th Bomb Group, ACC, McCannell AFB, Kan., to Cmdr., 7th Wing, ACC, Dyess AFB, Tex., replacing B/G (M/G selectee) Jerrold P. Allen . . . B/G Peter F. Hoffman, from Cmdr., AFMOA, Office of the Surgeon General, Hq. USAF, Bolling AFB, D. C., to Command Surgeon, Hq. AMC, and Command Surgeon, Hq. USTRANSCOM, Scott AFB, Ill., replacing M/G Charles H. Roadman II.

M/G Joseph E. Hurd, from Ass't Dep. Under Sec'y (Internat-

tional Affairs), OSAF, Washington, D. C., to Dir., Ops., J-3, Hq. USCENTCOM, MacDill AFB, Fla., replacing retiring M/G William A. Studer . . . Col. (B/G selectee) Leslie F. Kenne, from Prgm. Dir. for F-16, AFPEO, Under Sec'y (Acquisition), OSAF, Washington, D. C., to Vice Cmdr., ASC, Hq. AFMC, Wright-Patterson AFB, Ohio, replacing B/G Raymond A. Shulstad . . . B/G Timothy A. Kinnan, from Mil. Ass't to the Sec'y of the Air Force, OSAF, Washington, D. C., to Cmdr., 347th Fighter Wing, ACC, Moody AFB, Ga., replacing B/G James I. Mathers . . . B/G James D. Latham, from Commandant, AFROTC, AU, Hq. AETC, Maxwell AFB, Ala., to Cmdr., 20th Fighter Wing, ACC, Shaw AFB, S. C., replacing B/G John B. Hall, Jr. . . . M/G Charles D. Link, from Dir., Plans & Policy, J-5, Hq. USEUCOM, Stuttgart-Vaihingen, Germany, to Spec. Ass't to the Sec'y of the Air Force and the C/S, USAF, for Roles and Missions, Hq. USAF, Washington, D. C. . . . B/G James I. Mathers, from Cmdr., 347th Fighter Wing, ACC, Moody AFB, Ga., to Command Dir., NORAD Combat Ops. Staff, Hq. NORAD, Cheyenne Mountain AFS, Colo. . . . M/G Kenneth A. Minihan, from Dir., JEWIC, Jt. Staff, and Cmdr., AIA, Kelly AFB, Tex., to Ass't C/S, Intel., Hq. USAF, Washington, D. C., replacing M/G (L/G selectee) Ervin J. Rokke . . . B/G Pedro N. Rivera, from Cmdr., 89th Medical Group, AMC, Andrews AFB, Md., to Cmdr., 81st Medical Group, AETC, Keesler AFB, Miss., replacing Col. Walter A. Divers, Jr.

M/G Charles H. Roadman II, from Command Surgeon, Hq. AMC, and Command Surgeon, Hq. USTRANSCOM, Scott AFB, Ill., to Cmdr., AFMOA, Office of the Surgeon General, Hq. USAF, Bolling AFB, Washington, D. C., replacing B/G Peter F. Hoffman . . . L/G Michael E. Ryan, from Ass't to the Chairman of the JCS, Washington, D. C., to Cmdr., Allied Air Forces Southern Europe, NATO; and Cmdr., 16th AF, USAFE, Naples, Italy, replacing retired M/G Ralph R. Rohatsch, Jr. . . . M/G Richard T. Swope, from Ass't C/S, Ops. and Logs., and Senior USAF Representative, Hq. AFCE, NATO, Brunssum, the Netherlands, to Cmdr., 13th AF, PACAF, and Cmdr., Southwest Pacific Air Defense Region, PACOM, Andersen AFB, Guam, replacing M/G Hiram H. Burr, Jr. . . . B/G Thomas C. Waskow, from Spec. Ass't to the Supreme Allied Cmdr., Europe, NATO, SHAPE, Mons, Belgium, to Cmdr., 502d ABW, AU, Hq. AETC, Maxwell AFB, Ala., replacing retiring B/G Albert D. Jensen . . . Col. (B/G selectee) George N. Williams, from Dep. Dir. of Plans, DCS/P&O, Hq. USAF, Washington, D. C., to Cmdr., 97th AMW, AETC, Altus AFB, Okla., replacing B/G (M/G selectee) Edward F. Grillo, Jr. . . . B/G John L. Woodward, Jr., from Dir., Comd., Control, Communications, and Computer Sys., Hq. AMC, Scott AFB, Ill., to Dir., Communications-Computer Sys., Hq. ACC and Dep. Dir., Communications-Computer Sys., ACOS, Langley AFB, Va., replacing B/G (M/G selectee) William J. Donahue . . . Col. (B/G selectee) Michael K. Wyrick, from Chief, Health Care Mgmt., and Dep. to the Command Surgeon, Hq. AMC, Scott AFB, Ill., to Dir., Medical Prgms. and Resources, Office of the Surgeon General, Hq. USAF, Bolling AFB, D. C., replacing M/G Robert A. Bueth, Jr. . . . B/G David L. Young, from Dep. Dir., Ops., G-3 (Resources), Hq. FORSCOM, Fort McPherson, Ga., to Cmdr., 2d BW, ACC, Barksdale AFB, La., replacing Col. (B/G selectee) William C. Brooks.

SES CHANGE: William A. Davidson, to Administrative Ass't to the Sec'y of the Air Force, Office of the Administrative Ass't, OSAF, Washington, D. C.

before the launch. The major's widow, Betty Lawrence, and his mother were honored at the renaming ceremony.

■ SMSgt. Joseph P. Sullivan, Jr., of Scott AFB, Ill., is the Air Force's First Sergeant of the Year for 1994. Sergeant Sullivan is with Air Force Command, Control, Communications, and Computer Agency headquarters. He is credited with establishing stress-management classes and developing the suicide-awareness briefing adopted by the Scott Mental Health Clinic. He also helped to found a mentoring program for junior enlisted members. He began his Air Force career in 1979.

■ Two B-1B bombers from the 28th Bomb Wing at Ellsworth AFB, S. D., completed a twenty-one-hour global power mission in June that began a six-month congressionally mandated test. The aircraft flew a round-trip bombing mission to Captieux bombing range near Bordeaux, France. The mission was the 28th BW's first overseas flight of the bomber operational readiness assessment.

■ The Pentagon's active-duty dependents dental plan will increase its monthly premiums in October by thirty-five cents for enrolled active-

duty family members and seventy cents for active-duty sponsors with two or more enrolled family members.

■ A life-size bronze statue of a Doberman pinscher was unveiled in June at the Pentagon, honoring the work and sacrifices of military dogs. The Doberman was the official US Marine Corps dog during World War II. The statue was moved for permanent display to the War Dog Cemetery on Guam in July. The unveiling in Guam was tied to the fiftieth anniversary of the Battle of Guam. In that battle, twenty-five Marine Corps Dobermans died in action.

■ The F-22 System Program Office received the 1994 Air Force Small Business Special Achievement Award as the leading Air Force SPO supporting the Air Force Small and Disadvantaged Business Program through its use of Mentor-Protégé agreements.

■ AFSPC's 20th Air Force celebrated its fiftieth anniversary in June. Known as the most decisive US Army Air Forces unit in the Pacific theater during World War II, 20th Air Force was credited with ending the war early and saving an estimated one million American lives. The nucleus of 20th Air Force was the B-29 Superfortress,

and its most famous aircraft were the *Enola Gay* and *Bockscar*. Those aircraft dropped atomic bombs on Hiroshima and Nagasaki, respectively, ending Japan's resistance and bringing about the unconditional surrender of that nation.

■ In June, the Department of Defense began releasing classified documents from Operation Desert Storm in order to provide as much data as possible to answer questions and alleviate concerns of those who fear they may have been exposed to chemical or biological agents. A task force assigned to study the health effects from Desert Storm found no evidence to indicate that either chemical or biological warfare was employed at any level or that US troops were exposed to those agents.

■ The 44th Missile Wing, Ellsworth AFB, S. D., and its Minuteman II missiles were inactivated in June after thirty-two years of contributing to strategic deterrence and national defense. The last missile was taken from its silo in April.

■ The first flight of Orbital Sciences Corp.'s enhanced-performance Pegasus XL space-launch vehicle, which was intended to carry the Air Force's

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STEP Mission 1 satellite to low-Earth orbit, failed in June. The vehicle had to be destroyed approximately three minutes into the flight after an anomaly was detected. When the vehicle was destroyed, it was about 240 miles off the California coast. It had been launched from a Lockheed L-1011 carrier aircraft.

■ The Air Force selected 6,320 staff sergeants for promotion to technical sergeant in June. A total of 56,422 eligibles were considered, for an overall selection rate of 11.2 percent.

■ In July, the 5th Bomb Wing, Minot AFB, N. D., led a force that turned a remote airstrip into a forward strike location as a part of Mighty Force '94. The annual exercise changes an airfield in Roswell, N. M., to a small composite strike force center. Eight B-52s from Minot, four B-52s from Barksdale AFB, La., F-111s from Cannon AFB, N. M., and F-16s from Hill AFB, Utah, took part in the exercise.

Purchases

The Air Force awarded General Dynamics Corp. (now Lockheed Fort Worth Co.) a \$297 million face-value increase to a firm fixed-price con-



Boeing is teaming with USAF's Human Systems Center, Brooks AFB, Tex., to develop Combat Ace, a life-support system that adds chemical warfare protection to the Combat Edge system now used in the F-16. The new program adds an air filter pack, hood, respirator, and ventilation hose to the outfit.

tract for action to extend long lead funding through July 31, 1995, for 120 F-16A and thirty F-16B aircraft. Expected completion: July 1995.

The Air Force awarded United

Technologies Corp. a \$39 million face-value increase to a contract for eight additional F117-PW-100 engines for use on C-17 aircraft. Expected completion: December 1997. ■

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The two-war standard is reasonable, but the defense program is too thin and rests on too many optimistic assumptions.

The High-Risk Military Strategy

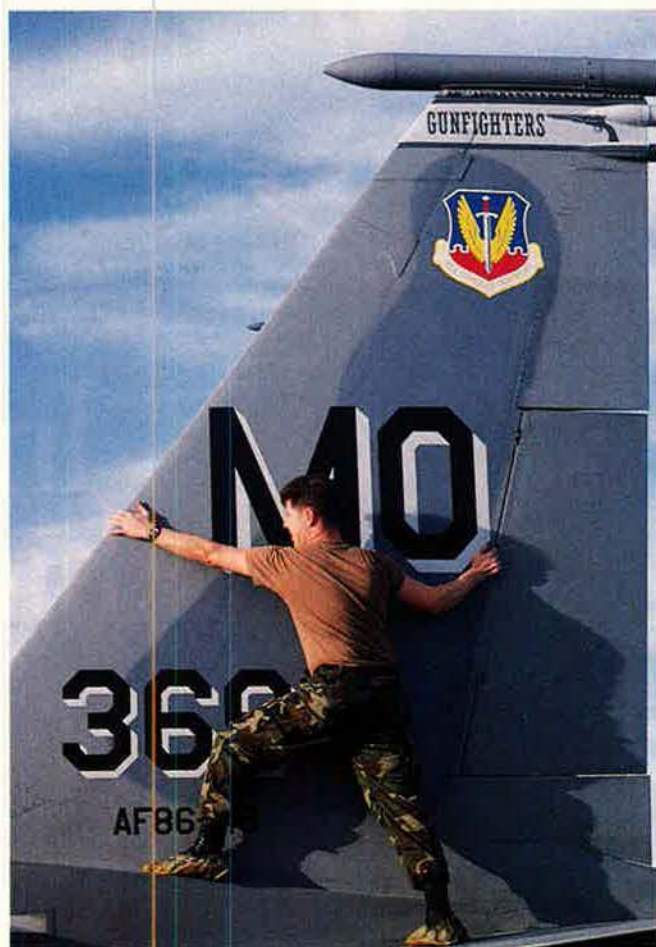
By John T. Correll, Editor in Chief

FOR SEVERAL weeks in the summer of 1993, Secretary of Defense Les Aspin tested public opinion with a proposal for a sequential military strategy called "Win-Hold-Win." The reaction to it was overwhelmingly negative. Mr. Aspin was in a fix of his own making. He was searching for a program that would match the radical defense spending cuts that he and President Clinton had already announced, before investigating the impact they would have on force capability. Details were to be worked out in a "Bottom-Up Review" to follow.

The initial Bottom-Up Review analysis of defense requirements pointed to a larger force than could be covered by the Clinton budget. That led to the Win-Hold-Win proposal, a strategy for US forces to prosecute fully one regional conflict but conduct a holding action on a second front until more forces could arrive. When that plan went down under fire, Mr. Aspin proclaimed a "two-MRC" strategy—US forces prepared to fight and win two major regional conflicts "nearly simultaneously."

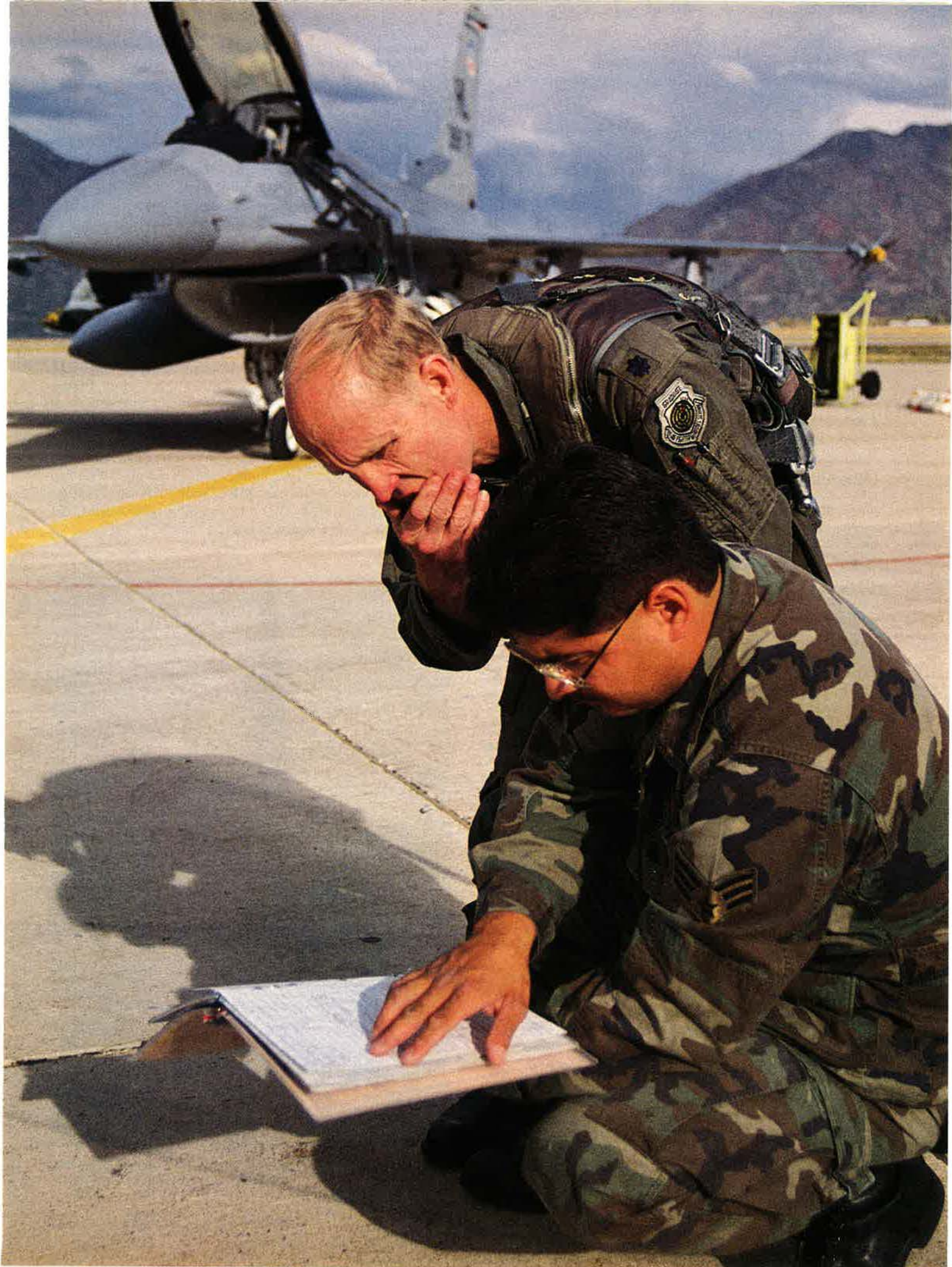
Four months later, Mr. Aspin announced the new force structure with which the US would try to implement this strategy. It marked a steep drop from the "Base Force" proposed by the Bush Administration. The Air Force, for example, would field twenty fighter wings rather than 26.5. The Army would have ten active-duty divisions instead of twelve. Concern about the Aspin two-conflict strategy has not abated. The argument is not with the basic concept—on which there is fairly general agreement—but about the force levels and budgets proposed to go with it.

The forces, requirements, and strategy issue has three



Photos by Randy Jolly

The 366th Wing at Mountain Home AFB, Idaho—the Gunfighters—is USAF's first "air intervention wing." The new strategy will tax such rapid-deploying combat units to the limit. At right, a pilot and crew chief from the 4th Fighter Squadron, Hill AFB, Utah.



parts, which can be expressed as questions: Is the new strategy sound? What does the strategy require? Is the strategy credible?

Soundness of the Strategy

As a form of planning shorthand, strategies are frequently described in terms of the number of wars or conflicts the armed forces are supposedly prepared to fight. Obviously, conflicts differ in scope and intensity. Definitions of "war" and "conflict" may vary as well.

Origins. The "two and a half war" standard was the basis for United States conventional force planning in the years 1961–68. It supposedly covered simultaneous response to a Soviet/Warsaw Pact invasion in Europe, an attack by China in Asia, and a "lesser contingency" elsewhere. The lesser contingency, or "half-war," was Vietnam—which was the equivalent certainly, and perhaps then some, to a full-up major regional conflict as defined today.

The "one and a half war" strategy, spanning the years 1969–81, was adopted initially by the Nixon Administration in response to the rupture of Sino-Soviet political and military relations. It was based on the declared capability to repel a Warsaw Pact invasion of Europe and fight a half-war elsewhere, e.g., a Chinese-sponsored North Korean invasion of South Korea.

The "no number" strategy was in effect during 1982–90. At the beginning of the Reagan rearmament program, Defense Secretary Caspar W. Weinberger rejected "mechanistic assumptions" about numbers of wars to be fought and said force structure would be based on "much broader and more fundamental judgments." The next two Defense Secretaries, Frank C. Carlucci and Dick Cheney, took generally the same approach. No specific number of conflicts was publicly stated as an element of strategy, but it always was clear that the defense posture was intended to cover multiple threats.

In 1990, just before the Persian Gulf War began, the US switched to a new strategy. It had a sharp new focus on regional conflicts and was built around smaller forces, fewer deployments overseas, and the assumption that the primary threats would be regional rather than global, as was the Soviet threat during the Cold War era. The reduced configuration of the armed forces was to be called the Base Force. The Base Force strategy was intended to cover "multiple regional crises." Secretary Cheney said that even while the US was engaged in a prolonged operation, "our forces must remain able to deter or respond rapidly to other crises or to expand an initial crisis deployment in the event of escalation, also on short notice."

A critical turn en route to the next strategy came in March 1993, when Secretary Aspin announced the Clinton Administration's first defense budget, covering Fiscal 1994–98. The plan roughly doubled the budget cuts that the Bush Administration had planned for this period, with force and program decisions to come later. The general inspiration for the new defense plan was a set of force and budget options—notably one called "Option C"—that Mr. Aspin developed while serving in Congress as chairman of the House Armed Services Committee.

In the summer of 1993, after the budget had been cut, the Joint Staff worked on force-structure options to

match up with the Administration's arbitrary 1994–98 projections. Details of the work in progress leaked and were published by the *New York Times*, the *Los Angeles Times*, and other newspapers. That was the first revelation of the Win-Hold-Win concept, and it was met with withering criticism. Within weeks, advocacy of it had become untenable. On June 24, Mr. Aspin finally gave up on Win-Hold-Win. In a major speech, he declared, "After much discussion, we've come to the conclusion that our forces must be able to fight and win two major regional conflicts, and nearly simultaneously."

Necessity. The negative reactions to Win-Hold-Win—and Mr. Aspin's fundamental retreat from it—indicate a fairly broad base of opinion that a stronger defense posture is required. While the two-MRC strategy was not Secretary Aspin's first choice, his stated logic for it was sound.

"There was concern," Mr. Aspin said in his 1994 Annual Report to Congress, "that if the United States was drawn into a war with one regional aggressor, another could well be tempted to attack its neighbors—especially if they were convinced that the United States and its allies did not have enough military power to deal with more than one MRC at a time. Moreover, sizing US forces for more than one MRC will provide a hedge against the possibility that a future adversary might one day mount a larger-than-expected threat."



Airmen service an MC-130H of the 16th Special Operations Wing at Hurlburt Field, Fla. "Force multiplier" SOF aircraft will be increasingly vital to tomorrow's smaller military.

Photo by Randy Jolly

The RAND Corp., in its assessment, pointed out yet another consideration: "A larger force structure provides flexibility and some margin for responding to the unexpected—both valuable qualities when dealing with something as inherently uncertain as military operations ten to twenty years in the future."

There is, to be sure, a body of opinion that holds a two-conflict strategy to be unnecessary, questionable, or excessive. In February, for example, the *New York Times* objected to the supposedly unrealistic requirement that US forces be ready to fight two nearly simultaneous MRCs. Within the month, the Clinton Administration had put both Serbia and North Korea, more or less simultaneously, on what sounded very much like warnings of war.

Some commentators speak of regional conflicts as if they would be little fights and local affairs, not amounting to much. The fact is that MRCs are not easy, as the US learned in Vietnam and as the Soviet Union learned in Afghanistan.

The United States has a fairly consistent history of underestimating in peacetime the forces that it will require in wartime. The Persian Gulf War, for example, ultimately required a third more fighter forces than the strategy had estimated. It required most of USAF's best aircraft and the largest coalition air fleet to see combat since World War II. RAND Corp. analysts, studying regional conflict for the Pentagon, discerned a pattern of imperfect US forecasts; it said peak US deployments needed to fight in Korea, Vietnam, and Iraq "exceeded planners' prewar expectations by a factor of two in critical areas."

The danger of global war has diminished, but there has been a corresponding increase in the probability of regional conflict. In some instances, such conflicts may have implications reaching beyond the region. The potential for escalation to larger, wider wars is always present. Early visions of a "new world order" to follow the Cold War were optimistic. It is now clear that the new order is characterized by instability, regional power struggles, and violence that in some cases had been restrained when the superpowers exerted more influence on lesser powers.

Five years ago, it was considered almost eccentric to worry about North Korea as a military threat. Nobody is smirking today. Five years ago, before the breakup of the Warsaw Pact and the collapse of the Soviet Union, the prospects of near-term conflict in Europe were rated as virtually nil. Few would make that judgment today with the same confidence, having seen the relentless animosity unleashed in the Balkans and the tensions at play among the new nations of the former USSR. It does not take a hyperactive imagination to conceive of trouble originating in—or spreading from—the old Soviet Union.

In times of peace, an austere defense posture can seem adequate. Cuts in defense may seem harmless, even wise. A limited crisis, well short of war, can upset such perceptions overnight. It is a safe bet that if a major crisis began, the nation would feel less secure in its defense arrangements than it does today. The standard for defense planning must be the level of capability the nation would need and want in wartime, not the posture that seems sufficient in the tranquility of peacetime.



Photo by Randy Jolly

Heavy, long-range bombers are recognized as make-weights of the two-war strategy. Here, a B-1B of the 28th Bomb Wing, Ellsworth AFB, S. D., flies a training mission.

Strategy's Airpower Requirements

The Bottom-Up Review concluded that the Pentagon should expect the aggressor in a typical MRC to have up to 750,000 troops, some 4,000 tanks, 1,000 combat aircraft, and 1,000 Scud-class ballistic missiles. Moreover, it concluded that the US should expect to respond to such a crisis in four operational stages:

Phase 1. Halt the invasion. Keep to a minimum the territory and critical facilities an invader can capture. Deploy US forces rapidly to the theater and enter battle as quickly as possible.

Phase 2. Build up US combat power in the theater while reducing the enemy's. Insert land, sea, and air forces to ensure the enemy does not regain the initiative. Mount sustained attacks to reduce enemy capabilities in preparation for a counteroffensive.

Phase 3. Decisively defeat the enemy. Conduct a large-scale air-land counteroffensive, retake territory, destroy enemy war-making capabilities, and achieve other objectives.

Phase 4. Provide for postwar stability. Maintain forces in the region to ensure that adverse conditions do not recur.

The plan's heavy reliance on airpower is obvious. Less evident is the extent to which the US would depend on landbased bombers and strike aircraft for early destruction of critical targets. One assessment by RAND analysts

1 Airpower Against High-Value Objectives in Early Phases of Major Regional Conflicts

Objective	Measure of Evaluation	Percent by Landbased Airpower
Destroy enemy's war-making capacity by destroying fixed assets	Precision ordnance deliverable against fixed targets	91%
Halt and destroy the invading force	Precision ordnance deliverable against moving targets	77%
Destroy dug-in forces	Kill potential against revetted armor	74%

Source: David Ochmanek and John Bordeaux, "The Lion's Share of Power Projection," *Air Force Magazine*, June 1993.

is summarized in Table 1 above. The figures can be—and have been—challenged. However, they are consistent with the experience of Operation Desert Storm, where USAF aircraft delivered ninety percent of US precision guided munitions (PGMs) and seventy-two percent of US gravity bombs.

The Bottom-Up Review was not the first effort to size a force for a major regional conflict. Considerable analysis had been done before and after the nation converted to Base Force strategy in 1990. The Base Force estimate—as well as most others that preceded the budget-driven Bottom-Up Review—found a requirement for a force substantially larger than the one projected by the Clinton Administration in its Fiscal 1995–99 budget plans.

The Base Force called for 26.5 fighter wing equivalents. However, the Joint Chiefs of Staff saw even the Base Force as having significant limitations. In a 1992 assessment, the chiefs concluded, "*the Base Force is capable of resolving quickly—with low risk—only one major regional crisis at a time.* For two crises occurring close together, the United States would have to employ economy of force and sequential operations and make strategic choices. The risk to US objectives in either case is no more than moderate, but there is little margin for unfavorable circumstances." [Emphasis added.]

RAND also looked at the requirements question before the Bottom-Up Review got under way. RAND found that even the Base Force would not have enough assets in some categories to cover two MRCs. In Desert Storm,

the Air Force used about thirty percent of its total fighter assets, but nearly all long-range fighter-bombers and C³I elements were committed. RAND's conclusions:

- A single MRC requires ten fighter wings, eighty heavy bombers, and ninety percent of US airlift.
- A second MRC would entail shuttling and shifting.
- Each MRC would require three aircraft carriers.

In the summer of 1993, the Joint Staff studied requirements for carrying out three strategies: a true "two simultaneous MRC" plan, a "Win-Hold-Win" plan, and a one-MRC plan. The Joint Staff initially came up with numbers displayed in Table 2 on this page.

The cost of the preferred two-MRC strategy was too high to match the "thin air" budget. To keep the two-MRC strategy and stay within budget, therefore, Mr. Aspin and his colleagues inserted "nearly" before "simultaneously"—and dropped four fighter wings. Note that the number of fighter wing equivalents eventually adopted for the two-MRC strategy is identical to that proposed for the discredited Win-Hold-Win. The Bottom-Up Review did not project airlift requirements or plans.

Eventually the corporate Air Force signed up to the budgeted force of twenty FWEs and only 100 operational bombers. Gen. Merrill A. McPeak, USAF Chief of Staff, endorsed that projection personally but said that until the B-2 and adequate quantities of PGMs are available, "the force structure will be pretty well stretched to accomplish the two-MRC strategy."

Gen. John Michael Loh, commander of Air Combat Command, has said he needs to know more about the nature and timing of the potential conflicts on which the strategy and force structures are predicated. For example, he asked, "what do we mean by 'nearly simultaneously'? And what do we mean by 'two MRCs'? Do we mean two Desert Storms? Do we mean a Desert Storm and a Panama?"

Questions about the bomber force have been particularly acute. In February, General McPeak told reporters, "Our analysis indicates we can service the entire target set that comes at you from two major regional contingencies, near simultaneously, with a bomber force of about 100 deployable bombers equipped with PGMs" and that the Air Force was "on a path" to having that PGM capability around the turn of the century.

General McPeak told the Senate Armed Services Committee in March that the Bottom-Up Review "set a requirement for bombers that [we already cannot meet] because the budget doesn't support the Bottom-Up Review bomber force structure. So for me, the Bottom-Up Review force structure is an abstraction. . . . The budget

2 Initial Joint Chiefs of Staff Force Computation (Summer 1993)

Strategy	Force Structure
Two MRCs simultaneously	24 FWE 12 active Army divisions 12 carriers
Win-Hold-Win	20 FWE 10 active Army divisions 10 carriers
One MRC at a time	16 FWE 8 active Army divisions 8 carriers

is a reality.” He said the Air Force “backed into bomber cuts” to meet lower budget ceilings and that nothing had changed to alter prior Air Force analyses, which called for a force of 184 bombers to cover critical targets early in a conflict.

For the past several years, the strong performance of US forces in the Gulf War has been cited often as evidence that capabilities are adequate or excessive. Testifying to Congress in 1994, Robert D. Reischauer, director of the Congressional Budget Office, cited Gulf War success to suggest the feasibility of making new reductions below levels now projected.

“Given the superiority that US forces demonstrated in Desert Storm,” he said, “it might be possible to eliminate some duplicative forces without endangering US national security.”

As Mr. Reischauer knows (or should know), the force that won the Gulf War no longer exists. It was reduced by the Bush Administration in its Base Force planning, and the Bottom-Up Review cut more. The superiority US

3 The USAF Fighter Force in 1996

Mission	Aircraft	Total FWE	Active-Duty FWE	Reserve FWE
Air superiority	F-15C/D	4.1	3.5	0.6
Long-range attack	F-15E/ F-111F	2.6	1.9/0.75	0
Multirole	F-16C/D	10.25	5.05	5.2
Attack	F-117	0.5	0.5	0
Defense suppression	F-4G	0.5	0.3	0.2
Close air support	A-10	2.0	1.0	1.0
All		20.0	13.0	7.0

forces demonstrated in Desert Storm is not a guaranteed element in planning for future wars.

Major Combat and Support Aircraft

Fighters. Beginning in 1976 and continuing into the 1980s, the Air Force officially was building toward a force of forty combat-coded fighter and attack wings. The forty-wing goal was somewhat arbitrary, representing a compromise between official requirements and available budgets. The requirement actually indicated by the analysis was about forty-four wings.

In 1987, the Air Force dropped its goal to thirty-seven

5 FWE Levels and Projections

Force level in 1990	24 active, 12 reserve
Base Force projection	15.25 active, 11.25 reserve
Win-Hold-Win projection	13 active, 7 reserve
Bottom-Up Review projection	13 active, 7 reserve
Force level in 1994	13.4 active, 8.7 reserve
FY 1995 budget projection	13 active, 7 reserve

wings, stating it would concentrate on supporting those wings properly. In February 1991, the Pentagon announced plans to again reduce USAF fighter structure—this time to twenty-six wings. In March 1993, the Pentagon’s annual budget announcement said the Base Force would be reduced to 24.3 FWE, the only major force-structure change Mr. Aspin announced at that time. The Bottom-Up Review, of course, dropped the fighter force structure to its lowest point yet—twenty combat-coded fighter and attack wings.

Tables 3, 4, and 5 show the diminishing level of Air Force fighter wing equivalents, the intended composition of the future force by mission and aircraft, and where that force will be based. Consequences of the drawdown include a reduction overseas of fifty-eight percent in aircraft and fifty-three percent in bases.

Table 6 on p. 40 shows the steady decrease in numbers of fighter and attack aircraft operated by the Air Force. Fiscal Year 1994 is a benchmark of note, since the active-duty fighter fleet will slip below 1,000 aircraft.

The Clinton force structure grew out of a set of options—the favored one being “Option C”—that Mr. Aspin devised in 1992 when he chaired the House Armed Services Committee. Option C used as its benchmark a “Desert Storm Equivalent.” The assumption was that the force employed in the Gulf War would be approximately the force required for a major regional conflict in the future.

Mr. Aspin said “the basic Desert Storm Equivalent—the ‘force that mattered’”—had, in addition to land and naval forces, the equivalent of twenty-four USAF fighter squadrons. General McPeak said Mr. Aspin’s numbers added up to “Desert Drizzle,” not Desert Storm. The actual Desert Storm force, said the General, comprised thirty-three Air Force fighter squadrons (eleven FWE) plus the equivalent of twenty-four coalition fighter squadrons, for a total of fifty-seven squadrons.

4 USAF Fighter Wings 1999, Regional Projection

	Europe	Pacific	US Active-Duty	US Air Reserve Component	Total
Air superiority	.5	1.25	1.75	0.6	4.1
Long-range interdiction	.6	.25	1.5	N/A	2.35
Short-range interdiction/CAS	1.2	1.7	4.25	6.4	13.55
Total	2.3	3.2	7.5	7.0	20.0

6 Air Force Fighter and Attack Aircraft PAA (Primary Aircraft Authorized)

	Active-Duty	Reserve	Total
FY 1990	1,722	873	2,595
FY 1991	1,560	861	2,421
FY 1992	1,254	924	2,178
FY 1993	1,131	816	1,947
FY 1994	963	627	1,590
FY 1995	936	504	1,440
FY 1996	936	484	1,420

The RAND Corp. says, "Historically, the Air Force has deployed an average of ten fighter wings [about thirty squadrons] to the three major post-World War II conflicts: Korea, Vietnam, and Iraq." Air Force operations data break it out more precisely, as can be seen in Table 7 below.

Bombers. The Bottom-Up Review said the US required 100 heavy bombers per MRC (but projected a total of 184 bombers for the two-war strategy).

In Senate testimony, Rudy de Leon, under secretary of the Air Force, sought to clear up confusion over the requirements. "The analysis supporting the Bottom-Up Review assumed a [total] bomber force of 184 [with] 158 [PAA bombers] in 1999," he said. "The analysis concluded that deploying 100 bombers forward with two crews per bomber would, in conjunction with other forces, including fifty-four F-111Fs, be sufficient to fight two

7 Force Size: MRC Experience

Korea July 1953	Vietnam December 1968	Desert Storm February 1991
10.4 FWE	10.6 FWE	10.6 FWE

nearly simultaneous major regional conflicts. The deployed bombers were shifted from the first to the second MRC, so that the total needed for the two-MRC scenario was still 100 bombers."

The Fiscal 1995-99 budget clearly does not fund 184 total bombers, as seen in Table 8 at right. The operational numbers also are uncertain. The budget funds 126 total bombers, according to USAF figures provided to Sen. Kent Conrad (D-N. D). Of these 126, said the senator, only eighty-seven would be combat-coded.

There are numerous estimates of the bomber requirement, but three main ones—all done since the end of the Cold War and Desert Storm and all predicated on the assumption that PGMs will be available—are of particular interest.

● The Air Force's June 1992 Bomber Roadmap revised the bomber requirement, projecting a fleet of 211

compared to the 300 or so B-52s and B-1s the Air Force had at the time. The B-1 was seen as the workhorse, to be employed against the bulk of defended, time-critical targets. The Air Force further noted that, in a Desert Storm-like war, the 1992 bomber fleet could destroy only twenty-four percent of priority targets in the first five days, whereas the projected fleet would be able to destroy 100 percent. Drawing on a classified "combat forces roadmap," ACC's General Loh told Congress in June 1993 that "we need about 180 to 200 operational bombers," thus "a total bomber force of between 210 and 230" to allow for attrition, training, and downtime for maintaining and upgrading the operational fleet.

● A 1993 RAND study, "The New Calculus," had considerable influence on the Bottom-Up Review. To MRC I, it allocated eighty bombers (sixteen PAA B-2s, sixty-four PAA B-1s). It said selected forces—including the B-2s—would shift to MRC II. RAND figured the force for the second MRC would be smaller but have the "ability to blunt an invasion successfully and conduct strategic strikes." However, it noted, "US capabilities for conducting an attack of surface forces and strategic targets simultaneously are reduced." (This sounds not unlike Win-Hold-Win.)

● Another RAND paper, "Providing an Effective Bomber Force for the Future," released in May, states that given adequate weapons and suitable modifications, the programmed bomber force of sixty B-1s, forty B-52s, and twenty B-2s should be able to handle "a stressing regional conflict." RAND says, however, that there is no reserve for nuclear use, little margin for attrition, no margin for tradeoff, no extra firepower for the unexpected, and only a limited capability to support a second MRC. The report adds that a force of sixty suitably equipped B-2s and forty B-52s would have more capability in a stressing major conflict as well as a moderately demanding, nearly simultaneous second MRC.

Transports. RAND, in a 1993 analysis of theater airpower requirements, war-gamed a response when one crisis was followed by another in five days. It found that "constraints on lift and tankers would make such operations implausible." To make the two-MRC strategy work, the scenario had to separate the two crises by twenty-one days—the time needed for the first sealift ships to arrive. This scenario shifted eighty percent of organic airlift and twenty percent of Civil Reserve Air Fleet (CRAF) aircraft to MRC II.

A new mobility requirements study prescribed airlift

8 Air Force Long-Range Bombers (DoD Projection, January 1994)

Aircraft PAA	FY 1994	FY 1995	FY 1996	FY 1997
B-52H	64	40	40	40
B-1B	84	60	60	60
B-2	4	7	11	12
Total	152	107	111	112



The Pentagon says one MRC would tie up ninety percent of US airlift. A critical issue is finding a replacement for the aged C-141 (above). The C-17 is the Air Force candidate.

of fifty-seven million ton-miles per day (mtm/d). Gen. Ronald R. Fogleman, commander in chief of US Transportation Command and commander of Air Mobility Command, said AMC's "current 'advertised' capability" is 49.2 mtm/d. "However," he noted, "to reach this figure we must completely activate the reserve component and the full Civil Reserve Air Fleet. . . . Our nonmobilized capability is less than seventeen mtm/d. In other words, extended periods of high OPTEMPO during peacetime places great strain on active-duty forces and limits our capability to respond to nonmobilized, surge operations."

How much airlift is needed per MRC? General Fogleman said that in the Gulf War "we averaged fifteen to seventeen million ton-miles per day into Saudi Arabia—after we had activated the Guard and Reserve, after we had called up the CRAF."

"Airlift in this country is broken right now," Gen. Joseph P. Hoar, commander in chief of US Central Command, told Congress in March. "I'm not sure it's workable for one major regional contingency." General Fogleman acknowledged, "I cannot provide the lift for two major regional contingencies. I can do it for one . . . although even there, there are some fairly heroic assumptions that are made with regard to activation of the Civil Reserve Air Fleet."

The critical issue is finding a replacement for the aged C-141 as the core airlifter. RAND noted that if the C-141

is not replaced when it reaches retirement "early in the next decade," organic airlift capacity will be reduced by about fifty percent.

