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AIR FORCE

PUBLISHED BY THE AIR FORCE ASSOCIATION

MAGAZINE

A front-facing view of an F-117A Stealth Fighter on a runway. The aircraft is dark and angular, with its canopy open. The landing gear is visible, and the number '813' is on the nose gear door. The background shows a clear sky and a runway with yellow markings.

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MAGAZINE

November 1992, Vol. 75, No. 11

- 6 Letters
- 10 Chart Page
- 13 Aerospace World
- 18 Index to Advertisers
- 21 Senior Staff Changes
- 79 Valor
- 80 This Is AFA
- 82 Unit Reunions
- 82 Bulletin Board
- 88 There I Was . . .

4 **Editorial: Global Change and National Security**

The 1992-93 AFA Statement of Policy, adopted by delegates to AFA's National Convention.

22 **How the Skunk Works Fielded Stealth**

By David J. Lynch
Stealth was achieved not because of any one technological breakthrough but by attention to tiny details.

30 **The Ton-Mile Gap**

By Peter Grier
The US is short almost sixteen percent of the airlift it will need by 1999.

34 **Russia Steals the Show at Farnborough**

By Frank Oliveri
Eager for exports, Russian officials declare everything in the air up for sale.

40 **The Wall-to-Wall Training Review**

By Bruce D. Callander
General McPeak now is turning his attention to the way USAF trains.

46 **India at the Crossroads**

By Richard Mackenzie
The world's fourth largest military lost its superpower patron with the demise of the Soviet Union.

50 **Roving Sands**

A photo feature of a Desert Storm-type joint training exercise in Roswell, N. M.

Convention 1992

52 **Industry's New "High-Low Mix"**

By Ramon Lopez
Exhibitors at AFA's Convention emphasized high value for low cost and risk.

61 **AFA Week in Washington**

By Tamar A. Mehuron
AFA's forty-sixth annual Convention honored the past and looked toward the future.



22

72 **Force Leaders Look Ahead**

By James W. Canan
US forces of the future will be smaller but powerful and flexible enough to meet a range of as-yet-unknown threats.

74 **The First Boeing**

By Terry Gwynn-Jones
Its first commercial flight awed the Maoris in New Zealand.

78 **The Von Kármán Scholars**

By Arthur C. Hyland
Ten ROTC seniors received Aerospace Education Foundation grants.



About the cover: Armed and ready for its next training mission, the F-117 is a menacing sight in this nose-on view. To learn how the world's first stealthy fighter was developed, see p. 22. Cover photo © Randy Jolly/Arms Communications.



34

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Editorial

The 1992-93 Statement of Policy, adopted by delegates to AFA's National Convention on September 14, 1992

Global Change and National Security

WE STAND at a great threshold of history. With the breakup of the Warsaw Pact and the collapse of the Soviet Union, a new world order has begun to take form. The end result, however, is not yet certain, nor is it predestined.

The United States has emerged from the cold war as the strongest nation on Earth. The Persian Gulf conflict confirmed our capability to project military power to safeguard our interests and fulfill our responsibilities. Furthermore, the principles that we defend have become both an inspiration and an example for a world in transition.

The new world order begins auspiciously. A spirit of freedom thrives where freedom has been suppressed for generations. The danger of global war is less today than at any time in the past fifty years. Nations East and West are committed to major reductions in their military forces. The United States and Russia have agreed to eliminate the majority of their strategic nuclear warheads.

These conditions, unfortunately, do not ensure peace and stability. In fact, instability is a leading by-product of the changes that produced the new world order. The prospect of regional conflict, perhaps with global implications, is extremely high. Political reform is still fragile, and many of the changes have shallow roots.

The United States is struggling to define its role in the new world order. That entails difficult decisions about policies, programs, and the allocation of resources. It is generally acknowledged that we cannot hold blindly to the approaches of the past. It is not equally recognized—although it should be—that we cannot make assumptions blindly about the future. The measure of our adjustment to change will ultimately be whether we establish strategies based on recognition of realities, risks, and prudent opportunities.

In this regard, we support the flexible approach prescribed by the National Military Strategy of the United States. We agree with the careful steps it proposes, leading gradually

toward a smaller but highly capable Base Force for the years ahead. We wish, particularly, to commend the US Air Force, which has shown extraordinary initiative and foresight in restructuring itself to meet the requisites of national security.

The prospect of regional conflict, perhaps with global implications, is extremely high.

We are deeply concerned by the demands of some political factions and special interests for radically deeper reductions and for defense funding lower than the austere 3.7 percent of Gross National Product projected by 1997. The present net assessment of the Joint Chiefs of Staff is that the defense program as forecast provides "minimal capability" to meet "low to moderate risk." We do not believe that an informed electorate would wish its government to materially diminish the capability from that level or that it incur any greater degree of risk. We invite others to join us in ensuring that the public understands the hidden consequences of such precipitous action.

We further believe that the performance of US forces in the Gulf War established a new standard of public expectation. In any future conflict, the armed forces will be expected to prevail quickly, decisively, and with few casualties. To enable our forces to achieve that result, we are obliged to ensure that defense programs and budgets are adequate to their requirements.

We concur, basically, with the popular depiction of the United States

as the world's only remaining superpower. This status derives from diplomatic as well as military instruments of power, and it has economic and ideological dimensions. It is important, however, to remember that other nations continue to possess significant military power. In some cases, that power is increasing. In certain instances or aspects, it may be equal to or greater than our own. Russia, for example, estimates that its armed forces will number 2.1 million by the end of 1995. The US plans a force level of 1.6 million at that time.

Most nations today possess at least some modern military technology, and we must expect that in the passage of time more of them will acquire weapons of mass destruction. As borders shift, interests change, and different balances of power evolve, the range of potential threats to the new world order will be enormous.

Schemes for the US to retreat from world leadership are neither wise nor realistic. We must remain an international power first of all to protect our own security and interests. Although we should expect—indeed insist—that our allies and other nations bear a fair share of the burden of global security, the leadership role is one that we cannot and should not seek to avoid.

Our specific interest is in the armed forces, and especially in the air forces, that the US will field to defend the nation and its stake in the new world order. Our forces must be adequate to deter war across the spectrum of conflict and, when need be, to conduct decisive military operations in support of national strategy.

The Air Force Association is proud of its relationship with the US Air Force. Our belief in airpower was upheld by the fact that it was the decisive factor in the nation's most recent conflict. We restate, however, our long-held conviction that a sufficient defense posture must include a balanced mix of mutually supportive land, sea, and air forces.

We are encouraged by the impending reduction in nuclear weapons, but we believe the nation still requires a

significant residual capability in all three legs of the strategic Triad of manned bombers, landbased missiles, and seabased missiles. In our judgment, the United States will not long maintain the relative combat advantages it now holds without continued improvements to its long-range power projection forces, including fighter and bomber forces. In at least two areas—space and airlift—we believe force requirements for the future will be even greater than they have been in the past.

It is imperative that the smaller US forces of the future have every edge that improved technology can give them. In addition to sustained modernization of major weapon systems, the missions ahead will require the development of increased capabilities in such areas as battlefield surveillance, targeting, and precision strike.

Force structure is but one element in military capability. When reductions are of the magnitude now planned, however, force size becomes an increasingly important factor. Between 1987 and 1997, the Department of Defense will lose more than one million people from the

ranks of its active-duty, Guard, Reserve, and civilian components. The active-duty Air Force will drop by twenty-nine percent.

We understand the reasons for the drawdown and recognize that it is a necessary element in the regeneration of forces for the future. We share, however, in the anguish the reductions cause to so many individuals who have served the nation so well. These departing veterans take with them a wealth of experience that the force could not replace easily or soon, should the need arise.

A similar phenomenon is occurring in the defense industry, where firms are releasing workers, closing plants, and turning to other markets. The defense industrial base is disintegrating, and it, like the military force structure, would be difficult if not impossible to replace.

For all of these reasons, we declare our opposition to the shameful and recurring ritual in which each successive defense cut is met instantly with the demand for more and deeper cuts. Defense reductions are touted as a painless means to resolve the federal deficit and fund all manner of spending initiatives.

The facts are these: If current defense outlays were reduced to zero, a deficit of \$142.4 billion would still remain. If defense budgets continue to fall by annual decrements without regard to consequences, our capabilities will decline and our risks will increase. The probability will diminish that our armed forces can prevail in combat quickly, decisively, and with few casualties. A weakened defense posture might also encourage military challenges that we would not otherwise confront.

The Air Force Association warns its members and all others interested in the security of their nation to beware of those who make easy promises of a large peace dividend and offer unduly optimistic assumptions about the future.

The new world order will not be shaped by the actions of the United States alone. We must, however, accept the leadership role in which circumstances have placed us and meet it responsibly. We can be a powerful influence for peace and stability and at the same time maintain a reasonable measure of control over our own security and destiny. We cannot afford to do less. ■



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Letters

Challenging Nunn

"Nunn's Challenge" [*Capitol Hill*, "September 1992, p. 14] against four separate air forces and other service duplications may return us to the days when real service rivalry flourished. Sen. Sam Nunn's predecessors, fellow Georgian military committee potentates Rep. Carl Vinson, chairman of the House Armed Services Committee, and Sen. Richard Russell, chairman of the Senate Armed Services Committee, in league with the Navy and Marines, shaped our present Pentagon Puzzle Palace.

Navy battle groups tote airplanes about the world on carriers the size of Rhode Island, hoping to make large, meaningful detonations somewhere but producing little bang for the buck. Is this a cost-effective way to employ what we used to call "airpower"?

Nunn follows his predecessors by assuring the Navy a prime air role in providing standoff jamming and perhaps tactical intelligence assignments to carrier planes. The Air Force couldn't move without them.

With the Air Force and Army suffering the deep cuts and Senator Nunn favoring the Navy, what happens to my retirement checks when USAF is abolished?

Lt. Col. Robert Farley,
USAF (Ret.)
Carmel, Calif.

Air Commandos' Successors

It was so gratifying to note that the list of major commands included Air Force Special Operations Command [*Photochart of USAF Leadership*, "September 1992, p. 80]. As a former commanding officer of the 1st Air Commando Wing at Hurlburt Field, Fla., and the first commander of the 14th Air Commando Wing at Nha Trang, South Vietnam, I feel that inclusion of AFSOC represents a great change in recognition of the role such a force can play in today's world.

AFSOC's major command status stands in quite a contrast to my situation in 1966, when I briefed the newly assigned 7th Air Force commander, Lt. Gen. William M. Momyer, about air commandos' capabilities. Instead of

being receptive, he curtly informed me that he was going to "educate you guys back into the Air Force." Never once during my thirteen-month tour did he solicit advice or even comments regarding the operational capabilities of the 14th ACW. We were tolerated, but that was about it—except for our Sandys, a very esteemed portion of the wing.

In a one-on-one departure debriefing in his office, General Momyer cautioned me not to defend or promote air commando capability unduly while in my prospective assignment as Chief, Special Warfare Division, Hq. USAF Plans Directorate, since to do so would obviously conflict with his concept of an all-jet Air Force.

On arrival in the Pentagon, I was informed in no uncertain terms that I would risk being fired if I even mentioned the word "helicopter" because the effort then was to negotiate the transfer of all of our helicopters to the Army.

It was during that time that we lost the "Air Commando" appellation—a meaningful name, dear to all those from World War II to the Vietnam era who took part in the "anytime, anywhere" portion of the Air Force. Today, although the Air Commando Association chooses to retain the revered name, I am sure all of us are pleased to note the recognition and force-structure capabilities provided to our successors in Air Force Special Operations Command.

Col. Gordon F. Bradburn,
USAF (Ret.)
Catharpin, Va.

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

Photochart Error

The AFMC organization that has been in Battle Creek, Mich., for sixteen years, doing ninety-nine percent of all the cataloging and standardization for the Air Force, was misidentified in the photochart. The correct name (since 1976) is the Cataloging and Standardization Center.

Our work force of 400 individuals is a proud AFMC partner in building the world's most respected air and space force.

E. Glenn Holmwall
Battle Creek, Mich.

Wing Commanders Omitted

I look forward each month to the delivery of AIR FORCE Magazine. I was especially excited about the September 1992 issue because I knew it would contain a lot of useful information about the reorganization of the Air Force. My excitement was short-lived. In the "Directory of Wing Commanders" [p. 55], only two wings and their commanders were listed under Air Force Materiel Command. The 3246th Test Wing at Eglin AFB, Fla., under the command of Col. Elton T. Pollock, and the 6510th Test Wing, Edwards AFB, Calif. [now the 412th Test Wing], under the command of Col. Richard L. Engel, were not listed. These two organizations are crucial to the mission of AFMC and the Air Force. As a proud member of the 3246th Test Wing, I felt slighted that my wing wasn't included. I'm sure the men and women of the 6510th felt the same. My biggest disappointment was in seeing such a major mistake in such a prestigious and high-quality magazine.

CMSgt. Donald E. Tipton,
USAF
Eglin AFB, Fla.

■ *We regret the errors.*—THE EDITORS

USAF's Glass Ceiling

Look at the "Photochart of USAF Leadership," especially the pictures and the names of the leaders of the commands and agencies, and ask yourself if the Air Force has minority personnel and women in its ranks. How disgusting that in 1992, this photo-



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Letters

chart is no different from one we might have seen in the 1950s, before the Air Force began to recruit minorities in the numbers now on board.

USAF leadership had best wise up. In its zeal to duplicate industry's Total Quality Management program, it also apparently decided to ensure that the "glass ceiling syndrome" would prevail.

There will surely be more women and minority members in the new Congress, and, sooner or later, some of them are bound to start asking some hard questions, just as Senator Nunn has engaged the services over the duplication issue. . . .

Col. Ruth Anderson,
USAF (Ret.)
Milton, Wash.

Remembering the "Blue Ox"

"The Blue Ox" [August 1992, p. 72] was of special interest to me, having been in the 7th Bomb Group in 1934 and having had some experience with the Norden bombsight. The article referred to the 19th Bomb Group, but it was not at March AFB, Calif., at that time.

I was in the first group of flying cadets who were forced to go on active duty as cadets or resign upon graduation from Kelly Field, Tex., due to the Depression and congressional restrictions on the number of pilot officers at that time. Thirty-five of us were very fortunate to arrive at March under the command of "Hap" Arnold, who went out of his way to see that the cadets were treated with the same respect as officers, in spite of some opposition. This was at the height of the "airmail" days, and, when those ended, the 7th was left with a bunch of worn-out Keystone and Curtiss Condor bombers.

Relief soon arrived when we received the new Martin bombers. Contrary to common belief, the first ones at the 7th Bomb Group were B-12s, not B-10s. It was a great step forward, but they were equipped with fixed-pitch propellers that produced poor takeoffs. Once airborne, they were a real pleasure. . . .

Regarding the Norden sights, even the early ones were a step forward. A ground trainer got us accustomed to the sight. It was a steel tube platform, fifteen to twenty feet high, with an electric propulsion system to move it across the hangar floor and work to a floor target. Many weary hours were spent on it before actually using the Norden sight in the B-12s.

In December 1934, the 7th Bomb Group moved to Hamilton Field, Calif.

We continued to work with the Martins and the Norden bombsight. In the spring of 1935, we did some work with the Navy. A year and a half later, we were flying the same Martins I had flown at Hamilton, but they were much improved with hydraulic controllable props.

After the 7th Bomb Group left March Field, it was replaced by the 19th Bomb Group with Martin B-10s, which had Curtiss Electric controllable props. They were fine machines. In 1938, we were reequipped with the Douglas B-18 with the Norden sight. We did a lot of work at Muroc, Calif., where we camped out at what became Edwards AFB. . . .

Dick Bullock
San Antonio, Tex.

After twenty-six months of daily work on the Norden bombsight while I was in Eighth Air Force, I felt I knew about as much about the sight itself as anyone. I was very happy to learn some of the story of its development.

I would like to add a few details. The Norden bombsight was always mated with the horizontal stabilizer of the Minneapolis/Honeywell autopilot. If we moved a sight from one plane to another, the stabilizer was also moved.

The Sperry bombsight was also in use, mated with the Sperry autopilot. When I went through school at Lowry Field, Colo., in 1942, half of each class studied the Norden and half studied the Sperry.

With regard to secrecy and the Germans, most of us who saw the bombsights every day felt that the security was mostly for psychological reasons. It made civilians feel better to think that we had something the Germans did not. Even if the Germans had been given a complete Norden sight, they had very few high-altitude bombers, they did not have the bombing tables, and without the Minneapolis/Honeywell autopilot, the Norden sight was useless.

Sometime in late 1943 or early 1944 a whole trailer full of captured German military equipment, including a German bombsight, came to our base. The brass would not let us open it up, but, from the outside, it looked almost exactly like our Sperry sight.

SSgt. Charles M. Hughes,
USAF (Ret.)
Ottsville, Pa.

With reference to "The Blue Ox," I would like to relate an incident that reportedly happened to Carl Norden in early 1940. Mr. Norden had gone to

Washington, D. C., to attend a hearing by a government committee on the purchase of his bombsight for the Army Air Corps. Upon leaving the hearing, Mr. Norden was questioned by reporters. One of them asked, "Mr. Norden, is it true that a bombardier using your bombsight from an altitude of 25,000 feet could hit a pickle barrel?"

Carl Norden replied, "Gentlemen, which pickle?"

Doug Krause
Oroville, Calif.

"The Blue Ox" noted the ability of the sight to synchronize on a slowly moving target. Although designed into the sight in response to a Navy requirement to bomb moving ships, this feature was used by the Air Force during the Korean War when B-26 Invader crews used the Norden to bomb moving trucks at night. Ironically, the Air Force probably got more use out of this feature than the Navy did, in addition to being by far the greatest user of a device that was totally Navy-procured.

Cmdr. J. E. Lyons,
USN (Ret.)
Oceanport, N. J.

Many thanks to Colonel Glines for his interesting and informative "The Blue Ox." He did yeoman work compiling the background information on Carl Lucas Norden and his famous bombsight.

At one point, however, he made the following statement: "The Norden bombsights were first used by American forces in combat during the summer of 1942, when Eighth Air Force B-17s arrived in England."

As a former member of the 22d Bombardment Group, I should like to point out that, after training on Norden M-3 (moving telescopes) and M-4 sights in B-18s and subsequently on Norden sights in the first B-26 Martin Marauders, our group flew its first combat sortie over Rabaul Harbor, New Britain, on April 6, 1942.

The 19th and 3d Bombardment Groups operated in the same area at about the same time, although I do not know which sights they had.

Col. Albert L. Catalo,
USAF (Ret.)
Grand Ledge, Mich.

Retargeting Missiles

As a former Minuteman missile combat crew member, I appreciated David Lynch's "Angst at Olympic Arena" [August 1992, p. 62]. I must, however, clarify a point he makes concerning retargeting missiles from the launch control centers.

He states, "Until the mid-1980s, retargeting an individual missile required time-consuming, manual replacement of computer tapes containing launch coordinates. The process took hours." This statement is only partially correct and is misleading. It was true for the LGM-30F Minuteman II missile, but the LGM-118A Peacekeeper missile has always had remote retargeting capability by the missile crew, as has the LGM-30G Minuteman III since the early 1970s, when that system received the remote retargeting capability known as Command Data Buffer. Command Data Buffer affords the missile crew the means to insert new target coordi-

nates in the missile's memory and takes only a few minutes to accomplish, not hours.

Steve Darr
Woodinville, Wash.

In Mount Arayat's Shadow

The picture on p. 60, upper right corner, August 1992 issue, is the only one in "Far East Color" not identified by location. The P-47s and B-25s stand under the shadow of Mount Arayat, probably at Clark Field, the Philippines. The cone of this volcano is very recognizable to those of us who lived within its view for years.

William A. Allen
Goodfellow AFB, Tex.

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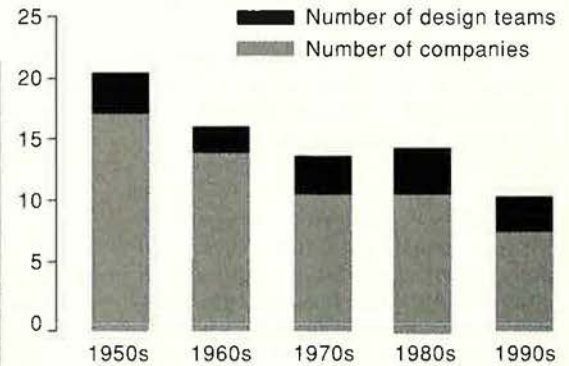
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The Chart Page

Edited by Tamar A. Mehuron, Associate Editor

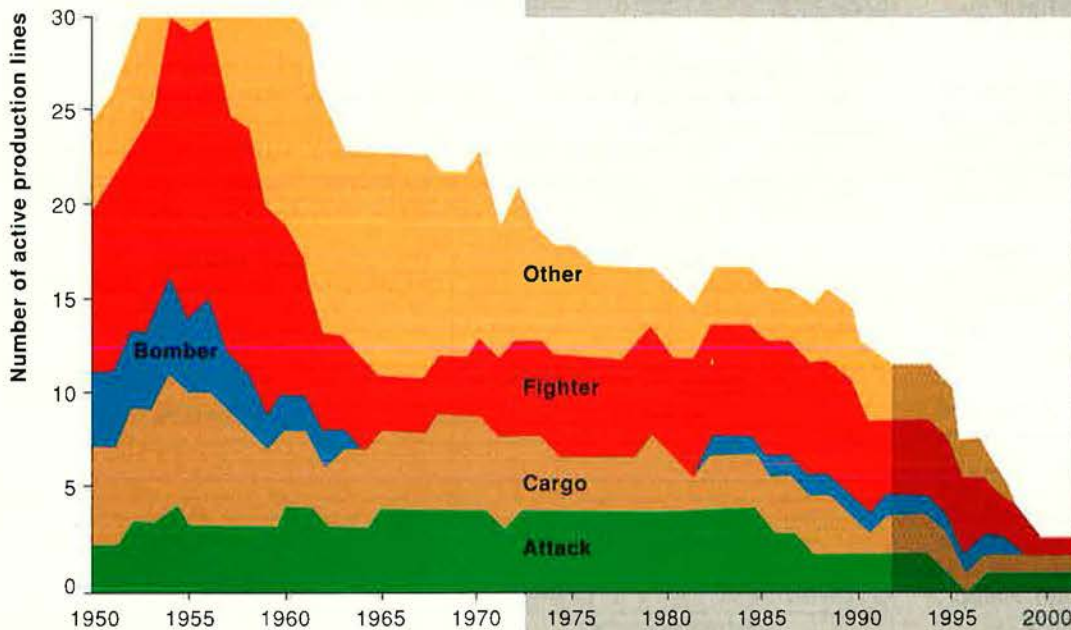
The Decline in Military Aircraft Design

A recent RAND Corp. study warned that a continuing decrease in aircraft design and production will affect the industry's ability to meet the Air Force's needs in the next decade. Decreasing procurement budgets, cost growth, and longer aircraft lifetimes contribute to this decline.



The trend is significant because industry might shrink below the level necessary to respond to Air Force needs. Remaining firms could suffer a loss of quality design capability.

Number of design organizations (1950-90)



The 1950s saw the production of forty-nine new fixed-wing aircraft. By contrast, four new designs have flown in the 1990s. Only one or two more are expected by 2000.

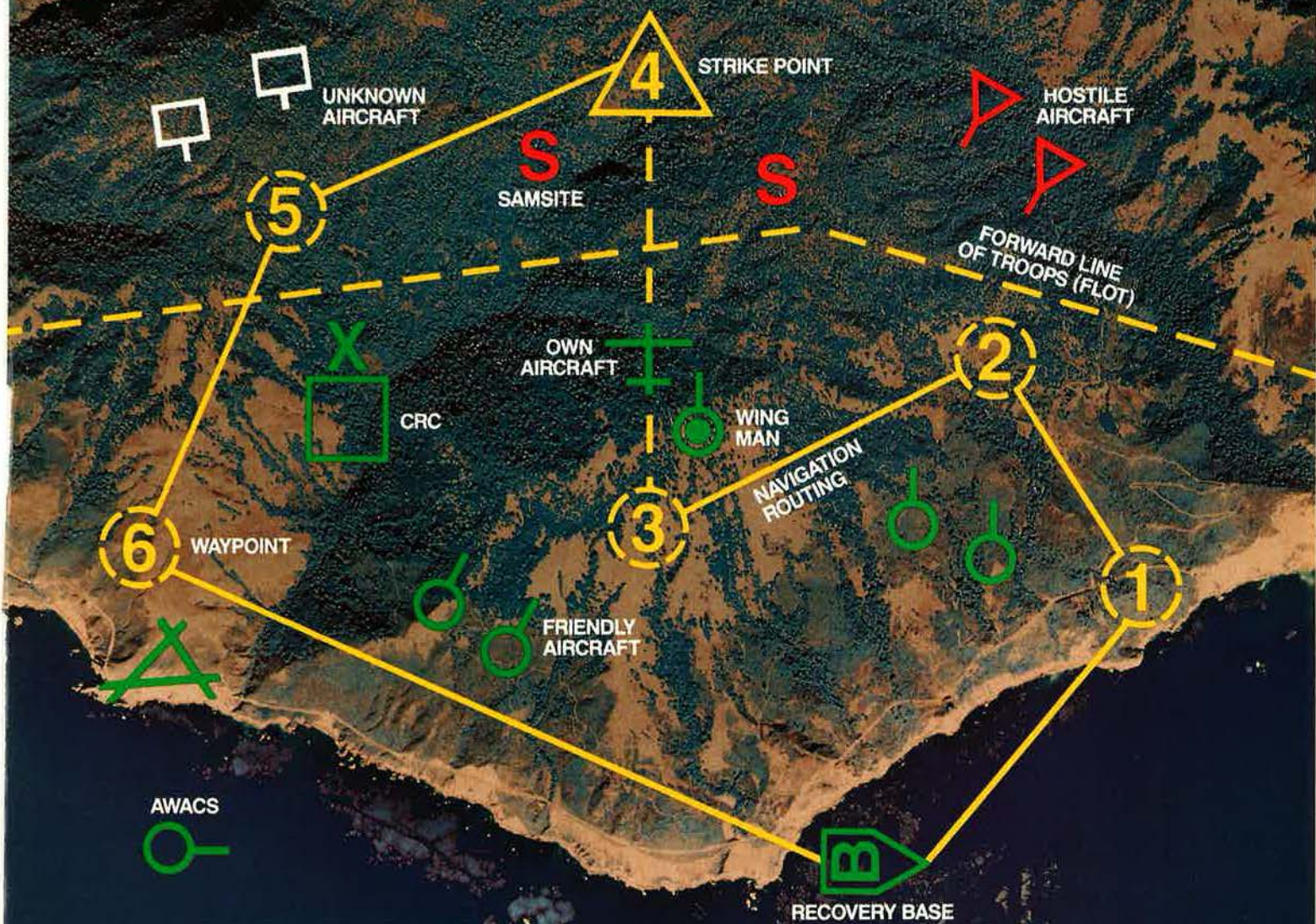
Number of designs per team (averaged by decade)

Industry stands to lose vital experience and skill. The ratio of designs per team has decreased steadily from 2.5 per decade in the 1950s to about one every two decades.



Source: RAND Corp., "Maintaining Future Military Aircraft Design Capability," 1992.

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Hughes Aircraft Company is developing a new extended-range version of the Maverick air-to-surface missile, fitted with a turbine engine. The new "Longhorn" turbine engine configuration could give Maverick a range as great as 40 miles, compared to its current 7- to 10-mile range with a rocket motor, depending upon altitude at launch. The new Maverick could provide a relatively low-cost, stand-off weapon to fill the U.S. Air Force's emerging Suppression of Enemy Air Defense (SEAD) requirements.

Another step was taken toward faster, smaller computers and signal processing systems when Hughes engineers achieved a record-breaking clock speed for high-density multichip modules. Several different types of gate arrays — ripple counters, shift registers and emitter-coupled logic devices — were assembled on a multi-layer silicon substrate using Hughes' HDMI (high-density multichip interconnect) process. The resulting demonstration modules were clocked at speeds of 348 MHz, compared to best previously reported clock rates of around 200 MHz. The work, part of the U.S. Navy's Manufacturing Technology Program, can lead to better communications systems, advanced radars and faster signal and data processing.