The Air Force's choice is the C-17. The initial planned buy of 210 was lowered to 120 in 1991. In late 1993, the Pentagon capped the program at forty, pending correction of acquisition problems. General Fogleman told House members in May that his analysis still confirms 120 as the best option, but he stunned listeners with his rock-bottom estimate: He said the Air Force could meet minimum outsize cargo requirements with seventy to eighty C-17s.

Deputy Defense Secretary John M. Deutch rejected that number. He said the Pentagon might halt at forty or press on to 120, but he could not see settling for seventy to eighty. General Fogleman said later, "The whole point that I was trying to make was not that I wanted to come down to eighty planes from 120 but [that] forty was not enough. You cannot stop at forty and have any kind of a viable core airlifter fleet."

Credibility of the Strategy

A multitude of reasons contributes to doubt that the armed forces are prepared to execute a two-conflict strategy. There is manifest disagreement about requirements. Chosen solutions smack more of fiscal expedience than of hard-eyed analysis. The projected defense budget is insufficient to fund even today's lower force levels. The program is based on questionable assumptions.

Requirements. The Administration's program developed in a strange order. First, in March 1993, came a decision on an overall budget total. Then the Bottom-Up Review began working to determine the defense requirements. This was followed by a declaration of the new strategy midway through the requirements review. Only after these steps were the actual force projections and corresponding budget allocations made public.

The capability to fight and win two major regional wars at nearly the same time is the basis for planning, but it is not the only task facing the armed forces. They have other missions, including direct defense of the US and its treaty allies and an expanding package of tasks termed "missions other than war." The Administration has shown a proclivity for multilateral peacekeeping operations. US forces may be employed for "limited objectives," and the standards for committing troops to combat are less restrictive than in the previous administration.

Dollars. On September 1, 1993, Mr. Aspin announced the force projections stemming from the Bottom-Up Review but said "we don't have the dollar figures today" to explain funding allocations to elements of the force decided upon. Dollar figures were announced six weeks later, on October 15. Mr. Aspin conceded the budget was \$13 billion short of covering the "Bottom-Up Review Force."

In the month of December 1993, Administration officials first said the funding gap was \$50 billion, then \$31 billion, then—with the addition of \$10 billion to the account—resolved. It was reliably reported that senior officials in the Pentagon and in the Office of Management and Budget were saying privately that the defense program was underfunded by at least \$100 billion. William J. Perry, who succeeded Mr. Aspin, said the plan



The Bottom-Up Review dropped Air Force fighter force structure to its modern low—twenty combat-coded fighter/attack wings. F-15Es must perform multiple tasks.

was about \$20 billion short. It is little wonder that belief persists that the two-conflict force is seriously underfunded.

Assumptions. The new defense strategy is awash in assumptions—some stated, some not stated; some correct, some not correct. For example, optimistic analyses assume extended warning and preparation time, similar to the five-month buildup before the shooting started in Iraq. There is no guarantee that an invader will pause as Saddam Hussein did after the invasion of Kuwait in August 1990. In fact, one probably should presume that a militarily competent aggressor would keep rolling while he still had advantages in surprise and numbers.

Mr. Aspin's original strategy statement, the Bottom-Up Review, and other assessments assumed—explicitly or implicitly—a sufficiency of American airlift. That is a very big assumption, considering that senior officers of all services declare strategic lift to be a major concern and that airlift is the primary factor limiting global deployments.

Mr. Aspin's designating a "Desert Storm Equivalent" as the benchmark for regional conflict contained an implicit assumption about circumstances of combat. Such benchmarks cannot be taken too literally; circumstances will vary. In the Gulf War, for example, US forces had the advantage of deploying without active opposition

upon arrival. Things would have been different had they been obliged to fight their way into the battle area.

The Base Force strategy assumed reconstitution of forces as a main pillar and as a basic condition for reducing forces. The nation would preserve the means to rebuild forces from scratch if the threat worsened. In 1991, the Joint Chiefs of Staff said "reconstitution may well prove to be the linchpin of America's long-term security." However, current defense policy virtually ignores reconstitution. The prevailing assumption seems to be that the armed forces can replace their losses by reactivating equipment mothballed during the force reductions.

Complexity. The complexity of deploying and sustaining a large battle force is often underestimated by laymen, and the effect of change in a single variable of the operation is greater than popularly imagined. Combat is more than guns and bullets. At one point in the Gulf War, empty cargo pallets were piling up in the war zone while a pallet shortage loomed at supply centers in the United States. This was not a trivial problem, and it illustrates the extraordinary number of details that must fit together to make a force deployment work.

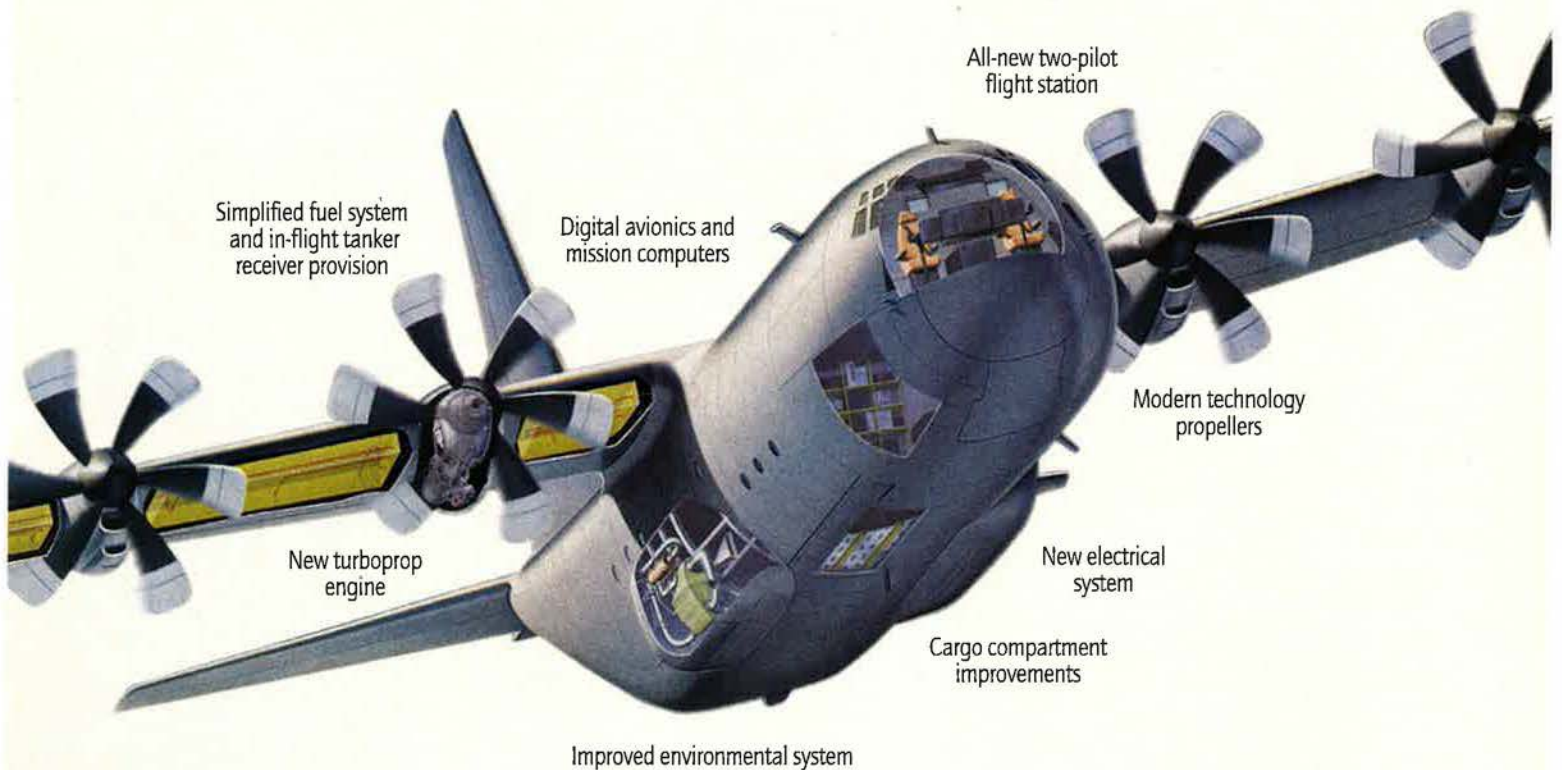
Without three staging bases—Lajes in the Azores, Torrejon in Spain, and Rhein-Main in Germany—US airlift throughput to southwest Asia would have been reduced by forty-six percent, and force closure time would have increased by forty-eight percent. The Air Force left Torrejon in 1992 and is returning most of its facilities at Rhein-Main to Germany. When the draw-down is over, the Air Force will have less than half the number of bases in Europe it once did. The number of other sites where supplies are prepositioned in Europe has dropped from seventy to nineteen.

Overall, the defense program is figured much too tightly to support the declared strategy. It is not possible to calibrate war that way—counting on the last bullet to kill the last enemy on the last day of the fighting. The new strategy hangs on too many optimistic assumptions about sufficiency of forces, timing, coordination of widely separated operations, and the shuttling of critical assets between conflicts. Without more depth in the force structure, it is not convincing enough to be credible.

The two-conflict standard is a reasonable basis for force planning and posture. It is appropriate also as the central focus of defense strategy. Implementation requires a more realistic force structure, both to carry out the tasks imposed by the strategy and to serve as a clear deterrent to aggression.

It is impractical to believe the force structure will be determined purely by military requirements. A balance inevitably will be struck with political and budgetary considerations. The goal must be a force that reaches the threshold of credibility and keeps risks to US security and interests within reasonable limits. The conventional US Air Force component of such a force structure would include:

- Not less than twenty-four combat-coded fighter and attack wings, modernized and properly equipped.
- At least 184 operational bombers, equipped with modern, precision guided munitions.
- A full complement of 120 C-17 airlifters—assuming the problems in the procurement program can be resolved.



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Lockheed leads.

 **Lockheed**

Though the Cold War is over, USAF's legendary high-flying spy plane has more work than it can handle.



The U-2 Comes In From the Cold

By Frank Oliveri, Associate Editor Photographs by Guy Aceto, Art Director





In flight, the sleek, black U-2 is a study in grace, whether soaring over San Francisco's Golden Gate Bridge (previous pages) or the countryside of northern California (above). Two underwing "superpods" carry some of its sensors.

THE U-2 WAS the ultimate Cold War aircraft. Born in the 1950s, built to overfly the Soviet Union, the spy plane became a key factor in East-West affairs. Even the disclosure of its existence on May 5, 1960, was a Cold War milestone. On that day, Nikita Khrushchev announced that the USSR had shot down a US aircraft and captured its pilot, Francis Gary Powers, touching off a nerve-racking superpower crisis.

U-2 pilots were a special, secret breed. During nearly four decades, only about 600 have flown solo.

The Cold War is dead and gone. To the surprise of many, however, the U-2 is not. In fact, U-2 operations have been on the rise. No longer is the U-2 mission focused on a single adversary. More than ever, the high-flying U-2 operates worldwide, using versatile collection systems to gather strategic and tactical information for national political leaders and theater commanders.

With the termination of SR-71 operations in 1990 and with RF-4s aging out of the force, the U-2 has become the primary USAF reconnaissance platform and the only high-altitude, air-breathing reconnaissance vehicle in the US inventory. After the Powers affair, the U-2 was returned to deepest secrecy, where it stayed for decades. Then in 1991 came Operation Desert Storm, and the U-2 once again became a high-profile player in national defense.

Desert Storm was a pivotal event. Operating above 70,000 feet, USAF U-2Rs overflew Kuwait and Iraq on the first morning of the Persian Gulf War—January 17, 1991—sometimes with fighter protection and sometimes without it. They continued these flights throughout the war. The details of specific U-2 operations are classified, but many in the operations community said that twelve on-station U-2 aircraft, flying round-the-clock missions over the front, turned in an astounding performance.

Col. Ash Lafferty, a U-2 operations group commander, said that ninety percent of the target information given to the US Army during the war came from U-2s. Of the specific targets that U-2s recommended to coalition forces, he said, eighty percent were found at the stated coordinates. F-15E attacks on fixed Scud missile launchers were usually based on U-2 targeting data fed to the fighters in near real time. U-2 data could also be sent to groundbased command centers, which sped the information out to field units.

No Letup

The pace barely slackened after the war ended. Air Force officers said that the United States has kept U-2s operating at a high tempo, providing information not only to US military and intelligence units but also to consumers in the United Nations, the North Atlantic Treaty Organization, and the organization that monitors compliance with the 1979 Mideast peace agreement between Israel and Egypt.

The sleek, black aircraft carry out not only photo intelligence but also radar intelligence, electro-optical signal analysis, and electronic intelligence. They can pinpoint the locations of emitters. U-2s monitor international treaties, track troop and equipment movements, and watch the nuclear facilities of hostile or potentially hostile nations. The U-2R



Images collected by U-2s flying at extremely high altitudes eventually come down to Earth, feeding a huge groundbased photo- and image-interpretation effort. Here, SSgt. Marvin N. Fisher plies his photo-interpretation trade.

assists various civilian agencies, enhancing scientific research and the response to natural disasters, such as California's earthquakes and heavy flooding in the Midwest. It can also perform such nontraditional tasks as air sampling, which was instrumental in confirming the 1986 Chernobyl disaster in the Soviet Union.

The basic U-2 was designed by Lockheed's Skunk Works and was first flown in the mid-1950s. The U-2R, forty percent larger than its predecessor, first flew in 1967. Ten years later the Air Force was building what it called TR-1s, using the basic U-2R design. These new aircraft were used exclusively for tactical reconnaissance while U-2Rs did strategic work. The new designation was dropped in 1992, when the Air Force decided to call them all U-2Rs.

The Air Force won't say how many



Lt. Col. Jim Lloyd, one of a handful of U-2 pilots, suits up for flight. Each suit is individually fitted, and the pilot's body is purged of nitrogen. Should cabin pressure fail, the suit prevents the pilot's fluids from boiling at high altitude.



Specialized life-support technicians keep a close watch on a U-2 pilot all the way into his airplane. Here, a technician hooks up Colonel Lloyd to his support systems just before he begins a high-flight training mission.

U-2s are in operation; the number is classified. The U-2 is known to be a multifaceted platform that can carry many different sensors, depending on the requirements of the mission. The aircraft are operated by four flying detachments at Osan AB, South Korea; Taif AB, Saudi Arabia; RAF Akrotiri, Cyprus; and RAF Alconbury, UK. When asked to elaborate on U-2 operations, Col. Larry W. Tieman, former commander of the 9th Reconnaissance Wing at Beale AFB, Calif., said, "I would

just tell you that the mission of the 9th Wing is to conduct worldwide reconnaissance."

Higher, Farther

The U-2 is a standoff platform, Colonel Tieman said. In compliance with all UN provisions as well as all international aviation standards, it does not overfly foreign soil in peacetime. The U-2 must fly its tracks in international airspace, in cooperation with another country, or in accordance with UN agreements. "In

today's environment, when we talk about penetration, we normally talk about *sensor* penetration in the area," the Colonel said. "It's pretty simple: The higher you fly, the farther you can see. . . . The higher we fly, the better look angle we have."

How the U-2R is flown and what is required of the pilot have remained basically unchanged for close to forty years. The Air Force added some amenities—for example, a much more comfortable pilot spacesuit, better food, and a Global Positioning System navigation receiver to help the pilot keep on course. The U-2R is receiving an engine upgrade. USAF is replacing the old J75 Pratt & Whitney powerplant with a variant of the F118 engine, which powers the B-2 bomber. The new engine is a great leap forward in technology, burning less fuel, cutting weight, and increasing power. It is equipped with far more reliable electronic generating packages, thus providing better cooling for the pilot. Missions are just as long, if not longer, however, and the threats still extremely dangerous.

The U-2R was one of the first truly modular aircraft systems. The airframe is a shell filled with sensors configured to match the needs of each particular mission. The U-2's sensors tend to cost far more than the aircraft itself.

Maj. Bryan Anderson, an instructor pilot with the 1st Reconnaissance

Squadron at Beale, says that there is a common misperception that the U-2 pilot doesn't know the identity of the target or how it is being observed. "As far as who gets the end product and what they are going to do with that end product, there is often not the need to know," he explained. "Knowing what the target is and how we're going to [observe] that target—the pilots are very familiar with that."

One of the U-2R's more advanced systems is the Advanced Synthetic Aperture Radar System II (ASARS II). The system, built by Hughes, is housed in an extended nose section, which replaces the normal nosecone of the U-2R. The system is more powerful than even such far-seeing radars as the Joint Surveillance and Target Attack Radar System, carried on the Air Force's E-8 aircraft. Most



SrA. Dawne Chance and TSgt. Bob Phillips, avionics technicians, go over the tail section of a U-2. This up-close look at the U-2's internal structure shows its extended air brakes and ultralight construction.



Another view of the U-2 provides an excellent look at the aircraft's Q-bay, location of cameras and sensors. Additional surveillance and reconnaissance equipment can be installed using superpods hung beneath the wings.

of the targeting data in Desert Storm were gathered by ASARS II equipment.

A U-2 can stay aloft for more than nine hours. This powered glider has a vast 103-foot wingspan and measures sixty-three feet nose to tail. Its wings give it tremendous lift; with a decent headwind, a U-2 can become airborne from a dead start using less than 500 feet of runway. Pilots wearing spacesuits hand-fly the yoke-and-rudder aircraft to about 40,000 feet and then engage an autopilot system

aided by the GPS equipment. The U-2 has a view sight that allows the pilot to look at the underside of the aircraft. It carries no radar, though it does employ a radar warning receiver and a limited electronic warfare suite.

The autopilot flies the U-2R to an altitude above 70,000 feet, where the fluids in the pilot's body would quickly boil if the cabin were not pressurized. (The pressurized suit is a backup.) During the preplanned flight, the pilot monitors the aircraft's systems. Above 40,000 feet the U-2

is docile and easy to fly. In fact, pilots say it wants to climb constantly.

Light and Simple

The U-2 was built to be very light and simple, with basic control systems. "We could essentially lose all our equipment and still recover the jet," said Col. Edward A. Walby, commander of the 99th Reconnaissance Squadron at Beale. "We can land without flaps. We can glide back to Earth without an engine, [though] you'd prefer to have one, so that if you screw it up you have a chance to try it again. We have no weather radar."

The flight controls consist of old-technology dials and gauges. The U-2 lacks a true fuel gauge. After they check the level of fuel in the wings with a dipstick for an approximation of the weight of fuel in the wings, mechanics set the fuel gauge in the cockpit to that level. Fuel flows freely from wing to wing.

Although the U-2 itself is very low-tech, most of its sensors are sophisticated and highly classified and, in many cases, worth more than the aircraft. Making pilots proficient in the use of the sensors is itself a major task. "It's primarily 'switchology' training," said Major Anderson. "Once the guys' clearances arrive, we brief them on exactly what the sensors do, what the capabilities are, how they'll be in-

terfacing with the mission." The aircraft also employs a state-of-the-art communications system, but pilots rarely use it for fear of revealing their location.

Because of the amount of gear that must be worn, the extremely high altitudes, and length of missions, pilots must remain hydrated and must eat. They do this using a tube system in the helmet.

U-2 pilots say the most challenging aspect of their mission is airmanship. "It's very difficult to fly the airplane well and to land it well," said Major Anderson. "The mission employment side of it tends to be

very difficult, after a nine-hour-plus sortie when the guy is very tired and very dehydrated, to come back and land an airplane [properly]."

The aircraft uses a bicycle landing gear, with a small gear at the rear and a large one in front. When the aircraft comes in for a landing, a chase car follows, calling out altitude as the U-2 approaches touchdown. The aircraft can slow to seventy knots in the air. Then the pilot must cut power and stall at about a foot or two off the runway.

The rear gear and then the large front gear drop to the ground. Inside the cockpit, a hot, dehydrated pilot,

wearing a restrictive spacesuit, makes sometimes violent corrections to the yoke to keep the wings fairly level until the aircraft slows, stops, and falls on one wing or the other. Then ground crew members race to the aircraft and insert pogo gears into the wings, allowing the pilot to taxi to the hangar. It is not unusual for new U-2R pilots to ground loop or spin off the runway; because the aircraft is traveling at low speed, it usually suffers only minor damage.

U-2R pilots are seasoned aviators selected through an arduous process. Applicants must have 900 hours of pilot command time and as an in-



less taxing than flying the airplane. So if a guy really enjoys the challenges of yoke-and-rudder flying the last tail-dragger in the Air Force, then I think [he] would really like it. We get people who really just enjoy hands-on, seat-of-the-pants flying."

No Easy Landings

The basic U-2R does not meet current Air Force specifications regarding airworthiness, several pilots said. The greatest test is the return home. After flying a long mission, it is a real feat of stamina wrestling the U-2 to the ground. "The final phase is where everybody makes their money in the U-2 world," Major Anderson said. "That is landing the airplane, and that is pretty much what we're about in the training program. We try to get guys to develop an aptitude for flying the airplane. It's



After flying a long, lonely, and tiring mission, the pilot faces a test of stamina wrestling the buoyant U-2 to the ground. Said one U-2 pilot, "The final phase is where everybody makes their money in the U-2 world."

structor pilot. If they come from such aircraft as the B-52, KC-135, C-141, or C-130, they must have 1,500 hours and at least one year as pilot in command.

The 9th Reconnaissance Wing runs a quarterly board to review applicants. Every detail of a pilot's career is checked before he is invited for a two-week interview. The pilot is watched to see how he interacts with others because even though the U-2 is a single-seat aircraft, "it takes thirty to fifty people to launch and recover the jet," said one officer. If all checks out, the pilot is sent to a flight surgeon for a physical and is later put into the spacesuit to see how he reacts to claustrophobic conditions.

The pilot is briefed on safety and egress training and then flies on three checkrides in the back seat of a U-2B. Progress is sought each time. The instructor pilot demonstrates takeoff and landing, and then the student is encouraged to take control. Fifteen to twenty landings are practiced during each flight. By the end of the third flight, instructors decide whether the pilot makes the grade. The 99th Training Squadron recently washed out five consecutive applicants. Currently, twenty to twenty-four pilots are trained each year to fly the U-2R.

Pilots are also checked out in the T-38. They must be dual-qualified. The T-38 allows pilots to remain pro-



The U-2 performs not only photo intelligence but also radar intelligence, electro-optical signal analysis, and electronic intelligence. The U-2R can perform such nontraditional tasks as air sampling for radiation.

ficient in the air. Typically, a U-2R pilot flies in the U-2 four times a month. A flight in the U-2 is followed by a down day. The taxing nature of U-2 flight requires time to recuperate. The rest of the pilot's flying time is spent in the T-38.

The checkout process—after the two-week interview—lasts six to eight months, including academics and flight training. Pilots also take courses in the wide array of sensors the aircraft employs.

"We look for guys who have a lot

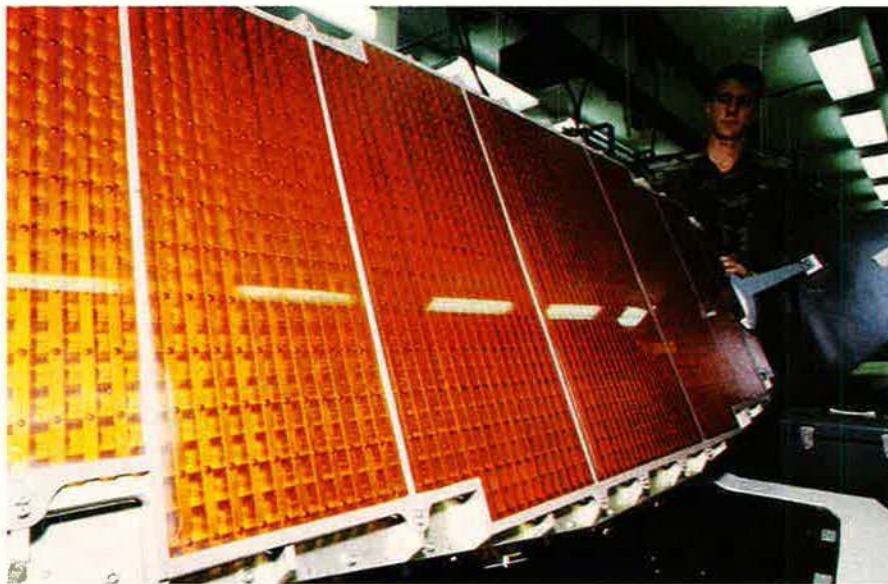
of experience," said Major Anderson, "and a lot of real strong ops credentials because when they go out there and fly, sometimes we'll launch an airplane and we'll hear them call an ops normal about an hour after takeoff; then you may not hear from that aircraft for over nine hours.

"So they're out on their own, making decisions on their own, often without the command-and-control setup that is familiar to most other airplanes, where you can call in and get assistance. They get out there and operate on their own a long way from home and, often, over some very hostile territory—if not politically, environmentally.

"The North Atlantic—there's 30° water there. These guys are on their own with their own wits, training, and skills."

One pilot took off, and along the way his inertial navigation system failed. The INS drives the autopilot, heading, and reference systems. The pilot was forced to make time and heading corrections all the way across the North Atlantic, past Greenland and Iceland, and finally arrived in the UK.

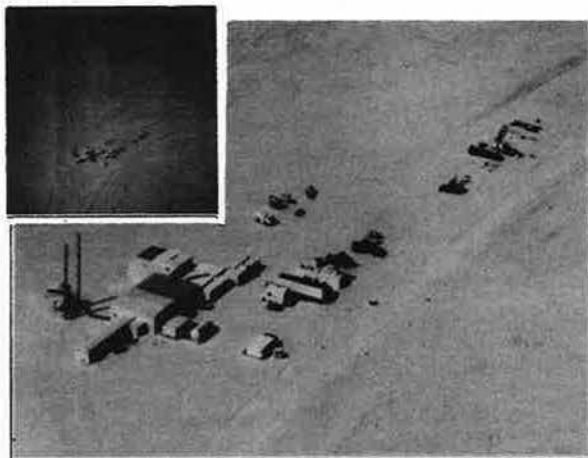
"He showed up over there about ten miles off course," Major Anderson reported. "What he was doing was seat-of-the-pants navigation—time and heading—just like Lindbergh did in 1927. That required a great bit of skill." ■



SrA. Kevin Kelly, part of a U-2 maintenance team, inspects the aircraft's ASARS II radar. The synthetic aperture radar can be carried in a specially designed nose section, giving it capabilities that rival the E-8 Joint STARS aircraft's radar in clarity and detail.

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Son of Star Wars

By Bill Gertz

THE REAGAN "Star Wars" concept, unveiled in 1983, was a vision of antimissile defenses on a grand scale, rooted in the belief that it was both desirable and practical to defend the US by erecting an impenetrable, high-technology, spacebased shield. It had an extraordinarily ambitious goal: Render the vast Soviet ICBM force "impotent and obsolete."

After eleven years and \$32 billion in outlays, the Reagan vision has faded, replaced by a more modest proposal. The Pentagon's quest today is for highly effective Theater Missile Defenses (TMDs), not to blunt a massive ICBM assault on American soil but to prevent attacks with primitive Scud-type weapons on forward-deployed US armed forces. Former Defense Secretary Les Aspin called this work the "first priority to cope with new dangers of the post-Cold War world."

The Pentagon plans to spend \$17 billion on missile defenses in the period 1995-98. It is developing several types of high-speed missile interceptors, launchers, radars, and battle management systems capable of shooting down Scuds and their longer-range brethren, whether they

are detected shortly after launch, in midcourse, or upon reentering the atmosphere.

The immediate goal is to field a three-layered system. It would comprise the Patriot PAC-3 antimissile defense battery (for point defense against incoming warheads), the Theater High-Altitude Area Defense system, or THAAD (for wide-area protection), and the Navy Lower Tier system, based on the AEGIS battle management radar (to deal with ballistic and low-flying cruise missiles).

For the longer term, Department of Defense officials say, the US might be in position to deploy one of several more advanced TMDs. Among them:

- An Air Force "boost-phase intercept" system capable of knocking down missiles within minutes of launch. Ideas under review include hanging antimissile weapons on special missile-killing fighter aircraft.

- A Navy seabased wide-area defense, Upper Tier, which could monitor hundreds of miles of air and space for missiles and would be able to protect Paris, Rome, and Berlin from a Middle East missile attack.



■ An Army area defense system known as Corps SAM, designed to protect maneuver forces deployed in regional conflicts.

Each program is oriented toward a specific military service and provides different, yet complementary, solutions to missile attacks. Because of cost limitations, only one will receive major funding, while the others will be stretched out.

New Name, New Mission

Early in his tenure, Mr. Aspin consigned the most elaborate Star Wars work to the back burner and radically reorganized its bureaucratic center, the Strategic Defense Initiative Organization. In May 1993, Mr. Aspin gave SDIO a new mission and changed its name to the Ballistic Missile Defense Organization, proclaiming the "end of the Star Wars era." BMDO has the job of building TMDs and studying national missile defenses. It occupies SDIO's old suite of high-security offices tucked away in the basement of the Pentagon.

Very few SDIO programs have continued within the BMDO structure. Most have been canceled or transferred to the military services. Pro-

grams based in space were particularly hard hit. Only one, a satellite-based missile-tracking system known as Brilliant Eyes, remains within BMDO. It is a crossover system providing over-the-horizon data on enemy missiles useful to both theater and national missile defense efforts. BMDO now calls the sensor system the Space and Missile Tracking System. Also gone from BMDO is the Global Protection Against Limited Strikes (GPALS) system, proposed in 1989 by Sen. Sam Nunn (D-Ga.), chairman of the Senate Armed Services Committee.

The current ballistic missile defense regime is focused on a five-year effort to field increasingly effective weapon systems capable of detecting, tracking, and shooting down relatively short-range missiles like the Scud derivatives deployed by Iraq, North Korea, and other potentially hostile states.

Under the new regime, there is a drive to keep the technology effort in sharp focus. Critics say a problem with the old SDIO was that it aimed too high, wandering in the technology forest without seeing any trees. "You had a group of technology guys

in the Air Force leap out and focus the program entirely on boost-phase attack," said Lt. Gen. William Odom, a retired Army intelligence expert who recently headed a team assigned to study the ballistic missile threat to the United States.

The billions spent on SDIO research produced extremely valuable technology that is now part of the current ballistic missile defense program. SDIO produced better sensors, capable of quickly detecting missile launches anywhere on Earth; vast advances in smaller, less expensive rocket motors; and ever-smaller high-technology guidance and tracking systems.

The debate over Star Wars has been replaced by policy disputes between the military and arms controllers over theater defense capabilities, budget battles between the Administration and Congress, and renewed rivalry among the military services over which programs will be funded and who will get a bigger share of the \$2.8 billion Congress authorized BMDO to spend in 1995.

Air Force Gen. Charles A. Horner, former commander in chief of US Space Command, remains the most

A Bullet Hits a Bullet

In the early hours of January 18, 1991, Army 1st Lt. Charles McMurtrey was wide awake inside the command unit of the Patriot antimissile battery deployed with US forces near the main air base at Dhahran, Saudi Arabia. Iraqi Scud missiles had landed the previous evening on towns in Israel. Similar attacks were expected in Saudi Arabia.

Lieutenant McMurtrey was waiting inside the cramped hut containing the computer systems used to track incoming ballistic missiles and fire Patriot interceptors at them. Moments later, at a command center deep inside Cheyenne Mountain in central Colorado, the first indication of an Iraqi missile launch was detected by the Defense Support Program system of satellites.

A mobile Scud missile launch in southern Iraq showed up clearly on the computer display screen monitored by US Air Force space controllers. Through a complicated electronic system, the launch data were relayed almost instantaneously to the battle management radar of Lieutenant McMurtrey's Patriot unit in Dhahran. Updates were sent every ten seconds.

One of the men in the hut immediately alerted Lieutenant McMurtrey, the tactical control officer, to the bogey that lit up one of the two Patriot radar display screens.

None of the three soldiers working that morning in the engagement control station doubted for a second what the green triangle on the screen was—an incoming Iraqi Scud. No bells went off; the triangle moved slowly from the top of the computer screen to the bottom, as the Scud edged closer to Dhahran.

The Patriot unit was in full automatic mode, meaning the computer decided whether the bogey was an incoming Scud, and it too had no doubt that night. Lieutenant McMurtrey and his crew could have scrubbed the launch but didn't. Less than a minute after the missile appeared on the screen, the Patriot interceptor roared out of its launch tube. The men were surprised when only one of the two missiles programmed to fire actually blasted out of the upraised, box-like launchers. The Patriot homed in on the Scud warhead and blew it out of the sky.

It was 4:28 a.m., and history had been made: For the first time, an antimissile defense system, operating under full combat conditions, had located and destroyed an incoming ballistic missile warhead. Lieutenant McMurtrey and his men took part in two more Scud intercepts later in the war.

Now a captain, Charles McMurtrey was deployed this summer with the Patriot missile batteries that were sent to South Korea to protect airfields and ports from North Korean Scud attacks.

outspoken advocate of better missile defenses. He was selected by the Joint Chiefs of Staff to be the designated proponent on the issue. General Horner speaks often about the need for missile defenses, Earth-based and spacebased, and about the threat posed by low-technology ballistic missiles, which he sees as the key lesson of the Persian Gulf War.

Iraq's Scud missiles rained down on Israel and Saudi Arabia as US airpower, otherwise superior throughout the conflict, struggled valiantly to locate and destroy Saddam Hussein's mobile missile launchers. Scud-hunting consumed vast amounts of flight hours for coalition aircraft, with limited success.

The Need Is Clear

"The lesson that must be learned by all of us is the need for ballistic missile defense," General Horner said. "I can see in the next conflict where we or our allies are going to be exposed to ballistic missiles, and

we absolutely must get on with some sort of ballistic missile defense system to protect our troops in the theater, to protect our allies, and also at some point in time to protect the United States as well."

US forces engaged in regional conflicts will remain vulnerable to missile attack until the late 1990s when THAAD, the first prototype of a dedicated antimissile system, will be made available for emergency US military use during regional wars.

The Pentagon's goal is to create two THAAD batteries in ten years to build the first wide-area system. At that point, THAAD will go into full production, and sales to US allies could begin. In the interim, BMDO plans to build the Navy's seabased Lower Tier and to develop the Patriot defense missile, first designed as an anti-aircraft weapon, into a system that can serve as both point and small-area defense.

"I think the program has been re-focused, and its sights have been set

on goals that are much more sellable, especially in Congress, on both sides of the aisle," said Army Lt. Gen. Malcolm O'Neill, BMDO's director since August 1993. General O'Neill said there is still opposition in Congress to current funding levels, but it is weakening: "I don't see the emotion, I don't see the fire that I saw several years ago."

Last year, President Clinton signed a secret order, Presidential Decision Directive 17, that provides guidance for BMDO, specifically making the organization's high priority the building of theater defenses. The order also requires that all new theater defenses comply with the ABM Treaty, which prohibits the building, testing, and deployment of nationwide defenses against strategic missile attack, limiting the United States and the successors of the Soviet Union to no more than 100 launchers.

BMDO is considering a ground-based test of a laser weapon designed for deployment in space. The organization thinks twelve spacebased lasers could provide effective global coverage of missiles launched in small numbers—about ten or so. The recent detection by the CIA of two longer-range prototypes of North Korea's No Dong missile—which some estimate could eventually be developed with sufficient range to reach the United States—is a specific threat that must be met by national defenses, say a number of lawmakers.

Douglas C. Kline, a senior BMDO official in charge of integrating antimissile systems into an overall "architecture," said BMDO's new approach to the task "has allowed us to focus on something that is much more important than it had been," namely regional defenses against missile attack.

Wide-Area Coverage

The THAAD system, which might be fielded sometime before 2001, would be the first deployed American weapon able to provide wide-area coverage against missile strikes. THAAD's emergence would mark the first time missile defenses will have caught up with existing missile threats. An early version of THAAD, the User Operational Evaluation System (UOES), will be built by 1996, with twenty to forty interceptors, in case missile defenses are needed in a regional conflict.



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TO CHOOSE
FROM. BUT
WE CAN PIN
DOWN MORE
REASONS TO
BUY OURS.**



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EGYPT



BRAZIL



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"THAAD UOES is not actually a fielded option," said Mr. Kline. "It is an on-the-shelf capability consisting of several tens of prototype THAAD interceptors and associated radar capability that could be used in the event of an emergency."

General O'Neill said the Air Force boost-phase intercept program of advance missile defense is high-risk but could be used against Scuds carrying electronic jammers or dummy warheads that would defeat other types of missile defenses.

The boost-phase intercept proposal envisions flying Air Force F-15 or Navy F-14 jets armed with super-high-speed air-to-air missiles that could locate a large ballistic missile shortly after it is launched, catch up to it, and crash into it. The jets would fly combat air patrols near enemy territory along with airborne sensor aircraft that would spot a missile launch and cue the fighters.

According to General O'Neill, the fighter would have to fire within thirty seconds. The pilot would have to turn the fighter and fire at the missile as it headed for space, destroying it by high-speed impact and leaving warhead debris—conventional, chemical, or nuclear—to fall over enemy territory.

Another advanced concept is the Navy's plan to build a defense from the AEGIS radar battle management system that could knock out incoming missiles over wide areas. The Upper Tier could be a variation of the THAAD. "The seabased Upper Tier can lay over the horizon, out of sight, out of sound, off the radar screen, and it can provide ballistic missile defense from the sea for a very large theater," General O'Neill said.

BMDO is also studying the Army's Corps SAM ballistic missile defense system that can protect rapid maneuver forces in a regional conflict against missile attack. "It goes with the combat force," General O'Neill said. "It has to be small, light, mobile, and it takes on a suite of targets including helicopters, RPVs [remotely piloted vehicles], ballistic missiles, and cruise missiles, and it must be able to shoot on the run."

BMDO is working with Israel's

Arrow antiballistic missile program. Japan is exploring two concepts for missile defense with characteristics of THAAD and Patriot PAC-3, although Tokyo has not expressed interest in purchasing US systems. Talks with Japan have been "in a receive mode rather than a send mode," one US official said. France, Germany, and Italy are developing THAAD-type systems, and some type of cooperative development is a possibility, according to General O'Neill.

He said ballistic missile technology research at government laboratories has been cut back "significantly," although the scientists who developed exotic laser weapons still provide valuable consulting advice. The contributions to laser research provided by scientists at Lawrence Livermore and Los Alamos are "incredible," the General said.

BMDO views the threat of missile attacks on cities and military forces as real and growing. Countries possessing theater ballistic missiles and designs number in the dozens, while existing launchers are counted in the hundreds and existing missiles in the thousands. Ranges vary widely from eighty km to 3,100 km. Apogees range from twenty km to 600 km; missile velocities range from one km per second to more than four km per second.

Who Owns What

Rep. Ike Skelton (D-Mo.), who chairs the House Armed Services Committee's Military Forces and Personnel Subcommittee, maintains that a key factor in the outcome of the missile defense debate will be the apparent struggle among military services for control of the effort.

"Who owns what aspect of it is the great debate," Representative Skelton said, adding that the Air Force, Army, and Navy are vying for control. "It's really the Air Force vs. Army; those are the prime players."

One vestige of the Cold War that threatens to constrain future theater and national missile defenses severely is US and Russian negotiation over the 1972 Antiballistic Missile (ABM) Treaty. Clinton Administration officials decided last year that the first

THAAD test would violate the ABM Treaty as they narrowly interpreted it. They therefore began negotiating with Russia and two other former Soviet states, Ukraine and Belarus, on a new agreement to permit THAAD testing. This was done even though THAAD is a theater system and technically not covered by provisions of the ABM Treaty.

Defense officials said the Administration has agreed to several Russian demands made in Geneva that will preclude development of space-based interceptors and spacebased sensors and place limits on theater defenses. These limits will prevent development of advanced theater defenses in the next century. In this matter, the uniformed Joint Chiefs were outvoted by Administration civilians.

Eric Thoemmes, defense aide to Sen. Malcolm Wallop (R-Wyo.), one of the Senate's most fervent missile defense proponents, has charged that the Clinton Administration is "negotiating away" important elements of future theater and strategic defenses. "The Russians want to put a demarcation right at the level where THAAD is, but they want anything more capable eliminated," he said.

Under the Russian proposal, all advanced theater defense systems—Navy Upper Tier and Air Force boost-phase intercept—will be precluded, Mr. Thoemmes said. "If the Russian program is done, you can kiss those programs good-bye."

One claim that no one seems inclined to dispute is that ballistic missiles are certain to pose an increasing threat to the security of US expeditionary forces engaged in combat in a regional war.

"If I were a Third World potentate," said General Odom, "the conclusion I would draw from the Gulf War is, 'Why spend money on [my own] air forces? I can never get a qualified cadre of pilots to stand up to US pilots. I can't train them, [and] I can never get the air fleet that could stand up to the US air fleet.'"

General Odom believes that such leaders could easily conclude, "It doesn't take anything like a sophisticated manpower base to fire a missile, and [American forces] don't have much in the way of defenses. Therefore, the only way I'm going to attack my opponent's rear is with ballistic missiles." ■

Bill Gertz covers national security for the Washington Times. His most recent article for AIR FORCE Magazine, "Scud's Bigger Brothers," appeared in the June 1994 issue.

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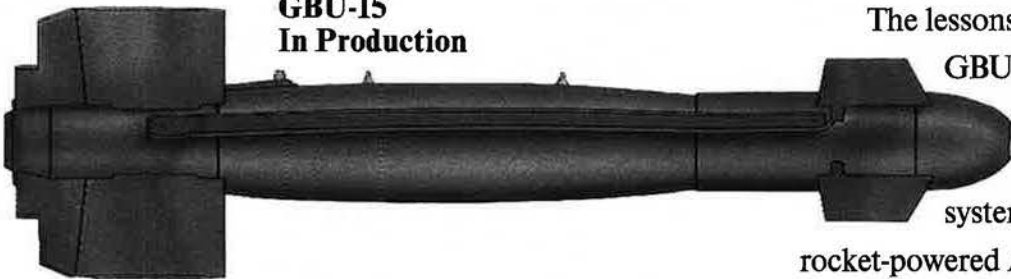
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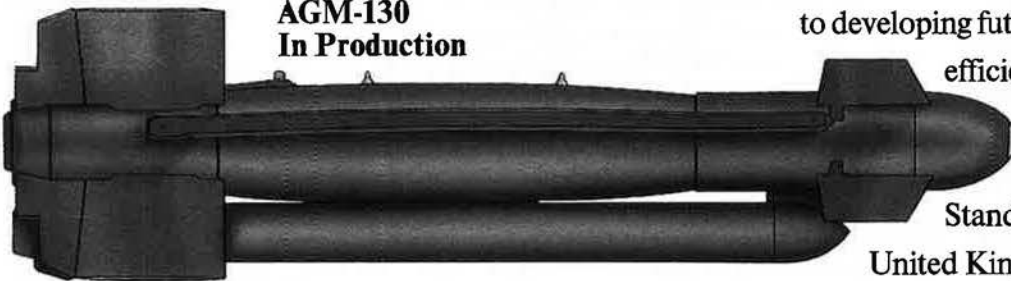
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The *Enola Gay* exhibit still lacks balance and still is emotionally charged, but the Smithsonian says the plans are final.

Photo by Paul Kennedy

“The Last Act” at Air and Space

By John T. Correll, Editor in Chief

THE *Enola Gay*, the B-29 that dropped the atomic bomb on Hiroshima in August 1945, has never been displayed to the public. Next year will be the fiftieth anniversary of its famous mission. The National Air and Space Museum of the Smithsonian Institution is completing preparations to show the *Enola Gay* in an exhibit that will open in May 1995. The plan, however, is to present the aircraft as part of an emotionally charged program about the atomic bomb.

The broad outlines of the exhibit plan have been known for some time. World War II veterans have been expressing their objections to the museum for years, but the issue did not receive wide notice until April 1994, when AIR FORCE Magazine published an article titled “War Stories at Air and Space.” The Air Force Association subsequently published, on April 7, a detailed content analysis of the museum plan, documenting specific areas of imbalance. Since then, veterans have bombarded Congress with complaints. Extensive news media coverage soon added pressure to the controversy.

The primary focus of AIR FORCE Magazine’s report was a 559-page

exhibition script, completed by the museum in January. We drew as well on a series of previous planning documents for the exhibition, an interview with the museum director, and a body of statements and letters from museum officials over the years.

The position of the Air Force Association has been that the planned exhibit was fundamentally lacking in balance and context. The curators picked up the story of the war in 1945 as the end approached. Their script depicted the Japanese as defenders of homeland and emperor but provided little background on Japan’s earlier aggression, which had made such a defense necessary. In this telling of it, the Americans were cast as ruthless invaders, driven by revenge.

Smithsonian officials have consistently disparaged—in public, at least—AIR FORCE Magazine’s report as inaccurate, unfair, and misleading. Privately, museum officials re-examined their plans and reached a far different conclusion. Dr. Martin O. Harwit, director of the National Air and Space Museum, told his staff on April 16 that he had “evidently paid greater attention to accuracy than to balance” in his initial read-

The B-29 Enola Gay is in the tenth year of a major restoration project, to be completed in time for the fiftieth anniversary of its historic August 6, 1945, mission—the atomic bombing of Hiroshima, Japan. The Enola Gay is being restored by workers at the Paul E. Garber Preservation, Restoration, and Storage Facility in Suitland, Md. Shown here are the famous airplane’s cockpit and bomb bay sections, restored to authentic condition.



ing of the script. "A second reading shows that we do have a lack of balance and that much of the criticism that has been levied against us is understandable," he said.

Dr. Harwit nevertheless resumes his attack on AIR FORCE Magazine in "Enola Gay and a Nation's Memories," a signed article in the August-September issue of *Air & Space Magazine*. His comments there are an imaginative interpretation of what we actually said.

The New Script

A revised exhibition script was completed May 31. Honoring a commitment made during a radio debate June 2, the museum provided a copy of the new script to AIR FORCE Magazine on June 23. The exhibit has been retitled and is now called "The Last Act: The Atomic Bomb and the End of World War II." It had been called "The Crossroads: The End of World War II, the Atomic Bomb, and the Origins of the Cold War."

In form letters sent to those who complain, the museum characterizes AIR FORCE Magazine's criticism of the January script as nit-picking a raw, initial draft fifteen

"Ground Zero" Artifacts and Photos

	January Script	Revised Script
Total photos	75	64
"Human suffering" photos	49	37
Photos featuring women, children, religious objects	25	23
Total artifacts	26	24
Object-related	16	16
Person-related	10	8
Artifacts related to women, children, religion	13	12

months before the opening of the exhibition. In correspondence as late as June 7, Dr. Harwit was still talking about "a year to cull out any inaccuracies, perceived imbalance, or phrases that could be misinterpreted or misconstrued in unintended ways." It was a short year. On June 21, Dr. Michael J. Neufeld, curator of the exhibition, summarily informed the museum's advisory board and the historians of the armed forces that the latest script "must be considered a final product, minor wording changes aside."

The January script, incidentally, was the *fourth* planning document, not the first, seen by AIR FORCE Magazine for this exhibit. Both the Janu-

ary and June scripts flowed directly and conceptually from earlier documents. Through all of those planning stages, the museum pumped out letters reassuring veterans that the exhibit would be fair to them. Here again, the internal correspondence tells a different story.

In a memo to Dr. Harwit July 17, 1993, Smithsonian Secretary Robert McCormick Adams worried that the museum would be vulnerable to criticism because the exhibit lacked "balance"—his assessment, well before AIR FORCE Magazine said it—and because it emphasized Japanese suffering while giving scant attention to American casualties in the Pacific war. He declared it inappropriate that "upon entering the exhibit . . . the central image will be one of a mushroom cloud."

Four days later, Dr. Tom Crouch, chairman of the museum's Aeronautics Department, sent Dr. Harwit a memo arguing against Secretary Adams's suggestions to tone down the message. "Tweaking the introduction," he said, would not delude visitors into thinking the central point of the exhibit was anything except the atomic bomb. "Do you want to do an exhibition intended to make veterans feel good, or do you want an exhibition that will lead our visitors to think about the consequences of the atomic bombing of Japan?" Dr. Crouch asked. "Frankly, I don't think we can do both."

In his 1994 *Air & Space* article, Dr. Harwit is back at his usual stand, describing the exhibit as he customarily does in public. "The focus of the exhibition," he writes, "will be the last months of the war in the Pacific and the role of the *Enola Gay* in bringing a fierce conflict to a sudden and merciful end for the millions of young servicemen who were poised to sacrifice their lives for their country."

The Revised Script's Emphasis on Japanese Suffering

Pages	Photos	Subject
58	64	Hiroshima/Nagasaki "Ground Zero"
21	28	Previous bombing of Japan
5	5	Hardship/deprivation on Japanese home front



Many veterans would like to see the whole restored Enola Gay (here it is in one piece in 1946, not long after the Hiroshima mission) displayed among the Air and Space Museum's other historic aircraft.

The Imbalance Remains

The revised script contains a number of commendable changes, but the extent of the revision is far less than the Air Force Association had expected. The changes consist of point additions and deletions that do not, in the aggregate, shift the mass of the exhibit appreciably. The plan is still unbalanced. It does not provide adequate historical context for understanding the events of August 1945. It is still a partisan interpretation that many Americans—and most veterans—will find objectionable.

Casualties in the Pacific war. AFA's criticism of the previous script said that the emphasis on Japanese suffering was so strong that visitors to the exhibit might well perceive Japan as the victim—rather than as the aggressor—in the Pacific war. In his April commentary, Dr. Harwit stated a similar conclusion. He said, "We talk of the heavy bombing of Tokyo, show great empathy for Japanese mothers, but are strangely quiet about similar losses to Americans." He suggested that the curators "put in an equal number of pictures of death and suffering in Section 200 ["The Decision to Build the Bomb"] for soldiers on both sides."

Some adjustments were made to the script, but the effect of the revisions was to reduce this particular imbalance from ninety-four to eighty-two percent—a definite improvement but still a long way from balance.

"Ground Zero" visual images. The curators planned for the "emotional center" of the exhibition to be Exhibition Unit 4, "Ground Zero: Hiroshima, 8:15 a.m., August 6, 1945; Nagasaki, 11:02 a.m., August 9, 1945." Because of the images in this section, the first line on the first page of the earlier script warned, "This exhibit contains graphic photographs of the horrors of war. Parental discretion is advised." (The warning has been eliminated in the revised script, even though most of the graphic images remain.)

In his April 16 commentary, Dr. Harwit acknowledged that "Section 400 [the Ground Zero segment] has far too many explicit, horrible pictures" and suggested the staff "take out all but about one-third of the explicit pictures of death and suffering in Section 400." As the table at the top of p. 60 shows, that did *not* happen.



GIs care for a comrade wounded in the bloody battle for New Guinea. Even Dr. Harwit noted that the exhibit is "strangely quiet" about American losses.

The Tilt Persists

	January Script	Revised Script
Photos of Japanese casualties	49	32
Photos of American casualties	3	7

Seventy-five percent of the "human suffering" photos are still included. Ninety-two percent of the artifacts remain. The graphic emphasis on women, children, and mutilated religious objects—documented in our April 7 report—is almost the same as before.

Another item of note: Our previous report cited as an example of emotional loading the intention to display a Hiroshima schoolgirl's lunch box with remains of peas and rice reduced to carbon. That artifact was specifically described in ten lines of text in the previous script. Specific reference to this item is deleted in the new script, although there is an entry at the corresponding point for a "Hiroshima lunch box—label copy to be provided." This is almost surely the same artifact, without the descriptive detail that drew criticism last time.

Emphasis on Japanese suffering. The emphasis on Japanese suffering is further seen in the number of text pages and photos devoted to that theme. (The revised script has a total of 295 text pages, of which eighty-four are about Japanese suffering. That emphasis is reinforced by ninety-seven photos.)

By contrast—and demonstrating the point about the lack of context—

the new script devotes less than one page and only eight visual images to Japanese military activity prior to 1945. The script lays virtually no groundwork about Japan's drive for conquest in the 1930s or popular support for the "Greater East Asia Co-Prosperty Sphere" that was on the verge of making the Pacific a Japanese lake by the 1940s.

Changes of Specific Note

The revision contains a number of other changes that should be specifically noted.

Copyright notice. The cover page of the new script adds a copyright notice and specifically forbids photocopying the document without written permission from the Smithsonian Institution. It is unknown whether this restriction was applied because AFA photocopied the previous script and made it available to veterans, news media, and Congress. AFA believes that plans for a controversial exhibit in a public museum, funded mostly by public money, should be open for public review.

At a meeting with veterans' groups July 13, Dr. Harwit said all of the publicity—most of it generated by AIR FORCE Magazine's reports—was needlessly "troubling elderly people."



The death struggle of US and Japanese forces in the Pacific played out not only on the islands and at sea but also in the air, as illustrated by this shot-up B-29. The bomber barely made it home and crashed on landing.

As of that date, the copyrighted script had received only limited circulation. Some of the veterans groups attending the meeting had not seen it yet.

(Selected people, however, had seen it. According to correspondence from Wakako Takeuji, program director of NHK Japan Broadcasting Corp. in Nagasaki, to AIR FORCE Magazine, the Smithsonian sent a review copy of the script to the Peace Museum in Nagasaki. It was the revised version, apparently, since Ms. Takeuji refers to the new title.)

Additions for balance. The segment "War in Asia and the Pacific: 1937-1945" adds eight graphic elements: photos of a Chinese baby in the ruins of a Japanese air raid on Shanghai, the carnage from the 1937 "Rape of Nanking," the US fleet under attack at Pearl Harbor (two photos, ships burning and exploding), and an "Avenge December 7" poster plus photos of the Bataan Death March, Marines after the fighting on Eniwetok, and a burial at sea. Added to the section on "Home Front USA" are three photos—a Gold Star mother who lost her sons, a death notice telegram, and a letter of condolence—and a flag used in the burial of a Navy Seabee. The strongest single element that has been added is a photo of a kneeling Australian flyer, about to be beheaded in August 1945, after Japan had surrendered.

Modification of "War of Vengeance." The January script included

the following assertion, which the Air Force Association and others found especially offensive: "For most Americans, this war was fundamentally different than the one waged against Germany and Italy—it was a war of vengeance. For most Japanese, it was a war to defend their unique culture against Western imperialism."

Asked about this by a reporter from the Washington, D. C., *City Paper*, Dr. Crouch acknowledged, "That's not a good sentence." The reporter understood that the lines were likely to be changed or eliminated in the revision, although Dr. Crouch believed the initial assertion was valid. "By then [the summer of 1945], the spirit of vengeance was pretty strong in the United States," Dr. Crouch said. "The Japanese had reached the point where they knew they were not going to win the war, and all they wanted to do was preserve national sovereignty."

The "War of Vengeance" assertion was modified and reads as follows in the revised script: "For most Americans, this war was different from the one waged against Germany and Italy: it was a war to defeat a vicious aggressor, but also a war to punish Japan for Pearl Harbor and for the brutal treatment of Allied prisoners. For most Japanese, what had begun as a war of imperial conquest had become a battle to save their nation from destruction."

A Tilt That Persists

The defining characteristics of the museum's plan include the unilateral emphasis on Japanese suffering in the war, the excessive use of provocative Ground Zero pictures and artifacts, and the slight attention paid to events prior to 1945. Other elements contribute to the distinctive ideological tilt of the plan:

Selective presentation of consequences. The final section of the script, "The Legacy of Hiroshima and Nagasaki," adds a wall label quoting a former soldier who says he and his colleagues heard the news of the atomic bomb with "relief and joy" because their lives would not be at risk in an invasion of Japan. (No photo is indicated.) The inclusion is welcome, of course, but this eight-line wall label is *all the exhibit says about the invasion that no longer needed to happen*. In the same section of the script, greater attention goes to the postwar antinuclear movement, complete with "Ban the Bomb" buttons, other artifacts, and peace demonstration photos.

An attitude of imbalance. The script is interspersed with a series of "Historical Controversies," such as: Would the Bomb Have Been Dropped on the Germans? Did the Demand for Unconditional Surrender Prolong the War? How Important Was the Soviet Factor in the Decision to Drop the Bomb? Was a Warning or Demonstration Possible? Was an Invasion Inevitable Without the Bomb? Was the Decision to Drop the Bomb Justified?

A recurring undertone in the plans and scripts for this exhibit has been suspicion about why the United States used the atomic bomb. Museum officials have seemed reluctant to accept the explanation that it was a military action, taken to end the war and save lives. Some of this speculation has been removed in the latest revision, but the script lingers respectfully on such individuals as nuclear scientist Leo Szilard, who protested the use of the bomb.

As the "Historical Controversies" listed above indicate, nearly all of the doubts and suspicions are directed at the United States. The Japanese are shown repeatedly in a quest for peace. Aggressiveness on their side is depicted as the province of a few military fanatics. The revised script eliminates a statement in the

previous version saying that prior to 1945, Emperor Hirohito “showed much enthusiasm for the armed forces and their conquests.”

The new script, like the last one, avoids showing warlike images of the Japanese armed forces. One of the few exceptions is the section on the *kamikaze*, who are treated with near-mystical reverence. They are seen facing certain death bravely as comrades and schoolchildren cheer their selflessness. Indeed, they are the only military members on either side who appear in heroic roles in this exhibit.

The internment issue. The exhibit script allotted two text pages to the internment of Japanese-Americans in the United States compared to one paragraph on Japanese treatment of American prisoners of war. In his April 16 commentary, Dr. Harwit said that “we do not note that conditions in the American internment camps were far more favorable than in Japanese internment camps, where slave labor conditions prevailed.” The balance is adjusted in the new script, although the comparison of conditions is not explicitly drawn. There is no coverage at all of Japanese “internment” of American civilians, such as occurred at the notorious Santo Tomas prison compound in Manila, the Philippines.

The internment of Japanese-Americans still commands a prominent place in the section on “Home



Ground Zero, Hiroshima, not long after the atomic blast at 8:15 a.m., August 6, 1945, that swept away much of the city and its inhabitants. The Air and Space Museum wants to make such images the “emotional center” of the exhibit.

Front USA.” This entry has been edited down in the revision, but a new label directs visitors to another exhibition, “A More Perfect Union” in the National Museum of American History, for more information on the wartime treatment of Japanese-Americans. (That exhibition, keyed to the 200th anniversary of the US Constitution, generated great controversy when it opened. Dr. Crouch was the curator of “A More Perfect Union.”)

View of the postwar world. The

final “Legacy” section of the exhibit gives a *single line*—preceded with a dismissive “on the other hand”—to the proposition that “nuclear deterrence may have ensured for the first time that wars between the great powers were no longer possible.” This concept is worth far more than a throwaway line. This is one of many instances where the curators seem either not to understand or to have light regard for military perspectives in an exhibition on a military subject.

The attention of this final section of the exhibit is on other things. It concentrates on the nuclear arms race, radiation effects of nuclear weapons, the rise of the antinuclear movement, nuclear waste and contamination, and the curators’ perspective on Mutual Assured Destruction, or MAD. Another theme of this postwar section is to show the American victors celebrating merrily in contrast to the anguish and suffering of the defeated Japanese.

What the Military Historians Really Said

According to museum officials, the script was drafted by four individuals, none of them veterans of military service. The changes to the revised script were incorporated by Dr. Michael Neufeld, the exhibition curator. He is a Canadian whose background is in European economic history.



Released by US liberation forces in February 1945, these American POWs—survivors of the Bataan Death March—show the effect of Japanese maltreatment. The exhibit does not contain many such photos.



Brig. Gen. Paul W. Tibbets, Jr., USAF (Ret.), pilot of the Enola Gay, calls the exhibit "a package of insults." He urges the museum to display the bomber alone, noting its mission. "You don't need any other explanation," he says.

Time and again, museum officials have left the impression that any imbalance is in the eye of AIR FORCE Magazine and that the exhibition is supported by the historians of the armed forces. A standard element in such remarks is to prominently identify Dr. Richard P. Hallion, Jr., Historian of the Air Force, as a member of the museum's advisory committee, followed by a statement that the committee is supportive of the museum's plan.

Dr. Harwit wrote in April, for example, "I believe I am not putting words into the committee members' mouths in saying that the unanimous response was that our exhibition plans were well informed, accurate, and responsible." Smithsonian Secretary Adams, writing to Rep. G. V. "Sonny" Montgomery to dispel "misinformation and unfounded rumor," said, "The script has been carefully scrutinized for accuracy and balance by a committee of some of the nation's leading scholars, including Dr. Richard Hallion, Chief of the USAF Center for Air Force History" [*sic*]. In the course of a radio debate, Dr. Crouch said that some of the service historians—specifically the historian of the Air Force—had endorsed the exhibit.

Dr. Hallion, speaking for himself, gives a different assessment: "The exhibit as currently structured is not one we would have done. We feel that though the museum has made

considerable progress over its original concepts, it still needs to show that the central issue behind dropping the bomb was shortening the war and possibly saving upwards of 500,000 Allied troops."

Writing to a veteran who inquired about his position, Dr. Hallion said, "The bottom line is that Harwit and his two curators, Crouch and Neufeld, came under heavy pressures (as you know) because the *Enola Gay* exhibit script was not in balance nor context. As a result, Harwit has formed a new committee to revise the script so that it doesn't seem that America was the aggressor in the Pacific!"

Referring to the January version of the script, Dr. Hallion reported that the professional historians of the armed forces "unanimously consider it a poor script, lacking balance and context."

Museum Director Harwit was well aware of this reaction from the services. Writing to a special group he had appointed to work on revisions, he said that "a team of historians from different branches of the military" had "expressed dissatisfaction with the script's overall balance. In their opinion, it was flawed in its portrayal of Japanese and American history, activities, and customs."

After reviewing the revised script, the Office of Air Force History said that "the overall impression gained from 'The Last Act' is that the Japa-

nese, despite years of aggression and wanton atrocities and brutality, remain the victims. The culprits in this version of history are the American strategic bombing campaign (against civilians) and those who directed and implemented it."

Other Opinions

There has been some suggestion also that objections to the Smithsonian's plans for the *Enola Gay* are limited to AIR FORCE Magazine and a small number of individual veterans. That is hardly the case.

In May, the national executive committee of the American Legion adopted a resolution strongly objecting "to the use of the *Enola Gay* and the heroic men who flew her in an exhibit [that] questions the moral and political wisdom involved in the dropping of the atomic bomb and [implies] that America was somehow in the wrong and her loyal airmen somehow criminal in carrying out this last act of the war, which, in fact, hastened the war's end and preserved the lives of countless Americans and Japanese alike."


In June, the Air Force Sergeants Association presented its first-ever "Freedom Award" to Brig. Gen. Paul W. Tibbets, Jr., USAF (Ret.), pilot of the *Enola Gay*, and special awards to surviving members of the crew. W. Burr Bennett of Northbrook, Ill., unofficial coordinator for a group of World War II veterans concerned about the *Enola Gay*, said that through August 8, 1994, he and his colleagues had collected more than 11,400 signatures on petitions of protest to the Smithsonian.

Since the publication of the Air Force Association and AIR FORCE Magazine reports five months ago, the letters and telephone calls supporting our position have not stopped.

General Tibbets says the "proposed display of the *Enola Gay* is a package of insults." How does he believe the National Air and Space Museum should exhibit it? "Like the Smithsonian displays any other airplane," he says. "Look at Lindbergh's airplane. There it sits, or hangs, all by itself in all its glory. 'Here is the first airplane to fly the Atlantic [solo].' OK. 'This airplane was the first one to drop an atomic bomb.' You don't need any other explanation. And I think it should be displayed alone." ■

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USAF's Space Warfare Center aims to link satellite sensors to shooters in the cockpit.

Spacepower Comes to the Squadron

By David J. Lynch

THE AIR Force has embarked on a major campaign to make space systems a key part of its fighting force. The focal point of this effort is Air Force Space Command's Space Warfare Center at Falcon AFB, Colo. With a full-time staff of 157, the center is a lean operation, but officials say its mission is among the most critical in the Air Force.

The origins of the center and its mission date to early 1991 and the Persian Gulf War. Shortly after the war ended, Gen. Merrill A. McPeak, the Air Force Chief of Staff, stated that USAF should seek to control and exploit both air and space. As a first step, General McPeak chartered a blue-ribbon panel to determine how to make that vision a reality. The panel, headed by Lt. Gen. Thomas S. Moorman, Jr., vice commander of Air Force Space Command, reported in November 1992 that the Air Force needed an entirely new approach to space resources and use.

"Air Force space emphasis and resources have been [concentrated] on acquiring and operating satellites," the panel reported. "Inadequate attention has been paid to the exploitation of space." In a key finding, the

Moorman panel recommended formation of a single, integrated space warfare center.

The need for a new space philosophy was demonstrated by Operation Desert Storm. In the war's aftermath, analysts focused on major deficiencies in the service's ability to make high-quality space information available to aircrews and ground unit commanders.

"When we got to the war, space resources were available but were not tailored to the warfighting problem," said Brig. Gen. David L. Vesely, the SWC's first chief. "Tactical warning was just not there. Likewise, reconnaissance data all arrived, but we did not get what was tactically useful."

An Air Force briefing document is more blunt: "Information flow to aircrews slowed to a trickle during mission execution."

Cold War Heritage

Problems in tactical exploitation stemmed from the historical orientation of US space systems. Born in the Cold War, the Air Force space program was designed to monitor and give warning of strategic thrusts by the Soviet Union. The concerns

Operation Desert Storm demonstrated the need for a new space philosophy. The Air Force now seeks to get high-quality space information directly to the cockpit and tailor it to meet the warfighter's needs.



of theater commanders were secondary. One consequence was that the system of strategic intelligence and warning had a low tolerance for false alarms, making it inapplicable to tactical problems.

By late 1993, the Moorman panel's chief recommendation had been implemented. Air Force officials then faced a pair of initial tasks. First, they needed to assess the extent of tactical utility in the existing infrastructure of satellites, personnel, and communications links. Second, they needed to effect a cultural change within the blue-suit community: They had to break down the internal Air Force division between operational warfighters in the theaters, who often had come up through the ranks as fighter, bomber, or tanker pilots, and the space experts, who had long focused on preparing for and preventing apocalyptic conflict.

As General Vesely and others looked at the existing space hardware, it became clear that much could be accomplished without costly new development programs. Current-generation satellites were more capable than had been understood. When these satellites were combined

with the past two decades' advances in data-processing power, the Air Force could do more than might have been expected.

"The great majority of our focus is trying to take space systems that are there and work out applications of these systems to tactical or theater problems," General Vesely said. "We're able to do things with national space surveillance systems to wring out available information from these systems."

On the cultural front, General Vesely's task is primarily one of education. He seeks to create "demanding customers" in the tactical community who recognize how spaceborne systems can make their jobs easier without viewing space as a "panacea." At the same time, he must foster an aggressive warfighting mentality among space personnel more accustomed to passive surveillance and warning functions.

Throughout the Air Force, efforts to better understand how to use space are under way. A formal Air Force space operations doctrine is scheduled to be released this month.

Lt. Gen. Patrick P. Caruana, former commander of 14th Air Force and

now AFSPC's vice commander, highlighted efforts to develop operational plans for tactical use of space. Such documents would "provide a clear understanding of required actions, from the CINC operations plan down to squadron-level execution," said General Caruana.

The front-line missionaries in this campaign are small SWC teams deployed to individual theaters, including Korea, to coordinate tactical space planning. The Forward Space Support in Theater teams are the responsibility of 14th Air Force and are tailored to the specific needs of theater commanders.

The TENCAP Angle

The principal mechanism for increasing the service's operational use of space is an initiative known as TENCAP (Tactical Exploitation of National Capabilities). The program dates to the early 1970s, but only recently—as a result of the formation of the SWC—has it gained serious attention.

TENCAP is divided into six programs code-named Talon. They include integrating Global Positioning System information into military

survival radios to make it easier to rescue downed airmen and providing satellite targeting data to cockpits in near-real time.

John Pike, a space policy analyst for the Federation of American Scientists and a frequent critic of Air Force space policies and programs, said the SWC's importance is as an "institutional center of advocacy" for the TENCAP program.

"There used to be TENCAP officers all over the place," said Mr. Pike. "Now there's a building I can point to. [SWC] has given TENCAP drastically higher visibility."

Lt. Col. Mitchell Fry, chief of the SWC's Combat Applications Division, said the Air Force only recently has given TENCAP the attention and support it has gotten from the Army and Navy space bureaucracies. The SWC is expected to receive an annual TENCAP appropriation of \$30 million to \$45 million.

TENCAP's lineage can be traced to a chance incident in 1973, when Army Lt. Gen. Daniel O. Graham, then deputy to CIA Director William Colby, made a routine visit to Torrejon AB in Spain. Airmen there had a demanding mission: In an all-out war with the USSR, they were to penetrate enemy airspace and destroy high-value targets in the southern portion of the Soviet Union.

General Graham, who later became head of the Defense Intelligence Agency, said that the Air Force pilots had highly classified target folders but relied on outdated photos from World War II. "I knew damn well we had photos of everything on the globe and ones that would be better than those," he said, "but it was compartmented intelligence."

General Graham mounted an effort to convince others within the intelligence community to relax their grip on the product of the extensive satellite-based collection program. Eventually, he persuaded Mr. Colby to have the CIA provide up-to-date photos to theater-based pilots. He continued his efforts once he took over the DIA several years later, meeting serious resistance from intelligence professionals accustomed to maintaining control of what they regarded as strategic data.

The same role was filled until recently by Gen. Charles A. Horner as commander in chief of US Space

Command and commander of Air Force Space Command. He called for eliminating "stovepiping" in intelligence and military satellite communications programs.

For General Horner, an important step occurred in January when the command completed studies on spacebased intelligence systems and the MILSATCOM system for the vice chairman of the Joint Chiefs of Staff, Adm. David E. Jeremiah. In April, General Horner told Congress he had developed an integrated priorities list for intelligence systems, which would be developed by the theater CINCs and presented to the DIA and the JCS. The intelligence community, he said, had accepted the need for greater operational input into its requirements.

Relocatable Targets

By the mid-1980s, another stimulus had arisen for Air Force efforts to provide near-real-time information to the cockpit. The Soviet Union had deployed mobile nuclear missiles, and Air Force officials were confronted with a huge targeting problem. To solve it, the Air Force launched a number of highly classified initiatives to deal with strategic relocatable targets (SRTs).

The interim solution entailed strapping advanced sensors into B-2 or B-1B bombers to aid in the hunt for mobile ICBMs. Pentagon officials requested a paltry \$1 million in Fiscal 1987 to test sensors already under development for the new mission. The SRT program evaporated when the Cold War ended, but it had revealed the difficulty of linking satellite data to airborne systems in a missile-hunting solution.

Today's mobile targets, though less potent than old Soviet ICBMs, are even more difficult to detect. During the Gulf War, the Air Force was frustrated in its effort to pin down Iraqi Scud launchers.

The problem is that medium-range missiles have inherently greater mobility than do larger strategic weapons. Road-mobile SS-25s and rail-based SS-24s had more limited deployment areas; consequently, less terrain had to be searched. Scud decoys are easier to build.

In addition, when it came to identifying Scud launches and alerting coalition troops, the Air Force found the existing strategic warning sys-

tem—the Defense Support Program (DSP) satellite system—ill-suited for the demands of a theater campaign.

The Air Force acknowledges that it was unable to pass DSP satellite targeting information directly to the fighters flying Scud combat air patrols. The system often provided multiple, uncorrelated warnings of a launch. The Air Force called the configuration *ad hoc*, saying it provided neither timeliness nor the required accuracy.

To boost US theater missile defense capability, the SWC is pursuing Talon Shield, a program aimed at fusing satellite intelligence with DSP readings of a missile's telltale infrared emissions. A prototype central processor—maintained at the National Test Facility (NTF), collocated with the SWC in Colorado—receives tactical incoming DSP warnings on a channel separate from that used to relay data from the strategic warning system.

Talon Shield will send warnings of theater missile launches to commanders in the field. The messages will include data on when and where the launch originated, its indicated target, and its expected impact time, according to the Air Force. The existing prototype operates at the NTF eight to twelve hours each day and can support only one theater at a time. The Air Force plans to expand that capability to a twenty-four-hour watch for two theaters beginning in Fiscal 1995.

A Hefty Investment

The Air Force aims to capitalize on its \$23 billion investment in its Cold War early warning system. New hardware construction is to be kept to a minimum. Talon Shield is expected to cost a modest \$67.5 million over five years. It is designed to use existing theater communication networks. Air Force plans call for an October 1 activation of the Talon Shield system under a new name, ALERT (Attack and Launch Early Reporting to Theater).

Even the new system will be limited by DSP data, according to General Horner. To improve upon ALERT, the Air Force plans to replace DSP with a new system known as ALARM (Alert, Locate, and Report Missiles).

The new emphasis on TENCAP has paid off, said General Vesely.



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Navigation, threat, and targeting data will be transmitted from satellites to fighters, bombers, transports, refuelers, and, as in the case of this Space Test Experiment Program satellite, ground stations.

"We've had several initial successes, but we're just beginning."

TENCAP has an ambitious agenda. It aims to harness spacebased assets in the service of pilots in fighter, bomber, and airlifter cockpits (Talon Swooper), battlefield command and control (Talon Command), mission-planning (Talon Ready), and special operations forces (Talon Night), while investigating support systems, such as communications (Talon Touch) and new technologies (Talon Vision).

To speed development of TENCAP offspring, the Air Force has established the Space Applications Program Office at the Space and Missile Systems Center at Los Angeles AFB, Calif. It is chartered with rapidly producing prototypes of systems designed to gain leverage with space-based assets. The first TENCAP product to make the transition to the acquisition community is a six-layer system to provide near-real-time intelligence updates for aircrews en route to a target. The Multisource Tactical System (MSTS) provides multispectral imagery from Landsat or SPOT satellites; digital charts and elevation maps; satellite intelligence (including signals intelligence) on air- and groundbased threats; and real-

time location data from the Global Positioning System.

On long missions, preflight briefings can become stale well before a crew reaches its target. MSTS is intended as an interim solution, both for aircrews and troop commanders riding along in the rear of the aircraft. In-flight updates can be provided by the existing Tactical Information Broadcast System of a nearby E-3 Airborne Warning and Control System aircraft.

Air Mobility Command is already committed to spending \$4 million on fourteen MSTS prototypes for testing on an array of platforms. The first pair of prototypes has been delivered to Scott AFB, Ill., for testing by air refueling specialists. The remaining units are to begin arriving at Charleston AFB, S. C., in July.

Snap-On Systems

The system debuted on a C-141 transport during Bright Star '94 in Egypt. It has been demonstrated on C-141, C-130, and KC-135 aircraft on relief missions over Bosnia-Herzegovina. On its maiden flight, the prototype required three people to operate it and took up an entire pallet load. The version used in recent flights over Bosnia is far more com-

pact. Described by those who built it as a "snap-on" system, it fit neatly into a C-130's navigation station, took twenty minutes to install, and required only one operator. Further work is needed on the graphical user interfaces for tanker aircraft and on expanded provisions for receiving weather updates from the Defense Meteorological Satellite Program spacecraft.

For now, MSTS is more appropriate for heavy-lift aircraft, which have sufficient space for the unit's twelve-inch computer monitor. The program office hopes that advances in flat-screen technology—now being pursued separately under the Talon Vision program—will make the gear suitable for fighter aircraft. Fully deployable MSTS units are envisioned as one of two standard-size black boxes, small enough to fit into a fighter cockpit. Today's color computer monitor should shrink to a flat screen just ten square inches in area, according to the Air Force.

Air Force officials describe Talon Sword as "sensor-to-shooter" technology that improves situational awareness for air crews, but some skeptics worry that continuously feeding raw data to the cockpit will overwhelm busy pilots.

"It's a very difficult issue to resolve," conceded General Vesely. "There are just huge amounts of data. Of that mass, how do you pull out the nugget that's of use to the person in that cockpit at that time? It's a very complex problem."

Program officials realize they cannot inundate a pilot with data on hundreds of targets. Only one target, or perhaps a few, will be of immediate concern.

The Air Force is separately studying putting a high-speed mini-supercomputer on board fighters under the Talon Lance project. The computer would work ten to thirty times faster than existing aircraft processors and would reduce the load of raw data pilots must handle. Talon Lance is initially envisioned as fitting aboard larger platforms, such as an EC-130 or E-8 Joint STARS.

The service has high hopes for Talon Sword. Colonel Fry describes it as "highest priority." Air Force documents quoted one F-16 pilot praising the prototype: "Elint targeting data [were] good enough to bomb with." ■

David J. Lynch covers defense and aerospace for the Orange County Register in California. He is a former editor of Defense Week Magazine. His most recent article for AIR FORCE Magazine was "The C-17 on Probation" in the March 1994 issue.