Pilots of U.S. Navy and Marine Corps F/A-18 Hornet aircraft are aided during low-level night attack missions by the Thermal Imaging Navigation Set (TINS) produced by Hughes. The system, pod-mounted on the starboard fuselage, provides a TV-like image of upcoming terrain that is projected on a head-up display. Hughes is also under Navy contract to build and flight qualify two AAS-38 targeting pods for the F/A-18, and weapon replaceable assemblies equivalent to more than 20 additional pods. The AAS-38, pod-mounted on the port fuselage, complements TINS and enables the aircraft to attack ground targets day or night, and in adverse weather.

A Hughes ID card used in security systems has several novel features, which give it an advantage over many electronic scanning systems. The microelectronic features of this Proxcard™ are so fine that its antenna and computer chip can be embedded in a card fabricated almost as thin as a credit card. In addition, by using RF signals, it outputs its data without direct contact with the reader, and is extremely reliable. The Proxcard, which can help companies save on security costs, has already been a tremendous asset to Quotron Systems, a global supplier of financial data and services to brokers.

Hughes and General Motors have taken a giant step toward becoming leaders in the electric car industry. Having recently finished designing an electronic motor control system for GM's sporty new electric car, the Impact, Hughes will soon begin mass producing these systems. They will also produce the Impact's power inverter and charging system, and eventually, electric drives for industrial motors. To accommodate electric car owners, Hughes is also developing an elaborate electric car service infrastructure throughout Southern California.

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

HUGHES

Aerospace World

By Frank Oliveri, Associate Editor

Humanitarian Flights Span Globe

USAF's Air Mobility Command undertook humanitarian operations on a nearly unprecedented scale, helping to provide aid to the storm-devastated residents of south Florida and Guam and to the starving people of Africa and Bosnia. On an average day, AMC airlifters and tankers conduct 500 missions. Just after Hurricane Andrew struck Florida in August, missions rose to a daily average of 700.

In southern Florida, AMC-chartered aircraft flew 875 missions in the weeks after the hurricane, delivering 20,483 tons of relief supplies and equipment and 11,956 troops.

In the Pacific, Air Force C-5, C-141, and C-130 transports conducted forty-eight missions to Guam, hauling thousands of tons of emergency aid and supplies to the victims of Typhoon Omar.

In Africa, Air Force transports delivered 2,192 metric tons of food to Somalia and Kenya, racking up 150 missions. AMC aircraft prepared to transport Pakistani troops to Somalia as part of the United Nations relief effort.

AMC planes also flew 117 missions to the besieged Bosnian city of Sarajevo, delivering 2,158 tons of aid.

Allies Back in Iraqi Skies

The United States, Britain, and France imposed a "no-fly" zone on southern Iraq, banning operation of Iraq's military aircraft south of the 32d parallel. By mid-September, the allies had carried out 1,705 fighter sorties over the area to enforce the flight ban.

The Pentagon said it mounted the new operation, called Southern Watch, to restrict armed Iraqi operations against the area's Shiite Muslims, who had been attacked by regular Iraqi units for months, and to monitor violations of UN resolutions.

The Air Force deployed F-15C, F-16C, and E-3 Airborne Warning and Control System aircraft in the no-fly zone. US Navy aircraft also patrolled the area. The operation drew no immediate response from Iraq.

Bush OKs Big Fighter Sales

General Dynamics and McDonnell



Pilot Capt. Amy Smellie steps off her C-130 at Zagreb, Croatia, during Operation Provide Promise, which seeks to aid victims of the turmoil in the Balkans. The 37th Airlift Squadron aircraft bears the markings of the United Nations High Commissioner for Refugees and is based at Rhein-Main AB, Germany.

Douglas both got big boosts when President Bush announced new sales of F-16 and F-15 fighters to overseas buyers. Few in Congress raised serious objections.

In early September, the President announced a \$5.8 billion sale to Taiwan of 150 GD F-16A/B fighters, forty spare engines, 900 AIM-9 Sidewinder and 600 AIM-7 Sparrow air-to-air missiles, 500,000 rounds of 20-mm cartridges, and spare and repair parts. In mid-September, the White House disclosed a new, \$9 billion arms deal. Saudi Arabia will buy seventy-two McDonnell Douglas F-15XP and air-superiority F-15 jets, twenty-four spare engines, forty-eight sets of navigation and targeting pods, 900 AGM-65D/G Maverick missiles, 300 AIM-9 and 300 AIM-7 missiles, 600 CBU-87 bombs, 700 GBU-10/12 bombs, mission planning systems, parts, and support equipment.

The sale to Taiwan drew a sharp protest from China, which demanded that Washington cease arming a nation China deems a renegade province. Israel registered a relatively mild protest against the Saudi sale.

The F-16 deal provides critical work for GD's Fort Worth, Tex., plant and will help stem layoffs there. The sale to Saudi Arabia of the F-15XP, a less potent variant of the USAF F-15E strike fighter, and more air-superiority F-15s provides work for the McDonnell Douglas line in St. Louis, Mo., which otherwise would have been forced to close down operations this year. The two deals will keep the F-16 and F-15 production lines open for several years.

New DoD Preseparation Guide

In August, the Defense Department released a new booklet titled "A Preseparation Guide," which is expected to answer questions concerning separation from the armed forces. It highlights special programs for service members facing involuntary separation.

The booklet is available at base transition offices. It explains the current separation program; education, medical, and dental benefits; reserve duty requirements; and federal employment opportunities.

USAF photo by SrA. Janel Schroeder

Rice Sets F-22 Review

Air Force Secretary Donald B. Rice commissioned an overhead cost analysis and control review of the F-22 fighter. He called it an attempt to move "aggressively" to control future F-22 cost growth.

The Secretary said the defense industry will have a smaller business base in the future to which it can allocate overhead costs, and there is a danger that these costs will be assigned disproportionately to big programs such as the F-22.

The F-22's major contractors—Lockheed, Boeing, and GD—will all be analyzed in the review, the purpose of which is "to establish a process to control and drive down overhead costs on the F-22 and derive lessons learned" for other programs. The review will be performed in three phases. The first will establish definitions, policies, and procedures. The second will review overhead data and develop cost reduction initiatives. The third will document lessons for the F-22 and other programs.

Taking part in the review will be senior officials from the USAF secretariat, Air Force Materiel Command, AFMC's Aeronautical Systems Center, the Defense Contract Management Command, and the Defense Contract Audit Agency. Results are expected in 1993.

B-2 Releases Inert Bomb

The B-2 Stealth bomber successfully dropped a test bomb for the first



The X-31 first reached an angle of attack of seventy degrees during a research flight at NASA's Ames Dryden Flight Research Facility, Edwards AFB, Calif., in September. The enhanced fighter maneuverability demonstrator uses thrust vectoring and advanced flight control systems to achieve high angles of attack.

time during a flight test at Edwards AFB, Calif., in early September, the Air Force announced. This was the first in a series of bomb release tests that will demonstrate the B-2's ability to release various weapons it will use in operational service.

The bomb used in the first test was a BDU-46, an inert test version of a B83 nuclear weapon. It was released from the B-2's left weapons bay from an altitude of 22,500 feet.

Air Vehicle 4, the newest of the bomber test vehicles, dropped the bomb. Test officials said the weapon behaved as expected, coming off its ejector rack well and separating cleanly from the aircraft.

"Miraculous" Mission to Ramstein

One Navy petty officer from the Naval Air Facility in the Azores is alive today in large part because of timely actions by a number of Air Force officers and enlisted men.

Last August, Petty Officer Julie Pena reported to Lajes Field hospital, complaining of a headache that had lasted through the evening and become unbearable that morning. Maj. Burton Plaster, the medical officer on call in the emergency room, said EM3 Pena became disoriented and was stumbling around the room. After Dr. Plaster began his examination, the patient became unresponsive and, in a classic sign of neurological disorder, "her pupils dilated right before my eyes."

Dr. Plaster said the patient was paralyzed on her left side and there were signs of increased pressure inside her head. In a short time EM3 Pena had lapsed into a coma. Dr. Plaster then placed her on a respirator and intravenous line.

Dr. Plaster informed the hospital commander, Lt. Col. Charles Grocn, and contacted a neurosurgeon at an Army hospital in Germany. Dr. Green contacted Brig. Gen. Thomas Pilsch, the 65th Support Wing's commander at Lajes. Dr. Green told the General

USAF photo by Jeff Marshall



Air Force Intelligence Command Vice Commander Brig. Gen. Graham Shirley (right) receives his retirement certificate from Assistant Vice Chief of Staff Lt. Gen. Thomas McInerney at Lackland AFB, Tex. General Shirley retires with more than 3,000 flying hours to his credit, including 200 combat missions during the Vietnam War.

an emergency aeromedical airlift was needed.

Dr. Plaster and Dr. Christopher Smithies, a neurosurgeon at the Army's Landstuhl Hospital near Ramstein AB, Germany, quickly consulted on EM3 Pena's condition and agreed she should be brought to Landstuhl quickly.

A transiting C-141 on the ground at Lajes was held up. TSgt. Dave Simms, NCO in Charge at Patient Administration, contacted the 2d Aeromedical Evacuation Squadron at Ramstein. The 2d in turn contacted the Tanker Airlift Control Center at Scott AFB, Ill., which rerouted the C-141 to Ramstein.

After the aircraft was reconfigured for aeromedical airlift, EM3 Pena and a medical team got airborne to Ramstein. In Germany, a CAT scan of the patient revealed a blood clot in her brain caused by a ruptured blood vessel. After pinpointing the blood vessel that burst, doctors began emergency surgery. The clot was removed and the blood vessel repaired. The next morning EM3 Pena was moving her hands and feet. Dr. Green called her condition miraculous: "We did not expect her to recover."

USAF Lab, CIS in Space Venture

The Air Force's Phillips Laboratory and the Commonwealth of Independent States (CIS) have formed an international cooperative venture to study the potential threat of space debris.

Air Force Materiel Command announced in August that the laboratory will work with NASA and the CIS on two experiments regarding atmospheric effects and the ability of ground-based sensors to detect space debris.

The first experiment, called Pion, focuses on two calibrated spheres designed to follow decaying orbits and reenter the atmosphere, providing new data on the atmosphere and drag effects. The CIS will provide the US with data from a ground-based surveillance network and telemetry data from the spheres. US Space Command's Space Surveillance Network will provide processed data that relates to the orbital element positions of the spheres.

The second experiment is based on Orbital Debris Reentry and Calibration Satellites. Equipment for this experiment was to be launched by NASA aboard a space shuttle. Work will center on six aluminum spheres deployed in gradually decaying orbits. This phase will measure the detection sensitivity of ground-based radar.

Another Tiltrotor Crashes

One of Bell Helicopter's XV-15 research aircraft, developed for NASA and the Defense Department to vali-

date the feasibility of tiltrotor technology, crashed in late August. Investigators cited mechanical failure as the cause. The plane's two pilots escaped with minor injuries.

The craft had been flying in its airplane mode for thirty minutes. After the aircraft landed twice in the hover mode, the third attempt brought disaster. At ten feet above the ground, the aircraft began a gentle roll to the right and then quickly flipped over into an inverted crash, said investigator Matthew Ellis of the National Transportation Safety Board.

According to Mr. Ellis, preliminary investigations indicated that the left control system for the prop rotor governor became mechanically disconnected. A bolt had come out, which had taken away control of the left prop rotor. A bolt and washer were found in the nacelle, but the nut and cotter key were not found. Mr. Ellis said the investigation will continue.

The XV-15 first flew in 1977. This was the third tiltrotor aircraft accident in the past year and a half. Two V-22 Osprey aircraft went down earlier.

New Job Training Plan

In August, President George Bush announced a five-year job-training package, worth \$10 billion, which could help defense workers who have lost jobs when companies made the transition to commercial work.

The program would nearly triple the current expenditures on skill training and worker adjustment. Funding levels would be set at \$2 billion a year for five years.

Two-thirds, or about \$1.3 billion, of the annual funding would be allocated to states, more than tripling the resources available today. The states would provide basic transition assistance and skill grants for training to dislocated workers regardless of the cause of dislocation.

One-third, or about \$670 million, of the annual funding would be retained by the Secretary of Labor for discretionary allocation. At least \$335 million of this would be reserved for dislocations, such as defense- or environmental cleanup-related layoffs.

C-17 Suppliers Stick Around

Despite Air Force and McDonnell Douglas claims that C-17 budget cuts would cause subcontractors to abandon the program, a new study says that reductions in the Fiscal 1991 budget request had little discernible effect on the subcontractor base.

The General Accounting Office report, "Military Aircraft: C-17 Supplier Management Problems Are Not Related to Budget Reductions," said that

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In Seattle, Wash., Boeing Defense and Space Group employees work on B-2 composite components in front of the world's largest autoclave. The two twenty-five-foot by ninety-foot structures are used to cure composite parts for the Stealth bomber with heat and pressure.

only six of thirty-three major suppliers reported any adverse effects and that none left the C-17 program.

The Air Force had requested an annual appropriation of \$2.14 billion for the C-17, with \$1.7 billion in procurement money to buy six planes. Congress authorized only two aircraft. At the time of the review, GAO found that about 3,500 subcontractors contributed to the C-17 program. McDonnell Douglas deemed thirty of these suppliers critical to the program.

In general, the Pentagon concurred with the report's conclusions, but it said, "Air Force and Douglas Aircraft Company concerns regarding the potential adverse impact that program budget reductions would have on C-17 suppliers were not unreasonable. Fortunately, various events have resulted in the key suppliers electing to remain with the program."

NRO's Existence Confirmed

The Pentagon declassified the existence of the National Reconnaissance Office (NRO) in September. The NRO performs research and development, acquisition, and operation of spaceborne and airborne data collection systems for the collection of intelligence information.

"The mission of the NRO is to ensure that the US has the technology and spaceborne and airborne assets needed to acquire intelligence worldwide, including [assets] to support such functions as monitoring of arms-control agreements, indications and warning,

and the planning and conduct of military operations," a one-page memorandum for correspondents said.

The NRO, an agency of DoD, is funded under the National Reconnaissance Program (NRP). The decision to declassify the office was initiated by the director of the Central Intelligence Agency.

The NRO is responsible to the Secretary of Defense. The director of Central Intelligence establishes the collection priorities and requirements for the targeting of NRP operations and the frequency of coverage. In addition, with the Defense Secretary, the CIA director approves the NRP budget.

The director of the NRO is Martin Faga, the Air Force assistant secretary for Space. Deputy director of the NRO is Jimmie D. Hill. Deputy director for Military Support is Rear Adm. Daniel P. March.

Hazardous-Waste Reductions

The Pentagon says it has reduced its requirement for hazardous-waste disposal by 53.9 percent since 1987, thereby exceeding its original goal of reducing such waste by fifty percent by the end of 1992.

Eighty-five percent of the reduction can be attributed to limited generation of waste at DoD industrial facilities, such as arsenals, shipyards, maintenance depots, and Air Logistics Centers. These activities account for sixty percent of all the waste generated by Pentagon activities. Daily

installation operations and training facilities account for the rest.

The waste reductions were primarily achieved through preventative measures, with specific programs developed to meet DoD's needs. Programs that reduced waste include prohibition on use of certain hazardous materials in design, manufacture, and operation of the F-22; replacement of cyanide stripping baths with noncyanide strippers; elimination of vapor degreasers by using an alternative cleaning process; and development of a centralized hazardous-material inventory control system, decreasing hazardous-material purchases by forty-nine percent.

USAF Plans NCO Retraining

The Air Force plans to retrain 1,900 noncommissioned officers in Fiscal 1993 under a three-phase program that aims to deal with surpluses in certain areas.

Under the retraining program, the Air Force is looking for volunteers to retrain from surplus skills into shortage skills. The retraining will be limited to master sergeants with fewer than eighteen years of service and technical and staff sergeants with fewer than sixteen years.

Phase 1 started in August and ended in September. In Phase 2, voluntary retraining will continue, but those eligible for involuntarily retraining will be notified. Phase 2 runs from October 1 through December 15. The last phase is involuntary retraining to fill skill shortages.

V-22 Funds Released

The Department of Defense has released V-22 Osprey funds to the Navy, making them available for obligation, according to the office of the Comptroller General. The Pentagon's move releases it from the danger of sustaining charges of illegal impoundment of appropriated funds.

The Comptroller General found earlier this year that the Pentagon may have illegally impounded funds appropriated for the V-22 Osprey without putting in a request for rescission. The Comptroller General's office confirmed on August 3 that V-22 funds had actually been made available for obligation.

ATARS Timetable Revised

The Air Force and Martin Marietta have agreed on a revised development timetable for the Advanced Tactical Air Reconnaissance System (ATARS), USAF said in September.

The new contract, signed in August,



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calls for system development, test, and evaluation to begin in January 1993. ATARS schedule and performance requirements have been redefined to meet the needs of the Navy and Marine Corps F/A-18D program; the Navy, Marine Corps, and Air Force Medium-Range Unmanned Aerial Vehicle program; and the USAF Joint Service Imagery Processing System.

Higher C-17 Sales Projected

McDonnell Douglas projects that it will sell some 100 C-17 transports more than the 120 aircraft it now expects to sell to the Air Force.

That is the word from Tom Ryan, vice president and general manager of Product Support for the C-17 program. He said that fifty of the extra aircraft will come from foreign sales and the other fifty could fill the Air Force's unfunded need for additional transports.

Mr. Ryan said that the company's figures are based on discussion with Air Force officials. Britain and Germany would be prime candidates for purchases, but McDonnell Douglas would have to convince other nations to look at overall airlift requirements rather than simply undertake a specific replacement program. Foreign sales deliveries could begin in 1995.

Mr. Ryan said that France, Cana-

da, Saudi Arabia, and Japan have expressed interest.

Day of the "Storm Trackers"

The Air Force Reserve's 403d Airlift Wing "Storm Trackers," operating from Keesler AFB, Miss., played a major role in saving the lives of many who might otherwise have perished in the winds and waters of Hurricane Andrew.

The job of the Storm Trackers is to fly WC-130 weather aircraft into the eye of the storm to gather data needed to save lives and protect property. Dr. Bob Sheets, director of the National Hurricane Center at Coral Gables, Fla., said, "From the time Andrew crossed fifty-five degrees west until the storm made final landfall in Louisiana, the Storm Trackers continuously provided vital information that was unavailable from any other source."

Under the direction of Dr. Sheets, the WC-130s began their twenty-four-hour vigil into and around Andrew on August 18, when the weather system slowly approached the Lesser Antilles. The Storm Trackers penetrated the storm even before the sixty-five aircrew and maintenance personnel in their four WC-130s reached their forward operating base in Antigua. In all, the unit flew twenty-eight missions, crisscrossing the storm to gather data on its movement, wind speed, baro-

metric pressure, and humidity. During the 225.2 hours of flying, the crews made sixty-eight penetrations to the eye of the storm. Ground crews worked round-the-clock to keep the aircraft flying properly.

US to Buy Russian Uranium

The US has agreed to help Russia convert highly enriched uranium (HEU) from dismantled nuclear weapons into low-enriched uranium (LEU) for use as commercial reactor fuel. The US Department of Energy will purchase the LEU and sell it for commercial use.

A portion of the funds Russia gains from the sale of the HEU must be used to upgrade the safety of nuclear reactors within the borders of the former Soviet Union. In addition, a portion of the funds gained in the sale of HEU must be used to build conversion facilities in Russia.

In a written statement, President Bush said, "Abroad, this agreement will help ensure that nuclear weapons-grade material does not fall into the wrong hands, while providing funds to promote economic reforms and the transition to a market-based economy. At home, this agreement will secure long-term supplies of less expensive fuel for US nuclear power stations to the benefit of American consumers, with no adverse impact on American jobs."

News Notes

■ The Air Force and Eaton/AIL reached an agreement in August on issues related to three B-1B ALQ-161 defensive avionics system contracts. Eaton/AIL will modify existing B-1B hardware to match the configuration of the ALQ-161 systems now flown in the B-1 fleet. Currently, ten aircraft in the fleet lack ALQ-161 hardware. As modified hardware becomes available, it will be installed in these aircraft.

■ The National Aerospace Plane (NASP) National Contractor team announced in August that it had successfully completed scramjet propulsion experiments at simulated flight speeds up to Mach 19. The hypersonic mixing experiment involved a series of tests requiring the mixing and burning of hydrogen fuel under operating conditions to Mach 19. It was conducted at California Institute of Technology's T-5 Free Piston Shock Tunnel in Pasadena, Calif.

■ In July, the US conducted the first on-site inspection in Russia under the Conventional Armed Forces in Europe (CFE) Treaty.

■ The 67th Missile Squadron became in July the first Air Force Minute-

Index to Advertisers

Air National Guard	81
Allied-Signal Aerospace Co.	59
Armed Forces Insurance	29
Central Fidelity Bank	5
Computer Business Services, Inc.	83
Computing Devices International	44-45
Fantasy Vacations	15
GEICO	60
General Dynamics Corp.	7
Grumman Corp.	Cover II
Hughes Aircraft Co.	12
Hughes Training Inc.	55
Lockheed F-22 Team	57
Lockheed Sanders Inc.	2
Magnavox Electronic Systems Co.	Cover III
McDonnell Douglas Corp.	Cover IV
Northern Telecom	1
Rockwell International, Collins Avionics and Communications Div.	11
SatoTravel	20
Showcase Model Co.	85
Systron Donner, Safety Systems Div.	21
Vought Aircraft	17 and 19
AFA Insurance	86-87
AFA Member Supplies	85
AFA Résumé Service	83
Airpower in the Gulf	71

5,600 flying hours, with 200 combat missions over Laos, North Vietnam, and South Vietnam.

■ The Army selected Lockheed Missiles and Space Co. to perform demonstration/validation for the Theater High-Altitude Area Defense (THAAD) weapon system. The \$688 million contract covers a forty-eight-month effort that includes design, fabrication, and testing of a demonstration weapon system. The contract calls for the building of twenty test missiles. With all contract options exercised, the contract could be worth about \$1.5 billion.

■ Reforger '92 began September 17 and was to run through November 15. About 6,500 soldiers from the US deployed by air and sea to Belgium, Luxembourg, and Germany. The US employed computers for training and simulation to reduce the number of participating troops.

■ The Air Force celebrated its forty-fifth anniversary in September. Air Force Secretary Donald B. Rice said, "As we make the final turn toward our golden anniversary, we must continue to build a new, quality air force to meet the challenges of a world very different than the one we faced just three short years ago. As we celebrate this forty-fifth anniversary, I share your pride in being part of the world's finest air and space force."

Purchases


The Air Force awarded Honeywell a \$5 million firm fixed supply contract for 131 multipurpose color display units in support of the AWG-27 weapon system status display system, applicable to the F-15 aircraft. Expected completion: February 1994.

The Air Force awarded Hughes Aircraft a \$7 million face-value increase to a firm fixed-price contract for nine programmable signal processors, nine radar data processor kits, and nine logic circuit card kits applicable to the APG-63 radar system used on the F-15 in support of the Fiscal 1992 multistage improvement program. Expected completion: June 1994.

The Air Force awarded McDonnell Douglas a \$19 million face-value increase to a firm fixed-price contract for seventy-eight Group A retrofit kits and 323 Group B retrofit kits in support of the Fiscal 1992 multistage improvement program to the F-15. Expected completion: September 1994.

The Air Force awarded McDonnell Douglas a \$166 million face-value increase to a fixed-price incentive firm contract for an extension of the Lot IV advanced buy/long lead for four C-17 aircraft and an extension of Lot V advance buy/long lead for eight C-17

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aircraft. Expected completion: August 1995.

The Air Force awarded Raytheon a \$27 million face-value increase to a firm fixed-price contract for incorporation of Block II production of the Advanced Medium-Range Air-to-Air Missile producibility enhancement program. Contract funds will expire by the end of this year.

Senior Staff Changes

RETIREMENTS: B/G Charles C.

Barnhill, Jr.; M/G Gerald A. **Daniel;** M/G James W. **Hopp.**

SENIOR EXECUTIVE SERVICE (SES) CHANGES: **Edward T. Curran**, from Chief Scientist, Aero Propulsion and Power, Wright Lab, Hq. AFMC, Wright-Patterson AFB, Ohio, to Dir., Aero Propulsion and Power, Wright Lab, Hq. AFMC, Wright-Patterson AFB, Ohio . . . **Cathlynn B. Sparks**, from Dep. Dir., Budget Ops., OSAF, Washington, D. C., to Dir., Budget Investment, OSAF, Washington, D. C. ■

The early design model that eventually led to the F-117 was a sharply angled aircraft dubbed “the Hopeless Diamond.”

How the Skunk Works Fielded Stealth

By David J. Lynch

IN RECENT months, a steady flow of new information about the F-117 has emerged, providing a detailed understanding of just how the first “stealth” fighter was transformed from a novel laboratory concept into the combat star of Desert Storm.

Newly declassified technical data and the recollections of key Lockheed Corp. participants show that what often has been portrayed as a smoothly run, top-secret development program actually encountered its share of problems. They were, however, resolved with unusual ingenuity and skill.

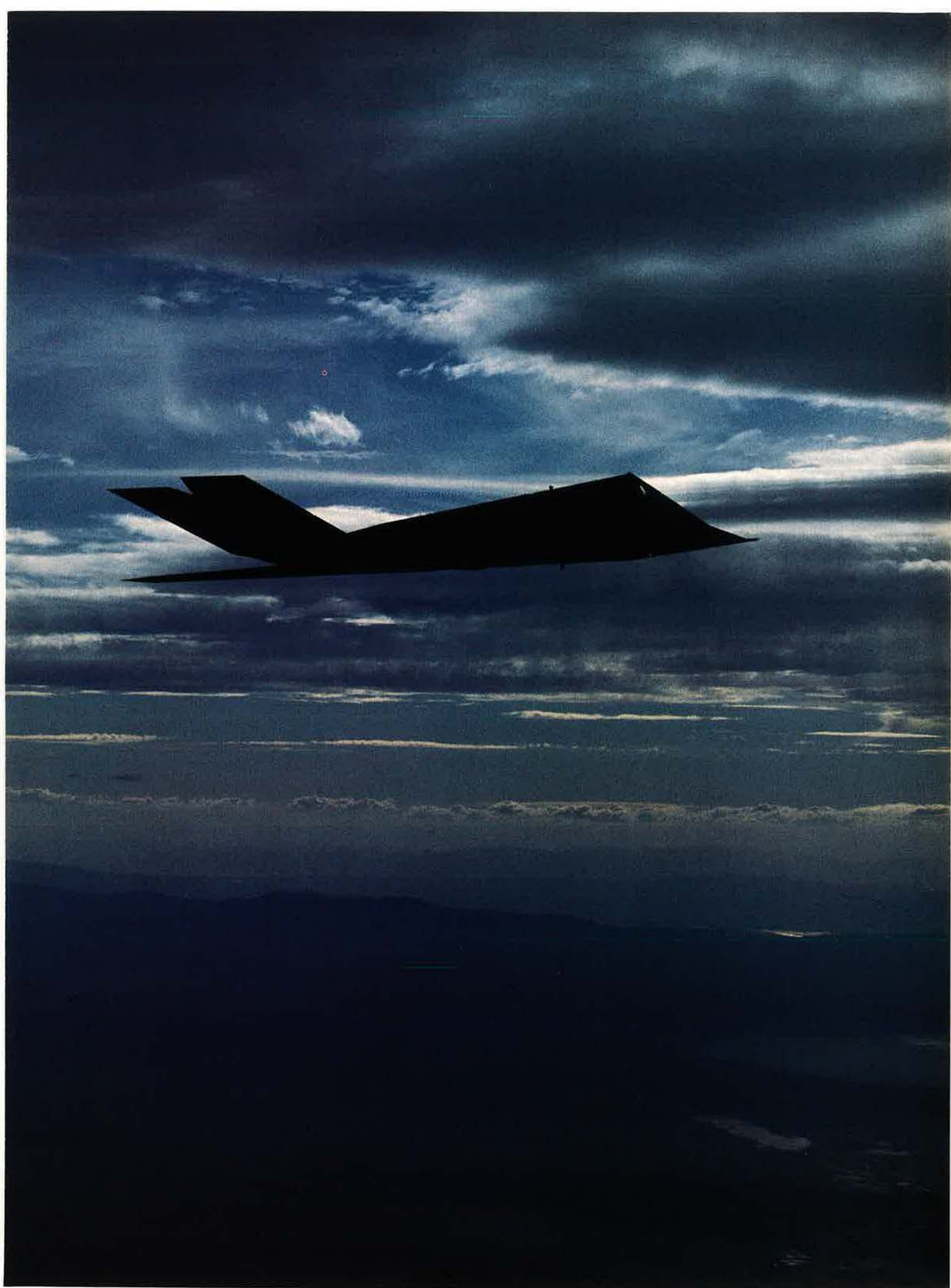
Despite the F-117's public image as the most modern of warplanes, the radar-evading aircraft had its technical origins late in the administration of President Dwight D. Eisenhower. Hula-Hoops were in vogue when Lockheed's Kelly Johnson and Ben Rich turned their attention to improving on the U-2 spyplane then flying reconnaissance patrols over the Soviet Union.