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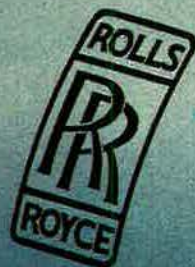
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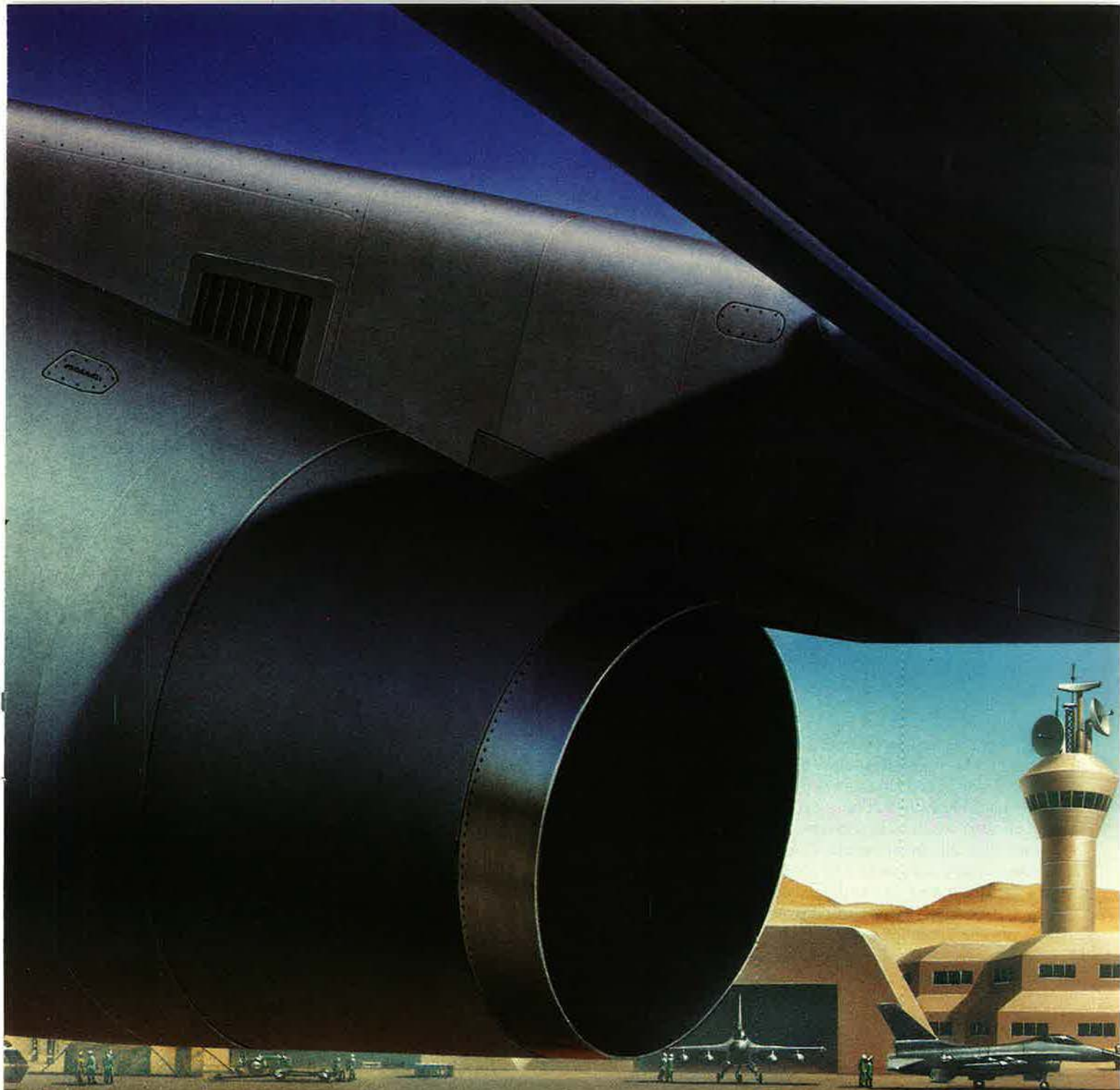
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The Air Force struggles to obey stiff environmental laws without sacrificing combat capability.

The Green Air Force

By Stacey Evers

EVERY time Air Force environmental managers study the service's ranges and bases, they uncover new candidates to put on their list of hazardous waste sites. Between the time that the most recent flurry of base closures began in 1989 and the end of 1993, Air Force officials placed an additional 1,500 polluted properties on the cleanup roster.

Though the Air Force's environmental managers have mounted an aggressive effort to clean up its property and prevent future contamination, the bill has begun to outgrow the budget.

More-rigorous environmental policies undoubtedly have contributed to the increase in cleanup sites. The Air Force has established demanding goals to restore its contaminated lands and to convert former bases into usable civilian properties as quickly as possible. Weapon system program managers already must include pollution prevention in their spending plans, and wing commanders must pay some environmental fines out of their operating budgets.

These tough measures have begun an environmental change in the Air Force. Diminished use of ozone-

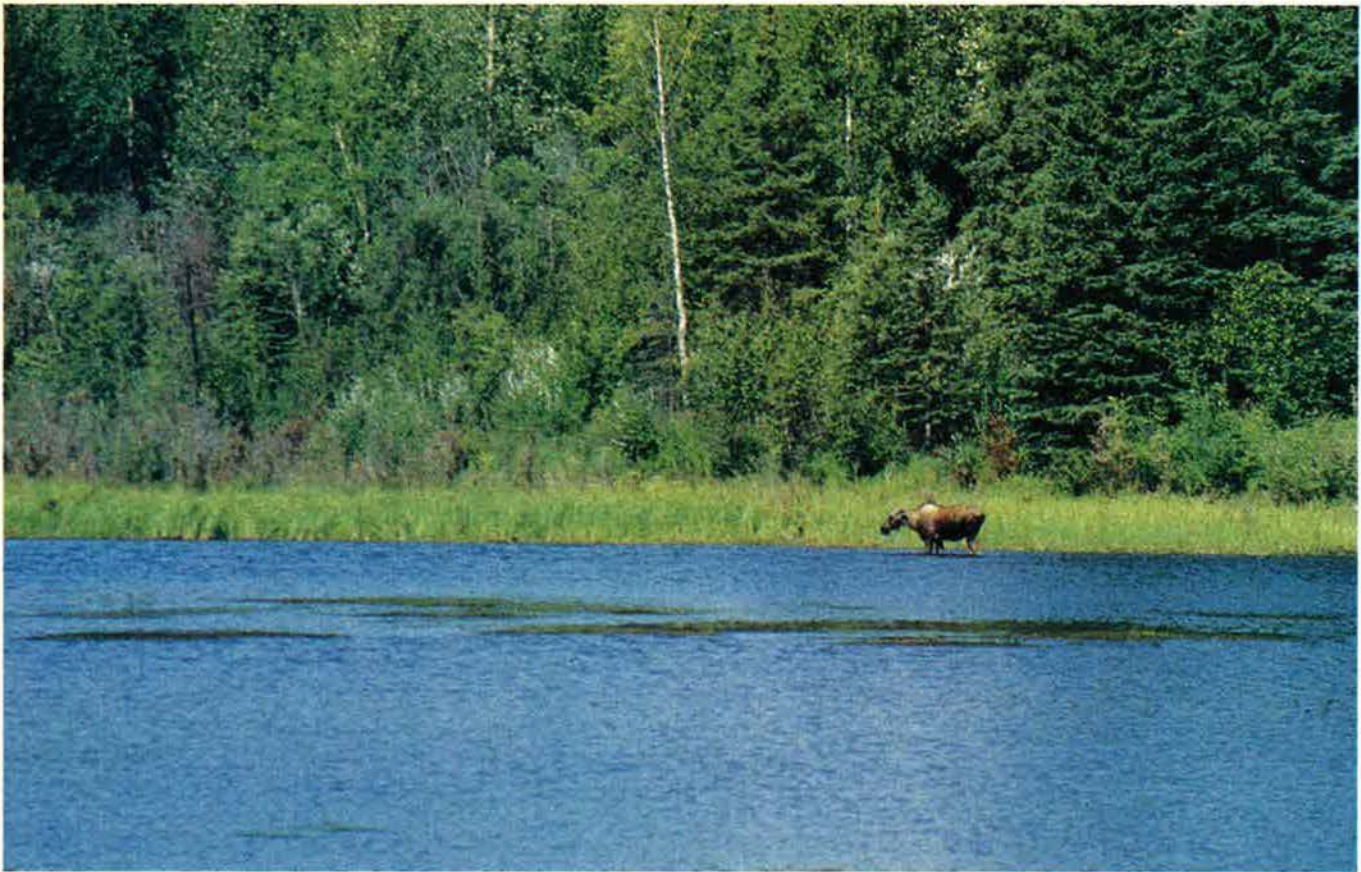
depleting substances is evident in the program to develop the F-22 fighter, which will have only one such substance—seventy-one pounds of Halon 1301 as a fire suppressant in engine nacelles. Compare this to the C-5, which needs 87,503 pounds of ozone-depleters for 3,031 different uses.

Pervasive budget troubles threaten to squelch the Air Force's aggressive green movement. Defense Department budget planners intend to slash USAF's environmental funding, providing only about sixty percent of the service's \$5.2 billion cleanup requirement in Fiscal 1995-99. In Fiscal 1994, \$257 million of the service's \$770 million cleanup requirement was not funded by DoD.

Every Dime Is Needed

When the Defense Department has finished chopping, USAF budgeteers will scrutinize the service's environmental budget to make sure not one dime is wasted. The Air Force needs all it can get to fund pollution prevention, environmental compliance, cleanup, and conservation.

"We are wire-brushing [the environmental budget] because every dol-



lar we put in the environmental arena takes away from some other vital Air Force program, including readiness," Maj. Gen. James E. McCarthy, The Civil Engineer of the Air Force, said at an AFA environmental symposium held June 13 in Arlington, Va. Also making detailed presentations at the forum were Lt. Col. Sherman Forbes, chief of the Air Force's acquisition pollution prevention program, and Anthony Zugay, executive director of the Air Force Center for Environmental Excellence (AFCEE) at Brooks AFB, Tex.

"In a lot of cases, we're going to be forced to take reductions in performance [of Air Force weapon systems] in order to minimize use of hazardous materials," Colonel Forbes said.

Does the Air Force really have to sacrifice capability in order to pump and dump the toxic leftovers of landfills and fuel spills?

When one looks at the budget, the answer seems to be yes. The Air Force has only \$7.98 billion with which to fill a \$10.5 billion requirement for cleanup, compliance, pollution prevention, and conservation in Fiscal 1994-99. All but \$32 million of the difference can be attrib-

uted to the cleanup portion of the budget, an allocation made by the Office of the Secretary of Defense, not the individual services.

General McCarthy believes he knows of a way to alleviate the trade-off tension between environmental responsibility and combat capability.

"The problem obviously is that the way we're doing business, we don't have enough money to achieve our goal, and Congress flatly isn't going to give us the money to meet that goal," General McCarthy said. "Frankly, I don't think they should give us the money. We've got to approach this in a different fashion."

General McCarthy and other Air Force environmental experts have several proposals. While most of the new methods would compensate for the cleanup cuts, a few would tackle compliance and pollution prevention.

One major change that General McCarthy wants to impose is a seemingly simple priority order for individual sites. Under this plan, the Air Force would tackle the most hazardous sites first and then proceed to the next most hazardous, and so on down the line. The Air Force now puts all sites at a base into a single grouping

to determine the priority of the base as a whole.

General McCarthy thinks Congress could be persuaded to give the Air Force the money to expeditiously address the high- and medium-risk sites. He is not so sure about the reaction of local, state, and Environmental Protection Agency regulators, who possess written Air Force commitments as to when certain cleanup tasks will be done.

Suspicious

"They're not sure they want to let us off the hook for a while," he said. "They think something's obviously wrong—that we're trying to get away with something—and they're worried about that."

The Air Force wants to convince regulators that the new implementation plan makes sense in terms of alleviating risks to human health, General McCarthy said, adding, "As it is now, we're all wrapped up in these agreements and working on some pretty low-priority things."

If the Air Force can switch its ranking method, environmental experts want to reduce all sites in the high- and medium-risk categories to

low risk by 2000, General McCarthy said. Ideally, the Air Force would like to restore at least ten percent of its hazardous waste sites annually in order to remediate all of them around the turn of the century, he said.

The majority of USAF's 4,970 contamination sites contain fuel and oil products that leaked into the ground from spills, defects in underground storage tanks, and fire training. These three causes account for fifty-four percent of the sites. Problems stemming from landfills constitute twenty percent. Less predominant are contaminants from waste pits, surface drains, disposal pits, and radioactive waste. General McCarthy said that the latter category of dump contains mostly medical waste.

Obviously, much of the cleanup task is related to the condition of Air Force sites on the Base Realignment and Closure (BRAC) list, and the Air Force has a plan for cutting costs there, too, said Mr. Zugay.

The Air Force, under intense pressure to restore closed bases and turn them over to the community as soon as possible, has cut up to thirty months off the time it takes to carry out an environmental impact statement.

Go Straight to Cleanup

Cleanup is far from finished when the assessment is done. Under the current process, the Air Force carries out a remediation investigation and feasibility study that eventually

wins regulatory approval and leads to a formal design, then to remedial action and long-term monitoring.

From start to finish, the process rarely takes less than seven years and can consume as many as ten. "We can't stand that," Mr. Zugay said.

AFCEE wants to accelerate the process by skipping the formal design phase and jumping straight to a remedial action plan developed from the remediation investigation and an experienced contractor's shop drawings.

"Ideally, we want the BRAC to get to the point where we can put a contractor on the base... [provided] we have a reasonably good characterization or definition of what the problem is and that we know what the remedy should be, based on what we've done in the past," Mr. Zugay said. "Let's go right in there and start cleaning it up and, at the same time, get in bed with the regulators and get the community to agree this is a good deal."

He estimated that this could slice as much as two and a half years off the cleanup process and could shave the cost by as much as \$2 million.

"We want to relieve ourselves of the paralysis of analysis out there," he said. "We spend too many years in the Air Force and too much of the money doing that."

Of a Fiscal 1994 BRAC total of \$208 million, the Air Force aims to spend about \$160 million on remedial action and the remainder on studies.

The Air Force intends to modify its approach to technology, General McCarthy said. For years, the Air Force "cruised along with a very robust budget without regard to bringing on board better, cheaper, and faster technology," he said. "Congress is right in not giving us money until we come up with new processes of bringing new technologies to bear."

"Bioventing" and natural remediation—that is, letting bacteria eat contaminants—are being used more often on bases. Natural remediation alone has saved \$16 million over the traditional pumping method, General McCarthy said.

AFCEE awarded \$10 million last year for further development of promising environmental technologies. It plans to spend another \$10 million under a second announcement issued in June and calling for new concepts. Contractors are to submit their restoration, compliance, and pollution prevention ideas to AFCEE, which will pay for further development of the best ones.

"We think this is going to pay us back big bucks," Mr. Zugay said. "We also think that some of this is going to be the source of some of our new, more innovative, and less expensive cleanup programs."

Since its creation in 1991, AFCEE has let about \$1.38 billion in study, design, and remedial action contracts. The center plans to award \$1.39 billion in full-service remedial action contracts this summer, including seventeen that are base-specific, and has budgeted \$125 million for five remedial study and design contracts that are set aside for small businesses.

AFCEE also is preparing to award five contracts in August as part of its "first big effort" in pollution prevention, Mr. Zugay said.

Drive Home the Message

Environmental experts agree that if the Air Force program is to be a success, it must drive home the message of pollution prevention. "We have no need to pollute, we have no right to pollute, and I think pollution prevention is the environmental product of the future," Mr. Zugay said.

Pollution prevention goals will reduce some Air Force contamination. Spurred by Executive Order 12858, the August 1993 document that requires the federal government to

Staff photo by Guy Aceto



Since wing commanders must now pay environmental fines out of operating budgets, the focus is shifting to pollution prevention. Innovative technologies, such as these electric vehicles, lessen environmental damage.

comply with community right-to-know laws and establish pollution prevention requirements, the Air Force intends to reduce hazardous waste disposal by twenty-five percent by Fiscal 1996 and fifty percent by Fiscal 1999 and to cut trash disposal thirty percent by Fiscal 1996 and fifty percent by Fiscal 1997.

In accordance with international law, the US stopped producing ozone-depleting chemicals in January, leaving the Defense Department to rely on a finite stockpile of these substances.

Even with these targets, minimizing hazardous material use in the life cycle of a weapon system will be extremely difficult. The offending substances are used primarily in existing weapons "where you have very little design flux left," Colonel Forbes said. Some of these weapons will not convert quickly or cheaply to EPA-approved chemicals and will have to keep drawing on the Defense Department's reserves.

One example is the Peacekeeper ICBM, which uses a chlorofluorocarbon in its guidance system. Engineering studies say retrofitting the ICBM with equipment using a non-toxic coolant would cost \$40 million to \$60 million—a pretty steep price for a piece of hardware scheduled to move out of the inventory by 2003.

With fewer new starts, however, the Air Force must find a way to cut down on its use of hazardous chemicals in existing programs and the need for toxic waste disposal. Colonel Forbes said, "We're going to be stuck with the weapon systems that we have today for a long time."

Last December, the Air Force's acquisition office issued a pollution prevention policy for weapon systems, mainly to reemphasize the decrees of the Montreal Protocol, the Clean Air Act Amendments of 1990, and the Federal Facilities Compliance Act, which allows citizens to sue the federal government for lack of compliance with local, state, and federal environmental standards.

The Federal Facilities Compliance Act now applies to Resource Conservation and Recovery Act activities but is expected to be expanded to the



USAF photo by MSgt. Rose Reynolds

Tough new environmental laws have driven the Air Force to change the way it does business, switching to more environmentally friendly methods for everything from film processing to fuel storage.

Clean Air Act and the Clean Water Act. Air Force policy dictates that fines for violating the federal facilities law will come out of the wing commander's operating budget.

Colonel Forbes said he hopes the Air Force policy helped managers to "really focus in on" pollution prevention and to make pollution prevention "an intimate part of their day-to-day system engineering activities."

The policy makes clear that program managers must minimize their use of ozone-depleting substances and hazardous materials without receiving any extra money for pollution prevention.

"We emphasize that in weapon systems, you have to make smart decisions," Colonel Forbes said. "You've got to trade off and look at life-cycle costs before you do things. [With] a lot of weapon systems, you may just have to live with what you've got because you just can't afford it. . . . There is no magic pile of money, so we've got to leverage money and time."

The EPA is about to make weapons managers' jobs more difficult by expanding the number of substances on its list of hazardous materials from seventeen to more than 300. The Air

Force will not immediately try to weed out all banned chemicals. "We can't eat it all in one bite," Colonel Forbes said. Instead, the service will capitalize on industry work to date on the "EPA Seventeen" in trying to find safer substances.

Colonel Forbes said he and other environmental engineers also try to make reasonable demands, realizing that all changes cost a great deal of money. "We don't have a lot of flexibility in that area," he said.

Air Force Materiel Command has set up a toll-free pollution-prevention telephone number at Wright-Patterson AFB, Ohio. AFCEE also has a hot line to respond to more general pollution prevention and restoration questions.

Eager to prove that despite all obstacles, pollution prevention is a reality for the Air Force, Colonel Forbes can recite a litany of successes: the F-22's ozone-depleting chemicals reduction, the B-2 bomber's hazardous materials program, a NASA and Titan System Program Office teaming to look at options for solid rocket motor manufacture, and a joint USAF-Navy-Army propulsion environmental working group.

"We come at it as environmental managers, not environmentalists," he said. "We manage this like reliability, sustainability—it's another one of the things that weapon system designers and developers and operators have to take into account." ■

Stacey Evers reports on R&D and other aviation topics for Aerospace Daily, a military and commercial aviation publication in Washington, D. C. This is her first article for AIR FORCE Magazine.

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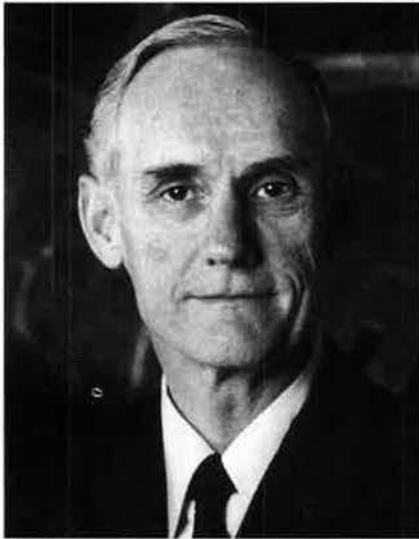


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12th Air Force
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Lackland AFB, Tex.

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Hurlburt Field, Fla.

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RAF Alconbury, UK

720th Special Tactics Group
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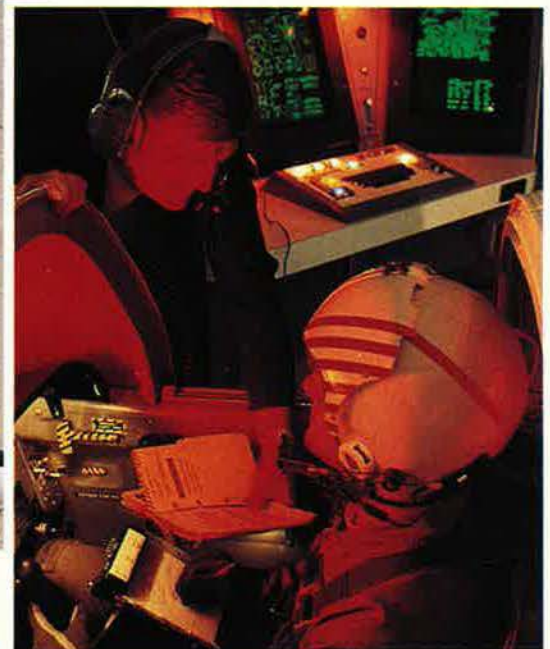
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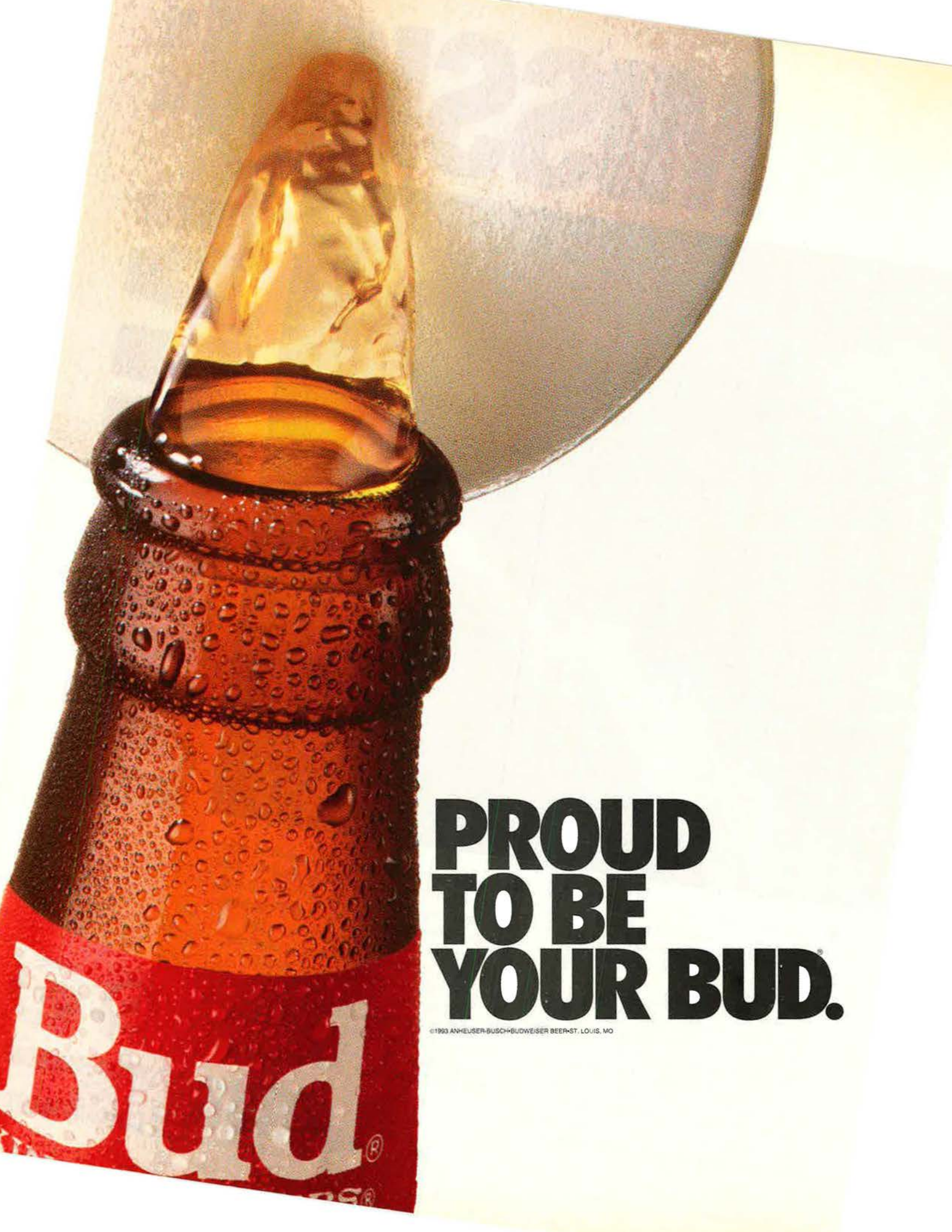
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Gallery of NATO Airpower

By John W. R. Taylor and Paul Jackson

Together with the "Gallery of USAF Weapons" in the May 1994 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.

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. Retrofitting replaced the original Larzac 04-C6 turbofans with more powerful 04-C20s. The German Alpha Jet squadrons began disbanding in April 1992, and only 30 of the aircraft now remain, with the Fürstenfeldbruck Training Group, to provide "Europeanization" flying for German pilots trained in the US. Of the others, 45 were donated to Portugal in 1993 and are operated from Beja by No. 301 Squadron for ground attack (including six with electronic countermeasures equipment in the rear cockpit) and by No. 103 Squadron for advanced training.

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 10 3/4 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, on zero/zero ejection seats. 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 Aermacchi 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. Of these, 72 had been delivered when production was halted temporarily in 1991. First to receive AMXs was No. 103 Squadron, part of 51 Wing at Istrana. No. 132 Squadron/3 Wing at Villafranca received its first AMX in October 1990; No. 14 Squadron/2 Wing followed in July 1991 and is now at Rivolto; No. 28 Squadron/3 Wing began reequipping in June 1993. The two squadrons of 3 Wing have a partial reconnaissance commitment. Later production aircraft may be of an upgraded version of the AMX with Grifo radar, for which Aeritalia (Alenia), Aermacchi, 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. 32 Wing at Foggia for advanced training.

Contractor: AMX International (Alenia, Aermacchi, Embraer).

Power Plant: one Rolls-Royce Spey Mk 807 turbofan; 11,030 lb st.

Dimensions: span 32 ft 8 1/2 in (over missiles), length 43 ft 5 in, height 14 ft 11 1/4 in.

Weights: empty 14,771 lb, gross 28,660 lb.



Alpha Jet, Portuguese Air Force (Paul Jackson)



AMX, Italian Air Force (Paul Jackson)



G91Y, Italian Air Force (P. R. Foster)

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, on zero/zero ejection seat.

Armament: one 20-mm M61 multibarrel gun; twin centerline pylon and four underwing pylons for bombs, cluster bombs, ASMs, 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 Araxos, and Nos. 340 *Lialaps* and 345 *Perseus* at Souida, 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 have no in-flight refueling capability. They were followed by five two-seat TA-7Hs and a further 36 ex-USN A-7Es, supplied from March 1993 to Nos. 335 *Tigreis* and 336 *Olympus* Squadrons at Araxos, replacing F-104G Starfighters.

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 *Falcoes* and 304 *Magnificos* 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, USA.

Power Plant: one Pratt & Whitney TF30-P-408 non-afterburning turbofan; 13,400 lb st.

Dimensions: span 38 ft 9 in, length 46 ft 1 1/2 in, height 16 ft 0 1/4 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, on ejection seat.

Armament: two 20-mm Mk 12 guns; two pylons under fuselage and three under each wing for up to 15,000 lb of Sidewinder AAMs, Maverick and Shrike ASMs, bombs, rocket packs, mines, 30-mm Mk 4 gun pods, ECM pods, sonobuoys, and flares.

G91Y

The first-generation G91R dual attack/reconnaissance aircraft, powered by a single Orpheus 803 turbojet, disappeared from the NATO inventory June 17, 1993, when the last Portuguese aircraft was withdrawn. Still operational is the twin-engine G91Y, with the larger wing of the G91T trainer, which first flew in December 1966. Over the next decade, 20 preseries and 45 production G91Ys were built for the Italian Air Force. They equip Squadron 101, shortly to disband at Cervia, and Squadron 13 at Amendola, the latter with a primary antiship role and scheduled for replacement by AMXs. **Contractor:** Aeritalia SpA, Italy.

Power Plant: two General Electric J85-GE-13A afterburning turbojets; each 4,080 lb st.

Dimensions: span 29 ft 6 1/2 in, length 38 ft 3 1/2 in, height 14 ft 6 in.

Weights: empty 8,598 lb, gross 19,180 lb.

Performance: max speed at height Mach 0.95, at S/L 690 mph, service ceiling 41,000 ft, combat radius 230-633 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: two 30-mm DEFA 552 guns in fuselage; four underwing pylons for 1,000-lb bombs, napalm tanks, rocket packs, or Sidewinder AAMs.

Harrier GR. Mk 7

Developed jointly by McDonnell Douglas and British Aerospace, the AV-8B Harrier II retains the basic fuselage of the original BAe Harrier GR. Mk 3/AV-8A 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 Harrier/AV-8A, it has greater span and area and 10° less sweep. There are six underwing pylons, and the Harrier II can lift an external load of 10,800 lb at its max short takeoff and landing (STOL) weight. Equipment includes a Hughes angle rate bombing set (ARBS) with TV/laser target seeker/tracker, working in conjunction with a mission computer. Although generally similar to USMC AV-8Bs, RAF aircraft have an extra pair of wing pylons for AIM-9L Sidewinder missiles.

McDonnell Douglas manufactures all wings for the Harrier II; 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 (now No. 20 Squadron) at Wittering, which then had a mix of GR. 3s and GR. 5s, plus two-seat T. Mk 4s. (The last two GR. 3s were withdrawn from RAF service in May 1994.) 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 forward-looking infrared (FLIR), Smiths head-up and head-down displays, and cockpits compatible with night vision goggles (NVGs). GR. 7 deliveries began in September 1990 to No. 4 Squadron in Germany; No. 3 began upgrading to Mk 7 two months later, followed in June 1992 by No. 1 Squadron (the first RAF Harrier unit to use the night avionics operationally), and the OCU from January 1993. All Mk 5s are being modified to Mk 7 under a contract due to be completed later this year. Delivery of 13 Harrier T. Mk 10 two-seat equivalents of the Mk 7 (lacking only ARBS) begins next year to replace Mk 4s. Since April 1993, Harriers have been based in Turkey for reconnaissance patrols over northern Iraq. (Data for Harrier GR. Mk 7.)

Contractors: British Aerospace plc, UK, and McDonnell Douglas Corporation, USA.

Power Plant: one Rolls-Royce Pegasus Mk 105 vectored-thrust turbofan; 21,500 lb st.

Dimensions: span 30 ft 4 in, length 47 ft 1½ in, height 11 ft 7¾ in.

Weights: empty 15,542 lb; gross for VTO 19,180 lb, for STO 31,000 lb.

Performance: max speed at height Mach 0.98, at S/L 661 mph; STOL T-O run 1,427 ft; combat radius (hi-lo-hi) with 4,000 lb weapon load 684 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: provision for two 25-mm gun pods under fuselage; four hardpoints under each wing, plus centerline position, for two or four Sidewinder AAMs, 12 BL755 or CBU-87 cluster bombs, or five 1,000-lb bombs. Alternatively, 500-lb bombs, Matra 155 or CRV-7 rocket pods, or 300-gallon tanks or centerline reconnaissance pod. Marconi Zeus internal ECM; Plessey missile approach warning system radar in tailcone.

Jaguar

Jaguars of the RAF and the French Air Force were delivered originally with Adour Mk 102 afterburning turbofans, but RAF Jaguars were retrofitted with 7,900 lb st Adour Mk 104s. Those in service with Nos. 6 and 54 Squadrons at Coltishall are mostly GR. Mk 1As and two-seat T. Mk 2As, with the more compact and capable Ferranti FIN 1064 inertial navigation system (INS) instead of their original NAVWASS (navigation and weapon-aiming subsystem) equipment. They will continue in tactical support and ground-attack roles until replaced by Eurofighter 2000s early next century; many other Jaguar squadrons have already converted to Tornados.

The French Air Force still has five 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, for which some of its aircraft are equipped to carry ATLAS (automatic tracking laser illumination system) designator pods for AS 30L laser-guided ASMs and laser-guided bombs (LGBs). One French wing will disband over the next few years. (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 2½ in, height 15 ft 9½ in.

Weights: empty 15,432 lb, gross 34,612 lb.



Harrier GR. Mk 7, Royal Air Force (P. R. Foster)



Jaguar A, French Air Force (Sirpa "Air")



Mirage 2000N, French Air Force (Sirpa "Air")

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, on zero/zero ejection seat.

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 ASMs, BGL 400 LGBs, 550 and 880 lb bombs, Belouga cluster bombs, BAP 100 area denial bomblets, BAT 120 antirunway bomblets, F1 rocket pods; Magic 2 AAMs, Barracuda electronic emission detectors, Bares or CT 51J jamming pods, Phimat chaff/flare pods; 317-gallon tanks.

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 (*Forces Aériennes Stratégiques*, or FAS) 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 300 kT *Air-Sol Moyenne Portée* (ASMP) medium-range air-to-surface nuclear missile. Equipment includes ESD Antilope 5 terrain-following radar, two SAGEM inertial platforms, two improved TRT AHV-12 radio altimeters and Thomson-CSF color CRT. Self-defense aids comprise two Magic AAMs and an integrated countermeasures suite comprising a Serval radar warning receiver (RWR), Caméléon 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 was delivered in 1993 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 90 have been funded. Minor differ-

ences from the 2000N include the addition of Global Positioning System (GPS) and deletion of the ASMP interface; the radar is Antilope 50 with terrain reference capability. Both versions can carry two 528-gallon drop tanks, but the 2000D will eventually offer a wider choice of weapons, including laser-guided AS 30L ASMs and BGL bombs, Apache standoff weapon dispensers, Exocet antiship missiles, bombs, and rockets, as well as several types of sensor pod. The first squadron, 1/3 *Navarre*, was declared operational at Nancy on March 31, 1994; EC 3/3 *Ardennes* is currently converting, following disposal of the last French Mirage IIIEs; EC 2/3 is to reequip from 2000Ns. Specification is generally similar to that of the Mirage 2000C, except for a length of 47 ft 9 in.

Tornado IDS

Operational since June 1982, RAF interdictor/strike (IDS) Tornado GR. Mk 1 aircraft currently equip Nos. 9, 14, 17, and 31 Squadrons of Strike Command at Brüggen, Germany, and an OCU. No. 15 Squadron, at Lossiemouth. Their equipment includes a Texas Instruments multimode ground-mapping and terrain-following radar, Ferranti FIN 1010 digital INS, Decca Doppler, head-up-display (HUD), and laser rangefinder and marked target seeker in an undernose pod. Weapons include nuclear bombs, but No. 9 specializes in defense suppression with ALARM (Air-Launched Anti-radiation Missiles), and No. 14 has day/night TIALD (thermal imaging airborne laser designator) pods.

Beginning in 1996, between 80 and 142 RAF GR. Mk 1s will undergo a midlife update (MLU), involving embodiment of a FLIR, a digital map generator, new HUD and pilot's multifunction display, and GPS. The prototype upgraded aircraft, designated Tornado GR. Mk 4, flew May 29, 1993. In 1994, 24 redundant strike Tornados began to reequip Nos. 12 and 617 Squadrons at Lossiemouth, after conversion to GR. Mk 1B standard, with provision for Sea Eagle antiship missiles.

German Air Force Tornados equip seven strike/attack squadrons, two each with JBG 31, 33, and 34, and one with JBG 38, alongside the OCU. The IDS version also equips Nos. 102, 154, 155, and 156 Squadrons of the Italian Air Force, which, like German squadrons, can carry MW-1 antiairfield bomblet dispensers.

A joint German-Italian MLU has been formulated in two parts, the first involving addition of FLIR, GPS, and software changes; the second concentrating on electronic warfare (EW) capability, including new defensive aids. A total of 688 IDS Tornados was ordered by four air forces and the German Navy. Production has been completed.

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 10½ 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-hi 863 miles.

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

Armament: two 27-mm IWKA-Mauser guns in fuselage; seven fuselage and wing hardpoints for 19,840 lb of external stores, including air-to-air, air-to-surface, and antiradiation missiles; cluster bombs, napalm; "smart," retarded, and conventional bombs; rocket packs; flare bombs; jamming/deception and chaff/flare ECM pods; and fuel tanks.

Bombers and Maritime

Mirage IV-P

The French Air Force planned 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 ASMP supersonic thermonuclear missile. A nineteenth was ordered subsequently as an attrition replacement. Navigation and targeting capabilities were improved by installation of a Thomson-CSF Arcana pulse-Doppler radar and dual inertial systems. Updated EW equipment includes, typically, a Thomson-CSF TMV 015 Bares 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 Serval RWRs are standard. Twelve of the bombers are able to carry a 2,200-lb CT 52 reconnaissance pod as an alternative to the ASMP. Combat radius can be extended by in-flight refueling from Boeing C-135F tankers. The Mirage IV-P became

operational with Squadron 1/91 *Gascogne* at Mont-de-Marsan (with a detachment at Orange) May 1, 1986, followed by 2/92 *Bretagne* (detachment at Istres); each now with seven aircraft. Retirement of the Mirage IV-P force is planned for 1996, although it has been proposed that some should be retained for strategic reconnaissance until 1998.

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, in tandem, on ejection seats.

Armament: one 300kT ASMP thermonuclear missile.

Atlantic

The 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. A GEC Avionics AQS-902C sonobuoy processing system and Litton INS were installed, together with Thomson-CSF Iguane radar and other features of the French Navy's much-improved Atlantic 2. Antisubmarine equipment standard on all Atlantics, in addition to the retractable radar, includes a magnetic anomaly detector (MAD) tailsting and an Arar electronic surveillance measures (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 (identification, friend or foe) 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 (SAR) missions (Spanish designation D.3B), three by the Spanish Ministry of Finance, one antisubmarine warfare (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. Three Srs 300s optimized for fisheries protection will soon be delivered to Portugal. Operational equipment can include a nose- or belly-mounted AN/APS-128 search radar, searchlight, FLIR, sonobuoys, smoke markers, and camera in the maritime patrol version; and a belly-mounted radar, ESM, OTPI, MAD, tactical processing system, IFF/SIF transponder, sonobuoy and smoke marker launcher, and weapons in the ASW version. (Data for Srs 300.)

Contractor: Construcciones Aeronauticas SA, Spain.

Power Plant: two Garrett TPE331-10R-513C turboprops; each 900 shp.

Dimensions: span 66 ft 6½ in, length 52 ft 11¼ in, height 21 ft 7¼ in.

Weight (maritime patrol version): gross 17,637 lb.

Performance: max cruising speed 220 mph, loiter speed 121 mph at 1,500 ft, service ceiling 26,000 ft, range 519-1,665 miles.

Accommodation: crew of five (maritime patrol) or six (ASW).

Armament: provisions for carrying torpedoes such as Mk 46 and Sting Ray, unguided rockets, and ASMs such as Sea Skua and AS 15TT.

F27 Maritime

Canary Islands Air Command (MACAN) is a miniature air force, separated by more than 800 miles of



Atlantic, Italian Air Force (*Sirpa "Air"*)

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 SAR 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 (now reengineered as Fokker 50) 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, the Netherlands.

Gulfstream SMA-3 and Gulfstream III/IV

The Royal Danish Air Force has three SMA-3 special-mission derivatives 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. Delivered in 1982, they are operated by No. 721 Squadron from Vaerlose, near Copenhagen, and detach in rotation for duty at Narsarsuaq, Greenland. Their primary job is fishery protection over huge areas of sea around Greenland and the Faeroe Islands. Additional missions are airdrop, medevac (including airborne surgery), SAR, tactical air transport, and VIP transportation for members of the nation's royal family. Two standard Gulfstream IIIs form part of the equipment of No. 306 Special Transport Squadron of the Italian Air Force, based at Rome/Ciampino. The Transport & Training

Squadron of the Irish Air Corps has a VIP Gulfstream IV. Two are operated by No. 224 Squadron, Turkish Air Force, at Etimesgut. (Data for *Gulfstream SMA-3*.)

Contractor: Gulfstream Aerospace Corporation, USA.

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 4½ 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: (maritime) crew of seven.

Armament: none.

Nimrod MR. Mk 2P

The RAF began taking delivery of 46 Nimrod MR. Mk 1 maritime patrol aircraft in 1969, with airframes based substantially on that of Britain's pioneer Comet 4C jet airliner of the 1950s. Thirty-five were upgraded to MR. Mk 2 operational standard, with Thorn EMI Searchwater 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 Falkland Islands 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) is the OCU. In 1992-93 the Nimrod force was reduced from 33 to 26 aircraft as a consequence of reduced Russian submarine activity. Nimrods are often used as aerial command posts for complex or large-scale SAR operations.

Contractor: British Aerospace plc, 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 8½ 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 AAMs.

Orion (P-3), Aurora (CP-140), and Arcturus (CP-140A)

The airframe of the original P-3A Orion antisubmarine and maritime patrol aircraft 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 Morón, has three P-3As and five of the seven P-3Bs (Spanish designation P.3) operated formerly by No. 333 Squadron of the Royal Norwegian Air Force; their APS-80 radar is being improved for surface surveillance tasks. Norway replaced them with four of the latest Update III P-3Cs for what was once its primary task of detecting



D.2 (F27 Maritime), Spanish Air Force (Paul Jackson)



Nimrod MR. Mk 2P, Royal Air Force (Paul Jackson)

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 were reassigned to Coast Guard duties, with the designation P-3N.

No. 601 Squadron of the Portuguese Air Force at Montijo has six ex-Australian P-3Bs, redesignated P-3P after major retrofit, a detection sensors upgrade, and expanded processing capability able to accommodate



CP-140 Aurora, Canadian Forces



Eurofighter 2000 (BAE)

Data Link 11, ALR-66(V)3 ESM, and interactive displays for the tactical coordinator and pilot. A new AN/APX-134 radar, dual AQA-7V9 sonar processor, infrared detecting set (IRDS), and Harpoon capability make the P-3Ps comparable to a P-3C Update II.5. In 1993, Greece confirmed its intention of leasing four ex-USN P-3A/Bs as a precursor to buying a similar number of secondhand P-3B/Cs to replace Grumman HU-16s of No. 353 Squadron at Elefsis.

The 18 CP-140 Auroras operated by 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 since December 1992 by the last three production P-3Cs for economic zone patrol under the designation CP-140A Arcturus. Unarmed and lacking ASW equipment, CP-140As have APS-134 radar and are based at the main CF Aurora base at Greenwood NS (404, 405, and 415 Squadrons). A fourth CP-140 unit, No. 407 Squadron, resides at Comox, B.C., on the Pacific coast. The Royal Netherlands Navy has 13 P-3C Update II.5 Orions. (Data for P-3C.)

Contractor: Lockheed Aeronautical Systems Company, USA.

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 (three hours on station) 1,550 miles.

Accommodation: crew of 10.

Armament: max expendable load of 20,000 lb, including 500/1,000/2,000 lb mines, Mk 54 depth bombs, Mk 43/44/46 torpedoes, Harpoon missiles, sonobuoys, marine markers, acoustic sensors, and parachute flares.

Fighters

Eurofighter 2000

The Eurofighter is intended to become the primary single-seat air-superiority combat aircraft of four NATO air forces at the beginning of the twenty-first century, with a secondary ground-attack capability. Current plans are for the RAF to receive 250, Germany 120-140, Italy 130, and Spain 87. The first of seven development aircraft (DA1), assembled in Germany by DASA,



**F-4F Phantom II, German Air Force
(P. R. Foster)**

flew March 29, 1994, DA2, assembled by British Aerospace, flew April 6. Both are single-seaters, with interim 16,000 lb st RB199-122 (Mk 104E) turbofans, similar to the engines of the Tornado. Subsequent aircraft will have Eurojet EJ200 engines, including the combat-capable two-seat DA4, the first with full avionics, including ECR 90 multimode pulse-Doppler radar, infrared search and track (IRST), and an advanced integrated defensive aids subsystem. The planned initial production batch of 30 Eurofighters will include 26 two-seaters.

A 53° swept tailless delta configuration, with canards, quadruplex digital fly-by-wire flight controls, and instability in pitch, combine to give high agility and STOL capability. A degree of low-observability is embodied, with fuselage, wings, fin, and rudder mainly of carbonfiber composites; but stores are carried externally. German Eurofighters are expected to have AN/APG-65 radar and a lower standard of defensive aids to reduce costs. Design life is 6,000 hours or 30 years.

Contractor: Eurofighter Jagdflugzeug GmbH, Germany; airframe manufacture by Alenia, Italy; BAe, UK; CASA, Spain; and DASA, Germany.

Power Plant: two Eurojet EJ200 afterburning turbofans; each 20,250 lb st.

Dimensions: span 34 ft 5 1/2 in, length 47 ft 7 in, height 21 ft 0 in.

Weights: empty 21,495 lb, gross 46,300 lb.

Performance (estimated): max level speed at height Mach 2, T-O and landing run (four AAMs, full internal fuel) 1,650 ft, combat radius 290-345 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: one 27-mm Mauser gun in fuselage; 13 external stations for AIM-120, Aspide and short-

range AAMs, two external fuel tanks, or up to 14,330 lb of air-to-surface weapons.

F-4 Phantom II

Following the transfer to interception duties of its last fighter-bomber wing January 1, 1994, the German Air Force has eight squadrons of F-4Fs in four air defense wings (JG 71, 72, 73, and 74). No. 73 Wing is shortly to reduce to one squadron and transfer to Laage in former East Germany, where it will be augmented by a squadron of MiG-29s. Beginning in 1992, 107 defensively tasked aircraft received an upgrade to give them look-down/shoot-down capability against multiple targets. MBB was prime contractor for the program, known as ICE (Improved Combat Effectiveness), which replaced the existing Westinghouse APQ-120 radar with an all-digital multimode Hughes APG-65 embodying advanced electronic counter-countermeasures (ECCM). The cockpit has been 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. A further 40 F-4Fs, formerly serving in the fighter-bomber role with what is now JG 73, have undergone partial update.

The other NATO Phantom operators in Europe have F-4Es, of which three squadrons (337, 338, and 339) serve with the Hellenic Air Force at Larissa and Andravida (two), and seven squadrons (111, 112, 131, 132, 171, 172, and 173) with the Turkish Air Force at Eskisehir, Konya, and Erhac. The 56 F-4Es originally received by Greece were augmented in 1991 by 28 from USAF. America was more generous to Turkey, which gained 125 surplus aircraft to add to 72 delivered new. (Data for F-4E.)

Contractor: McDonnell Douglas Corporation, USA.

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

Dimensions: span 38 ft 4 3/4 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, on ejection seats.

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 assigned to fighter ground-attack duties but used mostly for advanced/lead-in training. On NATO's southern flank, they are flown by Squadron 343 and part of Squadron 349 of the Hellenic Air Force, and Squadrons 133 (OCU), 151, and 152 of the Turkish Air Force. These two nations have absorbed many surplus F-5s from elsewhere, including former Netherlands NF-5s; but replacement is in prospect and the last Turkish F-5s will give way to F-16s in 1997. CASA-built SF-5As (A.9s) and SF-5Bs (AE.9s) operated by the Spanish Air Force had their proposed upgrade canceled and are now relegated to the weapons school (23 Wing) at Badajoz/Talavera la Real. The F-5B has received most attention, with 23 undergoing minor avionics upgrades, including RWR and IFF.

Canadair-built CF-5s (single-seat CF-116As and two-seat CF-116Ds) continue in use as fighter lead-in trainers with Canadian Forces. Upgraded with CF-18-type cockpit instrumentation and controls, 13 As and 33 Bs are being reassigned to 419 Squadron at Cold Lake during 1992-95. 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 have recently been equipped by Sierra in the US with F-16 avionics, the first two returning to service in September 1993. Updates include 1553B digital databus, air-data computer, HUDWAC equivalent to Block 40 F-16Cs, LN-93 ring-laser INS, multifunction throttle grip, and other avionics changes. (Data for F-5A.)

Contractor: Northrop Corporation, USA.

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, on ejection seat.

Armament: two 20-mm M39A2 guns in nose; Sidewinder on each wingtip; centerline pylon and two under each wing for about 4,400 lb of AAMs or ASMs, rocket packs, gun pods, bombs, or 275-gallon fuel tanks.

F-16 Fighting Falcon

On June 7, 1975, the governments of four European NATO nations announced their selection of the F-16 to replace their F-104s. Components, avionics, and equipment for two assembly lines at SABCA in Belgium and Fokker in the Netherlands were supplied by about 30 European companies. All of the aircraft produced are similar to basic USAF F-16As and Bs, except for 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. Squadrons are being disbanded or reduced in size from early 1994, and aircraft placed in storage, as a consequence of lessened tensions with eastern Europe. Accordingly, only 301 aircraft (Belgium 48, Denmark 61, the Netherlands 136, and Norway 56) will receive the MLU finally authorized on June 30, 1993, and due for implementation between 1996 and 2000 at depots in each country. MLU features include a wide-angle HUD, compatibility with NVGs, upgraded AN/APG-66(V2A) radar, GPS, Improved Data Modem, and some optional items such as new IFF. 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 (OCU), 314 (disbands 1996), 315, 322, and 323 of the RNLAf; and 331, 332, 334, and 338 of the RNoAF. Belgian squadrons have been reduced from 18 to 12 aircraft each and 43 F-16s offered for sale. The first of 17 new-build F-16As and three F-16Bs was handed over to Portugal, in the US, on February 18, 1994, prior to delivery to 201 Squadron at Monte Real.

When Turkey and Greece joined the list of F-16 operators, they both opted for uprated F-16C/D versions, with a General Electric F110-GE-100 engine and APG-68 radar. The initial batch of 40 Greek aircraft was allocated to 111 Wing at Nea Ankhalios, comprising Nos. 330 and 346 Squadrons. A further 40 were ordered in 1992, for delivery from 1996. Eight US-built aircraft were supplied to Turkey in 1987; a further 232 are being built in Turkey by TUSAS Aerospace Industries to equip 10 squadrons. Nos. 141 and 142 formed at Akinci in 1989-90; followed by 161 and 162 at Bandirma in 1991-92; and 191 and 192 at Balikesir in 1993-94. Nos. 181 and 182 at Diyarbakir are now equipping, to be followed by 151 and 152 at Merzifon in 1997-98. LANTIRN navigation and targeting pods were first issued to 161 Squadron in February 1994. (Data for Greek/Turkish F-16C.)

Contractor: Lockheed Fort Worth Company, USA.
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, on zero/zero ejection seat.
Armament: one 20-mm M61A1 multibarrel gun in port side wing/body fairing; Sidewinder AAM on each wingtip; centerline hardpoint and three under each wing for total 12,000 lb of stores, including ASMs (Penguin Mk 3 on Norwegian aircraft), single or cluster bombs, rocket packs, ECM pods, and fuel tanks. Internal chaff/flare dispensers.

F/A-18 Hornet

Canada acquired 98 single-seat CF-18As and 40 two-seat CF-18Bs. By comparison with US Navy F/A-18s, these have a different instrument landing system and an added spotlight on the port side of the fuselage for night identification of other aircraft in flight. They were the first combat aircraft to have a canopy shape painted on the underside of the front fuselage to confuse hostile pilots during combat maneuvers. The last of three CF-18 squadrons based in Europe disbanded in December 1992, allowing home squadron strengths to be increased from 12 to 18 aircraft. Primary role for Nos. 425 and 433 Squadrons at Bagotville and 416 and 441 Squadrons at Cold Lake is air defense of North America, although two (416 and 433) are allocated to support Canada's NATO force in central Europe in an emergency, requiring additional attack capability. Squadrons stand NORAD alert from forward bases farther north and west at Comox, Yellowknife, Inuvik, Goose Bay, and Iqaluit. No. 410 Squadron at Cold Lake is the OCU, with 23 Hornets.

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 Torrejón AB, also converted to EF-18s by mid-1990 and were joined by



F-16A, Royal Norwegian Air Force

an OCU in November 1992. Between September 1992 and 1995, Spanish Hornets are being upgraded to F/A-18A+/B+ standard, with new computers, software, wiring, and pylon modifications approaching F/A-18C/D configuration. (Data for CF-18A.)

Contractor: McDonnell Douglas Corporation, USA.
Power Plant: two General Electric F404-GE-400 augmented turbofans; each 16,000 lb st.
Dimensions: span over missiles 40 ft 4 3/4 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, on ejection seat.
Armament: one 20-mm M61 multibarrel gun in nose; Sidewinder AAM on each wingtip; centerline pylon, two on engine trunks, and two under each wing for Sparrow AAMs, CRV-7 rocket packs, bombs, BL755 cluster bombs, ECM pods, etc. (HARMS and Har-

poon missiles on EF-18.) Max external stores load 17,000 lb.

F-104 Starfighter

The day of the second-generation (F-104G) Starfighter draws to a close. Greece's last squadron disbanded in December 1992, while the final Italian single-seat aircraft was withdrawn from an OCU on June 5, 1994. Turkey's final squadron (No. 182 with ex-Canadian CF-104s) disappears next year. Remaining in Italian service are the TF-104G two-seat trainer and third-generation F-104S, the final version of the Starfighter, developed by Aeritalia (now Alenia) for the Italian Air Force, which bought 205. These now equip eight squadrons with its Nos. 4, 6, 8, 9, 36, 37, 51, and 53 Wings. Between 1986 and 1993, 147 remaining Italian Air Force F-104s received a major weapon system update 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 Aspid medium-range AAM is standard, as an alternative to the very similar Sparrows that accounted for the "S" in the aircraft's designation. Turkey's last squadron of the F-104S variant was reequipped with F-16s earlier this year, but the Italian ASAs will remain until replaced by Eurofighter 2000s early next century. (Data for F-104S.)

Contractor: Alenia, 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.



CF-18A Hornet, Canadian Forces (Calum Mackenzie)



Hawk T. Mk 1A



MiG-29 (NATO "Fulcrum")

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, on ejection seat.
Armament: AIM-9L Sidewinder on each wingtip; seven pylons under fuselage and wings for bombs, rocket packs, fuel tanks, and AAMs, including two Aspides or Sparrow IIIs. Max external stores load 7,500 lb.

Hawk T. Mk 1A

Eighty-nine Hawk jet trainers of the RAF advanced flying schools and of the RAF's Red Arrows aerobatic team were wired for carriage of two AIM-9L Sidewinder AAMs on their inboard underwing pylons and for optional activation of the previously unused outboard pylons. Fifty of these redesigned 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, excl 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, on zero/zero ejection seats. Pilot only in combat role.

Armament: one 30-mm Aden gun pack under fuselage; AIM-9L Sidewinder AAM on each inboard underwing pylon.

MIg-29 (NATO "Fulcrum")

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 is unchanged, except for deletion of R-60 (AA-8 "Aphid") AAMs. The MiG-29s will move to Laage in October, to be joined there by a squadron of Phantoms, the mixed wing to be known as JG 73. Further information on the MiG-29 can be found in the "Gallery of Russian Aerospace Weapons" in the



Mirage F1-CT, French Air Force (Paul Jackson)



Mirage 2000C (RDI), French Air Force (Sirpa "Air")

March 1994 issue of *Air Force Magazine*. (Data for Fulcrum-A.)

Contractor: Mikoyan OKB, Russia.

Power Plant: two Klimov/Sarkisov RD-33 turbofans; each 18,300 lb st with afterburning.

Dimensions: span 37 ft 3 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, T-O run 790 ft, landing run 1,970 ft, range 932 miles on internal fuel, 1,550 miles with external tanks.

Accommodation: pilot only, on zero/zero ejection seat (two seats in tandem in Fulcrum-B).

Armament: six medium-range radar/IR homing R-27 (AA-10 "Alamo-A/B") and/or close-range R-73A (AA-11 "Archer") AAMs 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 F1

Standard equipment on the basic F1-C, first ordered for the French Air Force in May 1969, includes a HUD and Cyrano IV-M multifunction radar, with a high degree of resistance to ECM. Many F1-Cs were retrofitted with an in-flight refueling probe and redesignated F1-C-200. From a peak of 10 squadrons, F1-C strength has fallen to just EC 3/12 *Cornouaille* and EC 3/33 *Lorraine* in France, plus EC 4/30 *Vexin* in Djibouti. Fifty-five 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 *Normandie-Niemen* at Colmar in February 1992; 3/13 *Alsace* was declared operational in April 1994; 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 Iraklion and Tanagra. The Spanish Air Force received 45 F1-CEs (known as C.14As) and 22 multirole Mirage F1-EEs (C.14Bs), with INS, nav/attack computer, and HUD. Since retirement of Mirage IIIs in October 1992, the F1 force, currently of 30 C.14As and 17 C.14Bs, has been pooled within 14 Wing at Los Llanos/Albacete from where aircraft are detached, one squadron each, to No. 11 Wing at Manises/Valencia and No. 46 Wing of MACAN at Gando AB, Las Palmas. The force will be updated in 1995–97 and augmented by 14 single-seat aircraft bought from Qatari and French surplus. (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 3/4 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 hours 15 minutes, attack radius, depending on flight profile and weapon load, 265–863 miles.

Accommodation: pilot only, on ejection seat.

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 AAMs, a Matra Magic or Sidewinder AAM on each wingtip, and chaff/flare dispensers for interception mission; or 14 x



Rafale C (Sirpa "Air")



Tornado F. Mk 3, Royal Air Force (BAe)

250-kg bombs, 30 antirunway 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 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. It is equally suitable for reconnaissance, close support, and low-altitude attack missions in areas to the rear of a battlefield. French Air Force procurement plans were curtailed by defense economies at 126 air-superiority Mirage 2000Cs and 27 Mirage 2000B two-seat trainers. 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 the now-disbanded 3/2 *Alsace* at Dijon. Squadrons 1/5 *Vendée*, 2/5 *Île de France*, and 3/5 *Comtat Venaissin* at Orange have Mirage 2000Cs with M53-P2 and RDI, as does 1/12 *Cambrésis*, which launched conversion of Cambrai-based 12 Wing from Mirage F1-Cs in early 1992, followed by the final squadron, 2/12 *Picardie*, September 1, 1993. The designation 2000DA (*Défense Aérienne*) is used frequently in collective reference to Mirage 2000Cs and two-seat 2000Bs. Funding was awarded in 1994 for the first of 37 late production 2000Cs to be retrofitted to 2000-5 standard for ECs 1/2 and 2/2, gaining RDY radar, modernized instrumentation, new HUD and ECM, plus ability to carry MICA AAMs. Redundant RDI radars will replace RDMs in early Mirage 2000Cs.

RDI 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, a detachable in-flight refueling probe, chaff/flare dispenser, and Thomson-CSF Serval RWRs. Control is fly-by-wire. 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 minutes of leaving the runway. Minimum speed in stable flight is 115 mph.

Delivery to 114 Wing (331 *Aegeas* and 332 *Geraki* Squadrons) of the Hellenic Air Force, at Tanagra, of 36 multirole Mirage 2000EGs, plus four 2000BG two-seaters, took place in 1988–92. Assigned to defend Athens, 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 1/4 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, on zero/zero ejection seat.

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 AAMs for interceptor mission. Ground attack weapons include eighteen 250 kg retarded bombs or BAP 100 anti-runway bombs, 16 Durandal penetration bombs, two 1,000 kg LGBs, six Belouga cluster bombs, two AS 30L or AM39 Exocet ASMs, two ARMAT antiradar missiles, four packs of 18 x 68-mm rockets, two packs of 100-mm rockets, or a twin 30-mm gun pod.

Rafale

Like the Eurofighter 2000 and USAF's F-22, the Rafale is a fighter for the twenty-first century. The original prototype, known as Rafale A, first flew on July 4, 1986, and was retired in January 1994 after its 865th sortie. Versions now flying include the two-seat Rafale B and single-seat Rafale C for the French Air Force and single-seat carrier-based Rafale M for the French Navy. Procurement to date totals only two preseries aircraft for the Air Force and three for the Navy, but the Air Force plans an eventual total of 234, of which 140 will be two-seaters carrying a pilot and weapon systems operator.

The Rafale has an RBE2 look-down/shoot-down radar able to track eight targets simultaneously, fly-by-wire controls, and HOTAS (hands on throttle and stick) with a sidestick controller. The first 20 aircraft for each service will not be fitted with automatic terrain-following, Spectra defensive subsystems,IRST, FLIR and laser rangefinder modules, voice command controls, and provisions for a helmet-mounted sight and ASMP nuclear standoff weapon, planned as standard from the 41st production Rafale. (Data for *Rafale C*.)

Contractor: Dassault Aviation, France.

Power Plant: two SNECMA M88-3 afterburning turbofans; each 19,558 lb st.

Dimensions: span 35 ft 9 1/4 in, length 50 ft 2 1/2 in, height 17 ft 6 1/4 in.

Weight: gross 47,400 lb.

Performance: max speed at height Mach 2, at S/L Mach 1.13, combat radius 680-1,150 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: one 30-mm DEFA 791B gun in engine duct; 14 external stations for up to 17,635 lb of MICA AAMs, Apache standoff weapon dispensers, one ASMP nuclear weapon, laser-guided and conventional bombs, AS.30L ASMs and Exocet antiship missiles.

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 AAMs to be carried in tandem pairs under the fuselage. After the first of three prototypes flew 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 173 production Tornado ADVs ordered for the RAF, the first 18 were built as F. Mk 2s with 16,920 lb st RB199 Mk 103 engines. These are stored or used for trials, their planned upgrade to near Mk 3 standard having been abandoned. All subsequent ADVs are F. Mk 3s, 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 for a combination of tanks and missiles or chaff pods.

The first F. Mk 3 flew November 20, 1985, and deliveries to the OCU (now No. 56 Squadron) at RAF Coningsby began in July 1986. Other units include Nos. 5 and 29 Squadrons at Coningsby, Nos. 11 and 25 at Leeming, and Nos. 43 and 111 at Leuchars. One further unit, No. 1435 Flight, is responsible for defense of the Falkland Islands. Although optimized for long-range interception in the Greenland-Iceland-UK gap, the Tornado F. Mk 3 was the only politically acceptable aircraft when Italy required an interim interceptor because of delays in the Eurofighter 2000 program. An initial 12 will be delivered to No. 12 Squadron at Gioia del Colle in the third quarter of 1995, followed by 12 to No. 18 Squadron at Trapani/Birgi. (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 7 1/2 in spread, 28 ft 2 1/2 in swept, length 61 ft 3 1/2 in, height 19 ft 6 1/4 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, on zero/zero ejection seats.

Armament: one 27-mm IWKA-Mauser gun in fuselage, four Sky Flash AAMs under fuselage, four AIM-9L Sidewinders under wings. Two 594-gallon tanks under wings.

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, and Portugal. Main uses are now light transport, SAR, 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 1/4 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



Chinook HC. Mk 2, Royal Air Force (Paul Jackson)



AS 555AN Fennec, French Air Force (Paul Jackson)



HH-3F Pelican, Italian Air Force (Paul Jackson)

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, 14 CH-113 Labrador helicopters form the mainstay of Canada's coastal and inland SAR 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. Cancellation of replacement EH-101s in November 1993 has raised the prospect of yet another CH-113 modification program.

Contractor: The Boeing Company, Vertol Division, USA.

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)

Conversion of 32 RAF Chinooks to HC. Mk 2 standard, equivalent to the US Army's CH-47D, is well in hand and will be complete by mid-1995 when three new-build helicopters will expand the fleet. The first Mk 2 returned to the UK from Boeing in May 1993 and, with other early arrivals, equipped Nos. 7 and 27 (OCU) Squadrons, both at Odiham. From February 1994, Mk 2s have also been issued to No. 78 Squadron on the Falkland Islands (two only) and No. 18 at Laarbruch, Germany. RAF Chinooks are well protected with AAR-47 missile approach warners, ALQ-157 IR jammers, chaff/flare dispensers, and ARI.18228 RWR; some have satellite communications for Special Forces' operations. The Netherlands Air Force is acquiring 13 CH-47Ds for 298 Squadron at Soesterberg. Ordered in 1993, these consist of six new and seven upgraded ex-Canadian CH-47Cs to be delivered in 1998 and 1995, respectively. (Data for Chinook HC. Mk 1.)

Contractor: Boeing Helicopters, USA.

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 11 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.

Accommodation: crew of four; up to 44 troops, or 24 stretcher patients, or internal or external freight.

Armament: two machine guns in forward hatchway and port forward window.

Ecureuil 2

The French Air Force has received 52 of these twin-turbine light helicopters for surveillance of strategic military bases and other support duties. The first eight are AS 355F1s, with 420 shp Allison 250-C20F turboshafts. The remainder, delivered from January 1990, are AS 555AN Fennecs. Particular assignments of note are combat SAR (with NVG capability) by 2/67 *Valmy* Squadron at Metz and armed patrol of the Ariane rocket launch site in French Guiana by 68 *Guyane* Squadron.

Contractor: Eurocopter International (Aerospatiale, France, and DASA, Germany).

Power Plant: two Turbomeca TM 319 1A Arrius turboshafts; each 479 shp.

Dimensions: rotor diameter 35 ft 0 3/4 in, length of fuselage 35 ft 10 1/2 in, height 10 ft 11 1/2 in.

Weights: empty 3,046 lb, gross 5,732 lb with slung load.

Performance: max cruising speed 140 mph, service ceiling 13,125 ft, range 448 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 RAF have been used mainly for training at No. 2 Flying Training School 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 SAR helicopter in 1974 and has since received orders for 35 for the Italian Air Force. The last 15 are being delivered with new radar, LORAN, FLIR, and navigation computer, which have been retrofitted in the remaining 18 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.

Armament: optional pintle-mounted machine gun in cabin doorway.

Kiowa and Bell 206B

Seventy-four Bell COH-58As, generally similar to the US Army's OH-58A Kiowa, were delivered to Canadian Forces to fill the roles of observation, reconnaissance, command and liaison, target acquisition, and fire adjustment. Known in Canada as CH-136s, they are flown by four full squadrons and three half-squadrons of No. 10 Tactical Air Group. Fourteen Bell 206B JetRanger IIIs (CH-139s) were bought for pilot training in 1981 and are now leased to a civilian operator that provides military training under contract. (Data for CH-136 Kiowa.)

Contractor: Bell Helicopter Company, USA.
Power Plant: one Allison T63-A-700 turboshaft; 317 shp.



CH-136 Kiowa, Canadian Forces
(Paul Jackson)



Puma HC Mk 1, Royal Air Force (Alex H. Porteous)

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.

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. Six Mi-8Ss and eight Mi-8Ts are operated from Berlin/Schönefeld by No. 3 Squadron/Special Air Missions Wing on VIP duties.

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 RAF 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. The French Air Force version, of which 29 remain, partly equipping four utility helicopter squadrons at home and two overseas, is the SA 330Ba (equivalent to SA 330H); RAF version is the SA 330E. Both have Turmo IIIIC4 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 and No. 230 in Germany. Under current upgrading in 1994-96, 42 Puma HC Mk 1s are receiving improved avionics, notably upgraded navigation systems. The nine surviving Pumas of the Portuguese Air Force are SA 330S1s, 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 SAR. Spain's five Pumas are VIP transports.

Contractors: Westland Helicopters Ltd, UK, and SNI Aerospaziale, France.

Power Plant: two Turbomeca Turmo IIIIC4 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.



Super Pumas (VIP), French Air Force
(Paul Jackson)

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 SAR, tactical troop transport, medevac, and cargo carrying, as well as the original naval antisubmarine mission. The RAF uses 19 Sea King HAR. Mk 3s (with six Mk 3As, having improved avionics, on order) to equip Flights of No. 22 and 202 (SAR) Squadrons throughout the UK, and (with Chinooks) No. 78 Squadron in the Falklands. Equipment of the HAR. Mk 3 includes ARI 5955 radar and a Decca TANS F computer, accepting inputs from a Mk 19 Decca nav receiver and Type 71 Doppler.

Sea King Mk 43 and 48 are similar SAR versions used by the Norwegian and Belgian air forces, respectively. By 1995, Norway's 330 Squadron will have a fleet of 12 new or rebuilt Mk 43Bs, with both nose- and spine-mounted radars, FLIR, and other improvements. The five Belgian helicopters will be improved under a 1994 contract, with FLIR, replacement RDR 1500B radars and GPS. Denmark has eight Sikorsky-built S-61As for SAR, also recently upgraded with FLIR. Canadian Forces deploy CH-124As on board ships for ASW duties and for SAR, 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 progres-

sive 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. Further life extension for the CH-124 is possible following Canada's cancellation of EH-101s. (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.

Accommodation: crew of four; six stretchers, or two stretchers and 11 seated persons, or 19 passengers.

Super Puma and Cougar

The French Air Force uses three AS 332 Super Puma developments of the original Puma for support duties at nuclear test sites in the Pacific and three more to equip a VIP transport squadron at Villacoublay. Three milspec AS 532s have been reported with the intelligence bureau flight, GAM 56 at Evreux. The Spanish Air Force acquired 10 AS 332s for SAR 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). The Netherlands ordered 17 AS 532U2 Cougars in October 1993, to be used for army support by 298 Squadron at Eindhoven from January 1996. (Data for AS 532U2.)

Contractor: Eurocopter International (Aerospaziale, France and DASA, Germany).

Power Plant: two Turbomeca Makila 1A2 turboshafts; each 1,845 shp.

Dimensions: rotor diameter 53 ft 1 1/2 in, length of fuselage 55 ft 0 1/2 in, height 16 ft 4 in.

Weights: empty 10,493 lb, normal gross 21,495 lb.

Performance: max cruising speed 170 mph, service ceiling 13,450 ft, range with standard fuel 494 miles.

Accommodation: crew of two; up to 29 passengers, or six stretchers and 11 seated persons, or 12 stretchers and four seated, or internal or slung freight.

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 and training. The Turkish UH-1Hs are used for support, liaison, and training. (Data for CH-118.)

Contractor: Bell Helicopter Company, USA.

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, 10 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. They are to be replaced by some of the 100 Bell 412HP (CH-146 Griffons) ordered in 1992, with initial deliveries to 403 Squadron at Gagetown (for training) this year. By 1997, the seven squadrons of 10 Tactical Air Group will have reequipped, together with base SAR flights around Canada.

Italy uses Agusta-built AB-212s for SAR and communications/light transport. Greece has four 212s 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. The Netherlands received three Agusta-Bell 412 SPs from February 1994 on-

ward, to replace Alouette IIIs of the SAR Flight at Leeuwarden. (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 3/4 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 RAF. Wessex HC. Mk 2 tactical transports equip No. 72 Squadron at Aldergrove, in support of the Northern Ireland garrison, No. 60 Squadron at Benson, No. 28 in Hong Kong, and part of No. 22 for SAR missions throughout the UK. Two Wessex HC. 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 3As. (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 ASMs, rocket packs, or machine guns.



Wessex HC. Mk 2, Royal Air Force (Paul Jackson)



EC-212 Aviocar, Portuguese Air Force (Paul Jackson)

Reconnaissance and Special Mission Aircraft

Aviocar (C-212)

A single EC-212 Aviocar is operated by No. 401 Squadron of the Portuguese Air Force for electronic intelligence/ECM duties. It carries 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 other C-212s equipped for photo and magnetic survey as well as underwater monitoring.

Two C-212s similar to the Portuguese EC-212 serve with No. 408 Flight of the Spanish Air Force for ECM duties, under the designation TM.12. Spain also has 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. Three remaining aircraft of the Canadian Forces, designated CC-137, include two tanker/transports that were modified to support CF-5s and now support CF-18s. Spain bases two similar tankers at Torrejón, with No. 451 Squadron, to refuel its EF-18 Hornets; and a further 707 is nearing completion with Israeli signals intelligence (sigint) equipment under Project Santiago for use by 408 Squadron at Torrejón. It also has a secondary tanker role. Four 707s obtained for VIP and support flights with the German Air Force's Special Missions Squadron, at Köln/Bonn, have been partially replaced by Airbus and will also be converted to tankers. Dornier of Germany headed a team that modified three 707-320Cs as trainer cargo aircraft, with cockpit similar to that of the E-3A, for training NATO Airborne Warning and Control System (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 tanker/transports, the first of which was delivered May 14, 1992. Operated by No. 8 Squadron at Pratica di Mare, they comprise two with seats for 110 passengers and two combis seating a maximum of 66.

C-135FR

Like the KC-135 Stratotankers of USAF, the 11 C-135FRs of the French Air Force have had their lower wing skin renewed to make possible another 25,000 flying hours. This justified reengineering them



C-135FR, French Air Force (Sirpa "Air")



CL-215, Spanish Air Force (Paul Jackson)

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. RWRs have also been fitted. The first conversion returned to service early in 1994. To maintain capability during the conversion program, France leased three USAF KC-135Rs from December 1992.

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, USA.

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 PR. Mk 9

Five Canberra PR. Mk 9s of No. 39 (1 PRU) Squadron, with cameras and infrared linescan in their belly, form the only dedicated strategic photoreconnaissance unit in the RAF.

Bulbous-nosed Canberra T. Mk 17s of 360 Squadron provide specialized ECM training by transmitting radio interference and using jammers and wingtip chaff dispensers. They will be withdrawn in October and replaced by civilian-contracted executive jets carrying appropriate pods.

Contractor: English Electric Company 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 Nos. 414 and 434 Squadrons of the Canadian Forces at Comox and Shearwater. Equipment of these interim CE-144s includes an ALR-76 ESM receiver, ULQ-21/23 radar jammers, a ZS 1910 communications jammer, and ALE-502 chaff dispenser. Three others will receive a definitive EW fit authorized in April 1993. A seventh, designated CX-144, serves the Aeronautical Engineering and Test Establishment at Cold Lake, Alberta, as a test-bed for developing future military applications, including maritime reconnaissance.

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 and CL-215T

Greece and Spain are subject to severe forest fires and rely on their air forces for aerial fire-fighting duties. The Hellenic Air Force's 355 Squadron at Elefsis has taken delivery of 16 CL-215 amphibian water-bombers for this purpose. The Spanish Air Force has received 30 under the designation UD.13, of which 21 have been converted to CL-215T standard, similar to the new-production CL-415, with two turboprops replacing the

original 2,100 hp Pratt & Whitney R-2800-CA3 piston engines. All are capable of other tasks, and eight of the Spanish aircraft are equipped for SAR and coastal patrol. Each air force has lost several aircraft during fire-fighting 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. (Data for CL-415.)

Contractor: Canadair, Bombardier Inc, Canada.

Power Plant: two Pratt & Whitney Canada PW123AF turboprops; each 2,380 shp.

Dimensions: span 93 ft 11 in, length 65 ft 0½ in, height 29 ft 5½ in.

Weights: empty 27,783 lb, gross 43,850 lb.

Performance: max cruising speed 234 mph, max range 1,507 miles.

Accommodation: crew of two; payload of 13,500 lb for water-bomber, 9,177 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. Canada's two transport CC-142s also belong to No. 402 Squadron.

Contractor: De Havilland Inc, Canada.

Power Plant: two Pratt & Whitney Canada PW120A turboprops; each 2,000 shp.

and were declared to NATO exactly one year later. The French E-3Fs are assigned to 36 *Escadron de Détection et de Contrôle Aéroportée* at Avord. Both the E-3D and E-3F have an in-flight refueling probe and USAF-style receptacle. RAF aircraft are fitted additionally with wingtip Loral 1017 Yellow Gate ESM pods and will receive the Joint Tactical Information Distribution System (JTIDS) data link. (Data for NATO E-3A.)

Contractor: Boeing Aerospace, USA.

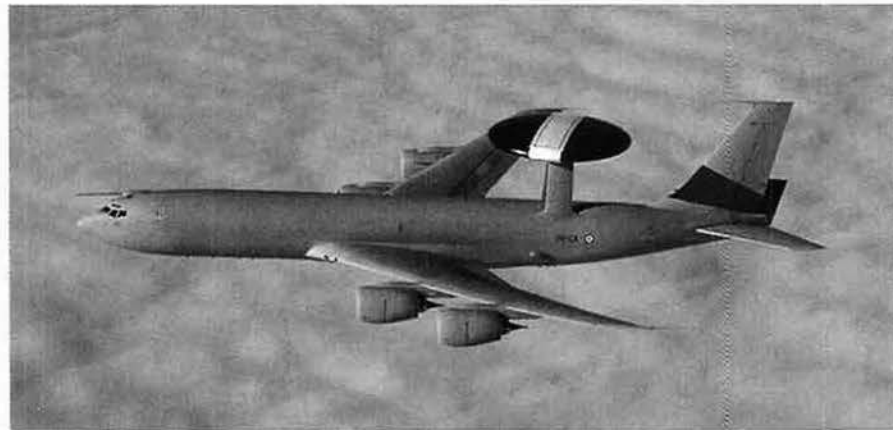
Power Plant: four Pratt & Whitney TF33-PW-100/100A turbofans; each 21,000 lb st.

Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 41 ft 9 in.

Weight: gross 335,000 lb.



DHC-8 Dash 8M (CC-142), Canadian Forces



E-3F Sentry, French Air Force (Sirpa "Air")

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.

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, Germany. Forward operating bases are at Orland, Norway; Konya, Turkey; Prévèza, Greece; and Trapani, Italy.

Seven E-3s were ordered for the RAF and four for the French Air Force, all with CFM56 turbofans. Deliveries to both air forces took place in 1990-92. The RAF aircraft formed No. 8 Squadron at Waddington July 1, 1991, under the designation E-3D Sentry AEW. Mk 1



Hansa Jet, German Air Force



Mystère-Falcon 20, Royal Norwegian Air Force (Paul Jackson)

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. A version of the F/A-18 Hornet's ATARS (Advanced Tactical Air Reconnaissance System) is sought for 1999 service entry. Reconnaissance pods have also been fitted to 10 F-16As of Denmark's No. 726 Squadron, to compensate for the RF-35 Drakens' withdrawal December 21, 1993. (Data as for F-16.)

G222GE and G222RM

The Italian Air Force has two G222GEs (*Guerra Elettronica*) for EW duties with the 71st Squadron at Pratica di Mare. Carrying a pilot, copilot, and up to 10 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 40 kw 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 (Radiomisure) 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 a reduced complement of three sweptforward-wing Hansa Jets for ECM training. Features include a cylindrical nose radome and a boat-shaped fairing under the rear fuselage. The same squadron operates a former East German Antonov An-26SM calibration aircraft from Dresden.

Contractor: Messerschmitt-Bölkow-Blohm 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 RAF 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, a VICON 18 Srs 600 long-range oblique photography pod was introduced as an alternative fit. French Jaguars may carry an RP 36P system, which is nothing more than a standard drop-tank with three nose-mounted cameras. This complements the panoramic camera fitted in the nose of all French Jaguars.