“Much to our amazement,” Mr. Rich recently recalled, “the Russians tracked us all the way. They couldn't do much about it, but they tracked us.” Then the USSR shocked the world in 1960 when it shot down a



Photos © Randy G. Jolly / Arms Communications

The success story that became the F-117 began in the late 1950s. Three decades and several glitches later, the black jet, with its potent bomb load and radar-evading properties, justified the faith of its proponents and made believers out of its critics with its sterling performance in the Persian Gulf War.





One difficulty for Lockheed in its construction of the F-117 fleet was getting security clearances for enough aerospace workers. "It was a tremendous problem," said Lockheed's Ben Rich. "It held us back."

U-2 and captured its pilot, Francis Gary Powers.

The Central Intelligence Agency asked Lockheed to investigate ways to reduce the radar cross section (RCS) of advanced aircraft. Together with Lincoln Laboratories, Rich and company went to work on the problem. The team achieved early success in its work on the A-12 and, later, the SR-71 Blackbird, reducing the RCS of the planes by two orders of magnitude. Two years later, the D-21 unmanned drone achieved a reduction of another order of magnitude.

The SR-71 was a breakthrough, according to Paul Martin, the program manager at Lockheed Advanced Development Co., known to the world as the "Skunk Works." It was in the SR-71 program, he said, that Lockheed "first developed aircraft shaping methods, radar absorbing structural edges, radar absorbing coatings, and other design features that greatly reduced the SR-71's radar signature."

In 1974, however, when the Defense Advanced Research Projects Agency (DARPA) requested proposals for a stealthy small fighter, Lockheed was not even invited to submit one. At the time, company officials were forbidden to boast of their prowess in low-RCS aircraft because the high-altitude snooping of the U-2 and SR-71 was being conducted for the CIA. The corporation was permitted to bid only after Mr. Johnson obtained a letter from CIA officials au-



Such a radical technology had its doubters. The model above was bombarded with radar beams without result. Once, a skeptical visiting officer claimed to "see something" on the display; a crow had landed on the model.

thorizing Lockheed to disclose limited details.

The Importance of "Echo 1"

In 1975, DARPA was persuaded to accept an unsolicited Lockheed proposal. The heart of the proposal was a computer program dubbed "Echo 1," which allowed its aircraft designers to predict a radar return. Skunk Works experts manipulated a set of well-established mathematical formulas for determining how various shapes would reflect electromagnetic radiation.

Lockheed's early computer modeling, however, was limited to calculations in only two dimensions, meaning that the resulting aircraft would have an ungainly, faceted design rather than a smooth, seamless one.

In fact, Mr. Rich and his Lockheed team christened that first, sharply angled aircraft "the Hopeless Diamond." The seven-foot-long model was brought to a range in Palmdale, Calif., for early radar testing. Initially, Pentagon officials regarded with deep skepticism Lockheed's claims of having developed some revolutionary radar-evading properties. "The reaction from the Air Force and DARPA was, 'That was all theory,'" said Alan Brown, the first F-117 program manager.

Mr. Rich recalls demonstrating the new approach for a visiting officer. With radar beams bombarding the test stand, the two men intently watched a

display screen. Nothing appeared. "All of a sudden," recalled Mr. Rich, "a black crow landed on the model. The officer said, 'I see something.'"

That series of demonstrations indicated Lockheed was on the right path, but the company and the Air Force had a long way to go before they would be certain they weren't chasing a mirage.

One early stumbling block was financing. The Pentagon wanted Lockheed to build two stealth prototypes with \$20 million in government cash. Mr. Rich knew he needed another \$10



Despite developmental problems, the F-117 program was a success, moving from design go-ahead to first flight in just thirty-one months and to initial operational capability twenty-nine months later.

million to pull off the assignment and had to approach Lockheed's top executives for the money.

His timing could not have been worse. Lockheed was just emerging from its L-1011 commercial aircraft debacle, which had cost the company billions. When Mr. Rich pitched the \$10 million request to Lockheed Chairman Roy Anderson and President Lawrence Kitchen, they blanched.

In 1976, however, Mr. Rich and Mr. Kitchen made a joint presentation to Lockheed's board on the potential of stealth. When they were finished, Mr. Rich had his \$10 million check.

From this point forward, stealth development went deep into "the black," or the classified world. The vehicle was the Have Blue program, which produced stealth technology demonstrators. To enhance security, program management was shifted from DARPA to the Air Force Special Projects Office.

"That'll Never Fly"

Under Have Blue, Lockheed built two single-engine stealth demonstrators, which began test flights in 1977. Each was about forty percent smaller than the F-117. Each was distinguished by tail surfaces that pointed inward. Even some Lockheed partisans were initially unimpressed with the Have Blue's unusual appearance.

"Kelly [Johnson] came in, kicked me in the ass, and said 'That'll never fly,'" Mr. Rich recalled.

The eighteen-month Have Blue test series, however, was a striking success and convinced the Air Force to go ahead with development of a stealth fighter.

On November 16, 1978, Lockheed received the contract for full-scale engineering development of what became the F-117, but the Have Blue flights foreshadowed a number of critical problems that would not be resolved until F-117 testing. Among them: how to mask the aircraft's exhaust and how to integrate a host of

off-the-shelf avionics packages with the new airframe. In addition, the designers had to grapple with 1,001 details that could have derailed the program.

"It was very good that we did Have Blue prototypes first," said Mr. Brown. "That gave us a real head start."

F-117 development commenced under a program called "Senior Trend." By the time the Skunk Works team was done, it had produced fifty-nine copies of the unique charcoal-black fighters for a unit flyaway cost of \$42.6 million. The program moved from design go-ahead to first flight in a mere thirty-one months and to initial operational capability in sixty months.

Once the F-117's existence was confirmed publicly in November 1988, Air Force and Pentagon officers depicted the jet's procurement as a model program whose success was due largely to the streamlined procurement and oversight of the black world. In the past year, however, a somewhat different picture has emerged.

"The F-117 program faced several fiscal, performance, and schedule challenges," the Air Force reported not long ago to a Senate subcommittee. Those challenges included "a shortage of aerospace workers, rapidly increasing inflation, growth in material lead time, and delays in security clearances."

It appears that none of the problems was ever viewed as a show-stopper,



The full-scale development aircraft of the Senior Trend program (above) lacked the F-117's distinctive black coloring, which was strictly an aesthetic choice that had nothing to do with the aircraft's stealthiness.



A highly classified system, the F-117 flew only at night for its first five years. Here, technicians work behind camouflage netting. Note exposed engines, normally behind plates to avoid detection of blades and exhaust.

but the schedule for first flight and initial operational capability slipped by almost one year after two test aircraft crashed. Over the life of the program, full-scale development costs increased by fifty-three percent, the Air Force told the Senate subcommittee.

The new information makes it clear that fielding the first operational stealth airplane did not stem from one technological solution or breakthrough. Rather, the work of the designers and engineers was all-encompassing, and close attention to seemingly minor details was critical. In the words of Mr. Brown, "We paid lots of attention to details—door openings and hinges, that sort of thing."

Seven Deadly Signatures

Lockheed officials say that, to meet their goal of building a warplane that was all but impossible to detect at useful ranges, F-117 designers had to address seven types of observable signatures: radar, infrared, visual, contrails, engine smoke, acoustic, and electromagnetic.

At a top speed of 646 miles per hour, the F-117's survival depends on its being impossible to detect in time for an enemy to take action. While the public understands the plane to be "invisible," stealth really is a combination of factors that makes the F-117 difficult for an enemy to detect, track, and target.

"You're not making these things



The plane's detractors had a field day mocking the angular surface of the F-117, but the faceting was vital, deflecting radar so that it was impossible to detect the aircraft in time for an enemy to take action.

invisible," said Benjamin Lambeth of RAND Corp. Stealth "reduces substantially the distance at which the plane can be detected. By the time detection occurs, it won't be tactically useful."

Relatively prosaic parts of the aircraft posed stiff design challenges. Concerns about the exhaust system had surfaced in the Have Blue flights. Normally, a jet's red-hot exhaust pours from the tailpipe in a cylindrical boil, leaving a beer-can-shaped hot spot in its wake. To make the F-117 difficult to see with infrared sensors, Lock-

heed needed a tailpipe that would flatten and cool the exhaust while simultaneously shrouding radar-reflecting portions of the plane.

In July 1979, the Skunk Works turned to a small, Santa Ana, Calif., firm to design the fighter's distinctive exhaust system. Astech/MCI, one of Lockheed's 500 or so F-117 suppliers, took only ten months to design a nickel alloy tailpipe of a special honeycomb design that flattened the exhaust. The design also hid the pinwheeling turbine blades of the twin General Electric F404 engines buried inside the airframe.

"We were trying to reduce the infrared signature and the radar signature," said Astech/MCI program manager Don Cunningham. "This [design] contributes to that at the back end of the aircraft."

Another sticky problem was de-

velopment of the four pitot tubes that extend from the aircraft nose to gather air data. The four faceted and heated probes contain multiple openings that gather differential pressure readings. The data are compared and analyzed by on-board computers, providing the F-117's flight-control computers with all the information they need to fly the airplane. Designers quickly decided it was impossible to coat the tips of these four tubes with radar-absorbent material. Coming up with another process to preserve the plane's low observability "took about three

years of very careful design," Mr. Brown said.

A host of problems, some very minor and several fairly serious, were encountered in development of the F-117's cockpit avionics. Most of the on-board systems were lifted from the Navy F/A-18 strike fighter and modified for the stealth fighter. The Skunk Works' Richard Silz said that initially even the fighter's intercom suffered "severe background noise." Getting a UHF radio antenna to retract properly at high speeds and "stay together structurally" was another problem.

Other Pilots, Other Planes

Many avionics problems surfaced only in flight testing. As off-the-shelf avionics packages were mated to the F-117, engineers found it difficult to determine if a problem had actually been solved. Six test pilots were flying three different planes, and what was good enough for one pilot was subpar for another.

The differentiation problem would reappear on weapons-release testing as each airplane demonstrated "its own personality due to equipment installation tolerances," Mr. Silz said.

Adapting the Infrared Acquisition and Detection System (IRADS) built by Texas Instruments was a major problem. From the start, Lockheed encountered half a dozen serious problems with the dual turret system, including picture quality and stability, acquisition and designation, video noise, and laser noise.

"Flight test got into trouble trying to solve too many problems at the same time," Mr. Silz told a meeting of the American Institute of Aeronautics and Astronautics in Irvine, Calif., earlier this year.

With the program stumbling early, Lockheed formed a "tiger team" under the direction of the Skunk Works chief scientist. The team, comprising experts from several different divisions, began by designating a single aircraft and pilot to conduct the IRADS tests, thus ensuring consistent test appraisals. The tiger team solved the problem in about one year and 100 test runs, according to Mr. Silz.

Making the turret openings on the aircraft invisible to radar proved more of a problem and is illustrative of the fine detail required for stealth to work in an operational environment. The challenge for Lockheed was to find a material for the turret coverings that

would allow the gear's own laser and infrared emissions to penetrate freely while remaining opaque to enemy radar.

The first choice, Mr. Brown said, was a gallium arsenide window. After a technician accidentally fractured one of the \$500,000 sheets in a test, however, Lockheed engineers decided it probably wasn't right for the tough acoustic environment of the turret housings.

Lockheed ultimately opted for a far less expensive and more effective solution, creating a stainless steel "tennis racket" screen to cover the turrets. The wire spacing was tight enough to keep radar out, while loose enough for IR and laser to penetrate, even though F-117 designers were concerned about the aerodynamics of allowing air into the housings. "I had to be damn sure I didn't make a harmonica," Mr. Rich said.

As weapon certification testing began, the F-117 team began to see more of the details that needed to be ironed out for stealth to work in practice.

Lower the Trapeze?

The F-117's weapons bays, for example, are fitted with a trapeze sling for loading and unloading bombs. At first, engineers feared that bombs like the GBU-10 would damage the plane and ordered that they be released from the aircraft with the trapeze sling down.

"This was a major detectability

problem for the aircraft," said Mr. Silz, because the sling would create a significant radar signature. Eventually, Lockheed's aerodynamics specialists reworked their calculations and found that the weapons could be dropped with the trapeze safely stored inside the bays. That cut the plane's radar exposure window during attacks by a factor of five, according to Mr. Silz.

F-117 weapon testing ended up taking about twice as long as it could have, however. Test managers had decided early in the program to fill one of the two weapons bays with test instrumentation. Forty-eight individual test plans were originally drawn up for the F-117. Eight to nine months into the flight-test effort, Lockheed concluded it would be impossible to carry out each of the written test plans and still achieve an early IOC. The Air Force and the test team decided to shelve the original plan in favor of a streamlined approach to certifying initial proficiency in day training, refueling, weapons, instruments, practice weapons, and initial guided weapons tests.

Mr. Silz said essential testing was completed by IOC in October 1983. For several years after that, Lockheed and the Air Force continued to fill in the missing parts of the test equation. "While this approach to testing worked and is probably in the best traditions of the Skunk Works, flight test is just this year finishing the final reports on the last of the



This realistic mission simulator shows the abundance of information at the pilot's disposal, especially from the forward-looking infrared display at center. A new wrinkle has been added: the Pilot Activated Automatic Recovery System.

Photo by Denny Lombard and Eric Schulzinger



Some credit the F-117's success to its avoidance of traditional procurement processes. A small team, working free from public scrutiny, brought stealth from the laboratory to operational use, which many said couldn't be done.

original test plans written over ten years ago," Mr. Silz said.

Initial worries about the maintenance sensitivity of the F-117's radar-absorbent materials appear to have been overstated. However, Lockheed went to great lengths to simplify the necessary maintenance and reduce the frequency with which radar absorbent material (RAM) coatings would need to be removed. Designers placed the access panels for servicing aircraft subsystems within the landing gear and weapons bays and also used a single avionics bay to minimize "the need to remove and replace RAM coatings around access areas," according to Martin.

Lockheed engineers made all of the panels on the F-117's underside hexagonal in shape. Every line on the plane's underside thus was parallel to the trailing edge of the wing, which ensured that any return from a door would be swamped by the minimal signature of the wing, Mr. Brown said.

No Swiss Watchmakers

"It had to be built by conventional airplane technicians," he added. "You don't want to design it so it had to be built by Swiss watchmakers."

Obtaining the necessary security clearances for each of the workers on the program was a daunting task. Each worker had to be cleared at the "secret" level, a process requiring several months. Mr. Rich said he spoke personally with every member of the

F-117 work force, which started with a core of about seventy-five and later grew to a few thousand. "We had a tremendous clearance problem," said he. "It held us back."

Top union officials were cleared first so that Mr. Rich could work with them to smooth the labor flow. Meanwhile, workers awaiting clearance were assigned to "the icebox," a large shop where they worked on parts that did not give away the real focus of their work.

Perhaps the key element in Lockheed's approach to moving stealth from concept to reality was a conscious decision to rely on off-the-shelf hardware as much as possible. In this way, engineers were able to focus on the breakthrough of reducing RCS without having to "invent" new avionics and engines. "We utilized proven systems from existing aircraft to reduce the overall system development risk," said Mr. Martin.

The F-117's "borrowed" components included the GE F404 engines from the F/A-18, cockpit gear from the Air Force F-16 and Navy F/A-18, the B-52's navigation system, environmental control systems from the C-130, and critical fly-by-wire flight-control computers from the F-16.

A corollary to the initial reliance on off-the-shelf hardware was a continuous improvement program after deployment. That effort was illustrated by Lockheed's response to the crash of three F-117s early in the program. The first crash, Mr. Rich said, occurred because of a mix-up in the pitch and yaw controls. The pilot called for a change in pitch, and the airplane yawed into a crash. The pilot survived with a broken leg.

Two of his colleagues were not so lucky when their operational fighters crashed. After finding that spatial disorientation had played a role in the two crashes, the Air Force commissioned the development of the Pilot Activated Automatic Recovery System. Mr. Silz described PAARS as operating at all altitudes and speeds whether the landing gear is up or down. Even if it is not engaged, the autopilot on command orders the flight-control system and autothrottle to execute a series of preplanned maneuvers that will recover a tumbling aircraft to straight and level flight.

"To our knowledge, no one has had to resort to use of this system for real, or at least they haven't admitted to it," said Mr. Silz.

PAARS, which was part of a broader improvement program, was delivered to Tactical Air Command in late 1990. It is the first automatic recovery system installed in Air Force fighters for general use, according to Lockheed.

The F-117's makers believe their success demonstrates the benefit of avoiding the traditional procurement approach. Working in secrecy and enjoying relative immunity from congressional and press scrutiny, the Skunk Works team worked with a small Air Force office to bring stealth from the laboratory to operational use. Mr. Brown, who was the first F-117 program manager, said he was relieved of normal contracting and paperwork chores, which went to another Lockheed manager. "That left me more time to do real work," he said. The Air Force monitoring team, he added, consisted of six officers, "which was delightful." ■

David J. Lynch covers the aerospace industry and national defense topics for the Orange County Register in California. He is a former editor of Defense Week Magazine in Washington, D. C. His most recent article for AIR FORCE Magazine was "The Risen Sun?" in the October 1992 issue.

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A new mobility requirements study finds the US short by almost sixteen percent of the airlift it will need by 1999.

The Ton-Mile Gap

By Peter Grier

IF ONE capability is becoming more important to the US military in the new global security environment, it is the power to move things. Fighting on short notice in unexpected places requires large amounts of mobility, as the US learned in the Persian Gulf War.

United States military airlift and sealift, operating under unrelenting time pressure, carried more than eight billion pounds of dry cargo to the Arabian peninsula—plus six million tons or so of petroleum products. Nine divisions worth of US troops were hustled to the Gulf, many on planes drawn from a Civil Reserve Air Fleet (CRAF) never tested in war.

In more recent months, Air Force airlifting power has been called on to deliver aid to Somalia, Bosnia, and other desperate corners of the globe. Once, the US policymaker's crisis question was, "Where are the carriers?" That cry lately has been superseded by, "Where are the airlifters?"

Recognizing this reality, Congress in its Fiscal 1991 defense authorization bill told the Pentagon to take a hard look at future power projection requirements and come up with an integrated mobility plan. The result is the Mobility Requirements Study.

The full MRS, which is still classified, analyzed threats, warning time, degree of allied participation, overseas bases—all the interrelated factors that affect the need for what might be termed "strategic agility."

The study's principal conclusion is that, at a time when US forces are shrinking, Washington should spend more on agility assets. In the words of an unclassified MRS executive summary, "The uncertain and dangerous future world will require more capability than the United States possesses today to project a powerful force quickly to overseas crisis areas."

In the past, requirements sometimes were set in a crude way. Theater commanders listed all the airlift or sealift they felt they could use, and the Pentagon combined the lists. The results were frequently unrealistic. By contrast, the Joint Staff imposed top-down discipline on the analysts who conducted the MRS. With a more realistic basis, the MRS has become a plan that actually might be followed.

"It is the best study of its type that we have done in the Department of Defense, ever," said recently retired Gen. H. T. Johnson, who served as

The C-17 (opposite) has a starring role in the new military mobility plan, which calls for a major increase in USAF airlift capacity by 1999. The plan would require the Pentagon to procure 120 of the advanced airlifters to offset retirement of C-141s.



commander in chief of US Transportation Command and commander of Air Mobility Command, both located at Scott AFB, Ill. (General Johnson also headed USAF's Military Airlift Command until it was disestablished June 1.)

General Johnson said the MRS set out to determine a Fiscal 1999 baseline for US mobility capability. Officials involved in the study analyzed lift needs for fighting in a number of potential crisis zones—from the Persian Gulf to southeast Asia, from Europe to the western hemisphere.

Though host nations and allies could help in all these possible conflicts, the MRS calculates that each ton of deployed combat equipment will need 1.5 tons of support gear. The study accepted what it terms “moderate risk” for US troops in both the first weeks of a deployment, when thinly supported forces might be overrun, and in weeks three through eight, when aggressors might still have enough of an upper hand to cause unacceptable damage or lay waste to occupied territory.

As the MRS analysts saw it, this moderate-risk deployment capability would not be able to handle two si-

multaneous crises. To do that, the US would have to carry out a substantial amount of “coercive requisitioning” of commercial shipping, as well as full activation of the CRAF program, said the study summary.

An Integrated Mobility Plan

The MRS lays out an integrated mobility plan that includes the following elements:

Airlift. By 1999, the US should have an overall airlift capacity of fifty-seven million ton-miles per day (mtm/d). Reaching that goal from today's forty-eight mtm/d capacity would require purchase of 120 new C-17 transport aircraft—the full quantity to be procured under current USAF plans.

About thirty-seven mtm/d of the 1999 goal would be provided by military aircraft, with the rest coming from the participation in CRAF of US air carriers. After 2000, retirement of the C-141s could drive US airlift capacity back toward today's levels.

“Airlift may have to be plused up a little,” from the MRS goals, said General Johnson. He added that the Pentagon can postpone the decision until later this decade.

An airlift force capable of twenty-

six mtm/d could move an airborne Army division and its support units to Europe in a week. Getting that same division to the Persian Gulf region in the same amount of time would take a capacity of forty-nine mtm/d.

Sealift. General Johnson said the single most pressing sealift need is to increase capacity for the transport of heavy combat equipment at the beginning of a crisis. The MRS recommends purchase of twenty new, large, medium-speed vessels of the type that can best handle tanks and tracked vehicles. These are the so-called “roll-on/roll-off” (RO/RO) ships.

Eleven of the twenty new RO/RO ships would be kept at high readiness at US ports. They would join eight SL-7 fast sealifters already maintained by the Navy for quick deployment of US heavy forces. The total capacity of this nineteen-ship, quick-reaction fleet would be two Army divisions, plus support equipment.

The other nine new RO/RO ships and two newly leased container ships would be used for afloat prepositioning. Loaded with combat gear for an Army heavy brigade, these ships could be anchored at an overseas naval base, such as Diego Garcia in the Indian

Ocean. The US already has twenty-one prepositioning ships for both Army and Marine equipment, and they were among the first lift assets to respond to the Gulf crisis in 1990.

The MRS urges a continued expansion of the Ready Reserve Fleet (RRF), which includes the most modern of inactive merchant vessels maintained by the Maritime Administration for the Pentagon. Current plans call for the RRF to grow, by the end of the decade, from ninety-six to 142 ships.

Infrastructure. To help bolster the US land transport system, the MRS asks that the Pentagon buy 233 new heavy-lift railcars for movement of tanks and other armored vehicles. Key ports will have to have additional berthing to handle any new surge sealift capability.

General Johnson is particularly concerned about the lack of a modern ammunition loading facility on the West Coast. A survey found one candidate, but its facilities have yet to be certified safe enough for the touchy job of loading explosives.

The Defense Department also plans to invest in specialized containers to be prepositioned at the home bases of units scheduled to move out quickly in any deployment. US civilian shipping has made greater and greater use of containers in recent years, but the military has not followed suit.

In traditional "break bulk" ships—vessels that carry dry cargo piece by piece—wooden sheds have to be erected



USAF photo by TSgt. H.H. Delfner

Humanitarian missions to desperate places are of growing importance. Here, SSgt. Timothy Blaize (in headset), a C-130E loadmaster with the 61st Airlift Squadron, Little Rock AFB, Ark., oversees food delivery in Somalia.

to ensure that no metal part of a munition touches a metal part of a ship. The process is much easier with preloaded containers. "All the ammo we used in Desert Storm could have been taken to the Gulf on eight container ships," said General Johnson.

If the mobility force outlined in the MRS is put into place by the turn of the century, the US would be able to get two Army divisions and two Marine brigades, plus their associated fighter squadrons, to Europe in about fifteen days.

A More Demanding Scenario

For the far more demanding scenario of a crisis in a region like southwest Asia, the US could deploy five Army divisions, along with a Marine Expeditionary Force and tactical air, within about eight weeks.

In a regional deployment, airlift would begin arriving on C-day plus one (C+1), moving about 4,500 short tons of cargo per day if only military aircraft were used. That figure could be increased to 6,750 tons if the CRAF were fully mobilized.

Ground troops flown in by air could begin linking up with equipment and moving out as soon as C+5. Prepositioning ships could deliver 53,000 tons in a week or so. The first fast sealift ships would begin arriving about C+20.

Specific deployment plans for this and other scenarios are in place and have practical projected times for force arrival.

In the Air Force's view, the operational experience of Operations Desert Shield and Desert Storm has been invaluable. Though the deployment succeeded, it also identified a number of mobility weaknesses, the Pentagon conceded in a recent report on the war.

For instance, the US had prepared detailed mobility plans only for rapid response units, such as the 82d Airborne Division, based at Fort Bragg, N. C. The Ready Reserve Fleet had problems getting going, and logisticians learned that CRAF aircraft did



A C-141 cockpit can be a busy place. Though the C-17 is being procured to replace these aging planes, some in Congress want to take a fresh look at the prospect of extending the StarLifters' service lives.

not have the flexibility needed to haul some military cargoes.

A second fact brought home in the Gulf War was the critical role of en route bases for deployment speed. More than eighty percent of all airlift missions to the Kuwaiti theater transited either Torrejon AB, Spain, or Rhein-Main AB, Germany.

With the US presence in Europe diminishing, General Johnson worries about future en route access. Torrejon will be mothballed. For a while, the US considered leaving Rhein-Main, said General Johnson, but the Joint Chiefs are committed to keeping it open.

"In the future, if we don't have en route countries [that are] agreeable, we just will not go," he said.

A third Gulf lesson is that transportation should be run by a single manager, in peace and war. Otherwise, the US can be hit by transition problems, such as the Navy's difficulty in dusting off the RRF and handing it over to TRANSCOM.

Finally, the Gulf experience showed that not enough operators were familiar with JOPEs, the Joint Operational Planning and Execution System. JOPEs is a computer system intended to plan, coordinate, and track unit deployments. In hindsight, TRANSCOM commanders learned they had not exercised the system enough in peacetime. JOPEs also was not flexible enough to adapt to all the midstream changes typical of an actual deployment.

A new computer system, the Global Transportation Network (GTN), is supposed to provide more capability. The GTN will tie together all the various deployment information management systems from the factory to troops, allowing users to find where any single piece of cargo is at any one time.

"We don't want cargo delivered to port unannounced without the information for theater commanders to move it forward to foxholes," said General Johnson.

Congressional Wariness

TRANSCOM's plans to upgrade the nation's strategic agility are ambitious. Though Congress generally has supported airlift and sealift requests in the wake of the Gulf War, it is far from certain that it will buy all the assets outlined in the MRS.

In a recent report, the staff of the Senate Armed Services Committee estimated that the MRS plans for sealift alone will cost \$10 billion. The report



The first four C-17s take to the air. The mobility force preferred by the requirements study could move two Army divisions, two Marine brigades, and support for their associated fighter squadrons to Europe in fifteen days.

nevertheless concluded that the US will have to buy some new sealift ships.

For lawmakers and their staff experts, the C-17 aircraft also remains a controversial purchase. Noting that the program is running more than a year behind schedule, the Senate authorization report said it may be another year before it is clear whether fuel leaks that have grounded the test C-17 three times have been fixed. The report added that the contractor had big problems in mating large sections of the fifth production aircraft.

To protect against further C-17 delays, the Senate wants to take a hard look at a program to extend the life of C-141 airlifters, whose retirement will accelerate in years just ahead.

General Johnson argued that the C-17 flight test program actually is going well, having completed over 400 flying hours. Quality control is getting better, he said, with rework and repair needs declining almost twenty percent every time a new aircraft enters production.

If C-17s had been available in the Gulf, the General added, the US could have moved forty-five percent more air cargo into the theater in the first forty-five days.

The venerable C-141, on the other hand, has problems with fatigue cracks in the wing, in the fuselage near the

pilot compartment, and at other hot spots. "The C-141 is reaching the end of its useful life," said the General.