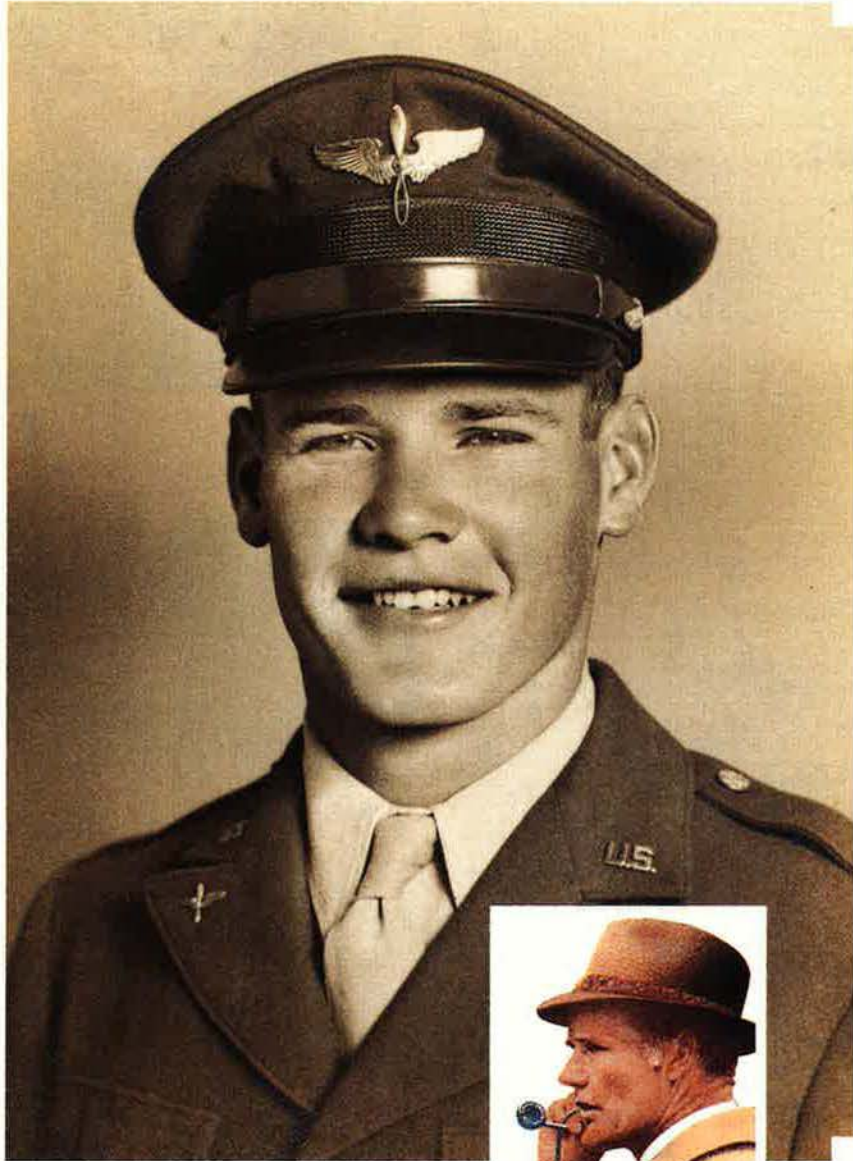
Mirage F1-CR-200

Both tactical reconnaissance squadrons of the French Air Force (1/33 *Belfort* and 2/33 *Savoie*, based at Reims) 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 Thomson-TRT 40 panoramic camera or a 150-mm Thomson-TRT 33 vertical camera. From 1993, FLIR has been installed in the port gun bay. 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. Data from Raphaël can be downloaded in flight if within 400 miles of a SARA mobile ground station. A Barax ECM pod can be

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carried underwing, together with two Magic AAMs for self-defense. (Data as for *Mirage F1-C*, except length 50 ft 2½ in.)

Mystère-Falcon 20

The French and Norwegian air forces use small numbers of Mystère-Falcon twin-jet transports modified for ECM training and combat area duties. The Norwegian aircraft of 335 Squadron at Gardemoen 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, Portugal, 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 6¾ 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 10 other persons or 3,750 lb of equipment or cargo, according to role.

Nimrod R. Mk 1P

Three Nimrod R. Mk 1s of No. 51 Squadron of RAF Strike Command at RAF Wyton are specially equipped for elint 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, thus 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. 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, although some have recently been withdrawn from service. 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 3½ 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.

RF-4 Phantom II

Three NATO air forces in Europe continue to operate reconnaissance versions of the Phantom II. No. 348 *Matia* Squadron of the Hellenic Air Force operates 28 recently received ex-German RF-4Es, as well as six of its original new-build aircraft, alongside the F-4Es of 110 Wing at Larissa. The Turkish Air Force also has RF-4Es in No. 113 Squadron at Eskisehir; these were augmented from April 1993 onward by 33 ex-German aircraft which have also been reequipped 173 Squadron at Erhac. Eight ex-USAF RF-4Cs (CR.12s) serve in No. 123 Squadron of the Spanish Air Force. Following the decision not to fit Spanish Hornets with reconnaissance equipment, the CR.12s have been upgraded with fixed in-flight refueling probes, APQ-172 radar (replacing APQ-99), 1553B digital databus and other improved avionics, and are to receive chaff/flare dispensers plus up to four self-defense AIM-9L Sidewinder AAMs. (Data generally as for F-4 Phantom II.)

RF-5A

The Hellenic Air Force has NATO's last eight operational RF-5As in No. 349 Squadron at Larissa. Spain's few remaining SRF-5As (designated AR.9) have been relegated to advanced training, while Turkish RF-5As were switched to attack duties in July 1994. Original standard equipment of the RF-5A comprised four KS-92 cameras in a modified nosecone. (Data generally as for F-5A.)

Tornado (Reconnaissance)

Tornado GR. Mk 1A cameraless reconnaissance aircraft equip Nos. 2 and 13 Squadrons of the RAF, based together at Marham, UK. The GR. Mk 1A has a BAe sideways-looking IR system, Vinten Linescan 4000 IR surveillance system, and Computing Devices signal



Tristar K. Mk 1, Royal Air Force
(Paul Jackson)



VC10 K. Mk 2, Royal Air Force
(Paul Jackson)



Airbus A310-300, French Air Force
(Sirpa "Air")

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 absence of 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. Nine pods are assigned as interim equipment to 40 ex-German Navy Tornados which formed Air Force reconnaissance wing AG 51 January 1, 1994. A new reconnaissance system is to be obtained for these aircraft, which are based at Schleswig/Jägel.

The German Air Force also has 35 specially developed Tornado ECR versions of the Tornado IDS in two squadrons within JBG 32 at Lechfeld. Retaining an air-to-surface combat role, except for the removal of guns, the ECR is fitted with a ground emitter locator; a Honeywell/Sondertechnik infrared linescan; FLIR; onboard 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/Electronica infrared imaging system (IIS) instead of linescan and addition of advanced radar warning equipment. A prototype was completed in March 1992, and deliveries will begin to No. 155 Squadron at Piacenza in 1996. (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 submarines. 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 the US Navy TACAMO E-6A Mercury. 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. 1/59 *Bigorre* Squadron at Evreux.

Two other Transalls, delivered to No. 1/54 *Dunkerque* Squadron at Metz in February 1989, are equipped as elint/ESM 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 RAF from British Airways are operated as dual-role tanker/transports 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 three Tristar C. Mk 2 and 2A passenger transports into dual-role tanker/transports.

Contractor: Lockheed Aircraft Corporation, USA.

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 RAF 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, and the first of these flew July 29, 1993. 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 at Brize Norton are being converted to C. Mk 1(K)s with only two wing pods and no additional fuel, thereby retaining full passenger/freight capability. The first conversion returned to service in August 1992. Three VC10 tankers are to be put into storage.

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.

Tactical and Strategic Transports

Airbus

Three former Interflug (East German Airline) Airbus A310-304s were taken over by the unified German government in October 1990 and transferred to the *Luftwaffe*. Following conversion to military transport requirements they were officially taken into service by



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the Special Air Missions Wing at Köln-Bonn Airport October 3, 1993, assuming many of the long-range transport tasks performed previously by the wing's four Boeing 707s and two Tu-154Ms. At almost the same time, two former Jordanian civilian A310-300s were acquired for France's long-range transport squadron, No. 3/60 *Esterel*, at Paris/Charles de Gaulle Airport. Delivered November 5, 1993, the pair replace two of four McDonnell Douglas DC-8s. Modifications include a cargo door, 28-seat cabin, and two additional fuel tanks, increasing max weight from 153 to 157 tons. Conversion to optional tanker is planned.

Canada's Airbus situation is less certain. The first three (of a planned five) A310-304s were delivered from surplus Wardair stocks, beginning December 1, 1992, under the designation CC-150 *Polaris*. Replacing Boeing 707s, they flew their first service January 22, 1993. Complete 707 replacement will not be achieved until two A310s are converted to tankers; but numbers four and five have not been bought, and the new government in Ottawa has ordered the *VIP Polaris* to be sold, reducing the fleet to two. (Data for standard Airbus A310 multirole tanker transport.)

Contractors: Airbus Industrie, France; airframe prime contractors Aerospaciale, France; Deutsche Aerospace Airbus, Germany; British Aerospace Airbus, UK; CASA, Spain.

Power Plant: two General Electric CF6-80C2A2 turbofans; each 53,500 lb st.

Dimensions: span 144 ft 0 in, length 153 ft 1 in, height 51 ft 10 in.

Weights: empty 178,200 lb, gross 346,125-361,557 lb.

Performance: typical cruising speed Mach 0.8, refueling speed 253-368 mph, normal range 5,523 miles, max range using transfer fuel 8,285 miles.

Accommodation: two crew on flight deck; others according to role. Palletized seats for up to 270 passengers available for tanker transports. Standard fuel 105,690 lb; up 61,730 lb of transfer fuel in eight underfloor tanks.

Armament: none.

Aviocar (C-212)

More than 50 Aviocars equip No. 37 Transport Wing of the Spanish Air Force at Villanubla, No. 461 Squadron of its Canarias Command, and No. 72 Parachute Wing (at Alcantarilla), 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 (at Sintra) and 503 (at Lajes in the Azores) 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. The final six are now assigned primarily to SAR missions, together with CH-113 helicopters, in No. 442 Squadron at Comox in Canada.

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, all NATO air forces operate transport versions of this classic aircraft, which first flew in prototype form 40 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, aerial refueling (five CC-130H(T)s modified from 1992, each with a pair of FRL Mk 32B pods), and SAR from Edmonton, Belgium, Denmark, Greece, Italy, the Netherlands, 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 RAF 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 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, and current programs are adding ALR-66 RWR and ALQ-157 IR jammers to half the fleet. RAF Hercules equip Squadrons 24, 30, 47, and 70 of Strike Command and No. 1312 Flight in the Falkland Islands. Portugal's five C-130Hs are being "stretched" locally by OGMA to match a single new C-130H-30. (Data for C-130H.)

Contractor: Lockheed Aeronautical Systems Company, USA.

Power Plant: four Allison T56-A-15 turboprops; each 4,508 ehp.

Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 3 in.

Weights: empty 76,469 lb, gross 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

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 (amended later to T.19A). Eighteen more (T.19Bs) were delivered to No. 35 Wing at Getafe. The French Air Force funded two in FY 1990 and six more in FY 1991, and 1/62 *Vercors* Squadron formed at Creil on August 1, 1993. Turkey has ordered 52 to replace veteran C-47s, 50 being built locally by TUSAS following two delivered by CASA in early 1992. Initial operator is No. 223 Squadron at Etimesgut.

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 2 1/2 in, height 26 ft 10 in.



C-130H-30 Hercules, Royal Netherlands Air Force



G222, Italian Air Force (Paul Jackson)



Transall C-160F, French Air Force (Paul Jackson)

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 1,102 miles, with max fuel 2,272 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 until recently 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. These are gradually being put into storage prior to replacement by several new types of aircraft including (in 1996) four similar-looking Fokker 60s. (Data for Troopship.)

Contractor: Royal Netherlands Aircraft Factories Fokker, the 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 3 1/2 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 fire-fighting 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 four G222s ordered by the Italian Ministry for Civil Defense as a rapid intervention unit for fire-fighting, oil slick dispersal, medevac, and airlift of supplies to earthquake and other disaster areas. In 1992, a G222 was modified with upgraded navigation equipment and self-defense aids as the prototype of an intended fleet MLU. (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 5 1/2 in, height 34 ft 8 1/4 in.

Weights: empty 34,610 lb, gross 61,730 lb.

Performance: max speed at 15,000 ft 303 mph, service ceiling 25,700 ft, range with max payload 783 miles.

Accommodation: crew of three; 46 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 of these C-160NGs built for the French Air Force, eight are standard transports, 10 are equipped as probe-and-drogue in-flight refueling tankers, five others have provision for rapid conversion to tankers, and six are Astarté/Gabriel special mission 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. French aircraft of both generations began an avionics update in 1993, involving an EFIS (electronic flight instrumentation system) optimized for NVGs, first pilot's HUD, ring-laser INS, and GPS. A similar upgrade is in prospect for German C-160s. In addition, 20 first-series C-160s equip No. 221 squadron of the Turkish Air Force.

Contractor: Arbeitsgemeinschaft Transall (Aerospaciale 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, excl probe, 106 ft 3 1/2 in, height 38 ft 2 3/4 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 2/2A

In addition to the former British Airways Tristars that have been converted into tankers, the RAF purchased

three similar passenger transports from Pan Am. These are operated by No. 216 Squadron as C. Mk 2 passenger aircraft with 267 seats, the third aircraft delivered April 2, 1993, being a Mk 2A—the only RAF Tristar with a full milspec communications fit.

Strategic Missiles

S3D (SSBS)

Second element of France's FAS, after its Mirage IV-P bombers, is the 1st Strategic Missile Brigade of S3D *sol-sol balistique 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 Rustrel 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 RAF Tornado IDS aircraft against hostile gun and missile radars, as a replacement for the AS 37 Martel and AGM-45 Shrike. Deliveries were advanced to allow use from Tornados during the Persian Gulf War in 1991. ALARM is 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 regular users are Tornado GR, Mk 1s of No. 9 Squadron, which are assigned to a pathfinding role and were declared officially operational January 1, 1993.

Contractor: British Aerospace plc, UK.

Propulsion: Bayern-Chemie solid-propellant rocket motor.

Guidance: passive homing, using GEC-Marconi seeker that homes on hostile radar emissions.

Warhead: high-explosive fragmentation 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.

AMRAAM (AIM-120A)

The Advanced Medium-Range Air-to-Air Missile was developed to replace the AIM-7 Sparrow on all USAF and USN fighters and is under consideration as primary armament of the Eurofighter 2000. It has been ordered to arm F-16s of the Norwegian and Turkish air forces. Compared with Sparrow, it offers increased average velocity, reduced miss distance, improved fuzing, increased warhead lethality, multiple target engagement capability, improved clutter rejection in low-altitude environments, improved ECCM capability, increased maximum launch range, reduced-smoke motor, and improved maintenance and handling.

Contractor: Hughes Aircraft Company/Raytheon Company, USA.

Propulsion: two-stage solid-propellant rocket motor.

Guidance: inertial midcourse, with active radar terminal homing and active radar fuze.

Warhead: high-explosive fragmentation type; weight 48 lb.

Dimensions: length 12 ft 0 in, body diameter 7 in, span of tail control fins 2 ft 1 in.

Weight: 345 lb.

Performance: cruising speed approx Mach 4, range approx 30 miles.

AS 30L

The AS 30L (for laser) supersonic ASM is intended for use against hardened targets on land and at sea, normally in conjunction with a Thomson-CSF Atlas 2 or PDLCT target illuminating pod carried by the launch aircraft. The warhead's hard steel casing allows penetration of more than six feet of concrete before detonation, using a delayed fuze. The AS 30L is carried by French Air Force Jaguars and is compatible with such types as the Mirage 2000, AMX, Tornado, and F-16. The first six French Air Force Mirage 2000Ds gained interim IOC with PDLCT and AS 30L July 29, 1993.

Contractor: Aerospatiale SNI, Division Engins Techniques, 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 1¼ 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 Techniques, 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 preprogrammable 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 1¼ 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, including home-on-jam capability. A version with active radar homing, known as Aspide Mk 2, received initial funding as insurance against rejection of AMRAAM for Italy's Eurofighter 2000s.

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.

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, by the Netherlands, Norway, and Turkey for their F-16s, 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 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. The latest AGM-88C version has a seeker able to counter frequency-agile targets and a more lethal warhead containing tungsten alloy cubes.

Contractor: Texas Instruments, Inc, USA.

Propulsion: smokeless dual-thrust solid-propellant rocket motor.

Guidance: passive homing, using seeker that homes on hostile radar emissions.

Warhead: high-explosive fragmentation 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 RAF were fitted with Sidewinder AAMs 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, USA.

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 7½ in, body diameter 1 ft 11½ in, wingspan 3 ft 0 in.

Weight: 1,145 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: Deutsche Aerospace AG, 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 1½ in, wingspan 3 ft 3¼ 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, it 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 IR counter-countermeasures (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 the 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 Etendard, 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 fragmentation type; weight 28.6 lb. Impact and RF proximity fuzes.

Dimensions: length 9 ft 0¼ in, body diameter 6¼ in, wingspan 2 ft 2 in.

Weight: 198 lb.

Performance: cruising speed above Mach 2, range 1,640 ft to 3.1 miles.

Martel (AS 37)

The Martel (Missile AntiRadar and TElevision) ASM 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 Jaguars of the French Air Force.

Contractors: SA Matra, France, and British Aerospace, UK.

Propulsion: solid-propellant rocket motors by Aero-spaciale and Hotchkiss-Brandt.

Guidance: passive homing, with seeker that homes on hostile radar emissions.

Warhead: high-explosive blast fragmentation type; weight 330 lb. Radar proximity fuze.



Martel (AS 37) antiradiation missile
(Paul Jackson)



Sea Eagle antiship missile (Paul Jackson)

Dimensions: length 13 ft 9½ in, body diameter 1 ft 3¾ in, wingspan 3 ft 11¼ in.

Weight: 1,180 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 ASM. 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, USA.

Propulsion: Thiokol TX-481 solid-propellant rocket motor.

Guidance: self-homing electro-optical system.

Warhead: high-explosive shaped charge; weight 125 lb. Impact fuze.

Dimensions: length 8 ft 2 in, body diameter 1 ft 0 in, wingspan 2 ft 4½ 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 HUD. It is claimed to be immune to ECM and able to discriminate between real targets and decoys.

Contractor: Norsk Forsvarsteknologi A/S, Norway.

Propulsion: solid-propellant rocket motor.

Guidance: programmed inertial midcourse guidance; IR terminal homing.

Warhead: high-explosive semi-armor-piercing type; weight 308 lb.

Dimensions: length 10 ft 5¼ in, body diameter 11 in, wingspan 3 ft 3¾ 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-10 Alamo-A). Short-burn semiactive radar homing version for use over medium ranges.



Super 530F AAM (Paul Jackson)

R-27T (AA-10B Alamo-B). Short-burn infrared homing version.

Contractor: unknown, Russia.

Dimensions: length 13 ft 1½ in (A), 12 ft 1¼ in (B), body diameter 9 in, wingspan 3 ft 2¼ in.

Weight: 558 lb (A), 560 lb (B).

Performance: range 1,640 ft to 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: IR homing, with active radar fuze.

Warhead: High-explosive fragmentation, 35 lb.

Dimensions: length 9 ft 6¼ in, body diameter 6¼ in, span of tailfins 1 ft 8 in.

Weight: 243 lb.

Performance: range 985 ft to 5 miles.

Sea Eagle

Sea Eagle is a turbojet-powered all-weather, day and night, fire-and-forget antiship missile. 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. This can be made from any selected bearing, with random maneuvers. 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 two squadrons of RAF 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 semi-armor-piercing type; weight more than 507 lb.

Dimensions: length 13 ft 7 in, body diameter 1 ft 3¾ in, wingspan 3 ft 11¼ in.

Weight: 1,320 lb.

Performance: cruising speed Mach 0.85, range more than 68 miles.

Sidewinder (AIM-9)

This pioneer IR homing AAM 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: IR 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, fin-span 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 AAM 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, with home-on-jam. Sky Flash is the primary weapon of the RAF Tornado ADV.

Contractor: British Aerospace plc, UK.

Propulsion: Aerojet Mk 52 Mod 2 solid-propellant rocket motor.

Guidance: semiactive radar homing, by GEC-Marconi.

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)

The Sparrow AAM 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 AIM-7M serves with the Canadian and Hellenic air forces. (Data for AIM-7E.)

Contractor: Raytheon Company, USA.

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.

Super 530

The basic Super 530F is an all-sector snap-up/snap-down all-weather AAM, with conical-scan semiactive radar seeker, deployed under the wings of Mirage F1 interceptors. The Mirage 2000 is armed with the Super 530D, with a monopulse CW Doppler semiactive seeker and digital microprocessing, making it considerably less susceptible to jamming. It is able to attack targets flying at speeds up to Mach 3 and heights from 200 to 80,000 ft. (Data for Super 530D.)

Contractor: SA Matra, France.

Propulsion: dual-thrust solid-propellant rocket motor, by Thomson-Brandt.

Guidance: semiactive pulse-Doppler radar homing, by Dassault Electronique.

Warhead: fragmenting high-explosive type; weight 66 lb. Active radar proximity fuze.

Dimensions: length 12 ft 5½ in, body diameter 10¼ in, wingspan 2 ft 1¼ in.

Weight: 585 lb.

Performance: cruising speed Mach 4.5, range more than 25 miles. ■

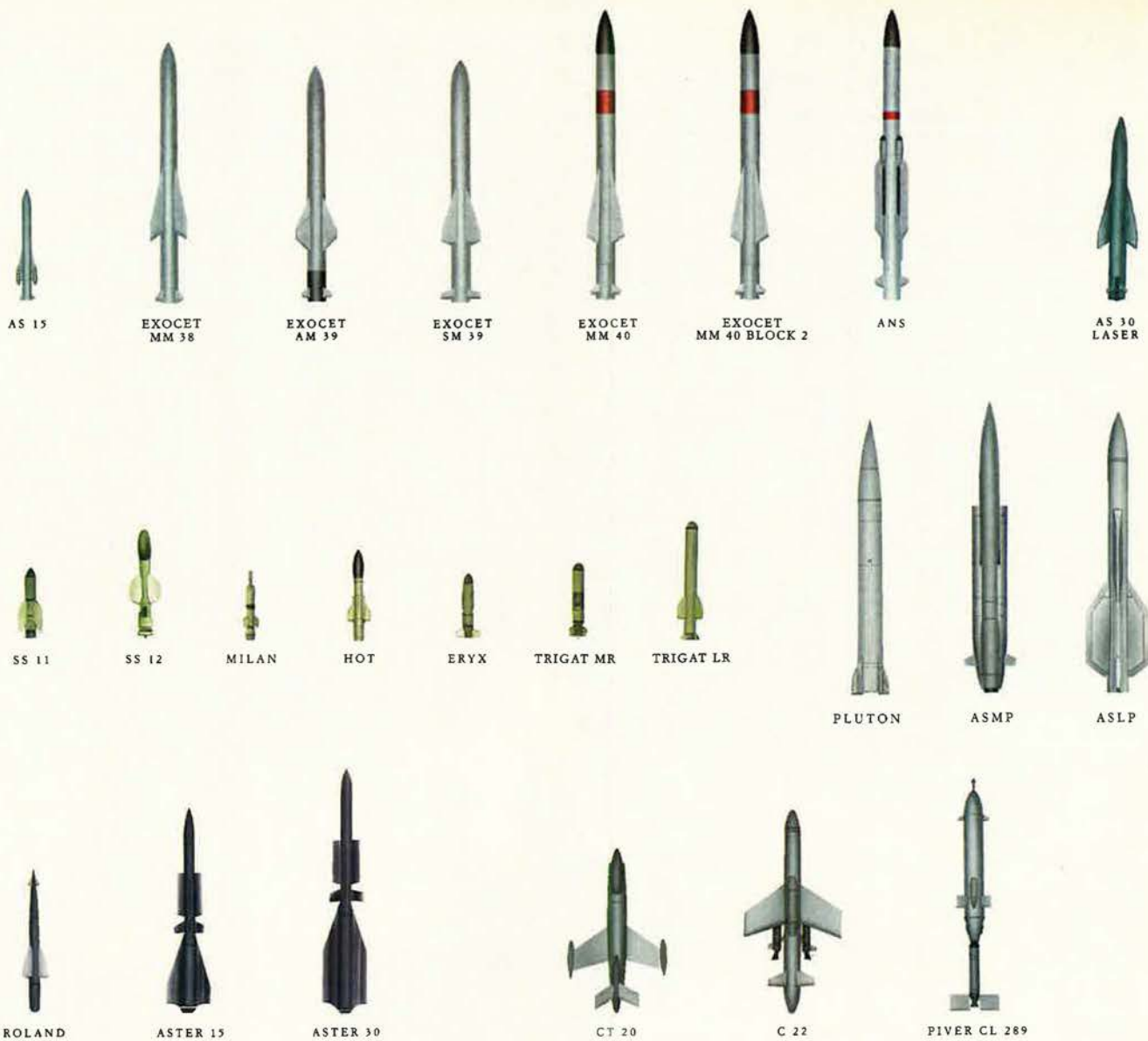


We salute the men and women of the United States Air Force. September 18.

USAF

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Top-notch duty performance makes these enlisted men and women the Outstanding Airmen for 1994. They will be honored at AFA's National Convention this month. For one year, they will wear the Outstanding Airman of the Year badge; they also receive a ribbon to wear throughout their service careers.

The Redoubtable Dozen

AS SUPERINTENDENT for Operations Training at NORAD headquarters, Cheyenne Mountain AFS, Colo., **SMSgt. Rodney E. Ellison** revitalized the Training Deputy Directorate by combining NORAD and USSPACECOM courses, eliminating redundancies and saving 650 instructor man-hours annually. His customer-service program customized training for all US services and Canada; a record number of trainees were upgraded successfully.

Co-producer of the 60th Fighter Squadron's maintenance plan for Air Combat Command's January 1993 Operational Readiness Inspection, **SMSgt. Stephen M. T. Haughton** coordinated and directed deployment of eighteen F-15 aircraft. The senior production superintendent's maintenance leadership during a deployment to Saudi Arabia for Operation Southern Watch resulted in an accident-free, 1,150-sortie flying program and a 97.7 percent mission capable rate.

As war-planning representative responsible for coordinating communication circuit requirements for the 51st Wing, Osan AB, South Korea, **SSgt. William T. Henshilwood** restructured the exercise communications requirements process. Supervisors called his managerial skills and technical expertise "key to the ultimate success of exercise Ulchi Focus Lens '93."

SrA. Linda M. Labonte, a target intelligence specialist at Offutt AFB, Neb., produces precisely measured geodetic coordinates for air target material. Her meticulous production of Aim Point Graphics resulted in a flawless B-1B bomb run in Bright Star '94. Her bombing aimpoints and targets for Cobra Gold in the Pacific led to top scores

by deployed bomber crews. She provided air target material for Operations Provide Promise and Provide Hope.

MSgt. William C. Lisse, Jr., a counter-intelligence technician at Wright-Patterson AFB, Ohio, managed a counter-espionage operation to protect a leading-edge weapon system. He designed and managed a highly classified special force enhancement operation that increased survivability of USAF aircraft in combat, potentially saving lives and protecting a \$65 billion technology.

A heating systems specialist with the 651st Civil Engineer Squadron, Kelly AFB, Tex., **SrA. Carlos S. Markham** devised a hoisting system for lifting 400-pound boiler doors at the C-5 maintenance hangar. He prefabricated replaceable items, using assets from other salvaged units, saving Kelly AFB hundreds of dollars in new material cost.

SrA. Gregory A. Marty, a computer systems programmer at Andrews AFB, Md., converted old mainframe data to a new format, saving 300 hours of laborious reentry of more than 3,000 records for the 89th Security Police Squadron. His efforts saved \$45,000 in annual mainframe usage and software support costs.

SSgt. Andre R. Prude, NCOIC of supply at the USAF Senior NCO Academy, Maxwell AFB, Gunter Annex, Ala., coordinated and executed a \$9.1 million expansion project. Under his direction, 840 items were ordered, delivered, assembled, and installed without a hitch. He also purchased \$50,314 worth of needed items when Air University announced "end of year money."

CMSgt. John E. Stacey, chief loadmaster for the 730th Airlift Squadron, March AFB, Calif., led his section

through the stress of downsizing and conversion to unit-equipped status. When airframe restrictions grounded thirteen of sixteen aircraft, Chief Stacey maintained loadmaster combat readiness and aircrew currency. He volunteered for an evacuation mission on New Year's Day 1993, airlifting fifty people to safety when terrorists threatened UN troops in Aden, Yemen.

As superintendent, ICBM Maintenance Inspections and Training, 20th Air Force, F. E. Warren AFB, Wyo., **MSgt. Pamela I. Turner** manages ICBM maintenance training assets for Minuteman/Peacekeeper weapon systems. She directed a flawless transition of the Maintenance Instructional Center from Vandenberg AFB, Calif., to F. E. Warren AFB. She is AFSPC's Outstanding Airman of the Year.

SrA. Michael A. Vandervoet, an equipment management specialist at Soesterberg AB, the Netherlands, developed and implemented a method to track equipment account inventories, reducing delinquencies by fifty percent. He led the redistribution of surplus items from Soesterberg to other bases, saving the gaining bases \$930,000 and freeing valuable storage space.

The mission: Rescue the crew and passengers of a downed MH-60D helicopter amid raging enemy fire in Mogadishu, Somalia. **TSgt. Timothy A. Wilkinson's** extensive expertise in combat search-and-rescue operations, trauma care, triage management, and casualty evacuation made him a natural choice as NCO leader of the rescue team. Superiors called his actions "heroic." For his extraordinary valor in the eighteen-hour firefight, Sergeant Wilkinson received the Air Force Cross. ■

AFA and the Air Force recognize eight award winners for their accomplishments in 1993.

Saluting the Best

Hoyt Award

Best Air Refueling Aircrew

The sortie was scheduled as an AMC Channel mission from Sicily to Spain. Shortly after takeoff, 310th and 380th Air Refueling Squadron crew members from Plattsburgh AFB, N. Y., lost one of their KC-135's transformer rectifiers; then the other TR started smoking. DC power went out, and battery power could not be switched on. Further failures sparked numerous system breakdowns. The aircraft began filling with toxic fumes, and the crew went on oxygen. Two crew members fought the fire while two others provided dead-reckoning navigation. The KC-135 landed safely. Crew members: Capts. Michael C. Araujo (shown, left), Steven C. Caron, and Daniel L. Bertrand; 1st Lts. Gregory J. Anderson and Steven L. Shinkel (right); MSgt. William F. Shippey; and SrA. Leroy Robinson, Jr.



Tunner Award

Best Air Mobility Aircrew

After delivering supplies to Mogadishu, Somalia, the KC-10 crew of the 911th ARS, 4th Wing, Seymour Johnson AFB, N. C., received an emergency request to evacuate sixteen patients to Ramstein AB, Germany. The crew lacked medevac training but helped set up a makeshift hospital in the KC-10. It was airborne in ninety-five minutes. After a stop in Cairo for fuel and medical personnel, the KC-10 arrived at Ramstein eleven hours after leaving Mogadishu. The fast trip saved lives and beat AMC's estimate by four hours. The crew: Capts. Shannon D. Weatherman, Robert L. Arends (shown, left), and Gary W. Dickinson (center); MSgts. Winfield Scott, Jr. (right), and Kelly D. Hankins; TSgts. Kenneth T. Acosta and Wayne A. Cannucci; and SSgts. Robert W. Fisher and Charles W. Sinkler.



Space Operations Award

Best Unit in Air Force Space Command

Delta II Launch Crew, 1st Space Launch Squadron, Patrick AFB, Fla., successfully launched Navstar Global Positioning System Satellite II-22 three days early to avoid an approaching hurricane and to quickly replace a failing Navy satellite. During accelerated launch preparations, the crew also successfully dealt with several emergency malfunctions, including electrical power loss to the launch complex and a fire below the launch pad. The launch occurred on time, August 30, 1993, establishing a new world record of forty-four consecutive successful space launches. At left, Launch Director Maj. Dave Froiseth and Assistant Launch Director Lt. Col. Joseph Wysocki, the squadron's commander, go over the countdown checklist.

Power Award

Best Strategic Missile Combat Crew

1st Lts. (from left) Michael W. Stern and Todd C. Ellison provided the leadership that enabled Crew S-150, 44th Missile Wing, Ellsworth AFB, S. D., to play an integral role in the wing's deactivation. Chosen ACC's Best Missile Combat Crew in the 1993 Missile Combat Competition, they contributed to the successful demate and custody transfer of 150 reentry vehicles—a critical element of deactivation. They also developed simulation scenarios to train missile crews in deactivation-specific procedures. Such performance earned "Excellent" ratings from ACC's Inspector General. Lieutenant Ellison received five "Outstanding Performance" ratings on local evaluations, and Lieutenant Stern received three "Outstanding Performance" ratings.



Crew Chief of the Year

USAF's Top Crew Chief

SSgt. Mark S. Allen is assigned to Red Sortie Generation Flight, 62d Aircraft Generation Squadron, 62d AW, McChord AFB, Wash. His C-141 logged 271 sorties in 1993, with a 94.6 percent on-time launch rate and a 92.3 percent mission capable rate. In Airlift Rodeo, Sergeant Allen won the Basic Postflight Inspection competition, setting an all-time record of 598 points out of a possible 600. He was selected to troubleshoot a fleet-wide engine flameout problem, and his recommendations were implemented by AMC headquarters. Sergeant Allen's identification and repair of a leaking brake assembly ensured a safe departure from Tajikistan just hours before civil unrest forced the evacuation of US Embassy personnel.



O'Malley Award
Best Reconnaissance Crew

RC-135 crew members of the 922d Reconnaissance Squadron, RAF Mildenhall, UK, were assigned to fly the first sortie of Operation Deny Flight over Bosnia-Herzegovina. While watching for threats to the humanitarian mission and maintaining radio coordination among coalition forces, the crew received word of a downed French Mirage 2000. Crew members quickly configured for a search-and-rescue mission. They picked up the Mirage's emergency beacon and relayed its position to the NATO E-3 AWACS. Capt. Donald I. Olds coordinated the rescue effort by translating between the AWACS and the French pilot, his leader, and a French aircraft carrier. Crew members pictured (from left): TSgt. Gregory Teasley, Capt. Theodore M. Spencer, and Capt. Douglas L. Purdy.

LeMay Award
Best Strategic Aircrew

Crew S-01, 28th Bomb Squadron, McConnell AFB, Kan., served as the lead crew in NATO's 1993 Dynamic Guard—a multforce, multinational exercise. In this first deployment of B-1Bs to Europe, Capt. Gary A. Mausolf, Kurt L. Austin, E. West Anderson, and Dana J. Garvey successfully attacked targets in Germany, achieving the best bombing accuracy of less than ten feet per attack. During the 1993 Nuclear Surety Inspection, Crew S-01 was graded "Outstanding," achieving 100 percent on all command-and-control procedures and evaluations. S-01 also demonstrated superior airmanship in recovering from several in-flight emergencies. During one landing approach, the flaps did not extend, and the crew made a no-flap landing after a twenty-three-hour transoceanic mission.



Chennault Award
Best Aerial Warfare Tactician

Maj. Timothy N. Merrell (right), 390th Fighter Squadron, 366th Wing, Mountain Home AFB, Idaho, developed innovative tactics to incorporate JTIDS inflight data link capability into fifteen F-15C multistage improvement program fighters. The test results of this effort already influence F-15C tactics and hold even more importance for future F-22 tactics. Major Merrell also designed tactics incorporating JTIDS into AMRAAM employment during both defensive and offensive counterair composite force operations. As USAF's air-to-air employment expert on the APG-70 radar system, he took twenty-two pilots through the entire training process, making them mission capable on the APG-70 in less than a year.



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Invited participants include the Secretary of the Air Force and the Chief of Staff, as well as other Air Force leaders from the major commands, who will provide insight into the state of today's Air Force and its course for the future.

In response to requests for a "streamlined" format, this year's symposium schedule is as follows:

- 8:00 a.m. Continental breakfast
- 9:00 a.m. Keynote address and three speakers
- 11:30 a.m. Sit-down luncheon
- 1:00 p.m. Two speakers
- 3:00 p.m. Adjourn to allow participants to prepare for the black-tie charity ball in the evening at the Century Plaza Hotel (separate registration required).

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

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In operations and exercises in the US and around the world, these crews were the best in AFRES and the ANG in 1993.

Reserve Component Class

President's Award Outstanding AFRES Crew

A normal Operation Restore Hope mission to Mogadishu, Somalia, quickly turned mortally dangerous for the 756th Airlift Squadron aircrew. Upon arrival in Somalia on June 6, 1993, aircraft commander Capt. John Gillham learned that a firefight was in progress nearby. The crew reconfigured its C-141B for an emergency aeromedical evacuation. With just enough fuel to fly to medical facilities at Ramstein AB, Germany, the crew volunteered to take more than fifty wounded Pakistani UN troops there. With the patients secured and on respirators, the C-141 was airborne in ten minutes. The crew: Captain Gillham; 1st Lts. Mark Barker and David Miles, copilots; TSgts. Richard Clowes and Steven Thomas, flight engineers; and TSgts. Maria Barreros and John Kaffka, loadmasters.



Earl T. Ricks Award

Outstanding Airmanship in the ANG

On March 16, 1993, Maj. (then Capt.) Richard G. Williams, Jr., of the 157th Fighter Squadron, South Carolina ANG, was flying a low-level training route at 500 feet and 480 knots when his F-16A was struck by a 4.5-pound turkey vulture. The impact demolished the front half of the canopy, exposing Major Williams to severe wind blasts. Rather than eject, Major Williams stayed with his aircraft. He slowed his airspeed and regained his orientation by looking out the side of the aircraft around the glare shield. Unable to read his instruments because of severe vibration, Major Williams joined on his wingman. Keeping his helmet on with one hand and relying on his wingman's aircraft for altitude reference, he flew a flawless recovery to an airfield.



Outstanding Reserve Unit

The 512th Airlift Wing, Dover AFB, Del., flew forty missions for or in support of Operation Restore Hope for Somalia. Crews delivered troops and cargo for UN efforts in Namibia, Croatia, and Macedonia. They flew support missions in Operation Deny Flight over the former Yugoslavia and to US forces in the Persian Gulf. When the Midwest was hit with devastating floods, the 512th AW flew in flood-control equipment. The 512th's readiness was reinforced by more than two dozen joint training exercises, including Dynamic Guard to Turkey and Bright Star to Egypt. The 512th participated for the first time in Volant Rodeo at Little Rock AFB, Ark., where the maintenance team placed second and the aircrew finished third. A safety record was set as the 512th AW surpassed 158,400 accident-free flying hours.

Chief Red Award

Outstanding Aerospace Maintenance

CMSgt. Howard L. Steffey's excellent planning and organization ensured that tools, supplies, and equipment were in place to support a smooth conversion from A-7s to F-16Cs for the 132d Fighter Wing, Iowa ANG. As a result, the conversion took place months ahead of schedule. Chief Steffey provided outstanding F-16 training; as a result, 71.96 percent of all Block 42 F-16 sorties landed Code 1 (fully mission capable) during the first eight months of the 132d FW's flying the aircraft. He supervised integrated combat turn procedures for the F-16 as well. Under his leadership, in sixteen years of A-7 flights by the 132d, no Class A or B aircraft accident was attributed to aircraft maintenance.