Airlift assets are particularly precious to logisticians. The speed and flexibility of air deployment ensure that, in almost any operation, commanders demand all the airlift they can get.

In the Gulf War, eighty-five percent of the dry cargo traveled by sea and fifteen percent by air. While that may sound unbalanced, much more US equipment was dispatched by air than had been planned. Ninety-nine percent of personnel arrived in the Kuwaiti theater of operations by air.

The unglamorous C-130 transport suddenly has become the symbol of American military presence around the world. In late summer, C-130s were busy ferrying relief supplies into Sarajevo, in embattled Bosnia. They were carrying aid into remote areas of south central Somalia. They were even in demand in the US, where they carried crucial stocks of food in the immediate aftermath of Hurricane Andrew's devastation of south Florida and the Gulf Coast.

"We are without peer when it comes to using airlift assets," said General Johnson. "If you want to operate anywhere in the world, you have to have the transportation to get there." ■

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Everything in the air is up for sale,
export-minded Russian officials declare.

Russia Steals the Show at Farnborough

By Frank Oliveri, Associate Editor

RUSSIA stole the Farnborough Air Show. Displaying some twenty aircraft, many of which had never before been seen in the West, the Russians dominated the flying demonstrations and pushed to forge cooperative ventures with European partners and to drum up sales of existing aircraft.

About 200,000 visitors turned out last September for the eight-day event, held just outside London. The show featured more than 670 exhibitors from thirty countries, but it was the Russians who seemed to be everywhere. Unofficial estimates put the total of Russian participants in the hundreds, and their aircraft drew the largest crowds.

By contrast, the American contingent was low-key. The US aerospace industry was represented most prominently by McDonnell Douglas, which displayed the Air Force F-15E dual-role fighter and F-15C air-superiority fighter, the Navy and Marine Corps F/A-18 strike fighter, and the Army AH-64 Apache attack helicopter.

The Russian presence overshadowed all others. The Sukhoi Design Bureau, in particular, brought an impressive range of aircraft. At the top of the list was the Su-35, an advanced

The Russian Yak-141 V/STOL supersonic fighter displayed its hovering capability to the Farnborough crowd, straying momentarily over the spectators. Clearly visible are the two forward engines and the large, vectored rear engine. The prototype is the only one of its kind.

Staff photo by Guy Aulito





The aircraft industry can be a "very touchy-feely business," as one industry official termed it. Here, an air show participant gets information about the Dassault Mirage 2000-5. Visitors had little trouble gaining access to most cockpits.

multirole fighter, derived from the highly regarded Su-27 "Flanker." Also on hand were the Su-27 fighter itself; the new Su-24MR multisensor reconnaissance aircraft based on the Su-24MK "Fencer"; the dual-seat Su-29 and single-seat -29T competition aerobatic aircraft; and the venerable Su-25T "Frogfoot," an all-weather, night-time, ground-attack aircraft.

On display was an array of MiG-29 "Fulcrum" models, including the MiG-29M fly-by-wire multirole fighter and the MiG-29C. The Russians brought the MiG-31 "Foxhound" all-weather, high-altitude interceptor; the supersonic Yak-141 "Freestyle" V/STOL naval multirole prototype; the Yak-38 "Forger" V/STOL fighter; and the Tu-22M-3 "Backfire-C" bomber.

Everything For Sale

Russia needs and wants to market its wares. Russian officials reported that every aircraft at the show was for sale in the export market. Officers of Sukhoi, the only independent Russian "company" at the air show, were talking to potential buyers from Middle East, Far East, and even NATO nations, seeking orders for their fighters and bombers.

Midway through the week, the Russian contingent held a press conference featuring general designers from several of the nation's top aircraft bureaus, drawing dozens of journalists to the chalet of Aviaexport Russian Federation. Among the general

designers speaking that day were R. A. Belyakov of the Mikoyan Design Bureau, M. P. Simonov of the Sukhoi Design Bureau, P. V. Balabuyev of the Antonov Design Bureau, A. A. Tupolev of the Tupolev Design Bureau, S. V. Mikheyev of the Kamov helicopter plant, and M. V. Vaynberg of the Mil helicopter plant.

They said their design bureaus would use their assets to target the commercial market in recognition of a worldwide decline in military spending. However, military aircraft will remain the jewel in the crown, they suggested.



Everything in the Russian stable of aircraft was for sale, and many participants at the show were drawn to the Ka-50, an attack helicopter with capabilities said to be similar to those of the US Army's AH-64 Apache.

A. G. Bratoukhin, general director of the Aviation Industry Department, said that Russia has developed an aviation plan for the remainder of the decade. Under the plan, commercial R&D would rise by about fifty percent. Mr. Bratoukhin would not provide actual figures in rubles. He said that Russian aircraft production employs 1.2 million workers, a figure that does not include those in avionics, electronics, and other related areas.

Though the static displays were impressive, Russian flying dazzled the audience. The huge, Mach 2.3+ Su-27 impressed viewers with its size and power, while the comparably fleet MiG-29 displayed great agility, reflecting the capability of fly-by-wire controls. Both Russian aircraft performed the now-familiar tailslide maneuver.

Late in the air show, audiences were treated to a public flight of the sole Yak-141 prototype. Earlier in the year, the only other Freestyle was destroyed in a crash. The Yak-141 was by far the loudest of the exhibition aircraft, firing its three engines (one Soyuz/Koptchyenko R-79 turbofan and two RKBK/Rybinsk RD-41 lift jets) in broad maneuvers. The single vectoring nozzle turns sixty-five degrees downward for short takeoff and ninety-five degrees downward and forward for vertical landing. Its maximum speed is Mach 1.7 at high altitude, with a range of 870 miles on internal fuel and 1,305 miles with external tanks.

Hard on the Ears

In hover mode, the aircraft was unable to maintain a rock-solid position like that displayed by the other V/STOL aircraft, the British GR. Mk. 7 Harrier. At one point, the Yak slipped over the crowd and then faded to one side, its engines creating a deafening roar.

The world champion aerobat Su-29 put on the most spellbinding flying display, performing dizzying spins, dives, and hair-curling turns. The Su-29 two-seat aerobatic aircraft is designated for military training and participation of pilot-sportsmen in home and international flying sports competitions. The airframe, more than seventy percent composite, has a permissible G load of +12/-10 Gs, according to Sukhoi.

An ominous sign of the future was the Tu-22M-3 Backfire-C bomber on static display. Mr. Tupolev indicated



Staff photo by Guy Aceo

Vertical/short takeoff and landing aircraft appear to hold some promise, but tradeoffs still have to be made. The Harrier (above) is capable of only subsonic speeds, and the Yak-141 (below) suffers lift penalties because of its weight.



during the Russian press conference that the medium bomber was up for sale on the world market. (Reports of a sale to Iran have circulated for some time.) The Backfire-C, which has a four-man crew, is capable of Mach 2 and of Mach .9 on the deck. It has a maximum unrefueled combat radius of 2,485 miles and is powered by two engines capable of 45,000 pounds of thrust with afterburner. The system can deliver the AS-16 "Kickback" SRAM, among other air-to-surface missiles. It can also carry twelve to eighteen 1,100-pound bombs. It has one GSh-23 twin-barrel 23-mm gun in the tail.

In the presence of such an array of aircraft, US participation seemed painfully thin. American representation, apart from the McDonnell Douglas fighters and helicopters, was based on a Lockheed-built Canadian C-130 transport, Sikorsky UH-60 utility helicopter, Bell OH-58C observation helicopter, General Dynamics F-16 multirole fighter, and a model of the GD/Fairchild Aircraft Multimission Surveillance Aircraft.

The MMSA was the newest aircraft design the US displayed. It is equipped with the Low-Intensity Conflict Aircraft Systems pod—configured with video or forward-looking infrared

(FLIR)—infrared line scanner, and radio frequency modem imagery system. It carries a multisensor operator console with digitized map display and automatic position and targeting functions.

The twin-prop, Garrett-powered MMSA can seat up to twenty-one passengers but typically seats three to ten. Its maximum cruise speed is 331 miles per hour. Martin C. Wehmhoner, Fairchild's director of Government Relations, said the system could perform maritime patrol, contraband interdiction, and regional surveillance missions. He said US government agencies have expressed interest, as have some South American countries.

Flying for the first time in an air show since being chosen as USAF's Enhanced Flight Screener in April 1992, the Slingsby T67M-260 Firefly showed off some of its aerobatic capabilities. The two-seat aircraft can perform at +6/-3 Gs at a weight of 2,500 pounds. Its maximum speed at sea level is 152 knots. It can climb at a rate of 1,650 feet per minute. The prop-driven Firefly has a single 260-horsepower Lycoming fuel-injected engine. The cockpit has full dual flight controls with conventional stick control column. The Air Force plans to buy as many as 125 of these trainers.

The Missing Americans

Only two US-designed aircraft—an F-16 of the Turkish Air Force and

a NATO E-3A Airborne Warning and Control System aircraft—flew during the air show. Some US industry officials were disturbed by the absence of US aircraft. "This is a very touchy-feely business," one industry official said. "People want to see these planes flying, even if it is only to show that we're in good shape."

British Aerospace (BAe) had one of the largest displays, exhibiting the UK/German/Italian Panavia Tornado F. Mk. 3 Air Defense Variant (ADV), the Harrier GR. Mk. 7 V/STOL aircraft, the two-seat Hawk 100, and the single-seat Hawk 200 military trainer and attack aircraft. The ADV has a longer fuselage than the GR. Mk. 1 interdicator/strike version of the Tornado, which saw considerable action in Operation Desert Storm. In addition, the ADV carries four Sky Flash and four Sidewinder air-to-air missiles.

Many Europeans were preoccupied with the trials of the European Fighter Aircraft (EFA) program. The existence of the joint venture among Britain, Germany, Italy, and Spain has been in doubt since Germany announced this summer that it could not afford to pursue the plane past development. Each of the four nations needs a new fighter, and Britain has sworn to stay in the program whether Germany stays or not.

BAe, in fact, displayed a full-scale mockup of the EFA. The EFA is a multirole fighter that can carry up to ten short- and medium-range air-to-



Staff photo by Guy Aceto

The American presence was low-key, with few US-built aircraft flying. This F-15E on static display nonetheless drew crowds, anxious for a closer look at the formidable strike fighter, a star performer in the Persian Gulf War.

air missiles, with at least four missiles in recessed fuselage stations. In an air-to-surface configuration, it can carry up to seven air-to-surface weapons, along with six air-to-air missiles. The original plan called for the actual prototype aircraft to fly at this Farnborough show, but delays pushed back the first flight to late 1992.

The fly-by-wire EFA, which employs canards, is expected to have a maximum speed of Mach 2, with a +9/-3 G limit. Its maximum takeoff weight will be about 46,218 pounds—lighter than most front-line Western

fighters. One reason is that seventy percent of its surface area is to be made up of carbonfiber composites. The EFA will be powered by two Eurojet EJ200 reheated turbofan engines in the 20,000-pound-thrust weight class. The EFA team includes BAe, Germany's MBB, Italy's Alenia, and Spain's CASA. The Eurojet engine team comprises Rolls-Royce, Germany's Motoren und Turbinen Union, Italy's Fiat, and Spain's ITP.

The cockpit is dominated by three multifunction displays, providing the overall tactical situation, system status and checklists, and map displays, including air traffic procedures. A direct voice input system allows the pilot to perform such tasks as manual data loading and head-up display/multifunction display selection. A helmet-mounted sight and HUD will include flight reference data, weapon aiming and cuing modes, and FLIR imagery. The helmet will also include night vision aids.

UK Won't Back Down

British Defence Minister Malcolm Rifkind, at an impromptu press conference, emphasized that Britain and the Royal Air Force would not back away from EFA's basic twin-engine design. "There is no doubt that we will need an aircraft to meet our requirements for the next thirty years," he said. "Remember that this aircraft is going to come into operation at the turn of the century and is then going to meet the



Staff photo by Guy Aceto

As usual, British Aerospace came to Farnborough in force, displaying its Hawk 200 attack/training aircraft and the Tornado Mk. 1 fighter in the BAe "Defense Park." The Hawk 200 is a single-seat version of the Hawk 100.



The Dassault Rafale (above) and the SAAB JAS-39 Gripen (below) both put on impressive flying displays. The two are being aggressively marketed. Germany, which may drop out of the EFA program, is seen as a possible customer.

RAF's needs for at least twenty years thereafter. You can't just go back to the drawing board now and believe that you'll end up with something cheaper."

Germany, seeking alternatives to the EFA, opened the door to possible procurement of US aircraft or even the Swedish JAS-39 Gripen. German willingness to look at other fighter aircraft caused ripples throughout the industry. With the EFA's future in doubt, Gripen becomes a potential alternative, but Swedish officials are moving with extreme caution. SAAB Military Aircraft officials said that SAAB is not strongly pursuing a deal with the German government.

The JAS-39, which flew aggressively at the air show despite poor weather, is a lightweight, single-seat, multirole fighter. It is a programmable aircraft, meaning that it can be easily adapted to changing requirements and missions. It weighs 17,800 pounds and has a single 17,800-pound-thrust General Electric/Volvo Flygmotor RM12 engine. The engine is derived from the F404 engine installed in the US F/A-18.

France had a sizable contingent on hand, with Dassault displaying its delta-winged Mirage 2000-5 and the prototype of its new Rafale fighter. Rafale, in fact, is another candidate for filling German requirements. However, Serge Dassault, the company's chairman and chief executive, said that Germany has not sought information on Rafale and that Dassault has



not yet approached the German government.

Tragedy Strikes

Just before the Farnborough Air Show, tragedy struck a Joint Primary Aircraft Training System (JPATS) contender. The Vought-FMA team's IA 63 Pampa aircraft flew into the ground, killing two Argentinian pilots and destroying the aircraft. The accident could hamper the aircraft's chances of winning the JPATS contract. Another JPATS candidate, the Embraer/Northrop EMB-312 Tucano turboprop trainer, enjoyed better luck and flew consistently throughout the

week. The tandem-seat Tucano is powered by the Pratt & Whitney Canada PT6A-25C turboprop engine.

Though aircraft dominate the show, they are outnumbered by small contractors showing off components from tires to nuts and bolts. Four huge exhibition halls were filled with such wares from around the world.

Several simulator technologies were exhibited. For example, McDonnell Douglas displayed its modular aircrew simulation system/reconfigurable cockpit, which simulated the properties of F-15C, F/A-18C/D, and F-16 fighters. The system is equipped with a flat-panel, high-resolution, touch-sensitive screen that is reconfigurable to simulate any of the three aircraft. It also can simulate virtually all sensors.

Munitions were prominently displayed. Rockwell displayed a mockup of the Extended Range AGM-130, its

candidate in Britain's Conventionally Armed Standoff Missile (CASOM) program. In its basic configuration, the weapon would carry either a heavy penetrating warhead or a BLU-109 2,000-pound penetrating bomb. The derivative would have a 100-mile range.

Textron displayed its Sensor-Fuzed Weapon, which will be used by the US Air Force. The system has an SUU-64/B tactical munitions dispenser, which contains ten BLU-108/B submunitions, each of which carries four skeet warheads for a total of forty warheads per weapon. The system provides multiple kills per pass against all vehicles, including heavy armor. ■

Those who expected General McPeak's "Year of Training" to be a ho-hummer are in for a surprise.

The Wall-To-Wall Training Review

By Bruce D. Callander

SUPPOSE that Air Training Command (ATC) took over some combat crew training conducted by operational commands, that enlisted technicians went back to tech school midway through their careers, and that the armed services used their surplus flight training capability to produce pilots for the airlines.

Radical? Impractical? Likely to spark turf battles? Maybe, but those are the kinds of ideas Gen. Merrill A. McPeak, the Air Force Chief of Staff, fired off with the speed of a well-tuned Gatling gun in a recent discussion about training. "We want to create a world-class training operation in the Air Force," the General remarked.

General McPeak announced several major training initiatives for the enlisted force at the Air Force Association's forty-sixth National Convention in Washington, D. C., in September. They called for sending more enlisted troops to formal technical schools, increasing the training times for award of higher skill levels, and raising the grade levels at which non-commissioned officers receive professional military education (PME). Other moves were in the works.

The changes have been long in the

making. Early this year, General McPeak ordered a "wall-to-wall" review of USAF's training programs and called for suggestions on how they could be matched with the stripped-down force structure. The result was not one but four studies—probing flight, technical, and acquisition training and the basic structure of ATC.

The study groups proposed fifty-six initiatives, ranging from low-cost, easy-to-accomplish reforms to major organizational changes, some of which promised to be expensive and controversial.

Initiatives announced in September were not the only ones in play. Others were still under review. Then there were some ideas, such as having ATC train pilots for the airlines, that did not emerge in the review but that, in General McPeak's mind, were logical extensions of the training reforms.

After leaving the tutelage of training instructors, such as SSgt. Larry Williams (opposite), most enlisted personnel enter technical schools, but many do not. General McPeak wants to examine whether technicians in such fields as supply would benefit from additional schooling after basic training.



USAF photo by MSgt. Michael Haggerty

Two Critical Steps

The Chief of Staff said that the studies were worthwhile for underscoring the two main steps the Air Force needs to take. One is to develop an overarching concept for how the Air Force trains. The other is to raise training standards by requiring more formal schooling throughout members' careers. He said that those two principles are pretty well accepted.

To illustrate both points, the General cited the case of enlisted technicians. At present, most recruits go to tech schools before they move to their first assignments, but large numbers do not. There is no initial technical training for such fields as airfield management, vehicle operation and maintenance, sports and recreation, and storage and distribution.

"Do we mean that supply is a total no-brainer," asked the General, "and you don't need any training at all to report to a base and start storing these high-value items? . . . In all those career fields, we have said, 'Well, it can be done by on-the-job training,' but I am not sure that it *can* be done by OJT."

He was equally concerned that most airmen who receive initial tech school-

ing never returned to a formal training environment. They earned both their five-level (journeyman) skills and their seven-level (supervisor and technician) skills through OJT. The quality of training varied from command to command.

In tech schools, General McPeak said, there are trained instructors who follow an approved syllabus. "People are bound to receive the information better," he said, "and retain it longer."

General McPeak concluded that the solution was to require airmen in all skills to receive some basic technical training and to return to tech schools at a career midpoint for award of their seven-level Air Force Specialty Codes (AFSCs).

This, he said, would have several benefits. Universal tech training for recruits would raise standards for apprentices and improve their ability to train on the job. The midcareer return to tech school would raise standards for skilled supervisors and technicians and make NCOs more competent to act as instructors.

Another initiative required that airmen be tech sergeants or tech sergeant selectees to attend NCO academies and senior master sergeants or

selectees to attend USAF's Senior NCO Academy. Emphasis would be on training in residence rather than on correspondence courses, General McPeak announced.

Higher training standards would not force the Air Force to raise its recruiting criteria, the General said. "I think the people we are getting now are great, so that's not the problem. The problem is that our standards haven't been high enough."

Expensive Training

General McPeak also wanted to see ATC take on more training of officers, particularly pilots moving to operational units. This would be a controversial move. At issue was the combat crew training performed by the operational commands. Historically, flight schools have trained pilots to fly and the using commands have trained them to fight. Flight school graduates have been sent directly to combat commands to train in operational aircraft and learn combat tactics.

General McPeak did not challenge the combat commands' desire to groom their own flyers for combat, but he said the studies raised questions about

how much of the initial crew training should be taken on by the combat commands. Fighter units, for example, used F-16s to school pilots in basic air-combat maneuvers. The General noted that ATC could provide the same training at much less cost in such trainers as the T-38. The more important training mission for the commands, the General said, was to groom their units for deployment with integrated forces.

"The real combat mission involves integration of F-16s and F-15s and AWACS and tankers and the rest," he said. "No F-16 pilot goes to war as an F-16 pilot. He goes to war as part of an integrated force that goes out and achieves combat objectives.

"The training mission that produces a trained F-16 pilot is different from the one that produces combat forces ready for deployment. We want to do the training mission that makes combat forces ready for deployment in the using command. That's the only place you can do it. But there is a logical break . . . between producing a combat-ready F-16 pilot and then the next step of enabling him to operate in this integrated aerospace combat environment."

A possible solution, General McPeak said, would be to give ATC's commander the power to decide what training should take place in ATC and which in the using command. "We can argue that we need one guy in a position to be able to look at the training as an end-to-end item, with a

combat-ready aircrew walking out the door to go to the unit and making all the trades in there to produce that commodity."

Though the commands did not want to give up some crew training, the realities of the force drawdown might make it a bit more palatable. Commands have had to cut back on lead-in training and on aggressor squadrons that have honed the skills of fighter pilots by playing the bad guys in realistic air battles [see "Demise of the Aggressors," August 1992, p. 38]. The cuts have strained budgets and training resources. As the studies showed, schooling new pilots entirely on first-line aircraft was an expensive and time-consuming proposition.

ATC was already shifting to a specialized undergraduate pilot training (SUPT) that aims to produce flyers oriented toward specific classes of aircraft. It will be years before SUPT is in full operation, however. The program will not include training in operational maneuvers. Commands may be receptive to having ATC provide pilots schooled in the basics of air combat.

General McPeak said ATC could take an even broader training mission: producing pilots as a national resource. The Air Force has been doing this indirectly for decades, but the drawdown has changed the dynamics of that situation.

Needed: 2,000 Pilots

Traditionally, the airlines have re-

cruited replacement pilots from the services. As many as half of them have come from the Air Force. USAF's own pilot production is slated to drop to about 500 per year in 1994 and 1995. During those years, the airlines will lose some 2,000 senior pilots to retirement.

What if the Air Force and other services dedicated some unused training capability to produce pilots specifically for the carriers? In the past, the services accepted the fact that they would lose a percentage of their experienced pilots to the airlines and adjusted training rates accordingly. It has been an expensive process. Using the military to train pilots for the carriers would simply acknowledge reality, and it might produce revenue to offset military training costs.

"It goes well beyond my warrant to talk about such matters," said General McPeak, "but somebody . . . ought to be grappling with . . . the national requirement for pilots, how it is being satisfied, and whether what we are doing in the Department of Defense today is helping or hurting. We may be going the wrong way here, but we have no choice. We are being told we are producing too many pilots even at the 500-per-year rate."

The study group recommended major changes in the Air Force's training structure. One would consolidate scattered training institutions under a single authority.

ATC's main job has been to provide basic military, technical, and flight training and to oversee USAF's college ROTC program, but the command never had a monopoly on the teaching business. The Air Force Academy produces a substantial percentage of the officers. Air University provides professional schooling and oversees graduate-level technical training at the Air Force Institute of Technology and civilian institutions. Other commands provide combat flight training and academies for their NCOs.

Roughly one-tenth of Air Force military and civilian strength is concentrated in the permanent-party elements of ATC, AU, and the Academy, much of it at the administrative level. The other commands have dedicated a sizable percentage of their strength to training. Past studies proposed reducing this overhead by merging various elements into a super Education and Training Command, but such proposals gained little support.



Pilot training is already undergoing radical change. Specialized undergraduate pilot training aims to produce flyers of specific classes of aircraft, and there is talk of transferring some of the combat commands' training functions to ATC.

USAF photo by CMSgt. Don Sutherland

One reason was that the present training entities are deeply rooted in the Air Force's past. ATC and AU were among the charter commands when the Air Force was founded in 1947. The Academy dates only to 1955, but it has ancestral links to the US Military Academy at West Point and the US Naval Academy at Annapolis. AU, ATC, and the Academy all are imbedded in USAF tradition.

Still, the Air Force did the unlikely when it recombined its Systems and Logistics Commands, the unpopular when it hollowed the staffs of numbered air forces, and the unthinkable when it dismantled Strategic Air Command. Against that background, the notion of a single training establishment seemed less farfetched. General McPeak said that Congress itself hinted that it would like to see the Academy put under ATC.

At AFA's Convention, General McPeak did not detail plans for beefing up the role of Air Training Command, but he did say that he and Air Force Secretary Donald B. Rice wanted the next ATC commander to be a four-star general rather than a three-star general, as has been the case since 1988. Such a move would not be justified unless the command received a broader mission.

There have been persistent efforts to combine training for all services. Whether a single Defense Training Command will ever emerge is a tough question. Traditionally, services have insisted that the need to school their members on specific weapons and tactics makes unified training impractical. Again, the prospect of saving money may weaken resistance to such ideas.

A Training Czar?

"There is a sense in which training is a Department of Defense problem," said General McPeak, "and there ought to be a training czar who handles it for all services." In addition, he called for a separate review of Air Force Specialty Codes. "We have too many AFSCs. We need fewer and, when we have fewer, people will have to be trained more broadly."

In his remarks to the Convention audience, the General added, "By merging similar career fields, we can reduce the number of enlisted Air Force specialties by about twenty percent. Naturally, this will consolidate and reduce technical training costs."

There has long been a debate about



USAF photo by Carlos Baker

General McPeak sees some shortcomings in on-the-job training, speculating that it might be better if airmen earned their five-level (journeyman) and seven-level (supervisor and technician) skills through the technical schools instead.

the relative merits of specialization and generalization. Particularly during wartime, the Air Force opted for quick courses to turn out narrowly skilled technicians who could go to work quickly. In a smaller, more stable, peacetime force, the tendency was to broaden skills so that a given technician could be shifted to other jobs with a minimum of retraining. At the same time, however, the growing complexity of weapons tended to increase specialization and frustrate the efforts at broad job training.

The shrinking force has required the Air Force to take another look at the AFSCs. "There is the same amount of work load," General McPeak said, "but we've narrowly specialized people to handle that work load. So, when we reduce the number of AFSCs, people will have to be more broadly prepared."

The Chief of Staff seemed generally satisfied with the current technical training of officers. An overhaul of AFSCs may call for some broadening of their initial schooling, and some changes may be brewing in training for the acquisition area.

The timing of professional training for some officers was being reviewed

as the Air Force beefed up its operational wings and put them under general officers. "Now we send officers to Air War College before they get twenty years," General McPeak said. "I think we'll continue to do that, especially in the support specialties, . . . but we will probably send operators later, at the eighteen- or nineteen-year points. They will be more senior colonels because, when they come out, they will go to joint staffs, major commands, or USAF headquarters; receive their promotions; and go on to be wing commanders."

For General McPeak, the main concern was not so much to focus on individual approaches as to find the best combination of training programs to improve the system overall. "I am sure this will be difficult to do in [Washington], especially if it involves any money, because it will be argued that the Air Force already gives the world's best training. The fact is that we are good, but we simply need to get better. We're convinced that we have to notch up here. Our vision of the Air Force is that we're going to be the world's most respected air and space force. Well, we want that to be true of the training we give." ■

Bruce D. Callander is a regular contributor to AIR FORCE Magazine. Between tours of active duty during World War II and the Korean War, he earned a B.A. in journalism at the University of Michigan. In 1952, he joined Air Force Times, becoming editor in 1972. His most recent article for AIR FORCE Magazine, "Jargon of the Air," appeared in the October 1992 issue.

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With the demise of the Soviet Union, the Indian military—fourth largest in the world—lost its superpower patron and main supplier of arms.

India at the Crossroads

By Richard Mackenzie

IN THE bad old days, when the Soviet Union still existed, the defense relationship between the USSR and India was close—so close that India got late-model MiG fighters nearly as fast as the Soviet Air Force got them.

The Indian Air Force (IAF) had especially strong links to the Soviets. India license-produced MiG-21s. By the mid-1980s, it had acquired advanced MiG-29 aircraft and was offered first crack at whatever came next. The IAF gained access to new arms before Warsaw Pact countries got them.

It is no surprise, then, that the collapse and disappearance of India's superpower patron in 1991 caused pretty big problems.

The world's largest democracy and fourth largest military establishment suddenly found its world turned upside down. India and the USSR had been locked in an arms arrangement worth some \$10 billion; it was supposed to run until 1997. India had a deal to repay loans at a concessionary interest rate of 2.5 percent. New Delhi could repay some debt in Indian rupees and in products. Each year, the USSR was buying \$2 billion in Indian textiles, clothing, and other goods,

many so shoddy they could not be marketed elsewhere. Then the Soviet regime vanished.

Today, with the global playing field tilted in a new direction and a new world order in store, India finds itself at a crossroads, facing decisions that will have a lasting impact on its armed forces. The giant nation of nearly 900 million is seeking new relationships and is "doing cartwheels," in the words of one US diplomatic official, to manage its emerging arms supply problems.

Some say that the prospects for improved Indo-American military ties have rarely been better. The latest evidence to support this claim was the late August visit to the United States of Air Chief Marshal N. C. Suri, the Indian Air Force Chief of Staff. In response to questions from AIR FORCE Magazine, Air Chief Marshal Suri explained that his and earlier, similar visits "have been primarily goodwill in content and essentially oriented to fostering better understanding among the armed forces of the two countries."

He added, "I have no hesitation in saying that dialogue between armed forces . . . does help promote better

India brought into its Air Force not only new Soviet aircraft but also advanced Western types, such as the Anglo-French Jaguar (opposite), built in India under license. The IAF also took delivery of the French Mirage 2000 and other Western gear, but such Soviet fighters as the MiG-23, MiG-25, and MiG-29 have long formed the backbone of the Indian fleet.



understanding of each other's philosophies in terms of application of airpower, maintenance, [and] logistics."

The Nuclear Dimension

How India's reassessment turns out is important, not only because of the size of its armed forces in a critical region but also because India and its archrival on the subcontinent, Pakistan, have the ability to go nuclear. In January 1992, CIA Director Robert Gates stated publicly that, although the US had no reason to believe either India or Pakistan currently possesses nuclear weapons, both countries could assemble such a weapon quickly and both have combat aircraft that could be modified to deliver such a weapon in a crisis.

India, despite its strong ties to Moscow, had earlier begun to hedge its bets and try to reduce its dependency somewhat. In the mid-1980s, New Delhi began looking further afield and found a slight warming in the US. In 1985, Prime Minister Rajiv Gandhi launched a concerted goodwill effort. As a result, the two nations signed a memorandum of understanding, under whose terms the US released certain technologies. These were useful

mainly in computers and civilian air traffic control systems.

The Indian military and economic infrastructure remained tightly bound to the other superpower, but the situation began to change in the last days of the Soviet state. One reason: Moscow, under financial pressure, began charging India near-market prices for aircraft.

In December 1990, an official US delegation led by Henry Rowen, Assistant Defense Secretary for International Security Affairs, traveled to India for talks with senior Indian defense officials. India's Chief of Army Staff came to Washington in August 1991. Three other visits to India have since been made by senior US military officers.

Some Pentagon officials who earlier argued strongly against sharing anything military with India are taking a fresh look at the prospect. A few have become enthusiastic supporters of such a venture, say observers.

Whether India is ready for a major new defense relationship with Washington is not clear. Air Chief Marshal Suri acknowledged that "a major portion of IAF aircraft and weapon systems" were manufactured in what he

called "the erstwhile Soviet Union," but he claimed that this situation was in hand. "The previous arrangements existing in terms of supply, etc., still continue, and no major problems have been confronted," he declared.

Some Washington analysts say that such statements must be treated skeptically on the basis of the record. Thomas Thornton, a National Security Council staff member during the Carter Administration and now director of Asian studies at Johns Hopkins University, has followed Indian affairs closely.

"Backbreaking" Work

"I understand they've got to say that, but I don't believe it," said Mr. Thornton. "They say they're making deals with private companies in the old Soviet Union. They may be getting most of what they need, but it's a backbreaking experience. It's not realistic to think you can continue to equip yourself in that way. They are obviously very unhappy with the situation."

He added, "The Indians are shopping around as best they can, but their economy is in such wretched shape."

More than forty years of heavy state

controls and socialist domination of the Indian economy have caused slow growth, rising unemployment, a devalued currency, and increased dependence on imported goods and technology. The Soviet collapse further wounded the Indian economy; the old USSR was a good client, while the independent republics that followed are demanding payments in hard currency. The Soviet Union was a dumping ground for Indian consumer goods, said Mr. Thornton.

Notwithstanding its economic woes, India is locked in a military standoff with Pakistan and, to a lesser degree, China. India and Pakistan have fought three wars since the partition of the British colony in 1947. "It's a ratchet relationship with Pakistan that will go into a never-ending spiral if it is not stopped," said Mr. Thornton.

For fiscal reasons, India would prefer to curtail its arms expenditures.

"Our effort has continued to be to master the existing weapon systems and to carry out replacements, if any, only when it is inescapable," Air Chief Marshal Suri explained. "Our orientation is to find ways and means of optimizing the existing manpower and reviewing the existing establishments to find out if any reductions are possible. We are very serious . . . and no effort will be spared in maintaining a lean Air Force."

He added, "Today, we have possibly the least spending on defense, approximately 2.5 percent of the GDP.

It is in this context that we sincerely hope that no alarming military growth takes place in our neighborhood."

Still, India is aware that its "neighborhood" is a dangerous one and that its military must be prepared for large-scale operations. Air Chief Marshal Suri declined to comment directly on relations with longtime foe Pakistan but did allude to the arms race. Describing India's philosophy as "reactive," he said, "Should any buildup take place in our neighborhood or [should there be an] escalation of weapon systems, then we would be compelled to develop appropriate capability to deter the same."

No Coherent Doctrine?

In August, a group of Indian legislators made public a scathing, 214-page report that assessed the state of the Indian armed forces. The legislators charged that successive Indian governments have created the fourth largest defense force in the world without basing it on a coherent defense doctrine.

The report noted that forty percent of all Indian defense expenditures are being eaten up by the high cost of maintaining a standing army of 1.2 million soldiers. The legislators called for cutbacks in troops' salaries in favor of procuring more and better equipment. The study further urged that senior uniformed leaders of the Army, Air Force, and Navy be given a bigger say in policy formulation through the

creation of an Indian National Security Council.

"The Indian military has always been infantry-heavy simply because manpower there is cheaper," said Mr. Thornton. "The Army is also useful for domestic law enforcement."

The IAF, by all accounts, is a strong fighting outfit. However, it was in poor shape after the Indian victory in 1971 in the Indo-Pakistan War. During the next ten years, it incorporated into the force twenty new aircraft types and subtypes, including such strike fighters as the Anglo-French Jaguar. The IAF also accepted delivery of the new French Mirage 2000, but Soviet fighters, such as the MiG-23 and MiG-25, also were obtained and, along with other MiGs, formed the backbone of the IAF.

The pace slackened in the 1980s, and the focus of modernization in the IAF during the past decade has been the effort to develop a new Light Combat Aircraft (LCA) to replace its aging inventory of Soviet aircraft.

Air Chief Marshal Suri envisions the LCA as a multirole aircraft with "state-of-the-art avionics and other systems. . . . Looking at the advanced technology involved, we in the Air Force have asked for technology demonstrators prior to the prototype. There has been some slippage so far, primarily because of financial constraints. I sincerely hope that these would be overcome and the LCA will become a reality in not too distant a future."

As the Indian Chief of Staff suggested, the program has had its share of difficulties. There is a chance that some of the IAF's MiGs will be retired from active service before the new LCA is ready to replace them.

Command Structure

India's air arm has a total of four operational regional commands, backed up by two support commands. The combat commands comprise one light bomber squadron, eighteen fighter and ground-attack squadrons, twelve fighter squadrons, three reconnaissance squadrons, one liaison fleet, one liaison detachment, and eleven helicopter transport squadrons. Each also has training contingents. In Asia, the IAF is second in size only to China's Air Force. One US official says the IAF's strategy and force structure were developed when India believed it had to prepare to fight two wars: one in the northwest against Pakistan and another in the northeast against China.



Like many Indian fighters, this MiG-27 ground-attack aircraft was produced by domestic industry. India established a MiG license-production facility in 1962 and has been churning out several types of Indian MiGs ever since.

India now appears to regard the danger of war with China as remote.

In at least two operations in the late 1980s, Indian airpower was used with success. When India sent troops to Sri Lanka on what it called a peacekeeping mission, the IAF's transport and helicopter arms flew more than 70,000 sorties in support of 100,000 troops and paramilitary forces. The IAF did not lose any aircraft and suffered few aborted missions.

In November 1989, the IAF carried out Operation Cactus, in which it transported an Indian parachute battalion some 1,000 miles to a remote archipelago of the Maldives. The government there had called on India to help to repel an invasion by some mercenaries. The Indian troops and overflights by Mirage 2000 jets put an end to the crisis.

Air Chief Marshal Suri, a former fighter pilot who flew combat missions in the 1965 and 1971 Indo-Pakistan wars, does not lean toward either the rigidly controlled Soviet or the independent American "style" of air combat. "The style of air warfare," he said, "is developed by a country based on the type of threat that it envisages, its political and military aims, and objectives [that] relate not only to the potential of the adversary but also its target systems, types of terrain, levels of technology, [and] command and control." The IAF, he said, formed its unique doctrine and concepts based on these factors.

If the Indian defense budget is cut again, the IAF is unlikely to be hurt too badly. It has 110,000 of India's 1.26 million-strong armed forces and is not generally seen as overlarge. The legislative report, with its call for modernization over manpower, could actually help the IAF.

Air Chief Marshal Suri said the 1991 Persian Gulf War taught India some important lessons about airpower. "It [proved] beyond doubt not only the lethality and potency of airpower but, above all, the supremacy of the same," he contended. "Although modern warfare would be a three-dimensional effort, the importance of airpower has now emerged. . . . Any indifference [to] the same would definitely be at the peril of one's country."

He added, "It now seems to have been universally accepted that airpower would be most significant in achieving one's aims and objectives in a battle or war."



Staff photo by Guy Accelo

Advanced MiG-29s, such as this Russian jet flown at the recent Farnborough Air Show, are the pride of the IAF. Whether India is ready for new defense ties to the US is uncertain, despite major problems caused by the breakup of the USSR.

The Air Chief Marshal also addressed the need for high technology. India, he implied, would need the latest and best in military hardware in any conflict with well-equipped foes. "The Gulf War has brought out the necessity of electronic warfare, night strike capability, and precision weapons with standoff capability and otherwise."

Breaking India's ties with the former Soviet Union was painful. The links go back to the 1955 Bandung Conference at which Rajiv Gandhi's grandfather, the late Jawaharlal Nehru, initiated the "nonaligned movement" advocating alliances among Third World countries and balanced, uncommitted relations with the world's more powerful countries.

When the Soviet Union crushed the Hungarian uprising in 1956, India was the only nonaligned country to vote with the Soviet Union in the United Nations. India also stood fast beside the Kremlin after its invasion of Afghanistan in 1979.

During the Persian Gulf War, India seemed to suffer an identity crisis. Initially, US military transport aircraft were given rights to land and refuel at Sahar Airport in Bombay. This led to a public outcry, however, and the gov-

ernment of Prime Minister Chandra Shekhar withdrew those rights. "In the process," wrote one Asian scholar, "it succeeded in alienating both Baghdad and Washington without winning any friends."

India's new Prime Minister, P. V. Narasimha Rao, began to face the realities of India's economic crisis, the collapse of the Soviet Union, and Washington's enhanced global importance. He appears to have made significant progress.

US officials note that India can be a difficult customer and that there are barriers to enlarging the US-Indian arms-supply relationship.

"They want production rights to the weapons they would receive, plus they want a level of sophistication in weaponry that the United States is not prepared to sell," said one Bush Administration official involved in arms transactions.

India's military seems certain to become more important in US calculations. Even now it is described as an "emergent" or "middle" power on the world scene. The growth of its conventional forces, its ability to project power beyond its borders, and its clear capability to field nuclear weapons make India a power to watch. ■

Richard Mackenzie, a free-lance writer in the Washington, D. C., area, was a war correspondent in Afghanistan from 1987 to 1990 and in the Persian Gulf War in 1991. His most recent article for AIR FORCE Magazine was "Iran Resurgent" in the July 1992 issue.

**The Army, Navy, Air Force, and Marines
battled the fictional nation "Dahibia" for
eleven days in the New Mexican desert.**

Roving Sands

OPERATION Roving Sands hones the same skills that were tested in Saudi Arabia, Kuwait, and Iraq. This annual joint exercise pits a Blue Force of Air Force, Army, Navy, and Marine aircraft and troops against a Red Force designed to mimic the tactics of a potential enemy. The "Dahibian" Red Force was the aggressor this year.

The two sides met near Roswell, N. M., and operations included combat search and rescue, paratrooper assault, air base defense, and more than 200 aircraft sorties per day around the clock. The Army's Forces Command sponsors the operation, and Army Special Forces units and maintainers from all services had prominent roles. ■



USAF photo by MSgt. Kurt Vail



The focus this year was on joint tactical air combat and defense operations, with particular emphasis on air base defense. Above, SSgt. Charles A. Mansfield of the 416th Security Police Squadron guards a row of Navy F-14s. Much of the operation was conducted in a simulated nuclear, biological, and chemical warfare environment that called for heavy protective gear despite the intense heat. Left, an Air Force KC-135, configured with a "basket" that allows it to refuel Navy fighters, takes off from the Roswell Industrial Air Center while a Navy E-2C Hawkeye (foreground) waits on the runway.

Photo © Joe Towers, 1992

"Jointness" is a watchword at Roving Sands, with aircrews from all the services sharing the facilities. Here, Navy F/A-18s taxi past Air Force B-52s from the 416th Bomb Wing, Griffiss AFB, N. Y. The austerity of the bare-base deployment to Roswell, formerly Walker AFB, near Fort Bliss, Tex., and White Sands Missile Range, N. M., makes interservice cooperation essential.



Photo © Joe Towers, 1992

Photo © Joe Towers, 1992



More than 11,000 troops took part in this twenty-four-hour-a-day operation. Air Force A-10s, F-15s, F-16s, F-111s, F-117s, B-1Bs, B-52Hs (left), KC-135s, and helicopters worked side-by-side with Navy and Marine aircraft and Army missile batteries and Special Forces soldiers in a realistic exercise that reinforced the expertise gained in Operation Desert Storm.

As in Desert Storm, the transports made it all possible, ferrying troops and equipment to, from, and between the bases at the staging area. The C-5, seen here "kneeling" to ease the offloading of an Army truck, was a workhorse, and airmen like CMSgt. James Arend of the 1st Mobile Aerial Port Squadron (directing traffic) gained valuable experience doing what they would have to if US forces are called on again to fight a desert war.



USAF photo by SSgt. Tony Lambert



Industry's New "High-Low Mix"

By Ramon L. Lopez

ONE NEED look no further than this year's Aerospace Development Briefings and Displays, held September 14-16 at AFA's National Convention, to see that the aerospace industry is driving to adapt its existing technologies to the requirements of twenty-first-century weapon systems.

At the same time, many of the seventy-four domestic and foreign exhibitors showing their wares at the Sheraton Washington Hotel in Washington, D. C., emphasized the continuing need to produce such advanced military systems as the C-17 transport, B-2 bomber, F-22 fighter, and a host of precision guided munitions.

Deep cuts in the Pentagon's budget have forced the Air Force to shape a new type of "high-low mix" approach to tactical aircraft procurement. In the past, that has meant buying groups of aircraft like the F-15 and F-16, planes of both extreme and more modest capability. Today, the "high-low mix" strategy means achieving high value for low cost and risk by applying current technology to pressing needs.

Take, for example, USAF's requirement for a Multipoint Refueling System (MPRS) on the Boeing KC-135 tanker aircraft, a requirement that resulted from the experience of Operation Desert Storm. Chrysler Technologies Airborne Systems and Israel Aircraft Industries' Bedek Aviation Division have teamed to compete in the recently initiated Air Force program. The international team can expect competition from Boeing Wichita and perhaps from E-Systems, Lockheed, and Rockwell International.

The Air Force's MPRS program is being undertaken to introduce wing-mounted hose-and-drogue refueling capability to approximately 100 KC-



Staff photo by Guy Aceto

At this year's Aerospace Development Briefings and Displays, Boeing touted its wide-body 767 for the Airborne Warning and Control System mission, citing its "growth potential, worldwide supportability, and improved performance."

135R tankers. The addition of this capability will require upgrades to the aircraft fuel system, structural reinforcement of the wings, cockpit modifications to accommodate fuel system controls and displays, and exterior lighting enhancements.

KC-135 Experience

Chrysler Technologies Airborne Systems, which has decades of experience performing major modifications to the KC-135, would be the prime contractor. Israel Aircraft Industries is an industry leader in designing and installing MPRSs on Boeing 707-type aircraft.

IAI has installed refueling systems

for the Israeli Air Force, the Royal Australian Air Force, and others. The Israeli Air Force's program included an undisclosed number of Boeing 707 conversions using an IAI-developed tail boom and a hose-and-drogue system made by US-based Sargent Fletcher. The three-year RAAF conversion program involved four Boeing 707s, the last of which was delivered this year. This project only involved installation of wingtip hose-and-drogue pods.

The MPRS would allow USAF to provide aerial refueling support to the Navy and to allied air forces without degrading existing tail boom refueling capabilities. The Air Force will conduct the MPRS acquisition in two phases. During Phase 1, the selected contractor will integrate, test, and demonstrate two different refueling pod designs (from Sargent Fletcher and the UK's Flight Refuelling Ltd.) concurrently on two KC-135R aircraft. Following completion of the flight test program, USAF will contract with a single pod manufacturer for production kits. The MPRS contract is valued at approximately \$150 million.

Another aircraft program that would use largely off-the-shelf systems to fill a need is the USAF-Navy Joint Primary Aircraft Training System (JPATS). At the AFA Convention, it was disclosed that AAI Corp. has joined the Lockheed-led team competing for JPATS. The addition of AAI completes the Lockheed JPATS team, which also includes Italy's Aermacchi Group, which is providing the MB-339A tandem-seat trainer, and the UK's Rolls-Royce, whose RB582-01 engine powers the MB-339A. AAI will serve as the ground-based training system team member.

The JPATS program is a major element of the US Trainer Aircraft Master Plan. It is a single replacement for aging in-service USAF T-37B Tweet trainers made by Cessna and Navy T-34C Mentor aircraft provided by Beech. JPATS will include 764 aircraft (417 for the Air Force and 347 for the Navy), simulators, and other ground training components.

Interest in the US military trainer sweepstakes is high, inasmuch as the JPATS program is estimated to be worth \$6 billion to the winning team. At the same time, there is a worldwide market of between 2,000 and 4,000 trainers worth \$16 billion through the turn of the century.



Photo by Paul Kennedy

Competitors for the hotly contested JPATS contract displayed their wares prominently. This Vought Aircraft, FMA, and Loral Pampa 2000 is typical of the joint and international nature of many of the JPATS entrants.

Other official contenders in the JPATS contest include teams of Northrop and Embraer with the EMB-312H Super Tucano; Grumman, Agusta, and Hughes with the S211; Vought Aircraft, FMA, and Loral with the Pampa 2000; Beech, Pilatus, and British Aerospace with the PC-9 Mk. II; Rockwell, MBB, and CAELink with the Fan Ranger; plus McDonnell Douglas and Valmet with the Redigo, the Promavia ATTA, the Enaer Turbo Pillán, the Shorts Tucano, and the Jaffe SA-32T.

A JPATS draft request for proposal (RFP) was scheduled to go out to industry in August, and the final RFP was expected to be issued in June 1993. The Air Force was set to announce the JPATS winner in February 1994, with aircraft deliveries beginning two years later.

JPATS Disarray?

Questions recently raised by senior Pentagon officials have thrown the project into disarray, and the original schedule has slipped. Those officials may direct the project office to require two prime contractors—one for the trainer aircraft and a second for the ground-based training system, including necessary aircrew and maintenance training devices, computer-based or computer-aided ground instruction, and all associated academic courseware.

Another future USAF aircraft procurement that could be a derivative of an in-service aircraft is the Multirole

Fighter (MRF). Air Force officials, however, plan to delay the start of the MRF project and instead ask for funds to purchase additional new General Dynamics F-16 Block 50 aircraft beginning in 1994.

The Air Force says that budget plans for the 1994-99 period call for the annual procurement of twenty-four new F-16s. The idea is to purchase enough new F-16s to support the proposed force structure of twenty-six fighter wing equivalents.

If this strategy is carried through, procurement of the MRF would not begin until after 2010. Industry is being asked to explore three different MRF options: an entirely new aircraft, an upgraded F-16 (the so-called Block 60), and a derivative of an existing fighter, which could be an F-16 or a McDonnell Douglas F/A-18.

The A/F-X, the Navy's future attack aircraft, was presented only in sketchy form. It would replace the venerable Grumman A-6 Intruder and, potentially, the Air Force's F-111, F-117, and F-15E attack aircraft.

Some have suggested that a derivative of USAF's F-22 fighter could be a strong A/F-X contender—a sentiment heartily endorsed by Lockheed. A company brochure distributed at the Convention claimed that the F-22 and A/F-X programs, "running in parallel, will enjoy never-before-experienced synergy and cost-effectiveness due to significant commonality in piece parts, software development, avionics, manu-



Space systems and launch systems were not neglected at this year's Briefings and Displays. General Dynamics showed off a variety of boosters that it hopes will assist the Air Force with this expanding part of its mission.

facturing processes, and mutual risk reduction throughout the lives of both programs.”

As all USAF and NATO E-3 Airborne Warning and Control System (AWACS) aircraft get AN/AYR-1 advanced passive sensor systems designed to improve detection and identification of aircraft, warships, and ground systems from their radar emissions, a Grumman team is studying the next century's airborne surveillance needs.

Grumman Melbourne Systems recently won a \$2 million Multimission Airborne Surveillance Technology (MAST) study contract from the Air Force. Over the next two years, the Grumman-led team will focus on operational requirements and technologies for an airborne surveillance system that will augment the Joint Surveillance and Target Attack Radar System (Joint STARS) and AWACS by providing the necessary technology for future airborne surveillance sensors. The team will conduct experiments to demonstrate the maturity of required technologies. Team members include Westinghouse Electronics Systems and Honeywell Space Systems.

Hopes for the 767

With the 707 aircraft out of production, Boeing hopes to sell future AWACS planes based on a derivative of the 767 commercial jetliner. Initial customers could include both Japan, which has an official requirement for

as many as twelve AWACS aircraft, and Saudi Arabia, which is reportedly considering the purchase of four additional AWACS aircraft to supplement the five bought in 1981 and now in operation.

Boeing reported, “The replacement of the Boeing 707 with the 767-200ER as the AWACS platform represents a significant achievement in the evolution of AWACS capabilities. The modern, wide-body 767 AWACS will be interoperable with other AWACS aircraft and offers the benefits of

growth potential, worldwide supportability, and improved performance.”

More broadly, the aerospace giant hopes that the 767 can become a common military platform in the same way that its 707 derivatives did in recent decades, serving in such roles as tanker and transport, executive transport, airborne early warning, electronic intelligence, and battlefield ground surveillance. Company officials said the increased interior volume, greater range, and long endurance of the 767-200ER make it the ideal platform for next-generation Joint STARS airplanes.

Meanwhile, the Air Force's E-8C Joint STARS aircraft is being upgraded with multiple FMS-800 Flight Management Systems under a multimillion-dollar contract awarded to Rockwell Collins by Grumman. The FMS-800 is designed to integrate and automate numerous cockpit and flight-management functions normally performed by the pilot, copilot, and navigator. Initial FMS-800 deliveries are scheduled for February 1993.

To correct deficiencies in conventional bomb performance identified in the Persian Gulf War, the Air Force and Navy have established a requirement for an autonomous, all-weather, accurate, and affordable bombing capability.

The proposed Joint Direct Attack Munition (JDAM) involves attachment of an inertial guidance kit (in a modified tailcone) to a general-purpose bomb



Foreign participation was high this year with Aerospatiale, Deutsche Aerospace, Israel Aircraft Industries, SNECMA, and British Aerospace (above) among the overseas companies that took the opportunity to reach Convention audiences.



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Here, one of Northrop's B-2 pilots uses a simulator to demonstrate some of the finer points of the advanced bomber's cockpit. Northrop emphasized emerging technologies related to the B-2's development.

or tactical munitions dispenser. JDAM succeeds an Air Force project known as the Adverse Weather Precision Guided Munition (AWPGM). While still aboard the launch aircraft, JDAM is continually updated with target information through the aircraft's avionics system. Upon bomb release, the inertial guidance kit takes over, guiding the weapon to the target.

Texas Instruments is leading a team developing the next-generation stand-off weapon system for the Air Force and Navy, the Joint Standoff Weapon (JSOW) system, which was previously called the Advanced Interdiction Weapon System (AIWS). At the AFA Convention, Lucas Aerospace said it received a contract from TI to provide JSOW's fin-control actuation system.

Common Components

JSOW and JDAM will have many common components, including the integrated inertial navigation system and Global Positioning System (INS/GPS) and, eventually, an advanced seeker.

Boeing displayed a JDAM tail section for the Mk. 82 500-pound gravity bomb, while Northrop showed a mock-up for the Mk. 84 2,000-pound gravity bomb. The JDAM program is being conducted in three phases. Phase 1 involves the Mk. 84 weapon; Phase 2, the development of an insensitive munition; and Phase 3, the fielding of an advanced seeker for the terminal phase of flight, which is also applicable to the JSOW.

With initial fielding of JDAM in 1996-97, a draft RFP is expected before year's end. The formal RFP would follow in January. Competitive contracts are planned, and other missile-makers, including Martin Marietta, Raytheon, and McDonnell Douglas, could also win development contracts.

Production could entail anywhere between 8,000 and 100,000 units. The Air Force desires a unit cost of \$40,000, and JDAM would be the first conventional precision weapon for the B-2. JDAM is also intended for use on the F-16, F-15E, F-111, B-1, and F/A-18.

Rockwell International, meanwhile, has introduced a new family of products that integrate off-the-shelf GPS and inertial measurement unit products to provide improved, low-cost GPS/INS units.

The Miniature Integrated GPS/INS Tactical System (MIGITS) product set is planned to satisfy the immediate need for accurate guidance for conventional weapons, military aircraft, and other applications. The first MIGITS product is termed C-MIGITS to denote the use of a C/A code Navcore GPS receiver. The system has entered performance verification testing.

Future products include the pos-

sible upgrade of the GPS receiver to a militarized version that deals with precision GPS codes (P-MIGITS). Another would be the addition of a solid-state inertial measurement unit in Micro-MIGITS, which will include a twelve-channel GPS receiver. Plans also call for adding an antijam antenna electronics unit in the High-Performance HP-MIGITS.

A "plan-off" is under way between Lockheed Sanders and McDonnell Douglas Missiles and Space for the Air Force Mission Support System. AFMSS will support flight planning for combat and transport crews down to the squadron level. The computer-based system offers basic map and digital terrain elevation data provided by the Defense Mapping Agency. The electronic order of battle is added to the database just before a mission.

A year ago, each of the two firms won contracts worth approximately \$7 million to provide four prototypes for testing at the Tactical Air Warfare Center at Eglin AFB. Testing is scheduled to be completed by the end of 1992, at which time a single production contract will be awarded.

Magnavox Electronic Systems was recently awarded an Air Force contract to build the ARC-XXX, a very-high-frequency AM/FM airborne radio set. The \$9 million award will fund production of ten test units for a twenty-seven-month qualification. The radio set is intended to replace the older ARC-186. The Air Force plans to install the radio initially in close air support platforms such as the A-10 and some F-16s. Production could reach 3,000 units.

The centerpiece of the Air Force's airlift modernization, the McDonnell Douglas C-17 program, has moved forward, but it continues to draw intense fire from Capitol Hill. David Swain, executive vice president of the company's Transport Aircraft unit, warned that Congress's apparent determination to reduce the annual production rate will result in the elimination of 1,500 C-17-related jobs—fifteen percent of the 10,000-strong work force—over the next eighteen months and add as much as \$2 billion to the total program cost. ■

Ramon L. Lopez, a free-lance writer and former managing editor for *Jane's Information Group*, has covered aerospace and defense issues in Washington, D. C., for nearly twenty years. This is his first article for *AIR FORCE Magazine*.



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Air-to-Ground Weapons—CEM and GAU-8/A Armor-Piercing 30-mm for A-10, CBU-87 Combined Effects Munition; Advanced Technologies—Telescoped Ammunition and Future Bombs and Weapon Systems

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Latest Aircraft Systems, Subsystems, Components, and Equipment from Bendix, Garrett, AirResearch, Bendix/King

Astra Holdings Corp.

Subsidiary Products Including Flares, Markers, Signals, Fuzes, Ammunition, and Training

Beech Aircraft

PC-9 Mk. II Trainer for JPATS; T-1A Jayhawk; Supersonic Targets

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Boeing Co., The

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Brunswick Technical Group

Improved Tactical Air-Launched Decoy (TALD)

CAE-Link

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Avionics Division Products Include Microwave Landing Receivers, Avionics Management, Velocity Sensor, and Data Interface Unit

COMSAT Aeronautical Services

Global Satellite Services, Voice and Data Communications

Delco Electronics Corp.