Outstanding Guard Unit

Only five months after its conversion to F-16s, the 185th Fighter Group from Sioux City, Iowa, was the first ANG F-16C unit selected by 12th Air Force for participation in ACC's Long Shot exercise. The conversion took place months ahead of schedule, in an efficient process that saved millions of dollars. The 185th FG completed thirteen years without a Class A accident—the longest such record of any active-duty, ANG, or AFRES fighter unit. It was one of the first four units to fly over northern Iraq in support of Operation Provide Comfort II in December 1993. The 185th FG has one of the soundest environmental programs in the Air Force, which the 12th Air Force's Inspector General attributed to the unit's "top-notch management."

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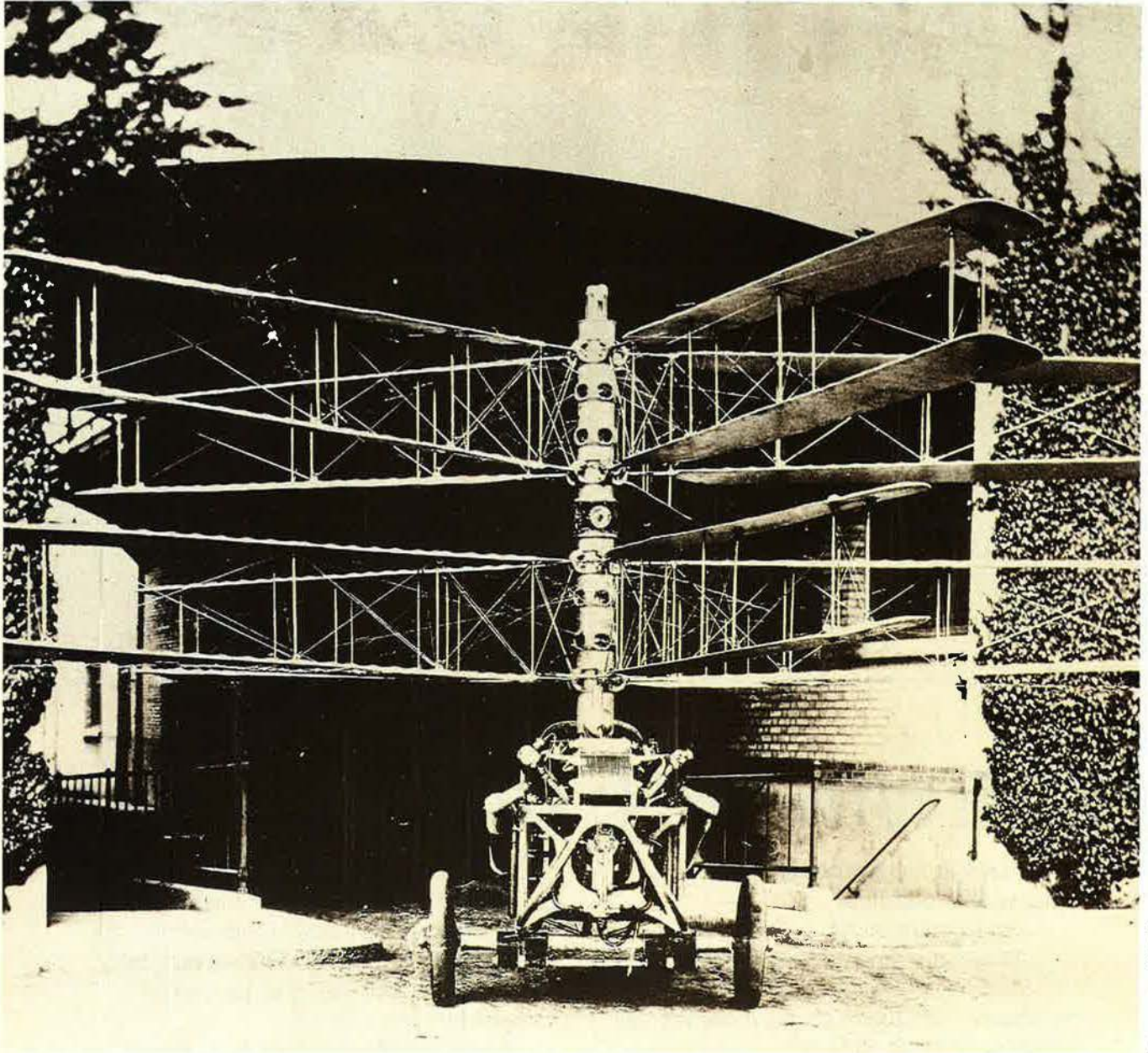


Photo courtesy C. V. Glines

In the early 1920s, several inventors experimented with vertical flight. Many ideas came off the drawing board of Spanish Marquis Raul Pateras Pescara, including this one. He experimented with various numbers of blades and rotors. This machine had a stick and switch to provide collective control by working the pitch of the blades. A 170-

horsepower Le Rhône rotary engine raised the contraption off the ground. Pescara later tried a more powerful engine and fewer lifting surfaces. In April 1924, his helicopter flew just under half a mile, about eight miles an hour, six feet off the ground, beating the flight record set the day before by rotary-wing pioneer Etienne Oemichen.



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- J. Gilbert Nettleton, Jr.
Los Angeles, Calif.
- Ellis T. Nottingham
McLean, Va.
- Gilbert E. Petrina, Jr.
Utica, N. Y.
- Jack G. Powell
Aurora, Colo.
- Jack C. Price
Layton, Utah
- William C. Rapp
Williamsville, N. Y.
- Julian B. Rosenthal
Durham, N. C.
- Peter J. Schenk
Pinehurst, N. C.
- Walter E. Scott
Dixon, Calif.
- Joe L. Shosid
Fort Worth, Tex.
- James E. "Red" Smith
Princeton, N. C.
- William W. Spruance
Wilmington, Del.
- Thos. F. Stack
Hillsborough, Calif.
- John B. Steele
Fairborn, Ohio
- James M. Stewart
Beverly Hills, Calif.
- H. A. "Hal" Strack
Incline Village, Nev.
- Harold C. Stuart
Tulsa, Okla.
- James M. Trail
Oro Valley, Ariz.
- Marie M. Vanover
San Antonio, Tex.
- Larry D. Welch
Alexandria, Va.
- A. A. West
Hayes, Va.
- Sherman W. Wilkins
Bellevue, Wash.
- Paul Adams Willard II
Beavercreek, Ohio
- Joseph A. Zaranka
Bloomfield, Conn.
- Monroe W. Hatch, Jr.
(ex officio)
Executive Director
Air Force Association
Arlington, Va.
- John O. Gray
(ex officio)
Executive Director
Emeritus
Washington, D. C.
- Rev. Richard Carr
(ex officio)
National Chaplain
Springfield, Va.
- Capt. Kathryn A. Day
(ex officio)
Chairman, Junior Officer
Advisory Council
Patrick AFB, Fla.
- CMSgt. Gary L. Thomas
(ex officio)
Chairman,
Enlisted Council
USAF Academy, Colo.
- Erica Richardson
(ex officio)
National Commander
Arnold Air Society
Champaign, Ill.

NATIONAL VICE PRESIDENTS

Information regarding AFA activity within a particular state may be obtained from the vice president of the region in which the state is located.



Dr. Dan Callahan
100 Ridgcrest Pl.
Warner Robins, GA 31088
(912) 929-1485

Southeast Region
Florida, Georgia, North Carolina, Puerto Rico, South Carolina



Bob Cantu
334 Madrid
Universal City, TX 78148
(210) 652-4873

Southwest Region
New Mexico, Oklahoma, Texas



William D. Croom, Jr.
7220 Big Valley Ct.
Colorado Springs, CO 80919
(719) 473-6222

Rocky Mountain Region
Colorado, Utah, Wyoming



Joseph R. Falcone
14 High Ridge Rd.
Ellington, CT 06029
(203) 875-1068

New England Region
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont



Samuel M. Gardner
1708 Prairie Park Ln.
Garden City, KS 67846
(316) 275-4555

Midwest Region
Iowa, Kansas, Missouri, Nebraska



Eugene B. Goldenberg
2345 Griffith St.
Philadelphia, PA 19152
(215) 332-4241

Northeast Region
New Jersey, New York, Pennsylvania



Harold F. Henneke
359 W. Edgewood Ave.
Indianapolis, IN 46217
(317) 786-5865

Great Lakes Region
Illinois, Indiana, Kentucky, Michigan, Ohio, Wisconsin



Ed Kantor
Landstuhl EMS
PSC 2, Box 6265
APO AE 09012
49-6371-14098

European Region



John Lee
P. O. Box 3759
Salem, OR 97302
(503) 581-3682

Northwest Region
Alaska, Idaho, Montana, Oregon, Washington



John W. Lynch
44-259 Portofino Ct.
Palm Desert, CA 92260
(619) 776-9223

Far West Region
Arizona, California, Guam, Hawaii, Nevada



Mary Anne Thompson
3146 Valentino Ct.
Oakton, VA 22124
(703) 734-6180

Central East Region
Delaware, District of Columbia, Maryland, Virginia, West Virginia



Bud Walters
903 Dixie Dr.
Blytheville, AR 72315
(501) 763-1825

South Central Region
Alabama, Arkansas, Louisiana, Mississippi, Tennessee



J. Robin Wohnsigl
8288 131st St. W.
Apple Valley, MN 55124
(612) 726-6872

North Central Region
Minnesota, North Dakota, South Dakota



For over forty years, fighter pilots have transmitted "Fox 2" to signal that a *Sidewinder*, one of the world's most successful air-to-air missiles, has been fired and is on its way to yet another air combat victory.

Now, however, current new threat missiles,

aircraft, and environments demand a new generation *Sidewinder* missile, AIM-9X.

The Hughes AIM-9X Team will retain the essence of *Sidewinder* heritage, while significantly improving its seeker and airframe performance.

AIM-9X

Reliable • Low Cost • Deadly

HUGHES

By John L. Frisbee, Contributing Editor

Victory From the Jaws of Defeat

Seconds before "bombs away," the battered B-17 was without a bombardier. Only one man, gravely wounded, could save the mission.

THE 305TH Bomb Group, based at Chelveston in the UK, was one of the four pioneer B-17 groups assigned to Eighth Air Force. It was commanded by Col. Curtis LeMay, a tough, no-nonsense leader and a tactical genius. All of the groups arrived in England without combat experience and faced a steep, perilous learning curve. They entered combat in the autumn of 1942.

It was obvious to LeMay that two major deficiencies of the bomb groups were formation flying and air discipline. He experimented with various formations to give maximum mutual protection against enemy fighters. To improve bombing accuracy, he had all B-17s in a group formation drop on signal from the bombardier of a select lead crew.

Because of the short range of escort fighters at that time, most early targets were in France or the Low Countries. The first penetration of German territory came on January 27, 1943, when LeMay's group took part in an attack on the port of Wilhelmshaven. Then it was back to targets in German-occupied western Europe for the most part.

On March 8, 1943, Eighth Air Force launched sixty-seven B-17s, a large force for the time, against railyards at Rennes, 190 miles southwest of Paris at the base of the Brittany peninsula. Sixteen of the B-17s were from the 305th Bomb Group. They suffered heavy fighter attacks before reaching the initial point to begin their bomb run.

One B-17 from the 305th's 422d Squadron, commanded by Lt. Albert Kuehl, bore the brunt of enemy attacks. It started its run with the number three engine out, a fire in the radio compartment, and damage to the control cables and hydraulic system. The crew had been decimated

by enemy fire. Both waist gunners, the top turret gunner, and the radio operator were wounded. A head-on attack had critically wounded the bombardier, Lieutenant Spatz, who lay unconscious over his bombsight. The navigator, Lt. Raymond Rahner, was severely wounded in the thigh.

Despite major damage to the aircraft, Lieutenant Kuehl was able to stay in formation on the bomb run with the help of copilot 2d Lt. Floyd Truesdell, who had recently transferred from RAF Coastal Command and was on his first B-17 mission. The wounded gunners all remained at their positions, but the crew was without a bombardier. Only minutes from "bombs away," navigator Rahner, suffering from painful injuries, lifted the unconscious bombardier from his bombsight and carried him to the rear of the nose compartment. He quickly applied compresses to stop the flow of blood and attached a walk-around oxygen bottle to the bombardier's mask.

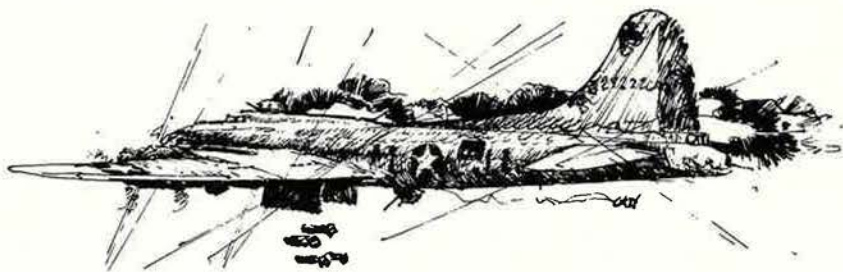
The time to "bombs away" now was measured in seconds. Unless someone replaced the incapacitated bombardier, all the damage and suffering would be for naught. Only Lieutenant Rahner was in a position to do it. He resolved that their mission should not fail. He crawled painfully back to the bombardier's position, opened the bomb bay doors, released the bombs on signal from the lead bombardier, and buttoned up the doors. He then returned to Spatz's side and continued first aid, undoubtedly saving the critically wounded man's life.

As the formation turned off target, fighter attacks on the damaged B-17 resumed. Alternately manning the two guns in the nose, Lieutenant Rahner drove off several head-on attacks. One of the waist gunners, SSgt. T. E. Johnson, wounded by 20-mm fire in both legs, one shoulder, and his right eye and with his electrically heated clothing inoperative, shot down a Bf-109 confirmed. A second gunner, Sergeant Johns, probably downed another. Three more fighters were known to have been damaged.

Heading north over the comparative safety of the English Channel, sixty miles wide at that point, Lieutenants Kuehl and Truesdell could no longer keep the aircraft with the formation. Lieutenant Rahner left the nose guns long enough to give the pilots a course to an RAF base in England, where they landed safely.

The valiant men aboard that B-17 salvaged what almost certainly would have been a failed sortie but for their heroism and teamwork. For his extraordinary performance as navigator, bombardier, gunner, and "flight surgeon," Lt. Raymond Rahner was awarded the Distinguished Service Cross. Pilot Albert Kuehl received the Distinguished Flying Cross and copilot Floyd Truesdell the Air Medal. The Purple Heart went to all six wounded members of the crew. They had written an early chapter in the long and gallant history of Eighth Air Force. ■

Thanks to George H. Collins for bringing this story to our attention.





National Report

Smithsonian Resists Veterans' Concerns

AFA Executive Director Monroe W. Hatch, Jr., and AIR FORCE Magazine Editor in Chief John Correll took part in a July 13 meeting between National Air and Space Museum officials and representatives from concerned veterans groups.

The exchange was disappointing, since the latest description of the planned 1995 exhibit, "The Last Act: The Atomic Bomb and the End of World War II," given by curator Dr. Michael Neufeld offered little in the way of substantive changes.

Current museum plans still present the Americans largely as the aggressors of World War II and the Japanese as the victims of the atomic bombing carried out by the *Enola Gay*. The exhibit still treats only a narrow slice of the war, presenting the "last act" without balance or context. Surprisingly, museum officials seem intent on pressing ahead with their plans, regardless of the vocal criticism from many quarters. Military historians, congressional members, and veterans have all expressed opposition to the exhibit, much of which has been covered in the national media.

AFA will continue to oppose the museum's current plans and to work for substantive changes to the exhibit.



AFA President Jim McCoy poses with Rep. Tillie Fowler (R-FL), a member of the House Armed Services Committee, after discussing the issues of Medicare reimbursement and cost-of-living adjustments (COLAs).

AFA Backs Incentives to Treat Medicare Cases

In discussions on Capitol Hill, AFA President Jim McCoy has been urging lawmakers to create new incentives for military hospitals to treat Medicare-eligible military retirees.

At the present time, there is little incentive for the Department of Defense (DoD) to give high priority to treating Medicare-eligible military retirees in the Military Health Services System (MHSS). Why? Because military hospitals receive no reimbursement for treating these patients. The same situation exists for patients treated in Veterans Administration facilities.

Under the current system, since DoD has no financial incentive to increase access to care for this group of beneficiaries, Medicare-

eligible military retirees are frequently the first group of beneficiaries to be turned away in the face of budget cutbacks.

In contrast, the new incentives would allow military treatment facilities to be reimbursed at the nationally established standard cost (the capitation rate) every time a beneficiary is treated. This change would save taxpayers money and provide hospital commanders with badly needed additional revenue -- revenue that could in turn be used for new equipment, supplies and contract personnel.

The Air Force Association supports Medicare reimbursement in any health care reform legislation that is adopted.



AFA's Network of Units Overseas

AFA UNIT	LOCATION
United States Air Forces in Europe (USAFE)	
Dolomiti	Aviano AB, Italy
Lufbery-Campbell	Ramstein AB, Germany
Spangdahlem	Spangdahlem AB, Germany
Pacific Air Forces (PACAF)	
Keystone	Kadena AB, Japan
Manila	Manila, the Philippines
Misawa	Misawa AB, Japan
Tokyo	Tokyo, Japan
Supreme Headquarters Allied Powers Europe (SHAPE)	
General Lauris G. Norstad	Mons, Belgium

Aerospace Education Foundation Officers

YEAR	PRESIDENT	CHAIRMAN OF THE BOARD
1961-63	—	Dr. W. Randolph Lovelace II
1963-64	John B. Montgomery	Dr. W. Randolph Lovelace II
1964-66	Dr. Lindley J. Stiles	Gen. Laurence S. Kuter, USAF (Ret.)
1966-67	Dr. B. Frank Brown	Dr. Walter J. Hesse
1967-68	Dr. Leon M. Lessinger	Dr. Walter J. Hesse
1968-69	Dr. L. V. Rasmussen	Dr. Walter J. Hesse
1969-71	Dr. L. V. Rasmussen	J. Gilbert Nettleton, Jr.
1971-73	Dr. Leon M. Lessinger	J. Gilbert Nettleton, Jr.
1973-74	Dr. Wayne O. Reed	George D. Hardy
1974-75	Dr. William L. Ramsey	George D. Hardy
1975-81	Dr. William L. Ramsey	Sen. Barry Goldwater
1981-84	Dr. Don C. Garrison	Sen. Barry Goldwater
1984-86	George D. Hardy	Sen. Barry Goldwater
1986-87	Eleanor P. Wynne	George D. Hardy
1987-89	James M. Keck	George D. Hardy
1989-94	Gerald V. Hasler	James M. Keck
1994-	Thomas J. McKee	Walter E. Scott

AFA Units of the Year

YEAR	RECIPIENT(S)	YEAR	RECIPIENT(S)
1953	San Francisco Chapter (Calif.)	1978	Thomas B. McGuire, Jr., Chapter (N. J.)
1954	Santa Monica Area Chapter (Calif.)	1979	General Robert F. Travis Chapter (Calif.)
1955	San Fernando Valley Chapter (Calif.)	1980	Central Oklahoma (Gerrity) Chapter (Okla.)
1956	Utah State AFA	1981	Alamo Chapter (Tex.)
1957	H. H. Arnold Chapter (N. Y.)	1982	Chicagoland-O'Hare Chapter (Ill.)
1958	San Diego Chapter (Calif.)	1983	Charles A. Lindbergh Chapter (Conn.)
1959	Cleveland Chapter (Ohio)	1984	Scott Memorial Chapter (Ill.) and Colorado Springs/Lance Sijan Chapter (Colo.)
1960	San Diego Chapter (Calif.)	1985	Cape Canaveral Chapter (Fla.)
1961	Chico Chapter (Calif.)	1986	Charles A. Lindbergh Chapter (Conn.)
1962	Fort Worth Chapter (Tex.)	1987	Carl Vinson Memorial Chapter (Ga.)
1963	Colin P. Kelly Chapter (N. Y.)	1988	General David C. Jones Chapter (N. D.)
1964	Utah State AFA	1989	Thomas B. McGuire, Jr., Chapter (N. J.)
1965	Idaho State AFA	1990	General E. W. Rawlings Chapter (Minn.)
1966	New York State AFA	1991	Paul Revere Chapter (Mass.)
1967	Utah State AFA	1992	Central Florida Chapter (Fla.) and Langley Chapter (Va.)
1968	Utah State AFA	1993	Green Valley Chapter (Ariz.)
1969	(no presentation)	1994	Langley Chapter (Va.)
1970	Georgia State AFA		
1971	Middle Georgia Chapter (Ga.)		
1972	Utah State AFA		
1973	Langley Chapter (Va.)		
1974	Texas State AFA		
1975	Alamo Chapter (Tex.) and San Bernardino Area Chapter (Calif.)		
1976	Scott Memorial Chapter (Ill.)		
1977	Thomas B. McGuire, Jr., Chapter (N. J.)		

H. H. Arnold Award Recipients

Until 1986, AFA's highest Aerospace Award was the H. H. Arnold Award. Named for the World War II leader of the Army Air Forces, it is presented annually in recognition of the most outstanding contributions in the field of aerospace activity. In 1986, the Arnold Award was redesignated AFA's highest honor to a member of the armed forces in the field of National Security. It continues to be presented annually.

YEAR	RECIPIENT(S)
1948	Hon. W. Stuart Symington, Secretary of the Air Force
1949	Maj. Gen. William H. Tunner and the men of the Berlin Airlift
1950	Airmen of the United Nations in the Far East
1951	Gen. Curtis E. LeMay and the personnel of Strategic Air Command
1952	Sens. Lyndon B. Johnson and Joseph C. O'Mahoney
1953	Gen. Hoyt S. Vandenberg, former Chief of Staff, USAF
1954	Hon. John Foster Dulles, Secretary of State
1955	Gen. Nathan F. Twining, Chief of Staff, USAF
1956	Sen. W. Stuart Symington
1957	Edward P. Curtis, Special Assistant to the President
1958	Maj. Gen. Bernard A. Schriever, Commander, Ballistic Missile Division, ARDC
1959	Gen. Thomas S. Power, Commander in Chief, Strategic Air Command
1960	Gen. Thomas D. White, Chief of Staff, USAF
1961	Hon. Lyle S. Garlock, Assistant Secretary of the Air Force
1962	Dr. A. C. Dickieson and John R. Pierce, Bell Telephone Laboratories
1963	The 363d Tactical Reconnaissance Wing, TAC, and the 4080th Strategic Wing, SAC
1964	Gen. Curtis E. LeMay, Chief of Staff, USAF
1965	The 2d Air Division, PACAF
1966	The 8th, 12th, 355th, 366th, and 388th Tactical Fighter Wings and the 432d and 460th Tactical Reconnaissance Wings
1967	Gen. William W. Momyer, Commander, 7th Air Force, PACAF
1968	Col. Frank Borman, USAF; Capt. James Lovell, USN; and Lt. Col. William Anders, USAF, Apollo 8 crew
1969	(No presentation)
1970	Apollo 11 team (J. L. Atwood; Lt. Gen. Samuel C. Phillips, USAF; and astronauts Neil Armstrong, Col. Edwin E. Aldrin, Jr., USAF, and Col. Michael Collins, USAF)
1971	Dr. John S. Foster, Jr., Director of Defense Research and Engineering
1972	Air Units of the Allied Forces in southeast Asia (Air Force, Navy, Army, Marine Corps, and the Vietnamese Air Force)
1973	Gen. John D. Ryan, USAF (Ret.), former Chief of Staff, USAF
1974	Gen. George S. Brown, USAF, Chairman, Joint Chiefs of Staff
1975	Hon. James R. Schlesinger, Secretary of Defense
1976	Sen. Barry M. Goldwater
1977	Sen. Howard W. Cannon
1978	Gen. Alexander M. Haig, Jr., USA, Supreme Allied Commander, Europe
1979	Sen. John C. Stennis
1980	Gen. Richard H. Ellis, USAF, Commander in Chief, Strategic Air Command
1981	Gen. David C. Jones, USAF, Chairman, Joint Chiefs of Staff
1982	Gen. Lew Allen, Jr., USAF (Ret.), former Chief of Staff, USAF
1983	Ronald W. Reagan, President of the United States
1984	The President's Commission on Strategic Forces (the Scowcroft Commission)
1985	Gen. Bernard W. Rogers, USA, Supreme Allied Commander, Europe
1986	Gen. Charles A. Gabriel, USAF (Ret.), former Chief of Staff, USAF
1987	Adm. William J. Crowe, Jr., USN, Chairman, Joint Chiefs of Staff
1988	The men and women of the ground-launched cruise missile team
1989	Gen. Larry D. Welch, Chief of Staff, USAF
1990	Gen. John T. Chain, Commander in Chief, Strategic Air Command
1991	Lt. Gen. Charles A. Horner, Commander, US Central Command Air Forces and 9th Air Force
1992	Gen. Colin L. Powell, USA, Chairman, Joint Chiefs of Staff
1993	Gen. Merrill A. McPeak, Chief of Staff, USAF
1994	Gen. John Michael Loh, Commander, Air Combat Command

AFA "Member of the Year" Award Recipients

State names refer to winner's home state at the time of the award.

YEAR	RECIPIENT(S)
1953	Julian B. Rosenthal (N. Y.)
1954	George A. Anderl (Ill.)
1955	Arthur C. Storz (Neb.)
1956	Thos. F. Stack (Calif.)
1957	George D. Hardy (Md.)
1958	Jack B. Gross (Pa.)
1959	Carl J. Long (Pa.)
1960	O. Donald Olson (Colo.)
1961	Robert P. Stewart (Utah)
1962	(no presentation)
1963	N. W. DeBenardinis (La.) and Joe L. Shosid (Tex.)
1964	Maxwell A. Kriendler (N. Y.)
1965	Milton Caniff (N. Y.)
1966	William W. Spruance (Del.)
1967	Sam E. Keith, Jr. (Tex.)
1968	Marjorie O. Hunt (Mich.)
1969	(no presentation)
1970	Lester C. Curl (Fla.)
1971	Paul W. Gaillard (Neb.)
1972	J. Raymond Bell (N. Y.) and Martin H. Harris (Fla.)
1973	Joe Higgins (Calif.)
1974	Howard T. Markey (D. C.)
1975	Martin M. Ostrow (Calif.)
1976	Victor R. Kregel (Tex.)
1977	Edward A. Stearn (Calif.)
1978	William J. Demas (N. J.)
1979	Alexander C. Field, Jr. (Ill.)
1980	David C. Noerr (Calif.)
1981	Daniel F. Callahan (Fla.)
1982	Thomas W. Anthony (Md.)
1983	Richard H. Becker (Ill.)
1984	Earl D. Clark, Jr. (Kan.)
1985	George H. Chabbot (Del.) and Hugh L. Enyart (Ill.)
1986	John P. E. Kruse (N. J.)
1987	Jack K. Westbrook (Tenn.)
1988	Charles G. Durazo (Va.)
1989	O. R. Crawford (Tex.)
1990	Cecil H. Hopper (Ohio)
1991	George M. Douglas (Colo.)
1992	Jack C. Price (Utah)
1993	Lt. Col. James G. Clark (D. C.)
1994	William A. Lafferty (Ariz.)

Christa McAuliffe Memorial Award Winners

YEAR	RECIPIENT	SPONSOR
1986	Allen T. King	Fort Wayne--Baer Field Chapter, Ind.
1987	Betty Ann Mosen	Sacramento Chapter, Calif.
1988	John W. Barainca	Salt Lake Chapter, Utah
1989	Dr. Ben P. Millspaugh	Mile High Chapter, Colo.
1990	Sue Ellen Darnell	Lexington Chapter, Ky.
1991	Melba Iris Harris	Mobile Chapter, Ala.
1992	Arthur I. Kimura	Hawaii Chapter, Hawaii
1993	Dr. Joseph E. Ciotti	Hawaii State AFA
1994	To be announced	

Aerospace Education Foundation Fellows

The following is a listing of Individual Fellows who have become fellows since the last such listing in the September 1993 issue of this magazine.

Individual Jimmy Doolittle Fellows

(Listed in order of affiliation. Represents \$1,000 contribution)

NAME	SPONSOR
1993	
MSgt. Samuel M. Gardner, Jr., USAF	Kansas State AFA and Kansas Chapters
Michael L. Salis	Paul Revere Chapter
Patricia and Edward Stearn	California State AFA
Brig. Gen. George Muellner, USAF	Langley Chapter
Lt. Gen. Thomas G. McInerney, USAF	Iron Gate Chapter
Maj. Gen. Kenneth R. Israel, USAF	Iron Gate Chapter
Capt. William Scott, Jr., USAF, Lt. Col. Carter C. Porter, USAF, and Capt. Walter E. Clarke, USN	Paso Del Norte Chapter, Roadrunner Chapter, The Daedalians, Lt. Col. W. L. Scott, USAF, and Lt. Col. G. H. Scott, USAF
Gen. James H. Doolittle, USAF (Ret.) (<i>in memoriam</i>)	John O. Gray
1994	
Robert L. Crippen	Cape Canaveral Chapter
Boeing B-17 Flying Fortress	Central Florida Chapter
Lockheed B-24 Liberator	Central Florida Chapter
Republic P-47 Thunderbolt ("The Jug")	Central Florida Chapter
Rockwell P-51 Mustang	Tennessee Valley Chapter
Thomas J. Lee	European Chapters
Gen. Robert C. Oaks, USAF	
Lt. Gen. Albert J. Edmonds, USAF	Iron Gate Chapter
I. Rex Frey	Langley Chapter
Daniel Hendrickson	Ogden-Wasatch Chapter
<i>USA Today</i> , St. Louis Office	Air Force Ball of Mid-America
Ron Stephens	Air Force Ball of Mid-America
James E. Cvik	Virginia State AFA
William and Martha Lafferty	Arizona State AFA
Joseph J. Nadel	Orange County/Gen. Curtis E. LeMay Chapter
Lt. Gen. Thomas G. McInerney, USAF	Donald W. Steele, Sr., Memorial Chapter
Tommy G. Harrison	Central Florida Chapter

Aerospace Education Foundation 1993-94 AFJROTC Contest Winners

Subject: Our Best Community Service Project

First-Place Winner (\$1,000)

Del Campo High School, Fair Oaks, Calif.

Second-Place Winner (\$750)

Novato High School, Novato, Calif.

Third-Place Winner (\$500)

Harlingen High School South, Harlingen Tex.

Honorable Mention

Forest High School, Ocala, Fla.

Oak Grove High School, San Jose, Calif.

Coatesville High School, Coatesville, Pa.

Citrus High School, Inverness, Fla.

Lowell High School, Lowell, Ind.

Santa Margarita High School, Rancho Santa Margarita, Calif.

Lafayette High School, Oxford, Miss.

John F. Kennedy High School, Tamuning, Guam

West Anchorage High School, Anchorage, Alaska

Piscataway High School, Piscataway, N. J.

Individual Ira C. Eaker Fellows

(Listed in order of affiliation. Represents \$1,000 contribution)

NAME	SPONSOR
1993	
Lt. Gen. Benjamin O. Davis, Jr., USAF (Ret.)	Tuskegee Airmen, Inc.
Mary Anne Thompson	Virginia State AFA
1994	
Lt. Gen. Thad A. Wolfe, USAF	Greater Seattle Chapter
Lt. Gen. Thomas S. Moorman, Jr., USAF	Iron Gate Chapter
Maj. Gen. Garry A. Schnelzer, USAF	Iron Gate Chapter
Maj. Gen. William P. Hallin, USAF	Carl Vinson Memorial Chapter
Stuart Symington, Jr.	Air Force Ball of Mid-America
Capt. Marcia Stevens, USAF	Air Force Ball of Mid-America
Larry C. Noggle	Riverside Chapter
Martin H. Harris	Central Florida Chapter

Barry Goldwater Fellows

(Represents \$5,000 contribution)

NAME	SPONSOR
1993	
The Tuskegee Airmen	Los Angeles Air Force Ball

W. Stuart Symington Award Recipients

Since 1986, AFA's highest honor to a civilian in the field of National Security has been the W. Stuart Symington Award. The award, presented annually, is named for the first Secretary of the Air Force.

YEAR RECIPIENT

1986	Hon. Caspar W. Weinberger, Secretary of Defense
1987	Hon. Edward C. Aldridge, Jr., Secretary of the Air Force
1988	Hon. George P. Schultz, Secretary of State
1989	Hon. Ronald W. Reagan, former President of the United States
1990	Hon. John J. Welch, Assistant Secretary of the Air Force (Acquisition)
1991	Hon. George Bush, President of the United States
1992	Hon. Donald B. Rice, Secretary of the Air Force
1993	Sen. John McCain (R-Ariz.)
1994	Rep. Ike Skelton (D-Mo.)

John R. Alison Award Recipients

Established in 1992, the John R. Alison Award is AFA's highest honor for industrial leadership.

1992	Norman R. Augustine, Chairman, Martin Marietta Corp.
1993	Daniel M. Tellep, Chairman and Chief Executive Officer, Lockheed Corp.
1994	Kent Kresa, Chief Executive Officer, Northrop Grumman Corp.

Sam E. Keith Aerospace Education Award of Excellence

YEAR	RECIPIENT	SPONSOR
1991	Jule Zumwalt	Sacramento Chapter, Calif.
1992	Col. Kenneth O. Wofford, USAF (Ret.)	General E. W. Rawlings Chapter, Minn.
1993	Pope Chapter	Pope Chapter, N. C.
1994	To be announced	

AFA's Regions, States, and Chapters

The figures on the right indicate the number of affiliated members as of June 30, 1994. Listed below the name of each region is the National Vice President for that region.

CENTRAL EAST REGION	15,364	Bob Hope	1,325	Kentucky	802
Mary Anne Thompson		David J. Price/Beale	689	Gen. Russell E. Dougherty	443
		Fresno*	472	Lexington	245
Delaware	1,026	General B. A. Schriever Los Angeles	1,218	West Kentucky	114
Delaware Galaxy	781	General Doolittle Los Angeles Area*	2,009		
Diamond State	208	General Robert F. Travis	1,612	Michigan	2,759
Henlopen Area	37	Golden Gate*	783	Battle Creek	284
		High Desert	290	Hoyt S. Vandenberg	377
District of Columbia	1,168	Maj. Gen. Charles I. Bennett, Jr.	663	Huron	154
Nation's Capital	1,168	Monterey Bay Area	317	James H. Straubel	576
		Orange County/Gen. Curtis E. LeMay	1,137	Kalamazoo	259
Maryland	3,287	Pasadena Area	453	Lake Superior Northland	474
Baltimore*	944	Redwood Empire	390	Lloyd R. Leavitt, Jr.	156
Central Maryland	461	Robert H. Goddard	1,020	Mid-Michigan	81
College Park Airport	138	Sacramento	2,276	Mount Clemens	317
Thomas W. Anthony	1,744	San Bernardino Area	1,170	PE-TO-SE-GA	81
		San Diego	1,142		
Virginia	9,545	Tennessee Ernie Ford	1,103	Ohio	6,710
Danville	46	Ventura County	299	Capt. Eddie Rickenbacker Memorial*	710
Donald W. Steele, Sr., Memorial	4,035			Cleveland	467
Gen. Charles A. Gabriel	960	Guam	278	Frank P. Lahm	554
Jack Manch	104	Guam-Arc Light	278	Mid-Ohio	230
Langley	2,852			Steel Valley	194
Leigh Wade	121	Hawaii	1,337	Wright Memorial*	4,555
Lynchburg	124	Hawaii*	1,304		
Northern Shenandoah Valley	72	Maui	33	Wisconsin	1,347
Richmond	457			Badger State	250
Roanoke	279	Nevada	2,351	Billy Mitchell	727
Tidewater	341	Dale O. Smith	496	Madison	370
William A. Jones III	154	Thunderbird	1,855		
				MIDWEST REGION	7,495
West Virginia	338	GREAT LAKES REGION	18,110	Samuel N. Gardner	
Chuck Yeager	338	Harold F. Henneke			
				Iowa	788
FAR WEST REGION	28,570	Illinois	4,589	All-Iowa	409
John W. Lynch, Jr.		Chicagoland-O'Hare	1,183	Gen. Charles A. Horner	109
		Greater Rockford	89	Lancer	43
Arizona	5,329	Illini	304	Northeast Iowa	39
Barry Goldwater	197	Land of Lincoln	214	Richard D. Kislung	188
Cochise	104	Quad Cities	118		
Frank Luke	1,284	Richard E. Carver	173	Kansas	1,343
Green Valley	351	Scott Memorial	2,065	Contraills	52
Phoenix Sky Harbor	1,222	West Suburban	443	Lt. Erwin R. Bleckley	848
Prescott	148			Major General Edward R. Fry	443
Tucson	2,023	Indiana	1,903		
		Central Indiana	475	Missouri	2,348
California	19,275	Columbus-Bakalar	45	Central Missouri	547
Antelope Valley	824	Falls Cities	49	Harry S. Truman	607
Bakersfield	83	Fort Wayne	187	Ozark	220
		Grissom Memorial	320	Spirit of St. Louis	974
		Gus Grissom	157		
		Lawrence D. Bell Museum	50	Nebraska	3,016
		Lester W. Johnston	36	Ak-Sar-Ben	2,732
		P-47 Memorial	64	Lincoln	284
		South Bend	283		
		Southern Indiana	142	NEW ENGLAND REGION	5,972
		Terre Haute-Wabash Valley	95	Joseph R. Falcone	

*These chapters were chartered prior to December 31, 1948, and are considered original charter chapters; the Major John S. Southrey Chapter of Massachusetts was formerly the Chicopee Chapter.