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Military Aircraft Programs from German Aerospace and Defense Manufacturer's Two Divisions: MBB and Dornier

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ECC International Corp.

Simulation and Interactive Computer-Based Training

ESCO Electronics Corp.

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E-Systems

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Full Range of Visual Systems for Simulation; Real-Time for Training and Mission Rehearsal

Fairchild Defense

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GEC Aerospace

Designs and Manufactures Electromechanical Actuation for Military and Commercial Rotary and Fixed-Wing Aircraft

General Atomics

Concepts Through Prototype to Full-Scale Development in Nuclear Spacepower, Directed Energy Systems, Electromagnetic Guns and Launchers

General Dynamics Corp.

Military Aircraft From the Fort Worth Division: F-111, F-16, and F-22; Space Division: Atlas II, Titan/Centaur, and National Launch System

General Electric

GE Aerospace

Enhanced Envelope Gunsight System, F-22 IRST, and Hypersonic Systems for Airborne Theater Missile Defense

GE Aircraft Engines

Celebrating Fifty Years of Jet Flight from America's First Jet Engine to Today's F110

Grumman Corp.

JPATS Candidate Aircraft Plus Joint STARS, FEWS, EF-111, A-10, A-X, and Training

GTE Government Systems

Secure Communications Switching, Data Fusion and Fusion Analysis, Digital Imagery, Weather Systems, and Terminal Replacement

Gulfstream Aerospace Corp.

The C-20H for Global Requirements of Special Air Missions

Harris Corp.

C³I for Airborne and Spaceborne Requirements; Information and Satellite Communication Systems; Electronic Warfare Simulation and Evaluation

Hercules Aerospace Co.

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Integrated Solutions for Avionics, Electronic Combat, Special Operations, Space-Based Surveillance, Satellite Control, Ballistic Missile Defense, and Computer-Based Training

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Litton Systems Inc.

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Litton Data Systems

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Litton Guidance & Control Systems

LN-100 Zerolock Laser Gyro Inertial Reference System for the F-22

Lockheed Corp.

F-22, JPATS, Airlifter Family, New A-X, and Multirole Fighter

Loral Corp.

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McDonnell Douglas Corp.

C-17 Airlifter, F-15E, Training Systems, Delta Launch Vehicle, Missiles, and Electronics

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NavCom Defense Electronics Inc.

AN/UPM-155 Radar Test Set

Northrop Corp.

Emergent Technology From Development and Production of B-2 Bomber

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Racal Communications, Inc.

Designs, Manufactures, and Supports Electronic Communications for Defense and National Security

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North American Aircraft Division

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SNECMA

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Systems Research Laboratories, Inc., & Snow Aviation

Radar Digital Scan Converter Integrated Display Systems, Snow Aviation's Two-Man Cockpit

Syston Donner

Fire Protection Equipment

Teledyne Electronics

APX-109 Combined Interrogator/Transponder

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Westinghouse Electric Corp.

The Electronic Systems Group's Wide Range of Defense Electronic Products, Systems Integration, Service, and Support

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Gas Turbine Engines for Trainer Aircraft, Strategic and Tactical Missiles, and Ground Systems

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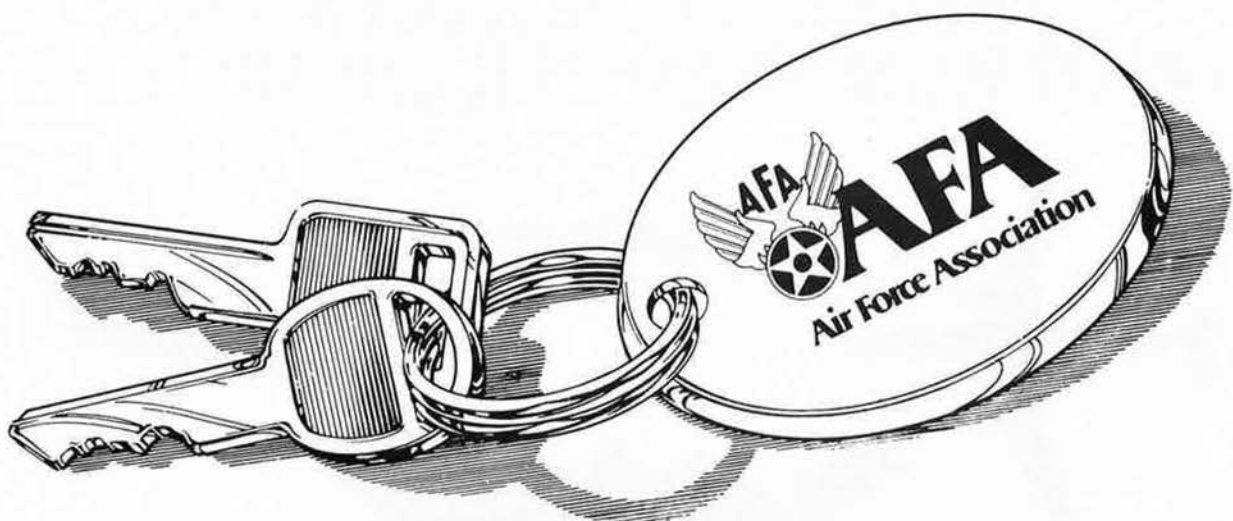
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AFA Week in Washington

By Tamar A. Mehuron, Associate Editor



Gen. Colin L. Powell, Chairman of the Joint Chiefs of Staff, addressed Convention delegates after receiving the H. H. Arnold Award, AFA's highest honor in National Security given to a member of the armed forces.

AIRMEN from four wars, with experiences ranging from the 1930s to the 1990s, gathered for the Air Force Association's forty-sixth National Convention, held September 14-16 in Washington, D. C.

The longest standing ovation of the week went to Bob Hope, on hand to receive a special AFA citation for his fifty years of touring battle theaters to entertain US troops.

Another highlight was the award, during the Convention's opening ceremonies, of the Presidential Unit Citation to the American Volunteer Group, the fabled "Flying Tigers" who flew against the Japanese invaders in China and southeast Asia in 1941 and 1942.

Among those representing the current generation of airmen was Convention keynoter CMSgt. George Moriarty, Air Training Command's Senior Enlisted Advisor. The twelve Outstanding Airmen of the Year were honored at a gala dinner Monday night of Convention week. That event and several others featured music by the US Air Force Band, directed by Lt. Col. Alan L. Bonner.

The Convention theme, "Aerospace Power and Technology—Shaping the Future," was much in evidence in the exhibit halls, where displays and other presentations of the latest defense systems covered 1.3 acres of floor space.

Election of Officers

James M. McCoy of Omaha, Neb., was elected President of the Air Force Association. O. R. Crawford of Austin, Tex., was elected Chairman of the Board. Mary Ann Seibel of St. Louis, Mo., was reelected National Secretary, and William N. Webb of Midwest City, Okla., was reelected National Treasurer.



The Presidential Unit Citation went to members of the American Volunteer Group, the legendary "Flying Tigers." In 1941 and 1942, they flew missions against the Japanese forces in the China-Burma-India theater.

Photos by Paul Kennedy

Gerald V. Hasler of Albany, N. Y., was reelected President of the Aerospace Education Foundation (AEF). James M. Keck of San Antonio, Tex., was reelected AEF Chairman of the Board. Thomas J. McKee of Fairfax Station, Va., was elected Vice President, John R. Alison of Washington, D. C., was reelected Treasurer, and Walter E. Scott of Dixon, Calif., was reelected Secretary.

For a complete list of AEF officers and trustees (as of September 15, 1992), see p. 64.

More than 6,000 persons took part in one or more of the Convention-related activities at the Sheraton Washington Hotel. The 373 registered delegates, representing forty-seven states, Guam, and the District of Columbia, were joined by senior military and government officials for the Aerospace Development Briefings and Displays, featured speeches, and social events. On hand to cover the Convention were 150 reporters and other news media representatives.

Meeting concurrently with the Convention were trustees of the Aerospace Education Foundation and USAF's command Senior Enlisted Advisors, as well as AFA's Air National Guard Council, Civilian Personnel Council, Enlisted Council, Junior Officer Advisory Council, Reserve Council, and Veterans/Retirees Council.

Resolutions and Changes

Among the significant changes decided upon was a change to the AFA Constitution to take effect at the close of the 1997 National Convention. At that time, directors who have served in a permanent capacity for three years or longer will automatically move to the nonvoting status of Board member emeritus. This will effectively reduce the number of directors by thirty-eight, resulting in a Board with between fifty-two and fifty-five members by the turn of the century.

Another significant Constitutional change empowers the Chairman of the Board to appoint up to three nonvoting directors, individuals who "will enhance the overall effectiveness and stature of the Board," for one-year terms.

Congressional Activity

Thirty-two state delegations sponsored twenty congressional breakfasts on Tuesday and Wednesday of Convention week. Sixty-five members of

Congress participated. Among them were Sens. Sam Nunn (D-Ga.), Edward M. Kennedy (D-Mass.), and J. James Exon (D-Neb.) of the Senate Armed Services Committee and Sen. Don Nickles (R-Okla.) of the Appropriations Committee. Attending from the House Armed Services Committee were Reps. Herb Bateman (R-Va.), Glen Browder (D-Ala.), Buddy Darden (D-Ga.), Chet Edwards (D-Tex.), James Hansen (R-Utah), Earl Hutto (D-Fla.), Jon Kyl (R-Ariz.), Martin Lancaster (D-N. C.), Owen Pickett (D-Va.), Ike Skelton (D-Mo.), and Bob Stump (R-Ariz.). Attending from the House Appropriations Subcommittee on Defense were Reps. Jerry Lewis (R-Calif.) and John Murtha (D-Pa.).

The Colorado state delegation visited House Armed Services Committee members Pat Schroeder (D-Colo.) and Joel Hefley (R-Colo.) Tuesday and Wednesday. The delegation also visited Senate Armed Service Committee member Timothy Wirth (D-Colo.). Washington delegates visited Sen. Slade Gorton (R-Wash.).

Gen. Merrill A. McPeak, Air Force Chief of Staff, attended breakfasts hosted by AFA's South Central Region and state delegations from Arizona, Georgia, Pennsylvania, Texas, Missouri, Florida, and Virginia.

The Distinguished Congressional Service Award was given to Senator Nunn, who chairs the Senate Armed Services Committee, by Jack Price, then Chairman of the Board. Sen. Lloyd Bentsen (D-Tex.), chairman of the Finance Committee, received a citation for his leadership in the effort to repeal the source tax, from then National President O. R. Crawford.

Other Elections

Eight new National Vice Presidents were elected. They are Mary Anne Thompson of the Central East Region, Harold A. Strack of the Far West Region, Harold F. Henneke of the Great Lakes Region, Earl D. Clark, Jr., of the Midwest Region, Eugene B. Goldenberg of the Northeast Region, John Lee of the Northwest Region, Bud Walters of the South Central Region, and Robert S. Cantu of the Southwest Region.

Dan F. Callahan III of McMinnville, Tenn., Alwyn T. Lloyd of Seattle, Wash., Robert A. Munn of Tucson, Ariz., Jack G. Powell of Aurora, Colo., James E. "Red" Smith of Princeton, N. C., and Joseph A. Zaranka of Bloom-

field, Conn., were elected to the Board of Directors for three-year terms.

Three new Under-Forty Directors joining the AFA Board are George R. Jernigan III of Columbia, S. C., Gilbert E. Petrina, Jr., of Utica, N. Y., and Marie M. Vanover of Austin, Tex.

For a list of all National Vice Presidents and Directors, including those reelected, see "This Is AFA," p. 80.

Aerospace Education Foundation

A video on "Our Best Community Service Project" won the Foundation's annual contest for presentations by Air Force Junior ROTC cadets. The winning entry was from American High School, Ramstein AB, Germany. For next year's contest, cadets will submit a video on the same topic.

Arthur I. Kimura of Hilo, Hawaii, won the Christa McAuliffe Memorial Award for the year's outstanding math and science teacher. Mr. Kimura, a twenty-year teaching veteran, currently teaches high school biology, serves as a Lieutenant Colonel in the Air National Guard, and is a NASA Teacher-in-Space finalist.

Col. Kenneth O. Wofford, USAF (Ret.), of Golden Valley, Minn., received the Sam E. Keith, Jr., Aerospace Education Award of Excellence. The award is named in honor of the late AFA leader and former National President and Board Chairman from Fort Worth, Tex.

Acknowledgments

Parliamentarian for the National Convention was Martin H. Harris. Ellis T. Nottingham was Sergeant at Arms. Inspectors of Elections were Walter E. Scott (Chairman), Bryan L. Murphy, Jr., and Jesse D. Kinghorn, Jr. Donald D. Adams chaired the Credentials Committee, serving with John E. Kitelson and M. Elizabeth Root.

The Association is particularly grateful to a corps of volunteers who assisted the staff in Convention support: Norm Aubuchon, 1st Lt. Scott Boyd, Cecil Brendle, Jimmy Canlas, Cadet Thomas M. Cooper, Evie Dunn, Michael Headly, Cadet Michael Li-quori, Charles and Mary Lucas, Cadet Jenifer Petrina, 1st Lt. Julie Petrina, Glenda R. Shepela, Debbie and Gregg Snyder, Dana Steinhauer, Janet Voltz, and John Zipp.

The 1993 Convention will be held at the Sheraton Washington Hotel, in Washington, D. C., on September 13-15. ■

Management, Energy Conservation, and C⁴ Excellence Awards

Award	Recipient(s)
Logistics Management	
AFLC Executive Management Award	John F. Stallings, Wright-Patterson AFB, Ohio
AFLC Middle Management Award	Lt. Col. Robert DeLuca, Wright-Patterson AFB, Ohio
AFLC Junior Management Award	Capt. Von J. Hawley, McClellan AFB, Calif.
Systems Management	
Distinguished Award for Management	Lt. Gen. Thomas R. Ferguson, Jr., Wright-Patterson AFB, Ohio
Meritorious Award for Program Management	Maj. Richard L. Wright, Eglin AFB, Fla.
Meritorious Award for Support Management	Frank D. Iozzi, Wright-Patterson AFB, Ohio
Energy Conservation	
Gen. Edwin W. Rawlings Award for Energy Conservation (Manager)	1st Lt. Brian S. Freeman, UK
Gen. Edwin W. Rawlings Award for Energy Conservation (Technician)	Gayle Douglas Gollott, Keesler AFB, Miss.
C⁴ Excellence	
Gen. Billy Mitchell Award	Russell E. Mullins, Cheyenne Mountain AFB, Colo.

Named in Memorial Tribute

USAF and AFA leaders and supporters and aviation pioneers who died during the past year.

<p>Ormond C. Abbot Maj. James R. Alden, USAF (Ret.) Maj. Gen. Brooke E. Allen, USAF (Ret.) Gen. James R. Allen, USAF (Ret.) Dr. William L. Allison CMSgt. Thomas W. Anthony, USAF (Ret.) Col. David L. Arnold, USAF (Ret.) Charles Backus Elizabeth L. "Bette" Bacon CMSgt. Robert T. Bainter, USAF (Ret.) Col. Bruce K. Baumgardner, USAF (Ret.) Lt. Col. T. Douglas Benefield Maj. Gen. T. Alan Bennett, USAF (Ret.) Alice W. Blake Benson Blank Brig. Gen. Jay R. Brill, USAF (Ret.) Lt. Col. Lucille B. Burt, USAF (Ret.) Brig. Gen. Joseph J. Cappucci, USAF (Ret.) Paul R. Choquette Maj. Gen. Chester Clifton, Jr., USA (Ret.) Col. John J. Clune, USAF (Ret.) David K. Collisson William S. Crawford Maj. Gen. Joseph A. Cunningham, USAF (Ret.) John E. Davies John "Jeff" Davis Col. Charles W. DeBaun, USAF (Ret.) Herbert R. Dimmick Maj. Gen. John J. Doran, Jr., USAF (Ret.) Elwood T. Driver Brig. Gen. Thomas J. Dubose, USAF (Ret.) Col. Eugene Ecklund, USAF (Ret.) Maj. Gen. Courtney Faught, USAF (Ret.) Zelig Finkelstein Frank A. Fishburne Tennessee Ernie Ford</p>	<p>William France Brig. Gen. Harry A. French, USAF (Ret.) Meryll Frost Maj. Gen. Edward R. Fry, USAF (Ret.) Col. Howard "Jack" Fry, USAF (Ret.) Tom Fry Marvin R. Fullmer Maj. Gen. Robert N. Ginsburgh, USAF (Ret.) Brig. Gen. John C. Gordon, USAF (Ret.) John E. Hall Brig. Gen. Richard L. Hall, USAF (Ret.) Col. E. Howard Hammersley, Jr., USAF (Ret.) George L. Harwick Edward H. Heinemann Brig. Gen. George M. Higginson, USAF (Ret.) Maj. Gen. James P. Hodges, USAF (Ret.) Hazel M. Humphries Lt. Col. Marjorie O. Hunt, USAF (Ret.) Lt. Col. William R. "Doc" Hutchinson, Jr., USAF (Ret.) Lt. Col. Jake Jenkins, USAF (Ret.) Ira Milton Jones Brig. Gen. Paul W. Kadlec, USAF (Ret.) Jack Katzen Lt. Col. William Kordas, USAF (Ret.) Maj. Gen. Julius K. Lacey, USAF (Ret.) Dr. Robert Lash Lt. Gen. Eugene B. LeBailly, USAF (Ret.) Helen LeMay Maj. Gen. Lee M. Lightner, USAF (Ret.) Maj. Gen. Curtis R. Low, USAF (Ret.) Lt. Gen. Roy H. Lynn, USAF (Ret.) Peter MacDonald Hon. Malcolm A. MacIntyre Joan M. Madden Lt. Col. Albert J. Magill, USAF (Ret.) CMSgt. Dominick N. Masone, USAF (Ret.)</p>	<p>Col. Thomas O. Massett Gerald J. McAllister Brig. Gen. Stephen D. McElroy, USAF (Ret.) Lt. Col. Margaret McEnerney, USAF (Ret.) James B. Minor Col. Hugh H. Moreland, USAF (Ret.) Brig. Gen. Robert H. Morrell, USAF (Ret.) Maj. Gen. Dolf E. Muehleisen, USAF (Ret.) Leonard Niederlehner Col. David B. O'Hara, USAF (Ret.) Col. Keefe O'Keefe, USAF (Ret.) Irving J. Perlman Gloria C. Pesch John L. Rainey Kathryn Fradkin Rawlings Ralph Reed Maj. Gen. Clifford H. Rees, USAF (Ret.) Col. Myron A. Roth, USAF (Ret.) Capt. Thomas E. Rowe, USAF Col. Frederick O. Rudesill, USAF (Ret.) Alfred I. Sherman Brig. Gen. Farmer S. Smith, USAF (Ret.) Ralph Solomon Maj. Gen. Richard R. Stewart, USAF (Ret.) Robert P. Stewart Col. John R. Stoner, USAF (Ret.) Jack Strickland Maj. Gen. Henry R. Sullivan, USAF (Ret.) Ellen K. Taylor Edward R. Trapnell Patricia S. Turner Maj. Gen. Fay R. Upthegrove, USAF (Ret.) Forrest L. "Woody" Vosler Rodney B. Ware, Jr. Col. John F. Whiteley, Jr., USAF (Ret.) Lt. Col. Friend F. Wilson, USAF (Ret.)</p>
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Individual Jimmy Doolittle Fellows

Recognizes \$1,000 contribution

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R. Donald Anderson
Bobby and Kay Case
Tennessee Ernie Ford (*in memoriam*)
Col. Tom L. Keal, USAF (Ret.)
Arthur L. Littman (*in memoriam*)
John S. "Connie" Sparks
Lt. Gen. Bob Springer, USAF (Ret.), and Bonnie Springer
Russell A. Taylor
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D. C., Chapters of Associazione Arma Aeronautica

Sponsors

CMSgt. Richard Russell, USAF (Ret.)
Nevada State AFA and Thunderbird and Dale O. Smith Chapters

James M. McCoy, newly elected president of AFA, presents his goals for the coming year as he gives his first presidential address to Convention delegates. The former Chief Master Sergeant of the Air Force is an eighteen-year veteran of AFA, having worked as national vice president for the Midwest Region, as Membership Committee Chairman, and in many other roles.



Photo by Paul Kennedy

1992 Unit Activity Awards

Donald W. Steele, Sr., Memorial Awards: AFA Unit of the Year
Central Florida Chapter, Fla.
Langley Chapter, Va.

Outstanding State Organization
Virginia State AFA

Outstanding Chapters
Lufbery-Campbell Chapter, Germany
(more than 900 members)
Rocky Mountain Chapter, Utah
(401-900 members)
Green Valley Chapter, Ariz.
(151-400 members)
Florida Highlands Chapter, Fla.
(20-150 members)

Exceptional Service Awards
Charles A. Lindbergh Chapter, Conn.
(Aerospace Education)
Utah State AFA (Best Single Program)
Alamo Chapter, Tex. (Communications)
Carl Vinson Memorial Chapter, Ga.
(Community Relations)
Colorado Springs/Lance Sijan Chapter,
Colo. (Overall Programming)
Florida State AFA (Veterans Affairs)

1992 Community Partner Membership Awards

These awards are presented to chapters with a significant outreach into the community and are based on the March 31, 1992, chapter membership totals.

President's Award

This award recognizes the chapter that has recruited the greatest percentage of Community Partners (in terms of chapter membership). Chapters must have a minimum of fifteen Community Partners to qualify.

Lloyd R. Leavitt, Jr., Mich.

Gold Awards

These awards recognize chapters that have a total number of Community Partners equal to or greater than two percent of their overall chapter membership. Chapters must have a minimum of ten Community Partners to qualify.

Altus, Okla.
Anchorage, Alaska
Ark-La-Tex, La.
Barry Goldwater, Ariz.
Cape Canaveral, Fla.
Carl Vinson Memorial, Ga.
Central Oklahoma (Gerrity), Okla.
Cheyenne Cowboy, Wyo.
Dacotah, S. D.
David D. Terry, Jr., Ark.
Eagle, Pa.
Enid, Okla.
Fairbanks Midnight Sun, Alaska
Florida Highlands, Fla.
General David C. Jones, N. D.
General Ira C. Eaker, Ark.
Green Valley, Ariz.
Huron, Mich.

Inland Empire, Wash.
Joe Walker-Mon Valley, Pa.
Langley, Va.
Llano Estacado, N. M.
Lloyd R. Leavitt, Jr., Mich.
Lubbock, Tex.
Morgan S. Tyler, Fla.
Paul Revere, Mass.
Pope, N. C.
Roanoke, Va.
Robert H. Goddard, Calif.
Scott Berkeley, N. C.
Tacoma, Wash.
Tidewater, Va.
Total Force, Pa.
Tucson, Ariz.
Wasatch, Utah
Wichita Falls, Tex.
Wright Memorial, Ohio

Achievement Awards

These awards recognize chapters that have a total number of Community Partners equal to or greater than one percent of their overall chapter membership. Chapters must have a minimum of five Community Partners to qualify.

Abilene, Tex.
Ak-Sar-Ben, Neb.
Billy Mitchell, Wis.
Cape Fear, N. C.
Central Florida, Fla.
Charleston, S. C.
Cleveland, Ohio
Colorado Springs/Lance Sijan, Colo.
Dale O. Smith, Nev.
Dallas, Tex.
Del Rio, Tex.
General Nathan F. Twining, Fla.
Golden Triangle, Miss.

Guam-Arc Light, Guam
Heart of the Hills, Tex.
H. H. Arnold Memorial, Tenn.
John C. Stennis, Miss.
Miami, Fla.
Ogden, Utah
Panhandle, Tex.
Rocky Mountain, Utah
Salt Lake, Utah
Southwest Florida, Fla.
Swamp Fox, S. C.
Tennessee Valley, Ala.

1992 Individual Activity Awards

Gold Life Membership Award

Edward A. Stearn

Man of the Year

Jack C. Price

Special Awards

Charles G. Durazo
Richard and Sally Reid
Julian B. Rosenthal
The Doolittle Raiders
The Flying Tigers
United States Air Forces in Europe
WASPs (Women's Airforce Service Pilots)

Presidential Citations

Ron Beezley
Robert J. Cantu
Fred F. Eubanks, Jr.
George D. Golden
Robert W. Gregory
Dan Hendrickson
William A. Lafferty
John T. McCarthy
Robert A. Munn
Mary Anne Thompson

Special Citations

Carl E. Beck
John L. Beringer, Jr.
David A. Brigham
Dr. Dan Callahan
Don Casteel
Gerald S. Chapman
William O. Christensen
Raymond D. Chuvalla
Robert Copley
Joanne and Bob Craig
Jack K. Gamble
Cheryl Gary
Robert Gates
Al Leferink
Lt. Gen. Glen Martin, USAF (Ret.)
George W. McKay
Don McKellar
George A. "Pete" Peterson
Larry W. Pritchett
William L. Sparks
H. A. Strack
Arthur F. Trost
Larry M. Williams
Air Force Automated Mission Planning
4th Wing, Seymour Johnson AFB, N. C.
52d Fighter Wing, Spangdahlem AB,
Germany

Exceptional Service Awards

John Ault
Christopher G. Bailey
Eugene R. Barnett
Theodore C. Beckett
William P. Binks, Jr.
Henry Boardman
Joan B. Burns
Caryl W. Calhoun
Roger R. Campbell
Paul G. Chace
Francis H. Chapman
William F. Cheek
John Haile Cole
Peter P. Colerico
Vicky Cottingham
John E. Craig II
William M. Cuthriell
Norman E. Davis

George Estrella
Edward W. Garland
Eugene B. Goldenberg
Richard E. Gordon
Ken Grant
Bernard L. Hanlon
Harold "Hap" Harris
Lester H. Hughes
Robert H. Johnson
Geraldine Jones
Fred Klopfer
Robin Kozelka
Ellen LaGrone
John Lee
Albert F. Litzler
Wayne Matson
John McGrath
Gordon Meinert
Alvin R. Moorman
Charles W. Myers
Joseph B. B. Nettleton
Jeremiah O'Fihelly
John A. Powell
Pat Rathman
Edward E. Reynolds, Jr.
Jimmy A. Richardson
Temple Robinson
Ronald A. Rowe
Michael Salis
Robert E. Schuldt
Victor H. Sternberg
Doris M. Stone
Joseph E. Tucker
Robert L. Undersander
Dolores Vallone
Frederic A. Veal
Col. James I. Wheeler, USAF
Lawrence L. White
James Youngson, Jr.
Frank Zachary

Jack B. Flaig Communications Award

Roy P. Whitton

Medal of Merit

James R. Adams
Donald P. Adee
Frederick C. Armstrong
Robert S. Beale
Karl W. Berg
Glenn F. Blacker
Michael P. Blaisdell
John Booth
Col. William E. Boston III, USAF
James E. Boyd
Carl W. Bradford, Jr.
Ralph H. Bradley
Terry Brady
William D. Brady
Anton D. Brees
James A. Brewer
Richard "Bugs" F. Bugeda
M. E. "Earnie" Callender
Col. Thomas T. Cavanagh III, USAF
J. Chris Conley
Brig. Gen. Keith B. Connolly, USAF (Ret.)
Sam S. Conte
M. Lee Cordell
Kendall A. Coupland
Daniel A. Cox
Ellen S. Crawford
Capt. Yolanda Cruz, USAF
Robert F. Cutler
Lt. Col. Lucian A. Dade, USAF
H. J. Dalton, Jr.

Donald Dandurand
Raymond V. Davila
Victor R. Davis
Merritt E. Derr
Gale A. Devore
William W. Diener, Jr.
Charles E. Dougan, Sr.
Bennie G. Drake
Gerald L. Dutka
Marleen E. Eddlemon
Thomas D. Eden
Philip V. Edsall
Danny Edwards
Edward A. Elbert
Loren Evenson
Vincent S. Fairlie
Col. Michael N. Farage, USAF
Allen P. Feedback
George D. Feil
Gene Foster
Robert B. Fox III
Phillip N. Francis
Joyce K. Frank
Phyllis A. Gallant
Richard Galloway
R. D. "Hoot" Gibson
Scott Glasser
Wendy Glenn
William R. Goerges
Harold E. Grant
Gene Gregory
Gene Gulick
Nilda A. Hasler
Robert "Herk" Herculson
Steve Hester
Paul Hibbits
Edward Higgins
Capt. Steven T. Hiss, USAF
Stanley V. Hood
Timothy H. Howard
Jake Huffman
SMSgt. Edward B. Huneycutt, USAF
Col. Tyler B. Huneycutt III, USAF
Homer R. Hunt
Joyce Ike
Stephen L. Ike
CMSgt. Delbert L. Johnson, USAF (Ret.)
Lt. Col. Leon J. Johnson, USAF
Onalee H. Johnson
Sheila K. Jones
Suetta Jones
Wanda F. Jones
Capt. Michael E. Kaufhold, USAF
Edward W. Keil
Robert Keith
Dennis P. Kelly
John Kelly
Frank J. Kilcheski
Roselyn Knapp
Duane N. Koller
Robert M. Kuhns
Ron Labar
Herbert M. Levy
John F. Lisella
Nellie M. Lokken
Gerald D. Loos
Alfred C. S. Malmsten
John McCormack
L. Ray McKee
Col. Robert K. McLeod, USAF
Valerie Mecham
Brig. Gen. Bob Mitchell, USAF
Thomas O. Moran
Capt. Harriet "Denise" Moultrie, USAF
James L. Mulligan

1992 Individual Activity Awards (continued)

Joseph Musil
 E. G. "Chris" Myers
 Jerry Nabors
 Erwin B. Nase
 Georgia L. Newton
 Bobby R. Noack
 Richard P. Norton
 Ellis T. Nottingham
 Col. Rolf Nymo, USAF
 Harold O'Berg
 Robert Olislagers
 Alan K. Olsen
 David A. Olson
 Richard A. Ortega
 Sherry L. Ott
 CMSgt. Ronald E. Palmer, USAF
 John A. Parrish, Jr.
 Bob Patterson
 Bryan B. Paul
 1st Lt. Julia E. Petrina, USAF
 Michael J. Polay
 Lt. Col. Jess Ramirez, USAF (Ret.)
 H. Thomas Reed
 Roger G. Ritchey
 Paul K. Robinson, Jr.
 James K. Rogers
 Anthony Romanelli
 William H. Russell
 Alphonso L. Salandra
 Ronald E. Sandhop
 CMSgt. Phillip C. Sandifer, USAF
 Francis Satterlee
 Keith Sawyer
 Lt. Col. John A. Schafer, USAF
 Fred Schwarz
 John K. Scott
 Fred W. Searles
 John C. Seely

Ralph E. Shadel
 Mervyn I. Silberberg
 Dr. George Silver
 Dr. Phillip J. Sleeman
 Howard D. Smith
 TSgt. Debbie E. Snyder, USAF
 Capt. John B. Steele, USAF
 Dr. Everett E. Stevenson
 Col. Richard Szafranski, USAF
 CMSgt. Jack Szalasny, USAF
 Deborah A. Trammell
 Herbert A. Trost
 Charles G. Tucker
 Charles Unice
 Robert T. Valentine
 Anthony Dominic Vallone
 Thomas R. Van Meter
 Leonard R. Vernamonti
 Charles J. Vesely
 C. Howard Vest
 Chester A. Walborn
 C. G. Wander III
 MSgt. Andrew J. Ward, USAF
 John H. Williams
 Robert M. Williams
 Floyd S. Wilson
 Lois J. Wilson
 Capt. Robbin A. Wimmler, USAF
 Marie Wissman
 Marvin J. Woodring
 CMSgt. John W. Wright, USAF
 Jerome Yarchever
 Wayne I. Yohe
 Louise Young
 Col. Michael E. Zettler, USAF
 Bonnie M. Ziegler
 Col. Kenton R. Ziegler, USAF
 Jule Zumwalt

Arthur C. Storz, Sr., Membership Awards

AFA's most prestigious membership awards are named after Arthur C. Storz, Sr., a former permanent AFA National Director, Life Member, and principal founder of Omaha's Ak-Sar-Ben Chapter. The Storz Membership Award, made possible through a generous endowment to the Association by his son, Art Storz, Jr., has been awarded for membership excellence based on criteria approved by AFA's Board of Directors for the year ending March 31, 1992.

Chapter Award

Presented to the AFA chapter that produces the greatest number of new members during the twelve-month period ending March 31, 1992, as a percentage of total chapter membership as of March 31, 1991.

High Desert Chapter, Calif.
 Gert R. Feiler, President

Individual Award

Presented to the AFA member or members who have done the most to promote AFA membership during 1991-92.

Lt. Col. James G. "Snake" Clark
 Timothy H. Howard

1992 AFA Membership Awards

The following chapters have qualified for these awards based on their recruitment of new members during the twelve-month period ending March 31, 1992. The chapters are listed in alphabetical order.

Diamond Award: 25% new members and 20% or greater net growth

Dolomiti, Italy
 Wasatch, Utah

Gold Award: 25% new members and net growth between 10% and 20%

Green Valley, Ariz.
 High Desert, Calif.

Silver Award: 25% new members and net growth between 5% and 10%

Eagle, Pa.

Achievement Award: 25% new members and net growth between 1% and 5%

Misawa, Japan
 Wichita Falls, Tex.

Special Membership Award: 20% new members

Eifel, Germany
 Langley, Va.
 Lloyd R. Leavitt, Jr., Mich.
 Paul Revere, Mass.
 Rocky Mountain, Utah

Photo by Paul Kennedy



Jack C. Price (left), former National Board Chairman, receives the Man of the Year Award from O. R. Crawford, the new chairman. Mr. Price was given the award for "dynamic leadership in directing his time, energies, and talent to enhance public understanding of the US Air Force and its mission." His contributions to AFA include service as former national president, national secretary, and national vice president of the Rocky Mountain Region.

National Aerospace Awards

Award	Recipient(s)	Achievement	Accepted by
H. H. Arnold Award (AFA's highest honor in National Security to a member of the armed forces)	Gen. Colin L. Powell, US Army, Chairman of the Joint Chiefs of Staff	Outstanding leadership as Chairman of the Joint Chiefs of Staff, guiding our forces to decisive victory, standing as a powerful advocate for the forces necessary to ensure national security, and strongly supporting the men and women of the US military	
W. Stuart Symington Award (AFA's highest honor in National Security to a civilian)	Hon. Donald B. Rice, Secretary of the Air Force	Far-sighted leadership as Secretary of the Air Force in developing and articulating the "Global Reach, Global Power" strategic planning framework and in organizing a new command structure	
John R. Alison Award (AFA's highest honor for industrial leadership)	Norman R. Augustine, Chairman, Martin Marietta Corp.	Dedication, vision, and leadership resulting in deeper appreciation of the contributions made by the US defense community to national security and to significant improvements in the acquisition process	
David C. Schilling Award (outstanding contribution in Flight)	Crew of space shuttle <i>Endeavour</i> , STS-49	Record-breaking mission with three complex rendezvous and four instances of extravehicular activity, resulting in rescue of errant satellite and significant progress in space station research	Lt. Col. Thomas Akers and Lt. Col. Kevin P. Chilton, astronauts
Theodore von Kármán Award (outstanding contribution in Science and Engineering)	Ballistic Missile Organization, Norton AFB, Calif.	Thirty-eight years of sustained excellence in the development of technology that contributed decisively to victory in the cold war, facilitated progress in arms control, and provided the basis for advanced civilian technology	Col. Ralph W. Holm, commander
Gill Robb Wilson Award (outstanding contribution in Arts and Letters)	Tom Clancy	Writing immensely popular novels and other creative works that vividly reflect the high ideals and professionalism of the men and women dedicated to the security of the US	
Hoyt S. Vandenberg Award (outstanding contribution in Aerospace Education)	Earl H. Tilford, Jr., Maxwell AFB, Ala.	Scholarship and teaching skills as an instructor at USAF's Air Command and Staff College that have made an impact on the study of airpower throughout military and civilian academic circles	
Thomas P. Gerrity Award (outstanding contribution in Logistics)	Col. William M. Rider, Shaw AFB, S. C.	Unparalleled professionalism in Operation Desert Storm as deputy chief of staff, Logistics, 9th Air Force, US Central Command, successfully orchestrating the largest logistics buildup over the greatest distance since World War II	
Department of Veterans Affairs Employee of the Year	Adan Alaniz, Jr., VA Regional Office, Houston, Tex.	Consummate professional assistance as a benefits counselor to more than 700 veterans and dependents per month	

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and Defense, is the prime contractor and
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based training for the Pampa 2000.

UNC provides aircraft logistics
support. Allied-Signal supplies
the engine, avionics and

environmental control system. And FMA provides the proven Pampa airframe. This team of companies represents
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THE AVIATION COMPANY

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Signal**

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man II unit to deactivate, another big step in the drawdown of US nuclear forces. The squadron was part of the 44th Missile Wing under Air Combat Command's 20th Air Force.

■ The Extended-Range Interceptor (ERINT) missile was successfully tested for the second time at White Sands Missile Range, N. M., in August. ERINT is a small, lightweight, guided hit-to-kill missile being developed to counter theater ballistic missiles. Eight tests are planned for ERINT.

■ Italy has informed the US of its intent to purchase thirteen AV-8B Harrier II Plus aircraft from McDonnell Douglas. The notification came in August. McDonnell Douglas will build the aircraft, but final assembly will take place in Italy. The AV-8B Harrier II Plus carries the APG-65 radar used on the F/A-18 Hornet.

■ The 600th Electronic Security Squadron was activated in August by Maj. Gen. Gary W. O'Shaughnessy, commander of Air Force Intelligence

Aerospace World

Command. The squadron is part of the Contingency Airborne Reconnaissance System, a quick-reaction, deployable package of personnel and equipment that will support contingency and combat operations when and where needed.

■ The kinetic kill vehicle integrated technology experiment (KITE) successfully completed the second test in the High Endoatmospheric Defense Interceptor (HEDI) program at White Sands Missile Range, N. M., in August. The KITE tests are designed to resolve critical technology issues related to intercepting reentry vehicles in Earth's atmosphere using an infrared homing seeker and a nonnuclear warhead.

■ Loral Corp. announced in August that it had completed the acquisition of LTV's missiles division. The net purchase price after closing adjustments will likely be about \$244 million. LTV Missiles is now named Loral Vought Systems Corp. Loral Vought designs and manufactures the Army's missile systems, including ATACMS (a stand-off surface-to-surface missile) and the Multiple Launch Rocket System.

■ The Navy successfully conducted its first test of an improved version of the McDonnell Douglas Standoff Land-Attack Missile (SLAM) in August. The test was conducted at the Naval Air Warfare Center at Point Mugu, Calif. The missile was launched by an F/A-18D Hornet. Once infrared video transmission was received and the pilot selected a precise aimpoint, the missile successfully hit the target.

■ The AH-64D Longbow Apache helicopter completed forty hours of flight testing in September at Mesa and Yuma, Ariz., to verify the aircraft's flight controls, stores jettison envelope, and handling qualities. About 2,500 hours of testing are planned for the four prototypes. Longbow will provide Apache with an advanced targeting system.

■ The Air Force's first "Gray Eagle," Maj. Gen. Fred R. Nelson, commander of Lowry Training Center, Lowry AFB, Colo., retired in August. The Gray Eagle award honors the active-duty officer who has the longest continuing rated service as a pilot or navigator. General Nelson earned his wings in July 1957 and has accumulated more than 5,000 flying hours. He flew 100 combat missions over North Vietnam.

■ Air Force Inspector General Lt. Gen. Eugene H. Fischer received the Gray Eagle award in August. General Fischer earned his wings in March 1956 and has accumulated more than

Special Citations and Other Awards

Award	Recipient(s)	Achievement	Accepted by
Gen. Curtis E. LeMay Award	Crews S-05/E-44, 55th Wing, Offutt AFB, Neb.	Best strategic aircrew	Capt. David F. Ellis, instructor aircraft commander
Gen. Thomas S. Power Award	Crew S-208, 44th Missile Wing, Ellsworth AFB, S. D.	Best strategic missile combat crew	Capt. Ferdinand B. Stoss III, commander
Lt. Gen. William H. Tunner Award	A crew of the 438th Airlift Wing, McGuire AFB, N. J.	Best Military Airlift Command aircrew	Capt. Thomas M. Beirne, flight examiner pilot
Lt. Gen. Claire Lee Chennault Award	Capt. Arden B. Dahl, 23d Fighter Wing, England AFB, La.	Outstanding aerial warfare tactician	
Gen. Jerome F. O'Malley Award	A crew of the 67th Reconnaissance Wing, Bergstrom AFB, Tex.	Best reconnaissance crew	Maj. Mark K. Hefferly, commander
Best Space Operations Crew	Bravo Crew, 2d Space Operations Squadron, Falcon AFB, Colo.	Best space operations crew	Maj. Earl Vaughn, crew commander
Verne Orr Award	39th Tactical Group, Incirlik AB, Turkey	Most effective utilization of human resources within USAF	Col. John W. Rutledge, commander

Citations of Honor

Recipient(s)	Achievement	Accepted by
1st Space Operations Squadron, Falcon AFB, Colo.	Perfect launch record; nearly flawless on-orbit operations with the Navstar Global Positioning System, Defense Support Program, and Defense Meteorological Satellite Program; and strong support of Operations Desert Shield and Desert Storm	Lt. Col. Robert L. Hooten, commander
Lt. Col. James G. Clark, Ramstein AB, Germany	Development of the USAFE Warrior Preparation Center; establishment of a Pentagon wargaming center; performance as chief, USAFE Combat Simulation Division; and significant input on mission planning for Desert Storm	
Maj. Gerald Diaz, USAF Academy, Colo.	Superb performance in signature modeling and ballistic missile flight analysis	
Lt. Col. Steven C. Gordon, USAF Academy, Colo.	Analysis of spacecraft orbit, orbital error determination, and station-keeping, materially improving the effectiveness of US space assets	
Lt. Col. Joseph C. Hampton, Jr., Scott AFB, Ill.	Professionalism as chief, Joint Rescue Coordination Center, US Central Command, during Desert Shield and Desert Storm. Oversaw all search-and-rescue operations throughout the southwest Asian theater; negotiated agreements with host countries, other allies, and US government agencies; and developed a theater-wide, multinational SAR infrastructure	
The men and women of Operation Provide Comfort, USAFE	The largest humanitarian relief effort of its kind, delivering vital supplies to 500,000 Kurdish refugees despite bad weather, difficult terrain, and threats of hostile action by Iraqi forces	Lt. Gen. James L. Jamerson, commander in chief, USAFE
The men and women of Strategic Air Command, Offutt AFB, Neb.	Forty-six years of securing peace with freedom, standing with unyielding vigilance on the front lines of the cold war until victory was won	Gen. George Lee Butler, commander in chief, USSTRATCOM
Alice B. Price, Washington, D. C.	Outstanding service as chief, Air Force Art and Museum Branch, Secretary of the Air Force Office of Public Affairs. The curator of 7,500 pieces of art and liaison to civilian illustrators, she assists in the documentation of the Air Force, enhancing the image of USAF and its members	

Air National Guard and Air Force Reserve Awards

Award	Recipient	Achievement	Accepted by
Earl T. Ricks Award	A crew of the 190th Air Refueling Group, Kansas ANG	Outstanding airmanship in the Air National Guard	Lt. Col. Kevin J. Sweeney, aircraft commander
Air National Guard Outstanding Unit	174th Tactical Fighter Wing, Hancock Field, Syracuse, N. Y.	Outstanding ANG unit of the year	Lt. Col. Tom Webster, air commander
Air Force Reserve Outstanding Unit	512th Military Airlift Wing, Dover AFB, Del.	Outstanding Air Force Reserve Wing of the year	Col. David J. Stanley, commander
President's Award for AFRES	Lt. Col. Roger G. Disrud, 442d Tactical Fighter Wing, Richards-Gebaur AFB, Mo.	Top flight crew in the Air Force Reserve	
CMSgt. Dick Red Award	SMSgt. Joan T. Davis, 184th Consolidated Aircraft Maintenance Squadron, Kansas ANG	Outstanding aerospace maintenance by an enlisted member of ANG	

Photo by Paul Kenedy

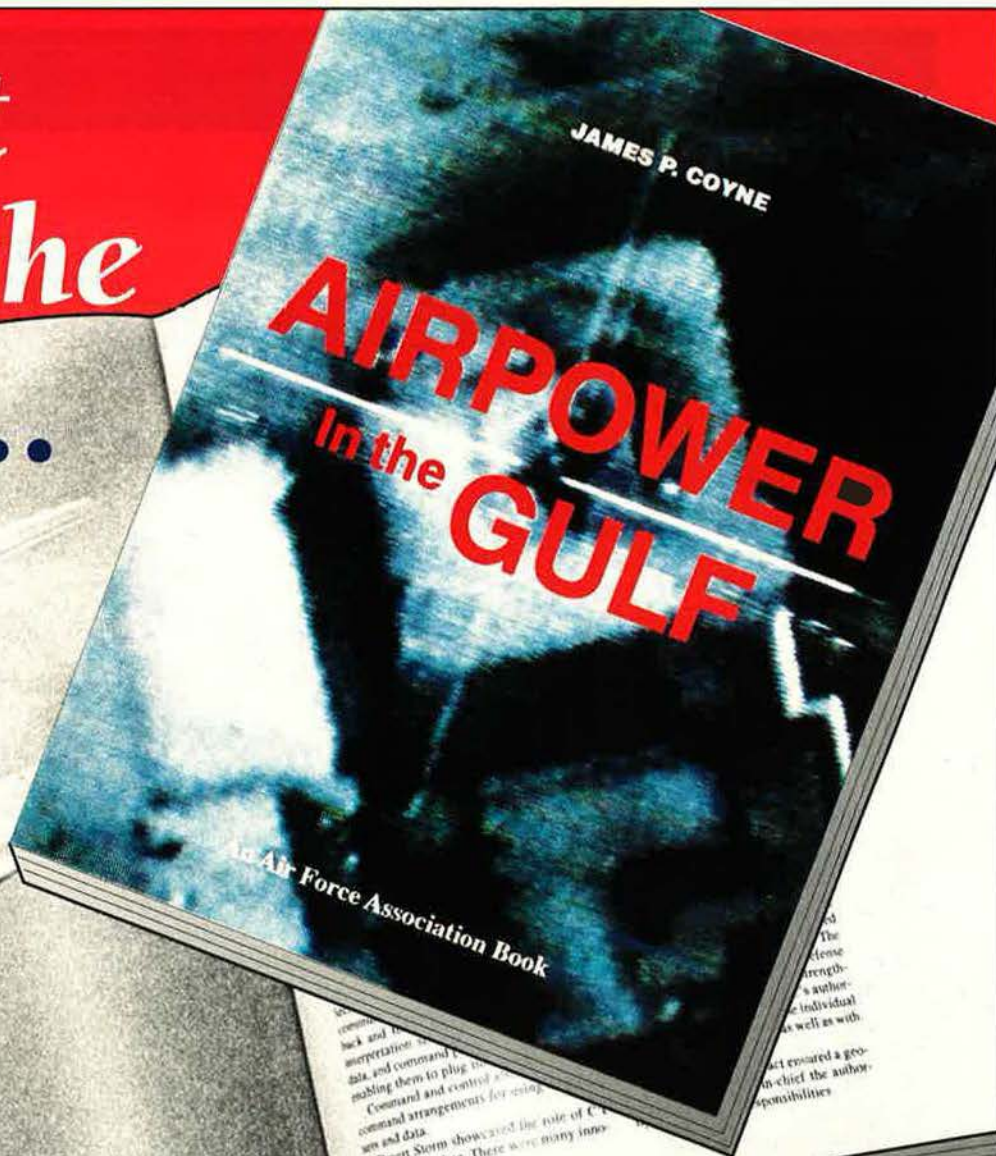
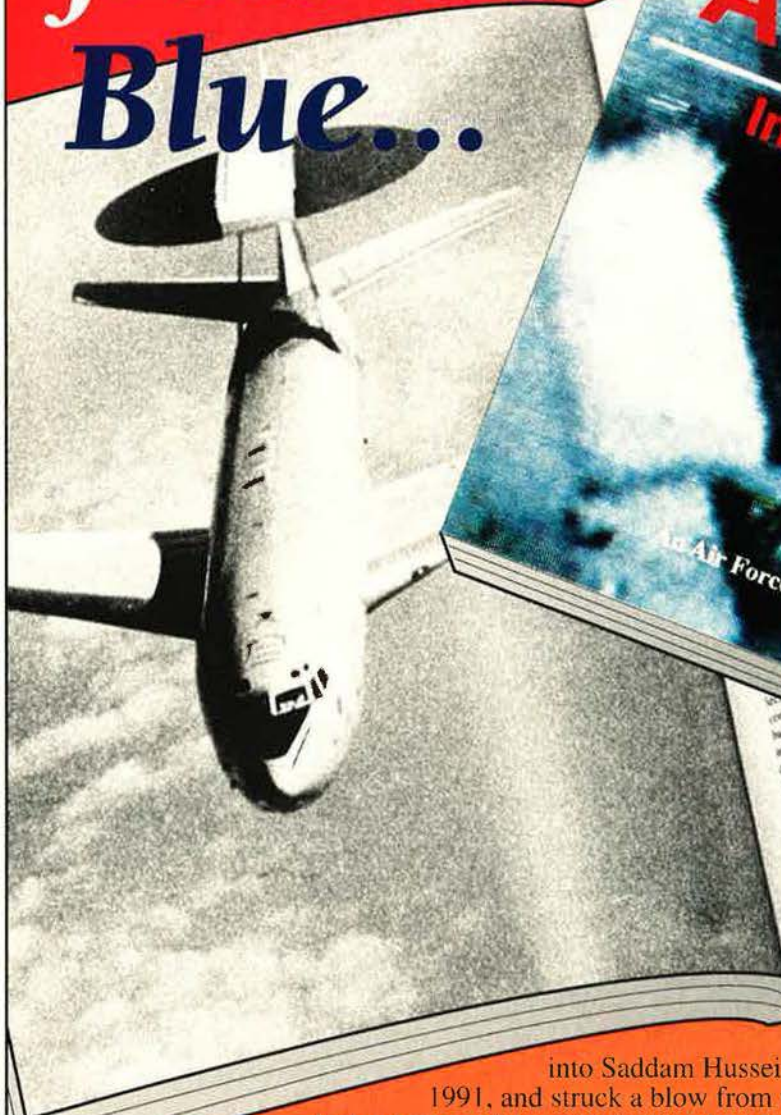


The first recipient of a new award for industrial leadership, Norman R. Augustine (center), Chairman of Martin Marletta, received the John R. Alison Award from National Board Chairman O. R. Crawford (left). Mr. Augustine was honored for his "dedication, vision, and leadership resulting in deeper appreciation of the contributions made by the US defense community to national security."

Professional, Civilian, and Educational Awards

Award	Recipient
Stuart R. Reichart Award for Lawyers	Col. William A. Moorman, Offutt AFB, Neb.
Paul W. Myers Award for Physicians	Maj. Jon R. Pearse, USAF
Personnel Manager of the Year	Lt. Col. David E. Edwards, Randolph AFB, Tex.
Crew Chief of the Year	TSgt. Zachary L. Wallace, Beale AFB, Calif.
Civilian Wage Employee of the Year	Edward F. Ruch, Jr., Eglin AFB, Fla.
Civilian Program Specialist of the Year	Johnny W. Weems, Patrick AFB, Fla.
Civilian Program Manager of the Year	Deborah L. Root, Maxwell AFB, Ala.
Civilian Senior Manager of the Year	Katherine H. Douglas, Eglin AFB, Fla.
Joan Orr Air Force Wife of the Year	Kim J. Kozlowski, Fairchild AFB, Wash.
AFROTC Cadet of the Year	Eric N. Treschuk, Duke University, Durham, N. C.
CAP Aerospace Education Cadet of the Year	Matthew L. McCloskey, Dayton, Ohio
Diane O'Malley Angel of the Year	Lisa Howard, Brigham Young University, Salt Lake City, Utah
Juanita Redmond Award for Nursing	Capt. Linda J. Cashion, USAF

A Bolt from the Blue...



Cloaked by darkness and stealth, more than 400 allied aircraft crossed the border into Saddam Hussein's Iraq in the early morning hours of January 17, 1991, and struck a blow from which the Iraqi armed forces never recovered. It was the beginning of the most impressive air campaign in history.

Here is the *real* story of Operation Desert Storm. You may have read other books on the Gulf War, but this is the one you'll turn to again and again over the years. Veteran fighter pilot Jim Coyne draws on a year's research and almost 200 interviews with participants—the sergeants and the airmen as well as the generals and the captains—to explain how the air campaign was planned, fought, and won. It's loaded with eyewitness reports and first-person accounts.

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by James P. Coyne

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Force Leaders Look Ahead

By James W. Canan, Senior Editor

STRATEGIES come and go. Force structures come and go. But one thing that I'm committed to, that all the Chiefs are committed to, is that we will not let this superb, professional force be broken by those who want to go too fast, too far."

Gen. Colin L. Powell, Chairman of the Joint Chiefs of Staff, made that statement to tumultuous applause at the Air Force Association's forty-sixth National Convention last September in Washington.

"Every time we've brought down the size of the military in the past, after a crisis had passed, we've fouled it up," General Powell declared. "We've cut too far, too fast, and in the wrong places, and we wound up later paying a terrible price, all too often in blood, for our shortsightedness."

His message: Although the cold war is over, US forces must be sufficiently large, powerful, and flexible "to project military power wherever and whenever it's required."

Addressing the AFA Convention, Air Force Secretary Donald B. Rice struck much the same theme, declaring that the US must be strong militarily before it can be strong in all other respects. He warned that excessive force cuts induced by false economies could cause a fatal "free fall" of the nation's military strength.

Dr. Rice asserted, "Maintaining military power is not a zero-sum game.

When you buy it, you don't give up economic power. Military power protects . . . and fosters prosperity."

Gen. Merrill A. McPeak emphasized at the AFA Convention that a smaller Air Force must be a better-trained Air Force. The Air Force Chief of Staff delivered a speech titled, "1992: The Year of Training," in which he disclosed plans for "tougher, more rigorous training and education" amid force cuts in a world that is "different from anything we've faced throughout Air Force history." [See "The Wall-to-Wall Training Review," p. 40.]

Smaller, More Lethal

In his spirited address to AFA Convention delegates, General Powell maintained that US military leaders are fashioning "a much smaller, but still lethal, military force" to meet the nation's needs in the post-cold war world. "We call it the Base Force, and if we're allowed to continue shaping it in the right way and at the right speed, we will have a smaller but even better force than we have today," the JCS Chairman declared.

He emphasized that the Base Force "will be, first of all, a joint force" composed of "the right combination of forces and capabilities, no matter which service they belong to," for all missions. Each of the armed services must be permitted to retain its tradi-

tions and unique capabilities, including individual air components, and each must be prepared to team up with the others in times of crisis and war, he said.

Each service contributed mightily in its own way to the allied victory in Operation Desert Storm, but "it was the team that won the war," said General Powell. "Desert Storm proved that a truly joint, coordinated campaign is the only intelligent way to fight and that we can, in fact, fight very successfully that way."

Although "airpower by itself did not win Desert Storm," it was "decisive in that war," the JCS Chairman said. "It made the rest of what we had to do much easier. Airpower won the game ball. In another war, the game ball may go to someone else. . . . The bottom line is that the ability to operate jointly has become the new hallmark of the American military."

General Powell praised General McPeak in particular for having "moved aggressively to adapt the Air Force to this philosophy and to the demands of the twenty-first century." He said the sweeping Air Force reorganization undertaken by General McPeak and Secretary Rice "will result in a lean, capable Air Force that is ready for its post-cold war mission."

"The creation of Air Combat Command and Air Mobility Command has helped lead the way in the Pentagon toward a new vision on the use of joint military power," General Powell declared. "Global Reach, Global Power" has become more than just a slogan. It is the defining vision of the new Air Force, . . . a vision that is fundamental to our post-cold war strategy."

That national strategy and the military forces needed to implement it must be "based on capabilities and not just on threats," General Powell declared. In a rapidly changing world, many threats may come out of nowhere and cannot be predicted, he said.

Mistakes and Regrets

The JCS Chairman said that the armed forces must be sized and shaped to "meet [all] challenges and win . . . in a short time, with minimum loss" and also to carry out humanitarian relief and peacekeeping operations around the world.

He noted that "there are those who argue with this approach [of] maintaining versatile capabilities" and who

"insist that we can have forces matched to a specific identifiable threat."