Connecticut	1,167	Brooklyn "Key"	344	Wyoming	634
Central Connecticut	157	Chautauqua	70	Cheyenne Cowboy	634
Charles A. Lindbergh	169	Colin P. Kelly	711		
First Connecticut	175	Forrest L. Vosler	307	SOUTH CENTRAL REGION	10,628
Flying Yankees	154	General Daniel "Chappie" James, Jr., Memorial	102	Bud Walters	
General Bennie L. Davis	70	Genesee Valley	304	Alabama	3,021
General George C. Kenney	85	H. H. Arnold	292	Birmingham	448
Igor Sikorsky	131	Iron Gate	238	Gadsden	35
Northern Connecticut	169	L. D. Bell-Niagara Frontier	495	Mobile	330
Sergeant Charlton Heston	57	Lloyd Schloen-Empire	40	Montgomery	1,849
		Nassau Mitchel	291	Tennessee Valley	359
Maine	513	Queens	261		
Eastern Maine	231	Suffolk County	200	Arkansas	1,699
Major Charles J. Loring, Jr.	159	Thomas Watson, Sr., Memorial	198	David D. Terry, Jr.	1,222
Southern Maine	123	Westchester Falcon	268	Fort Smith	77
				General Ira C. Eaker	146
Massachusetts	2,890	Pennsylvania	3,762	Ouachita	67
Boston	242	Altoona	71	Razorback	187
Laurence G. Hanscom	232	Beaver Valley	111		
Major John S. Southrey*	257	Brandywine	186	Louisiana	2,111
Minuteman	310	Colonel Stuart E. Kane, Jr.	152	Alexandria	166
Otis	173	Eagle	67	Ark-La-Tex	1,192
Paul Revere	1,105	Erie	109	Baton Rouge	285
Pioneer Valley	210	Freedom	392	Greater New Orleans Area	468
Taunton	169	Greater Pittsburgh*	476		
Worcester*	192	Joe Walker-Mon Valley	141	Mississippi	1,717
		Lehigh Valley	286	Golden Triangle	467
New Hampshire	880	Lt. Col. B. D. "Buzz" Wagner	122	Jackson	200
Amoskeag	339	Metropolitan Philadelphia*	377	John C. Stennis	1,050
Pease	541	Mifflin County*	117		
		Olmsted	402	Tennessee	2,080
Rhode Island	236	Pocono Northeast	211	Chattanooga	133
Metro Rhode Island	236	Steel Valley	99	Everett R. Cook	488
		Total Force	172	General Bruce K. Holloway	548
Vermont	286	York-Lancaster	271	General Dan F. Callahan	583
Burlington	286			H. H. Arnold Memorial	328
		NORTHWEST REGION	8,310		
NORTH CENTRAL REGION	3,425	John Lee		SOUTHEAST REGION	25,423
J. Robin Wohnsigl				Dr. Dan Callahan	
		Alaska	1,472		
Minnesota	1,293	Anchorage	1,088	Florida	13,527
General E. W. Rawlings	1,037	Fairbanks Midnight Sun	384	Cape Canaveral	1,572
Richard I. Bong	256			Central Florida	1,307
		Idaho	844	Citrus Belt	159
North Dakota	1,194	Boise Valley	565	Colonel H. M. "Bud" West	283
General David C. Jones	543	Magic Valley	98	Eglin	2,652
Happy Hooligan	167	Snake River Valley	181	Falcon	380
Red River Valley	484			Florida Gulf Coast	329
		Montana	734	Florida Highlands	140
South Dakota	938	Big Sky	627	Gainesville	173
Dacotah	271	Bozeman	107	General James R. McCarthy	333
Rushmore	667			General Nathan F. Twining	520
		Oregon	1,319	Gold Coast	420
NORTHEAST REGION	11,794	Eugene	329	Hurlburt	329
Eugene B. Goldenberg		Klamath Basin	142	Indian River	127
		Portland*	848	Jerry Waterman	1,186
New Jersey	3,489			John C. Meyer	204
Admiral Charles E. Rosendahl	151	Washington	3,941	John W. DeMilly, Jr.	291
Aerospace Founders	67	Greater Seattle	1,329	Miami	405
Atlantic City Area	201	Inland Empire	1,013	Morgan S. Tyler	246
Brig. Gen. Frederick W. Castle	193	Tacoma	1,599	Ocala	118
Garden State	20			On Wings of Eagles	165
Hangar One	157	ROCKY MOUNTAIN REGION	8,555	Panama City	1,178
High Point	86	William D. Croom, Jr.		Peace River	138
Hudson*	90			Southwest Florida	282
John Currie Memorial	39	Colorado	5,829	Spacecoast	102
Mercer County	230	Colorado Springs/Lance Sijan	3,396	St. Augustine	66
New Jersey Public Affairs	30	Flatirons	223	West Palm Beach	422
Passaic-Bergen*	264	General Robert E. Huyser	130		
Sal Capriglione	121	Longs Peak	241	Georgia	4,913
Teterboro-Bendix	35	Mel Harmon	118	Athens	151
Thomas B. McGuire, Jr.	1,334	Mile High	1,721	Atlanta	666
Tri-County	69			Cari Vinson Memorial	2,304
Union Morris	320	Utah	2,092	Chatahoocnee Valley	96
Wings	82	Ogden-Wasatch	825	Coosa Valley	64
		Salt Lake	483	Dobbins	846
New York	4,543	Ute-Rocky Mountain	784	Savannah	219
Albany-Hudson Valley*	422				

South Georgia	518	Columbia	494	Aggieland	187
Southeast Georgia	49	Ladewig-Shine Memorial	254	Alamo	6,237
North Carolina	3,796	Strom Thurmond	344	Austin	1,472
Blue Ridge	291	Swamp Fox	966	Concho	520
Cape Fear	137	SOUTHWEST REGION	25,405	Corpus Christi	159
Eastern Carolina	83	Bob Cantu		Dallas	1,248
First in Flight	45	New Mexico	3,098	Del Rio	325
Kitty Hawk	73	Albuquerque	1,673	Denton	283
Piedmont	455	Fran Parker	726	Fort Worth	2,478
Pope	978	Llano Estacado	699	Ghost Squadron	148
Roanoke Valley	35	Oklahoma	4,374	Heart of the Hills	191
Scott Berkeley	993	Altus	616	Lee Glasgow-Waco	298
Tarheel	418	Central Oklahoma (Gerrity)	2,497	Lubbock	518
Triad	288	Enid	775	Northeast Texas	346
Puerto Rico	188	Tulsa	486	Panhandle	176
San Juan	188	Texas	17,933	Paso Del Norte	201
South Carolina	2,999	Abilene	709	Permian Basin	142
Charleston	941			San Jacinto	1,335
				Wichita Falls	960

AFA's National Presidents

AFA's Board Chairmen

Pictured are Chairmen who never served as National President.



James H. Doolittle
(1946-47)



Thomas G. Lanphier, Jr.
(1947-48)



C. R. Smith
(1948-49)



Robert S. Johnson
(1949-51)



Harold C. Stuart
(1951-52)



Arthur F. Kelly
(1952-53)



Edward P. Curtis
(1946-47)



Carl A. Spaatz
(1950-51)



George C. Kenney
(1953-54)



John R. Alison, Jr.
(1954-55)



Gill Robb Wilson
(1955-56)



John P. Henebry
(1956-57)



Peter J. Schenk
(1957-59)



Howard T. Markey
(1959-60)



James M. Trail
(1958-59)



Julian B. Rosenthal
(1959-60)



Thos. F. Stack
(1960-61)



Joe Foss
(1961-62)



John B. Montgomery
(1962-63)



W. R. Lovelace II
(1963-64)



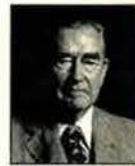
Jess Larson
(1964-67)



Robert W. Smart
(1967-69)



Jack B. Gross
(1963-64)



Daniel F. Callahan
(1979-81)



George D. Hardy
(1969-71)



Martin M. Ostrow
(1971-73)



Joe L. Shosid
(1973-75)



George M. Douglas
(1975-77)



Gerald V. Hasler
(1977-79)



Victor R. Kregel
(1979-81)



Edward A. Stearn
(1985-86)



John G. Brosky
(1981-82)



David L. Blankenship
(1982-84)



Martin H. Harris
(1984-86)



Sam E. Keith, Jr.
(1986-88)



Jack C. Price
(1988-90)



O. R. Crawford
(1990-92)



James M. McCoy
(1992-94)

AFA's First National Officers and Board of Directors

This panel of officers and directors acted temporarily until a representative group was democratically elected by membership at the first National Convention.

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 Everett Cook
 Reiland Quinn
 Forrest Vosler
 J. H. Whitney

Unit Reunions

C-7A Caribou Ass'n. October 13-16, 1994, in Nashville, Tenn. **Contact:** Nick Evanish, 210 48th St., Gulfport, MS 39507-4317. Phone: (601) 863-8688.

F-16 Pilots ("Viper Drivers"). September 29-30, 1994, at the Wigwam Resort, Phoenix, Ariz. **Contact:** Viper Driver Reunion Committee, 11345 W. Citrus Grove, Phoenix, AZ 85323. Phone: (602) 877-8132.

Glenn Miller AAF Band (Special). November 11, 1994 (rescheduled from March 5 because of the Los Angeles earthquake), Studio City, Calif. **Contacts:** Thomas Cochran, 424 E. 52d St., Apt. 6-G, New York, NY 10022. Calvin Beaugard, 10 E.

Del Mar Blvd., Pasadena, CA 91105. Phone: (818) 792-4911.

Luke AFB Cadet Class 1942-43. Seeking former members for a reunion October 6-9, 1994, in conjunction with the Confederate Air Force air show. **Contact:** Phillip Coady, 12935 Rio Oso Rd., Auburn, CA 95602-7502. Phone: (916) 269-2302.

National Explosive Ordnance Disposal Ass'n. October 5-8, 1994, in Colorado Springs, Colo. **Contact:** SMSgt. William D. Mitchell, USAF (Ret.), 6560 Delmonico Dr., Apt. #301, Colorado Springs, CO 80919. Phone: (719) 531-7983.

8th Attack Squadron, 3d Bomb Group (World War II). October 5-9, 1994, at the Grand Isle Hotel, Bossier City, La. **Contact:** Col. Andrew H. Weigel, USAF (Ret.), 2512 Fairmount St., Colorado Springs, CO 80909. Phone: (719) 632-8576.

20th Tactical Recon Squadron (CBI/World War II). October 12-16, 1994, at the Holiday Inn, Durango, Colo. **Contact:** Stanley Gawlik, 661 Woodland Dr., Tallmadge, OH 44278. Phone: (216) 633-5750.

23d Bomb Squadron. October 6-9, 1994, in Pigeon Forge, Tenn. **Contact:** Lindsey Boyd, 3904 24th Ave. W., Bradenton, FL 34205. Phone: (813) 746-5569.

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Unit Reunions

24th Combat Mapping Squadron. September 25–28, 1994, in Charleston, S. C. **Contacts:** John G. Wolfshorndl, 11791 Avenue 22, Chowchilla, CA 93610. Phone: (209) 665-3502 or (404) 373-2436 (Jack Sandow).

32d Troop Carrier Squadron, 314th Troop Carrier Group, 52d Troop Carrier Wing (World War II). October 5–9, 1994, in Williamsburg, Va. **Contact:** Bob Shawn, 12707 Garberry Ct., Herndon, VA 22070. Phone: (703) 435-3142.

Cadet Classes 54-A, -B, and -C. October 1994, in Kinston, N. C. **Contact:** Russell D. Tucker, 130 Autumnwood Dr., Saraland, AL 36571. Phone: (205) 675-4380.

Undergraduate Pilot Training Class 70-02 (Randolph AFB, Tex.). September 30–October 2, 1994, at the Sheraton-Gunter Hotel, San Antonio, Tex. **Contact:** Steve McPhail, 2411 Prairie Creek Dr., Richardson, TX 75080. Phone: (214) 238-0780.

76th Troop Carrier Squadron, 435th Troop Carrier Group (World War II). September 22–25, 1994, at the Hilton–Norfolk Airport, Norfolk, Va. **Contact:** Al Forbes, 1614-B Berwick Ct., Palm Harbor, FL 34684. Phone: (813) 785-6075.

90th Bomb Squadron (Korea). October 11–13, 1994, at the Imperial Palace Hotel/Casino, Las Vegas, Nev. **Contact:** Gene Hogan, 960 S. E. 16th, Hillsboro, OR 97123. Phone: (503) 648-2136 or (503) 648-7562.

318th Fighter Squadron (Thule, Greenland, 1953–54). October 6–9, 1994, fortieth-anniversary reunion, at the Radisson Inn–Airport, Colorado Springs, Colo. **Contact:** Larry Green, 1617-AW, Cheyenne Rd., Colorado Springs, CO 80906. Phone: (719) 473-1994.

Mall unit reunion notices well in advance of the event to "Unit Reunions," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

330th Bomb Group. October 20–23, 1994, at the Holiday Inn–Palo Verde, Tucson, Ariz. **Contact:** Robert C. Flischel, 413 E. Center, Germantown, OH 45327. Phone: (513) 855-7946.

342d Fighter Squadron, 348th Fighter Group, 5th Air Force (World War II). September 21–25, 1994, at the Marines Memorial Club, San Francisco, Calif. **Contact:** Frank Timmers, 379 Castello Rd., Lafayette, CA 94549. Phone: (510) 283-8864.

376th Air Refueling Squadron (KC-97s, 1953–65). October 7–9, 1994, at the Grand Isle Hotel, Bossier City, La. **Contact:** 376th Air Refueling Squadron Reunion, P. O. Box 376, Barksdale AFB, LA 71110.

441st Troop Carrier Group. October 6–8, 1994, in Nashville, Tenn. **Contact:** Jack Ramer, P. O. Box 159360, Nashville, TN 37215. Phone: (615) 297-3566.

458th Service Squadron, 318th Service Group, (World War II, 1943–45). October 6–8, 1994, in Dayton, Ohio. **Contacts:** G. Paul Gerbracht, 2114 W. 29th St., Erie, PA 16508. Phone: (814) 864-2433. Arthur Hutchinson, 1128 Autumn St., Roseville, MN 55113. Phone: (612) 488-4829.

433d Fighter-Interceptor Squadron (Truax Field, Wis./Ladd AFB, Alaska, 1953–57). Seeking anyone interested in a reunion in Middlesboro, Ky. **Contacts:** Dave and Pat Eby, 3206 Martin Blvd., Wichita Falls, TX 76308. Phone: (817) 766-2523.

524th Fighter Squadron, 27th Fighter Group (World War II). Seeking information on 524th Fighter Squadron reunions. **Contact:** B. L. Williams, 20641 S. Augusta Ct., Sun Lakes, AZ 85248.

Bulletin Board

Seeking contact with pilots who flew **F-16s** or **F-4Gs** for the 35th Tactical Fighter Wing and 561st Tactical Fighter Squadron during Operation Desert Shield. **Contact:** Monica L. Koepfel, 75 Strauss Dr., Suite #104, Winnipeg, Manitoba R3J 3R6, Canada.

Collector seeking **FB-111** cloth name tags and color photos or copies of **FB-111** scarves from Pease AFB, N. H., and Plattsburgh AFB, N. Y. Also seeking stickers and scarves from the 380th and 509th Bomb Wings. **Contact:** Curtis J. Lenz, 32 June St., Nashua, N. H. 03060-5345.

Seeking the whereabouts of **Samuel Bradley**, who served 1940-41 in Cheshire, UK, with 71st RAF Sealand, 96th RAF Cranage, or OTU Harwarden. **Contact:** Valerie Kadwill, c/o Tenterden Post Office, 2 Manor Row, High St., Tenterden, Kent TN30 6HP, UK.

Seeking operational test and evaluation, exercise, mission, deployment, project, or program **patches** having the names Busy, Coronet, or Giant in them. **Contact:** Martin Pratt, 144 Millway Rd., Andover, Hampshire SP10 3AY, UK.

Author seeking **photos** or **manufacturer's artist concepts** of the B-59, B-74, F-103, F-109, C-136, C-138, C-139, V-14, and V-16. **Contact:** Bill Yenne, Box 460313, San Francisco, CA 94146.

Seeking the whereabouts of the crew members and passengers of a **DC-47** that flew from **Sicily, Italy**, in November 1943 and landed in **Albania** by mistake. **Contact:** John A. Graham, The Gatehouse, Laburnum Farm Close, Ness, South Wirral, Cheshire, UK.

Seeking **pen pals**. **Contact:** Orange Ribbon/Friends of the Military, c/o Mary Schanz, 969 Goshen Pike, Apt. 146, Milford, OH 45150-5902.

Seeking information on **Nolan Holland**, a technical sergeant at Burtonwood AB, UK, 1951-54, or anyone interested in a reunion of airborne or ground radar personnel stationed at Burtonwood then. **Contact:** Roger H. Cockrell, 17 Majestic Oaks Dr., Signal Mountain, TN 37377.

Former photo lab airman at **Taegu and Seoul, South Korea**, 67th Reconnaissance Technical Squadron, will swap photos or videos of personnel, planes, or local scenes. **Contact:** Leon J. Welk, 5908 88th St., N. E., Marysville, WA 98270.

Seeking information on the **19th Air Support Operations Squadron's** history, tactical air control party support to the 101st Airborne Division in World War II and Vietnam. **Capt. James E. Parker**, and radio call sign "Antidote." **Contact:** Lt. Col. David B. Beatty, Det. 5, 18th Air Support Gp., 2301 Indiana Ave., Fort Campbell, KY 42223-5351.

Collector seeks new or old **military airlift photos** or memorabilia. **Contact:** Danny Gast, 9113 Margery Ave., Cal City, CA 93505.

Collector seeks **patches** for fighter, tactical fighter, fighter-interceptor, defense system evaluation, and combat crew training squadrons. **Contact:** MSgt. David Petzoldt, P. O. Box 248, Niceville, FL 32588-0113.

For the 2d Bombardment Association, seeking veterans of the **2d Bomb Group** or **2d Bomb Wing**. **Contact:** Kemp F. Martin, 806 Oak Valley Dr., Houston, TX 77024.

For a newsletter and reunion, seeking former members of the **433d Tactical Fighter Squadron**, 8th Tactical Fighter Wing, Vietnam War era, 1966-68. **Contact:** MSgt. Robert F. Clinton, 3885 Camellia Dr., San Bernardino, CA 92404.

Seeking contact with friends or family of **Theodore H. Bacheneheimer**, 504th Parachute Regiment, 82d Airborne Division, killed October 22, 1944, in the Netherlands. **Contact:** Wil Cornelissen, Fluessen 16, 8032 MJ Zwolle, the Netherlands.

Seeking the whereabouts of **Jerry Knuckles** (or Nichols), who was stationed at Mito Firing Range, Yokota AB, Japan, in 1969 or 1970. He returned to the US in September 1970. **Contact:** Kieko Hitoki, 1-105 Sakuragaoka 359-6 Miwa, Mito-shi, Ibaraki-ken, Japan.

Seeking contact with **Karen Mackjust** from Saginaw, Mich., whose last known rank was Airman First Class at Offutt AFB, Neb., in 1987. **Contact:** David L. Samu, P. O. Box 492-#196218, Ionia, MI 48846.

For an 11th Air Force reunion, seeking contact with **John E. Pross**, pilot of a B-25 crew (77th Bomb Squadron) stationed at Attu, Alaska, 1944-45. **Contact:** Dale R. Luttmann, 1209 S. Despelder St., Apt. #5, Grand Haven, MI 49417.

Historian seeks photos and information from 8th Tactical Fighter Wing, 18th Tactical Fighter Wing, 6441st Tactical Fighter Wing, and 41st Air Division in Japan and Okinawa for a history of the **F-105 Thunderchief**. **Contact:** Theo W. van Gefen, 598 Romerostraat, 3573 AW Utrecht, the Netherlands.

Seeking the whereabouts of **C. L. Kemp, J. T. Palmer, A. C. Schembri**, and **M. J. Madsen**, who crashed in Poland March 18, 1945. **Contact:** Richard R. Scroton, 2 Boland Rd., Apalachin, NY 13732.

Collector seeks **AAF memorabilia** from World War I through World II, especially leather flight jackets, uniforms, flight equipment, and photo albums. **Contact:** Jon Cerar, 425 John St., Carlinville, IL 62626.

Seeking the whereabouts of **Lt. George R. Bishop** and **Sgt. Clayton N. Carter** of the 878th Bomb Squadron, 499th Bomb Group, 73d Bomb Wing. **Contact:** Col. Arthur W. Dern, USAF (Ret.), 37 Coes Hill Rd., Southwick, MA 01077.

Seeking a pair of **winged props**, the insignia worn on lapels or shirt collars of aviation cadet blouses during World War II. **Contact:** Col. William H. Cox, USAF (Ret.), 441 Sandstone Dr., Vacaville, CA 95688.

Seeking contact with **David B. Waldrop III**, formerly of the 388th Tactical Fighter Wing and an F-105 pilot. **Contact:** Norman E. Gaines, Jr., 28 Fieldstone Dr., Apt. 11C, Hartsdale, NY 10530.

Collector seeks patches from the **341st Missile Wing** and the 10th, 12th, and 490th MISs from Malmstrom AFB, Mont. **Contact:** Jimmy Fallon, 3025 S. E. Burton St., Topeka, KS 66605-2100.

Seeking information on **Gordon O. Ault**, whose hometown was Oakland, Calif., and who served in the China-Burma-India theatre as a radar operator during World War II. **Contact:** Maj. William R. McGuire, USAF (Ret.), 659 Ensenada Ave., Berkeley, CA 94707.

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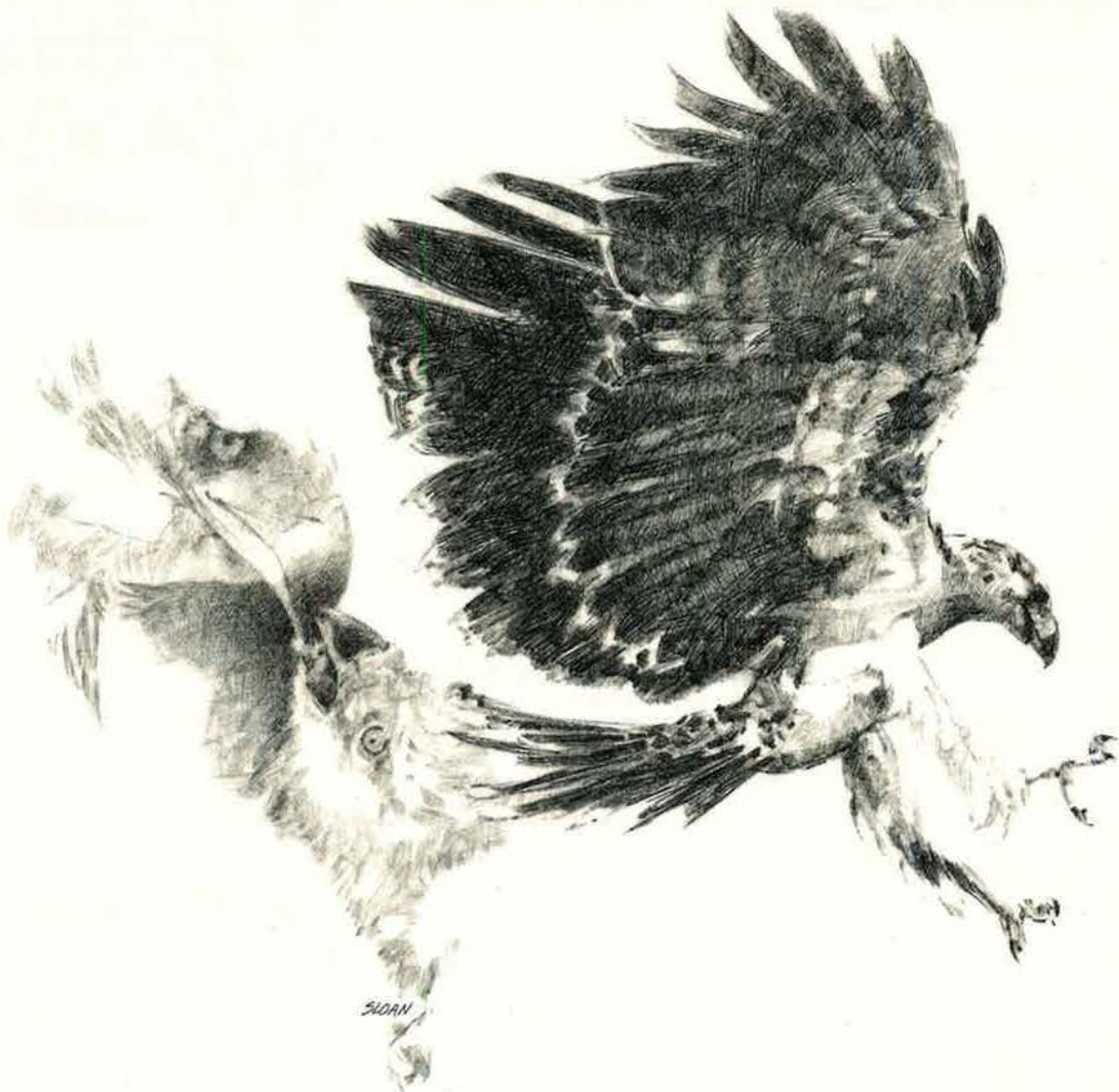
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Bulletin Board

Seeking the whereabouts of **Roland Hall**, a USAF officer whose last known address was San Jose, Calif. His wife is named Penny, and his mother lived in Van Nuys, Calif. **Contact:** Betty M. Jacobs, 23 Nelson St., Low Moor, Clitheroe, Lancashire BB7 2NQ, UK.

Seeking the whereabouts of **William Dodd**, who was stationed at RAF Upper Heyford, UK, and married Margaret Smith there in the 1960s. He was later stationed in South Dakota, Texas, the Philippines, and California, where he remarried. **Contact:** Kathryn Stevens, 514 Morrison Dr., Clarksville, TN 37042.

Seeking the whereabouts of **Andrew Fisher**, originally from Pennsylvania, who was based in Bedfordshire and Norfolk, UK, 1957-58. **Contact:** Claire Tindall, 29 New Brighton Rd., Sychdyn, Mold., Clwyd CH7 6EF, UK.

For a reunion of Keesler AFB, Miss., personnel, seeking the whereabouts of **Norman Hipsher, John Karner, Herb Lacy, Charles Merkel, Walter Stone, and Thorny Thornhill**. **Contact:** Perry K. Gerhart, 1456 Klines Mill Rd., Breinigsville, PA 18031.

Seeking information on **1st Lt. Thomas C. Lafferty**, who was shot down over North Korea January 31, 1952. His name appeared on a list of Korean War POWs likely to have been taken to the Soviet Union. **Contact:** Linda VanderLas, 20515 108th St., Ct. E., Bonney Lake, WA 98390.

Seeking information on **Douglas Bertram Barker**, who enlisted in the Royal Canadian Air Force in 1941, served in the UK, and transferred as a pilot to USAAF in 1943. **Contact:** S. Ronald Barnette, 1065 E. 26th St., Hialeah, FL 33013.

For a book on Ninth Air Force, seeking original color slides of personnel, aircraft, activities, or scenes from **358th Fighter Group** veterans. **Contact:** Lt. Col. Robert W. Bowen, USAF (Ret.), 215 Mockingbird Ct., Pinehurst, NC 28374.

For an article on World War II, seeking the whereabouts of **1st Lt. Ellsworth L. Dougherty, 2d Lt. Andrew McQuire, TSgt. Dwayne Young, SSgt. Andrew McCay, and SSgt. Lawrence Burger**. **Contact:** Charles A. Natalie, 2309 Heatherstone Rd., Edmond, OK 73034.

Collector seeks **B-52 squadron and wing patches**, particularly for units inactivated before the mid-1970s. Also seeking patches from B-52-related systems, weapons, and events. **Contact:** Jon D. Drieling, 2456 Graylake Ct., Dublin, OH 43017.

Author seeks **aviation-related humor**—jokes, anecdotes, cartoons, poems, or photos. **Contact:** Lt. Col. Larry V. Rider, USAF (Ret.), 3104 E. Camelback Rd., Suite 548, Phoenix, AZ 85016-4502.

Seeking contact with **Edwin R. Decker, John F. Gibson, Robert Van Pelt**, and members of the 1901st Engineering Aviation Battalion (World War II) who constructed air fields at Kadena, Japan, and Kimpo, Korea. **Contact:** William J. Curwood, 1504 Pine Ave., Sylvan Shores, Lake Placid, FL 33852.

Seeking the whereabouts of **SMSgt. Dean Harper, Michael Burns, and Lawrence Stuart**, who were stationed with the 5010th Combat Support Group, Eielson AFB, Alaska, 1965-67. **Contact:** Larry D. Sossbey, 921 E. Mills Ave., Indianapolis, IN 46227.

Seeking the whereabouts of **Bennie Parker**, originally from Chicago, who was stationed at Whittington, Shropshire, UK, 1944-45. **Contact:**

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Seeking contact with **Lt. Cmdr. Henry S. O'Connor**, based at RAF Macrihanish, Scotland, in 1968, and **Sgt. Richard O'Connor**, possibly a Marine, who served in Vietnam in 1968. **Contact:** Alan Cuthbertson, 8 Larchfield Grove, Wishaw, Scotland ML2 8TU, UK.

Seeking the whereabouts of **Col. M. C. Davenport, Lt. James G. Antrim, T5 Shepard J. Wilder, and Paul Coley**, who were associated with the 306th Station Hospital, Appleton, Cheshire, UK, in 1944-45. **Contact:** John Wynne, 7615 S. E. 40th St., Mercer Island, WA 98040.

Seeking biographies of **airlifter/tanker crews** for The Airlifter/Tanker Association's history book. **Contact:** Douglas W. Sikes, P. O. Box 3101, Paducah, KY 42002-3101.

Seeking pilot **Capt. Ned W. Richardson**, navigator **Lt. Benjamin J. Smith**, and waist gunner **Sgt. Eugene Squires**, of the 335th Bomb Squadron, 95th Bomb Group, 8th Air Force (World War II). **Contact:** Anthony Molino, R. D. 1, Box 89, Jeffersonville, NY 12748.

Restorer seeking whereabouts of **Lt. Kenneth P. Allmond**, pilot of a captured German aircraft forced to land in Gallatin, Tenn., July 24, 1946. Also seeking contact with anyone who served in Tunisia and has **Henschel Hs 129** souvenirs. **Contact:** Martin Mednis, 10 Billa Rd., Bangor, New South Wales 2234, Australia.

Seeking information on the **XB-42**, the **Fairey Gannet** carrier aircraft, and the **ACT23X** attack cargo transport. **Contact:** Neal Cosentino, ATA14S/ACT23X Projects, Tampa International Airport, P. O. Box 26414, Tampa, FL 33623-6414.

Bulletin Board

Seeking **gaggle patch** from the 61st Fighter Squadron, 56th Fighter Group, MacDill AFB, Fla. **Contact:** Bill McCarthy, 212 Anchorage St., Fort Myers Beach, FL 33931.

Seeking "Airlift Lafts," a booklet of cartoons about the Berlin Airlift by Jake Shuffert. **Contact:** MSgt. Harry M. Kennell, USAF (Ret.), 2 El Sereno Dr., Colorado Springs, CO 80906.

Seeking information on **radar countermeasures** operations during World War II from anyone who participated in aircraft, ship, ground, or intelligence activities. **Contact:** Arne Martinsen, 1 Coachlight Dr., Little Rock, AR 72207-6435.

Modeler seeks information on and photos of the **Convair NB-36H Crusader** and chase aircraft, including C-119 troop carriers. **Contact:** Marc Williams, 17705 Breckenridge Ct., Granger, IN 46530.

Researcher seeks contact with members of the 345th Fighter Squadron, 350th Fighter Group, 12th Air Force, and **Capt. Marius A. Bugnand, Jr., 1st Lt. W. A. Riza, and 2d Lt. Norbert J. Gorski.** **Contact:** David B. Lindsay, P. O. Box 342, San Pedro, CA 90733.

For a unit history, seeking historical information on and photos of the **7th Air Commando and 7th Special Operations Squadrons, 1964-94.** **Contact:** Capt. Patrick G. Welch, USAF, PSC #47, Box 535, APO AE 09470.

If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Letters should be brief and typewritten; we reserve the right to condense them as necessary. We cannot acknowledge receipt of letters. Unsigned letters, items or services for sale or otherwise intended to bring in money, and photographs will not be used or returned.—THE EDITORS

Seeking contact with air crew members who served with the **488th or 381st Bomb Squadrons** between November 1944 and July 1945. Particularly interested in those who flew with pilots George Miller, Neal Hailmark, Marable, or Browning. **Contact:** Gerald M. Rosenthal, 17261 La Rinconada Dr., Los Gatos, CA 94030.

Seeking Air Force personnel who served temporary duty with Army engineering units in World War II, particularly the **3217th Engineer Fire Fighting Company, Portland AAB, Ore.** **Contact:** William L. Case, 2544 Glenn St., Bettendorf, IA 52722.

Seeking the whereabouts of **Charles E. Murphy** of Syracuse, N. Y., who was stationed at Midland AAF, Tex., and Biggs Field, Tex. **Contact:** Earl Miner, 1473 W. Via de la Gloria, Green Valley, AZ 85614.

Seeking historical and operational information on **Saglek AFS, Labrador, Canada**, particularly on a B-26 crash in December 1942. **Contact:** Maj. Rex Harris, USAF (Ret.), 130 Leonard Cir., Camden, SC 29020.

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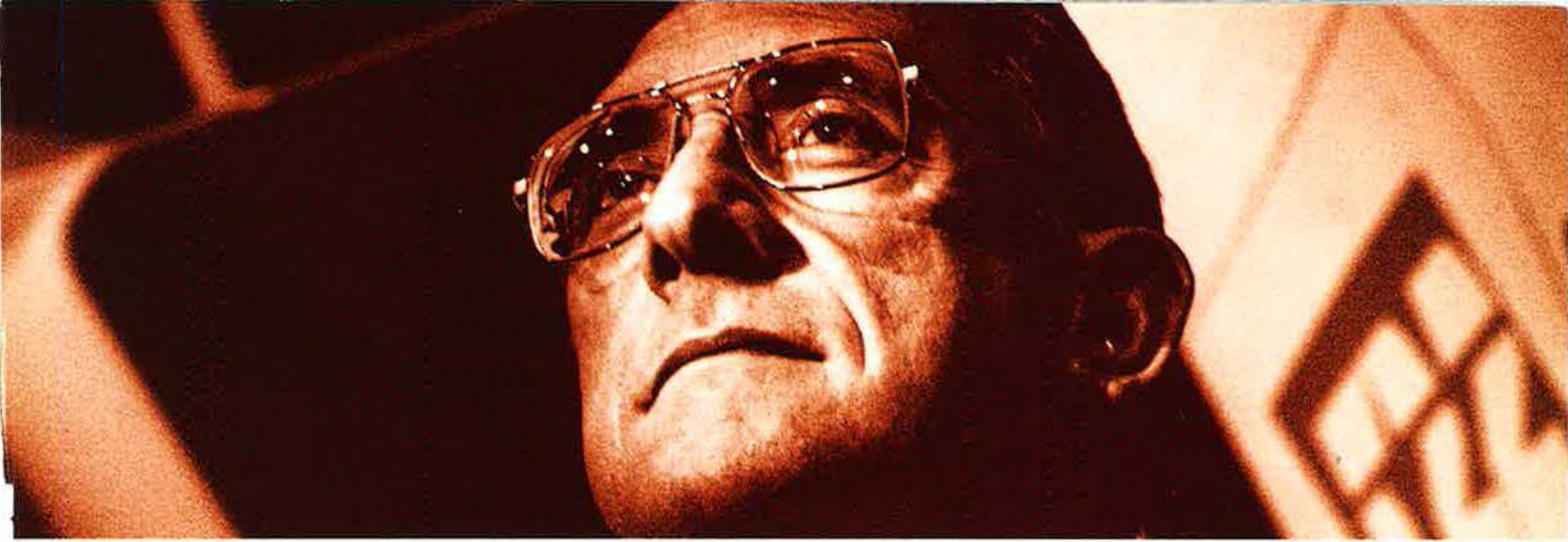
A Hot Seat in the Cold War



Memorabilia courtesy Air Force Museum, Wright-Patterson AFB, Ohio, Diana Bachert, David W. Menard, and Joe Skinner

This is the bombardier's station in the nose section of a B-36 Peacemaker. Initially designed in 1941 as a bomber capable of striking Germany from bases in the US, the Convair B-36 did not make its maiden flight until 1946, just in time for the Cold War against a new adversary, the Soviet Union. The B-36 had a 162-foot fuselage, a

wingspan of 230 feet, nineteen-foot pusher propellers, and fuel tanks for 19,976 gallons of fuel. At 4,772 square feet, it was the largest airplane in the world. Proponents of the B-36 point out that it never dropped a bomb in anger and credit its intimidating capabilities with helping to keep the Cold War from becoming hot.



Micky Blackwell, President, Lockheed Aeronautical Systems Company

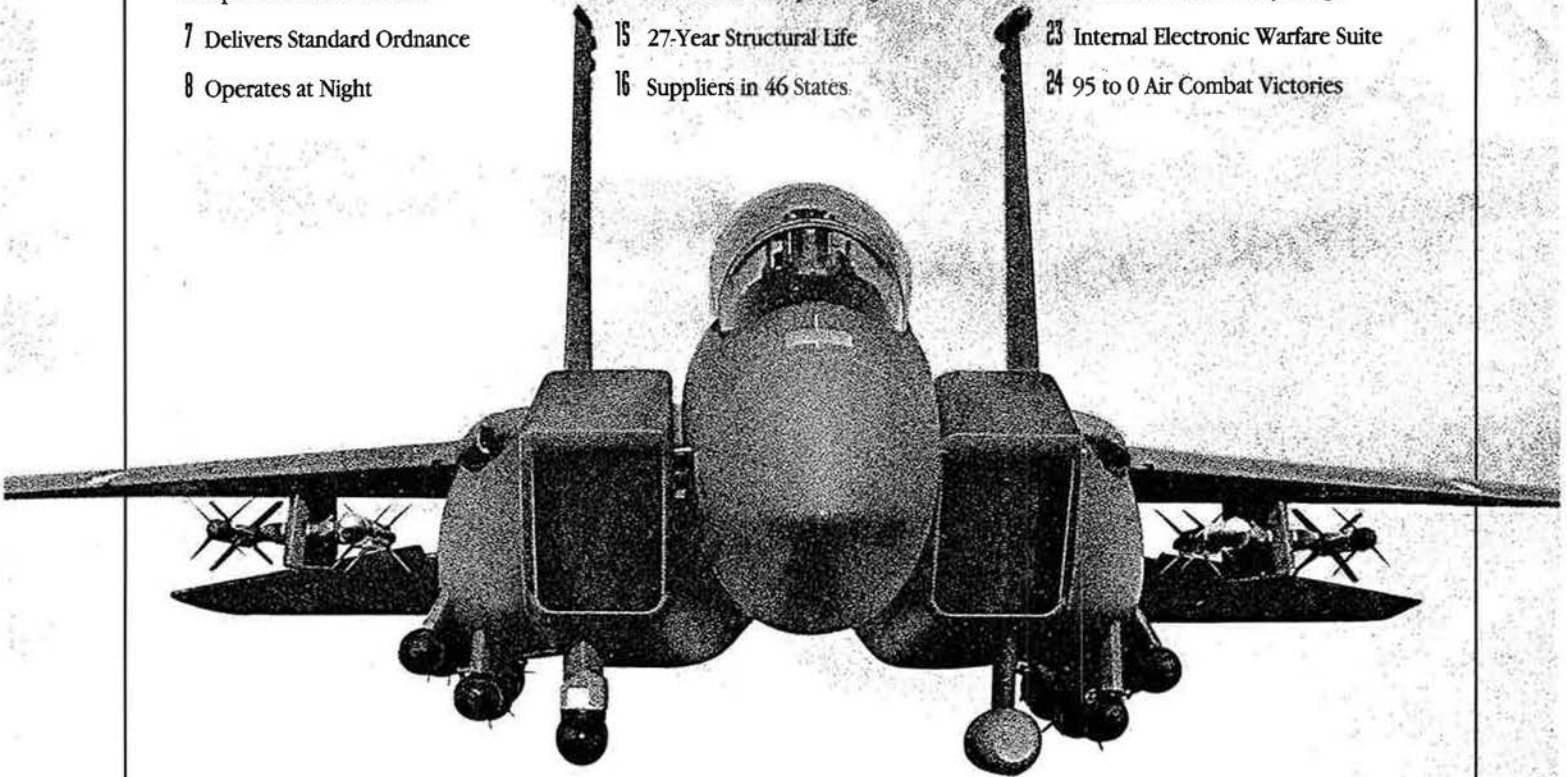
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