"This is not only a mistaken concept, it is a dangerous concept," he said. "We have regretted [adopting] it in the past. I can assure you that [Defense] Secretary [Dick] Cheney, I, and the Chiefs will resist it."

General Powell noted that "Congress and others" are rightfully "challenging us to justify the capabilities we say we need" and to "clearly delineate the roles and missions of our individual services." Roles and missions are under review, he said, and "where there is duplication, inefficiency, or cold war thinking, we will fix it, but where those different forces complement each other, we will preserve their complementary and critical edge."

By 1997, he said, US defense spending will be at its lowest since World War II as a percentage of Gross National Product and of the federal budget. The Base Force is being shaped to "make the best use of this country's finite defense resources" at a price that the American public ought to be willing to pay, he said.

Secretary Rice said in his Convention speech that "America is safest and most prosperous in a world where people, goods, and ideas move freely, and that's why the mission of the Air Force—to defend the United States through control and exploitation of air and space—is of such consequence."

By 1995, the Air Force will embody 100 active wings and fifty Air Force Reserve and Air National Guard wings, he said. Of the active wings, seventy-nine will be "operational Air Force wings." The other twenty-one wings, including "training, test, and some support wings," will perform "Department of the Air Force 'organize, train, and equip' functions," he said.

"We'll increase our relative reliance on the fifty Guard and Reserve wings across the board," Dr. Rice declared. He gave a "rough sketch" of what the Air Force will look like in the mid-1990s, following force-structure and personnel cuts now under way or in the offing, as follows:

■ The Air Force will maintain a fleet of 170 operational bombers (the figure excludes aircraft committed to testing or in the maintenance pipeline) for conventional war and regional conflicts, with precision guided conventional weapons on B-2s, B-1s, and B-52s. "We'll keep some nuclear ca-

pability. The B-2 will spearhead the force, with the B-1 as backbone."

■ Tanker aircraft numbers and air-lift capacity "will drop only slightly." C-17s will replace C-141s in terms of capacity and capability, not one for one. The projected C-17 buy stands at 120 aircraft.

■ "On the fighter side, the F-22 is needed for the uncontested control of the skies that our sister services and the nation have come to expect." There will be "several forward-based fighter wings in Europe, two or three in the Pacific, and the rest in the US."

■ The ICBM "end point," in keeping with Washington-Moscow agreements, is a US force of 500 single-warhead Minuteman III missiles.

Dr. Rice said he expects major space and C³I programs to hold steady, accounting for "just over eighteen percent of Air Force spending each year through this decade. . . . Milstar, the other satellites, the booster programs, upgrades to launch pads and ranges, all will be maintained."

"Solid" Procurement Base

The Air Force Secretary predicted "a solid base of procurement funding for contractors to compete for" plus increased spending on research and technology in the years ahead. Procurement funding "should approach \$50 billion to \$55 billion a year," he said, and production quantities "will be smaller, emphasizing the need for flexible factories and manufacturing technology."

General McPeak told his AFA audience that USAF "will need to dedicate more resources" to upgrading the education and training of the enlisted force in many respects. He emphasized that it will be money well spent.

"I am not contending that our training system is worthless," the Chief of Staff declared. "By and large, Air Force people are very well trained. Our performance over the years tells us that.

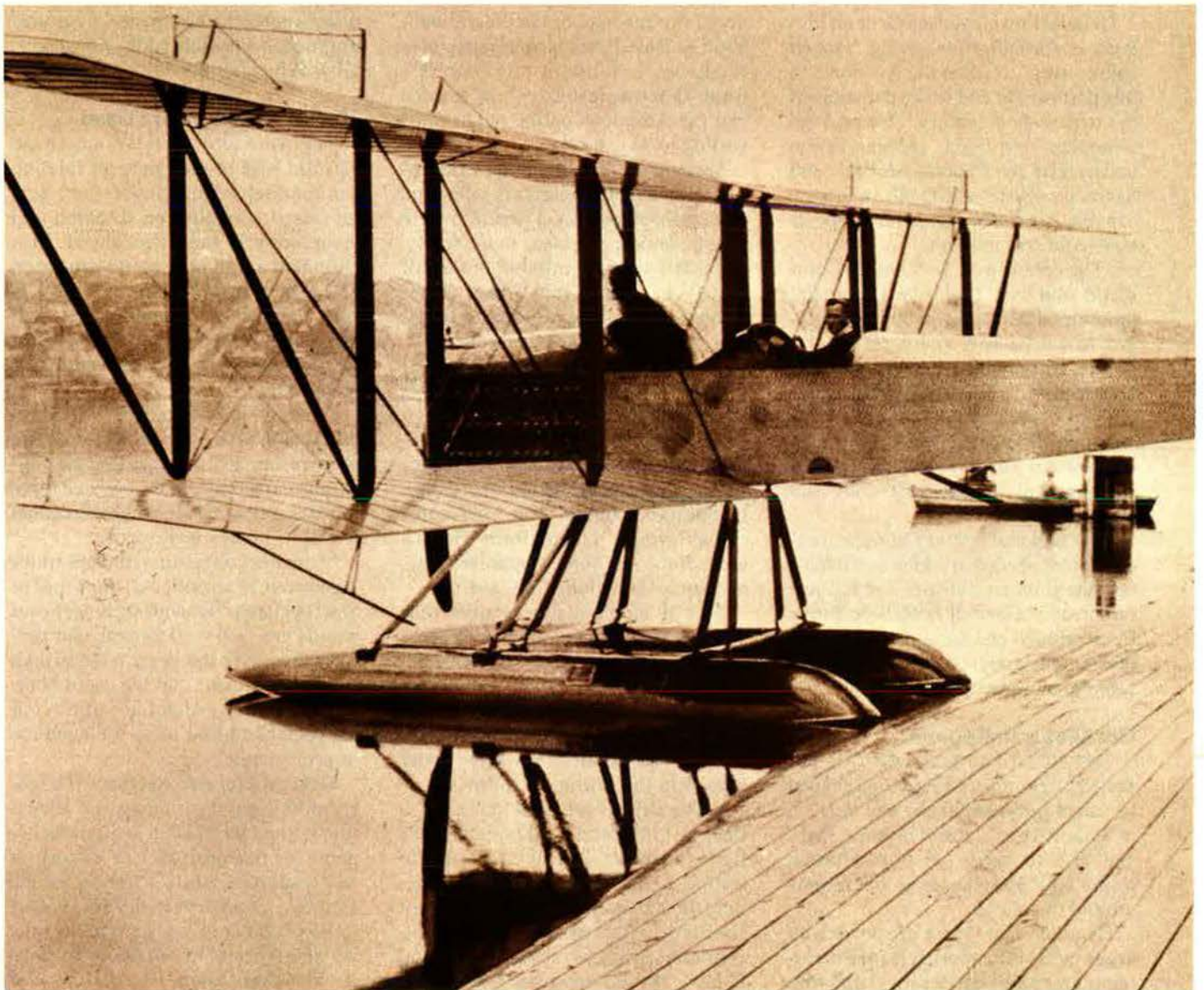
"But it is clear that we can do better, and . . . we shouldn't allow our successes to blind us to the need for improvement."

General McPeak asserted, "Tougher, more rigorous training and education is good for us as an institution, it's good for our prospects of victory in any contest of arms, it's good for the nation. . . . If and when the time comes to reconstitute at higher force levels, we should remind ourselves to raise our standards again." ■

Its first commercial flight was in New Zealand, where it awed the Maoris.

The First Boeing

By Terry Gwynn-Jones



GEORGE Bolt could hardly contain his excitement. He was certain this was the day he would prove the potential of airplanes to those skeptical New Zealand postal officials. He cautiously taxied his floatplane out from the New Zealand Flying School's seaplane base at Kohimarama, near Auckland, turned into wind, and took off.

The date was December 16, 1919. The first Boeing aircraft ever built was embarking on its maiden commercial flight. Soon there would be other interesting developments. The aircraft would be rescued by a steam-powered locomotive. North Island Maoris would come to regard its pilot as a cultural hero.

Bolt's Boeing Model I B&W biplane was the forerunner of the Boeing family of airliners. Compared with today's machines, it was a midget. Lined up nose to tail, eight B&Ws could be parked beneath the body of a Boeing 747-400.

The origins of the historic 1919 flight could be found three years earlier, when two seaplanes were hand-built in a boat shed on Lake Union, near Seattle, Wash. These

aircraft were the products of the imagination of a Seattle timber magnate, William Boeing, and a US Navy officer, Cmdr. Conrad Westervelt—hence the name "B&W" applied to these planes.

Boeing and Westervelt were determined to produce a new airplane that would put America back at the leading edge of world aviation—a position it had gradually lost to overseas rivals. In the thirteen years since 1903, when the Wright brothers made the first successful powered flight at Kitty Hawk, European aircraft builders had stolen a lead. French monoplanes had reached top speeds exceeding 100 mph. Russia's Igor Sikorsky had built four-engine airliners powerful enough to carry a dozen passengers.

Meanwhile, back in the US, most American pilots were still flying crude, Wright-inspired, box kite-type machines. One frustrated airman remarked that they "look like flying front porches—and fly about as well."

Boeing and Westervelt, however, were confident that things were about to change. Their Model I B&W (the airplane Bolt flew in 1919) proved to be stable, yet it could be maneuvered easily. The B&W cruised at sixty-five mph



Determined to regain the lead in aviation for the US, Seattle timber magnate William Boeing and Cmdr. Conrad Westervelt designed the Model I B&W (left), shown here prior to a test flight on Seattle's Lake Union. At right, George Bolt poses next to his Model I before one of his New Zealand airmail flights in 1919.



and had a range of 320 miles. Its 125-horsepower Hall Scott A-5 engine was cantankerous, but it did the job.

As it turns out, the US military services did not buy these machines. Nevertheless, the Navy encouraged Boeing to open a small factory and keep trying.

Impetus of the War

In 1917, shortly after America entered World War I, Boeing received his first significant order. Two Model IV landplanes were purchased by the Army. The Navy ordered the production of fifty Model V floatplane trainers for use at the fleet's San Diego Naval Air Station.

With the Armistice, military sales dried up, and Boeing was forced to make furniture and powerboats to keep his plant going. He did, however, manage to sell the original, unwanted B&Ws to the New Zealand Flying School.

The flying school was formed in 1915 by New Zealand's aviation pioneers Leo and Vivian Walsh. These two brothers had trained more than 100 New Zealand pilots for World War I duty in Britain's Royal Flying Corps. With the war over and few civilians interested in flying, the Walsh brothers and their chief instructor, George Bolt, searched for ways to keep the school solvent. One of their first ideas was to use the Boeing airplanes to provide an airmail service for New Zealand's postal department.

It took almost a year before approval was granted. Postal officials were loath to trust their precious mail to airplanes. The new flying machines, they complained, were "very tricky." The bureaucrats preferred trains and the slow-but-safe steamers that carried the mails to the isolated villages and settlements dotting New Zealand's rugged coastline.

The Post and Telegraph Department finally recommended the opening of an experimental service "in order to investigate the practical utility of the conveyance of mail matter by air in New Zealand." The authorization formally stipulated that there would be no registered mail (valuables) carried in the series of short trial flights between Auckland and Dargaville, a town located on an estuary seventy-five miles north.

As he landed in Auckland Harbor to pick up the first mail load for Dargaville, Bolt was confident that the little Boeing airplane was up to the test ahead. He moored alongside the launch landing at the foot of Queen Street. About 2,000 Aucklanders gathered for the occasion could see the words "Royal Mail" glistening in gold paint on the airplane's fabric-covered fuselage.

The crowd watched as Bolt was sworn in as an official mail carrier. Postal workers loaded onto the plane three bags containing 825 letters plus a bundle of newspapers.

Stay Near Water

At 10:15 a.m., precisely on schedule, Bolt took off from Auckland Harbor. Flying parallel to the eastern coastline, he remained over the water as the aircraft slowly gained altitude. The flight plan prepared by Bolt was a circuitous, 112-mile route that would enable him to cross from the east to the west coast over a narrow neck of land and then track along the shore to the destination. "Due to the unreliability of engines in those days," Bolt later explained, "we never cared to go very far away from the water."

Almost two hours after leaving Auckland, Bolt brought the Boeing down on the river at Dargaville. The town turned out in force, and the aviators were greeted by factory whistles and clanging firebells. The return flight was equally smooth. In the words of the *New Zealand Herald*, "The pioneer aerial Royal Mail of New Zealand was carried without a hitch in the arrangements."

The airmail trials were expanded to include other destinations. In March 1920, the first "hitch" occurred.

While landing in a river, Bolt's plane hit a log, which punched a hole in one of the floats. As the float filled with water, Bolt and a passenger pilot climbed onto the wingtip on the opposite side, trying to use their weight to prevent the crippled seaplane from turning over.

The situation seemed hopeless until a steam locomotive came to the rescue.

A railway track ran close to the water's edge. Nearby, a train had stopped to allow its crew to watch the Boeing



This giant bird (to the Maoris' eyes) brought pilot George Bolt to the very rock where the ancestral King Toroa is said to have landed after his journey across the Pacific centuries before. Admiring Maoris gave Bolt the honorific "Toroa II."



The arrival of an airplane was still rare enough in 1920 to draw a crowd. On this flight, Bolt had an important passenger, the soon-to-be Prime Minister of New Zealand, Gordon Coates, arriving for a political rally in Pahi.

come in for a landing. Realizing that the plane was sinking, the train's crew members threw a rope to Bolt. Once the line was secured to the plane, the engineer shunted the train slowly backwards, dragging the waterlogged Boeing up onto the mud flats.

The news got out, and chuckling journalists soon were reporting how an airplane had been rescued by a train. It was an aviation "first," one Bolt would have happily forgone. He soon suffered further embarrassment when he made a forced landing at sea and was towed back to Auckland by a passing steamer.

His Royal Highness Proclaimed

Bolt and his Boeing became a familiar sight along the coastline of the North Island. When he flew the first service to Whakatane on the Bay of Plenty, he tied up to the rock where, according to local legend, the first Maori canoe to reach New Zealand had moored after voyaging across the Pacific centuries earlier. The canoe, so the story goes, had carried the fabled Maori chief, Toroa.

One of Toroa's descendants, who had never seen an airplane, paddled out to greet Bolt and his "big bird." He was so delighted at the coincidence of events that he named the airman "Chief Toroa the Second." In time, Bolt/Toroa II reluctantly became a hero to the Maoris of New Zealand's isolated coastal settlements.

"The Maoris treat us as though we come from another world," Bolt wrote in a letter to his mother, "and it [is] embarrassing, in a way, when some of them kneel down as we walk along the road. In some places, these people have never seen a car, let alone an aeroplane."

By late 1924, however, flying was in the doldrums. With government interest waning, the New Zealand Flying School closed down.

The Boeing Airplane Co., too, struggled through these lean postwar years. Bill Boeing, like the Walshes of New Zealand, had seen the airmail services as a possible means for keeping his company afloat. In 1919, he helped establish a service between Seattle and Canada's Vancouver Island, with the route serviced by an improved version of the original B&W.

He later formed Boeing Air Transport, using his factory's products on the lucrative transcontinental airmail service. The success of Boeing transport planes helped to establish the company firmly. In 1931, Boeing Air Transport Co. became a part of United Airlines.

George Bolt went on to help pioneer New Zealand's first international airline company, Tasman Empire Airways, the forerunner of today's Air New Zealand. In 1940 he was among the crowd of dignitaries that welcomed the arrival of Boeing's most famous seaplane—the Boeing 314 flying boat. Operated by Pan American Airways on the San Francisco–Auckland service, the giant flying craft moored alongside the jetty where its tiny ancestor had commenced the inaugural airmail service twenty-one years earlier.

Nobody is quite sure what happened to the historic B&Ws. Following the demise of the New Zealand Flying School, they were dismantled, crated, and put into storage. Some Aucklanders recall seeing crated aircraft and floats stored in underground tunnels below cliffs near Auckland. The tunnel system was used as an ammunition dump during World War II and was afterward sealed off by the authorities. Subsequent searches have turned up no sign of the airplanes.

One day, perhaps, a landslide or some other act of nature may uncover the subterranean network. Then searchers exploring long-forgotten tunnels might well come upon George Bolt's beloved Boeings. ■

*Terry Gwynn-Jones served as a fighter pilot with the RAAF, the RAF, and the Royal Canadian Air Force. In 1976, he set an around-the-world speed record for piston-engine aircraft. His most recent book, *Farther and Faster* (Smithsonian Institution Press), is a history of speed and distance competition in aviation. His most recent article for *AIR FORCE Magazine*, "The Bad Luck of Harriet Quimby," appeared in the April 1992 issue.*

ROTC seniors will pursue graduate degrees with help from Aerospace Education Foundation grants.

The von Kármán Scholars

By Arthur C. Hyland

THE Aerospace Education Foundation has announced its third class of Dr. Theodore von Kármán Graduate Scholarship winners. AEF is awarding each recipient \$5,000 for graduate-level academic work in aerospace-related fields.

The ten winners—three women and seven men—are beneficiaries of a program established by AEF in 1989. Competition is open to Air Force ROTC graduates pursuing advanced degrees in science, mathematics, and engineering.

The scholarships commemorate Dr. Theodore von Kármán, science advisor to the Army Air Forces in World War II. At the urging of Gen H. H. "Hap" Arnold, Dr. von Kármán organized and chaired what was later to become the US Air Force Scientific Advisory Board.

The winners were selected by a panel headed by Dr. John W. Williams, Embry-Riddle Aeronautical University's Vice President for Academics and an AEF Trustee. Also serving on the panel were AEF Trustee Charles B. Jiggetts and AFA National Secretary Mary Ann Seibel.

The Foundation supports the program with proceeds from an initial sum placed in a scholarship fund and builds the endowment with contributions from AFA members, states, chapters, and corporate supporters.

The 1992 AEF Theodore von Kármán Graduate Scholarship winners:

Sean L. Borrer, Liberty Center, Ind. BS, aerospace engineering, Purdue University. Graduate goal: MS, aerospace engineering, Massachusetts Institute of Technology.

Anthony L. Brinkley, Virginia Beach, Va. BS, mechanical engineer-

ing, Virginia Military Institute. Graduate goal: MS, nuclear engineering, Massachusetts Institute of Technology.

Heinrich A. DuBose-Schmitt, Jr., West Columbia, S. C. BS, mathematics and physics, Rose-Hulman Institute of Technology. Graduate goal: MS, mathematics, Clemson University.

Christine M. Fiori, Hamilton Square, N. J. BS, civil engineering, Drexel University. Graduate goal: MS, civil engineering, Drexel University.

Kevin W. Gilbert, Fergus Falls, Minn. BS, mechanical engineering, Rose-Hulman Institute of Technology. Graduate goal: MS, mechanical engineering, Rose-Hulman Institute of Technology.

Serdar N. Gokcen, Charlotte, N. C. BS, electrical engineering, Georgia Institute of Technology. Graduate goal: MS, electrical engineering, North Carolina State University.

Kristen D. Lowney, St. Peters, Mo. BS, aeronautical engineering, Rensselaer Polytechnic Institute. Graduate goal: MS, mechanical engineering, Rensselaer Polytechnic Institute.

Stephen F. McGrath, Oxford, Mass. BS, mechanical engineering, Worcester Polytechnic Institute. Graduate goal: MS, mechanical engineering, Theodore von Kármán Institute for Fluid Dynamics, Waterloo, Belgium.

Lara D. Medoff, Reston, Va. BS, mechanical engineering, Cornell University. Graduate goal: MS, aerospace engineering, Stanford University.

Scott H. Sinkular, Papillion, Neb. BS, physics, University of Kansas. Graduate goal: MS, space physics, University of Kansas. ■



Borrer



Brinkley



DuBose-Schmitt



Fiori



Gilbert



Gokcen



Lowney



McGrath



Medoff



Sinkular

Arthur C. Hyland is the Aerospace Education Foundation's Public Affairs Associate.

By John L. Frisbee, Contributing Editor

One Definition of Valor

A young, inexperienced copilot suddenly found himself in command of a stricken bomber with wounded aboard.

THE 44TH Bombardment Group, first in USAAF to be equipped with the B-24, carved out a distinguished combat record in the European theater from its baptism by fire in November 1942 to V-E Day. Among its many memorable missions was its major role in the August 1, 1943, low-level attack on oil refineries at Ploesti, for which the 44th's commander, Col. Leon W. Johnson, was awarded the Medal of Honor.

In late 1944, the 44th was heavily committed to strategic bombardment's first priority—the German oil industry. Second priority was a campaign against the factories and ordnance depots that equipped Germany's mechanized ground forces. (Hitler had assigned precedence to tank production.) That relatively unsuccessful Allied air campaign of August to October succeeded in completely destroying only one target: the Henschel plant at Kassel, sole producer of the new Tiger tank. The *coup de grâce* for Kassel was delivered by a mission of October 7, for which the 44th put up thirty-seven B-24s. Two bombers of the group's 506th Squadron were shot down by flak in the target area. One, aircraft #894, made a successful emergency landing in Belgium with a seriously wounded pilot and copilot and an injured flight engineer.

The crew of #894 was flying its seventh mission. At the start of its bomb run, the B-24 took flak hits that punctured the right wing tanks, damaged both left engines so that they were producing little power, and knocked out the radio and compass. These were not problems to be taken lightly, even if there had been healthy pilots on the flight deck—and there were not. Pilot 2d Lt. John Jones's legs were mangled by flak fragments. Copilot 2d Lt. Clement Holcomb was hit in the left shoulder, rendering his left arm useless. Flight engineer SSgt.

R. A. Kirtland, who also had been hit, was saved from serious injury by his flak suit.

Holcomb, seeing that Jones was in shock, immediately ordered bombardier 2d Lt. Edward Baier to salvo the bombs as the B-24 fell out of formation in a skidding, power-on dive. With his left arm paralyzed, Lieutenant Holcomb could not retard the throttles. He had engineer Kirtland move Jones, climb into the pilot's seat, control the throttles at his command, and help with the rudder pedals. With the plane still in a dive, the number four engine caught fire, but as they lost several thousand feet while regaining control, the fire blew out.

As the B-24, structurally damaged and with only partial power, continued to lose altitude, Holcomb and Kirtland regained stable flight and headed for friendly territory. As aircraft commander because of Lieutenant Jones's condition, Lieutenant Holcomb pondered his alternatives. The aircraft was losing fuel rapidly through leaks in the tanks. Holcomb estimated there would not be enough

to make it to England. Jones probably could not survive ditching in the cold waters of the Channel. The B-24 was not a good aircraft to ditch, anyway. Next, he could bail out the crew when they reached friendly territory, but again that might be fatal to Jones. He could order the crew to bail out and crash land with Jones aboard—not an attractive alternative, either.

Then navigator 2d Lt. James Westenhiser remembered that Strip B-58 near Brussels had been taken from the Germans a few days earlier and might be in good enough condition for an emergency landing. With a malfunctioning compass, the navigator could only estimate what turned out to be a correct course to B-58.

As the strip came in sight, the runway was seen to be pockmarked with hastily filled bomb craters. To make a tense situation even more unnerving, a battle-damaged B-17 ahead of them on final approach crashed and burned short of the runway, but with Sergeant Kirtland handling the throttles, Lieutenant Holcomb got the B-24 down in a safe, if not picture-perfect, landing.

Jones, Holcomb, and Kirtland were taken to the 8th British Army Hospital, where Jones's left leg was amputated. After further hospitalization in England, Lieutenant Holcomb returned to the 506th Squadron and flew twenty-three more missions before returning to the States.

In a postwar account of that October mission, Clement Holcomb neglected to mention that he was awarded the Silver Star for his skill, professional judgment, and heroism in mastering a critical emergency, saving the life of his pilot and probably of other crew members. Although partially but painfully incapacitated, he had turned potential disaster into victory over most challenging circumstances. That is one definition of valor. ■

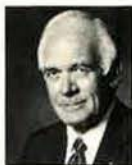
Thanks to Will Lundy, compiler of the "44th Bomb Group Roll of Honor" and a wartime member of the group. Mr. Lundy reported that Clement Holcomb died in February 1992.



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Defense Communications Personnel

Personnel assigned to the Defense Communications Agency, European area, will hold a reunion April 23-26, 1993, at the Embassy Suites Hotel in Atlanta, Ga. Military and civilian personnel, contractors, and dependents are invited. **Contact:** Charles R. Timms, P. O. Box 6892, Marietta, GA 30065.

Sewart AFB Personnel

Personnel who were stationed at Sewart AFB, Tenn., between 1948 and 1970 will hold a reunion May 26-31, 1993, in Nashville, Tenn. This outfit was formerly the 314th Troop Carrier Wing/Tactical Airlift Wing. **Contact:** Bart McCarthy, 361 Monaco Dr., Hermitage, TN 37076. Phone: (615) 885-3689.

4th Ferrying Group

The 4th Ferrying Group (World War II) will hold a reunion May 13-15, 1993, at the Airport Quality Hotel in Orlando, Fla. **Contact:** Wendell Jordan, 140 Wildwood Dr., Zebulon, GA 30295. Phone: (706) 567-8112.

7th Bomb Wing B-36 Ass'n

Members of the 7th Bomb Wing (B-36 era) stationed at Carswell AFB, Tex., between 1948 and 1958 will hold a reunion April 16-18, 1993, in Fort Worth, Tex. **Contact:** Richard S. George, P. O. Box 330279, Fort Worth, TX 76163. Phone: (817) 292-4932.

Class 43-B

Class 43-B (Luke and Williams Fields, Ariz.) will hold a fiftieth-anniversary reunion February 4-6, 1993, at the Royal Palms Inn in Phoenix, Ariz. Class 43-B graduates who were stationed in

Douglas, Ariz., are also welcome. **Contact:** Col. John V. Back, USAF (Ret.), 3463 E. Pasadena Ave., Phoenix, AZ 85018.

Class 43-E

Class 43-E will hold a fiftieth-anniversary reunion May 20-23, 1993, at the Holiday Inn Riverwalk Hotel in San Antonio, Tex. **Contact:** Bill Shelton, 7147 N. Vandiver, San Antonio, TX 78209. Phone: (512) 824-3043.

79th Fighter Squadron

The "Tigers" of the 79th Fighter Squadron at RAF Upper Heyford, UK, will hold a seventy-fifth anniversary reunion February 4-7, 1993. **Contact:** Capt. Ron Graves, USAF, 79th Fighter Squadron/ROAR, APO AE 09466. Phone: (0869) 23-4279. DSN: 263-4279.

4080th Strategic Recon Wing

Personnel who served with the 4080th Strategic Reconnaissance Wing (U-2/RB-57D) and its squadrons will hold a reunion May 27-29, 1993, at the Civic Center in Del Rio, Tex. **Contact:** 4080th SRW Reunion Committee, P. O. Box 1526, Del Rio, TX 78841-1526. Phone: (512) 755-5346.

Muroc Veterans

For the purpose of planning a reunion, I am seeking contact with veterans who served between 1933 and 1945 at Muroc AFB, Calif. (now Edwards AFB). **Contacts:** James L. Ballance, 100 Niagara Ave., San Francisco, CA 94112. Phone: (415) 585-9640. CMSgt. Kenneth D. Summers, USAF, Edwards AFB, CA 93523. Phone: (805) 277-3913. DSN: 527-3913.

5th Troop Carrier Squadron

Seeking members of the 5th Troop Carrier Squadron who are interested in holding a reunion. **Contact:** O. C. Wilkins, 2329 Maben Ave., Palm Harbor, FL 34683. Phone: (813) 785-7764.

Class 58-G/H

I would like to hear from members of Class 58-G and H who are interested in holding a reunion. **Contact:** Howard Chilton, Jr., 3306 Wiley Post Rd., Suite 106, Carrollton, TX 75006. Phone: (214) 980-6870.

Readers wishing to submit reunion notices to "Unit Reunions" should mail their notices well in advance of the event to "Unit Reunions," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

93d Security Police Squadron

For the purpose of organizing a reunion, I would like to hear from members of the 93d Security Police Squadron who served between February 1972 and September 1973. **Contact:** William S. Krajewski, 179 Prospect St., Woonsocket, RI 02895. ■

Bulletin Board

Seeking information on crew members of the B-17s piloted by Lieutenants Tune, Garland, Bullock, Weiler, McCloskey, Thomas, and Prentice, 20th Bomb Squadron, 2d Bomb Group, 5th Bomb Wing, 15th Air Force, based in Amendola, Italy, who were shot down on August 29, 1944, over Czechoslovakia. **Contact:** Michael Sisovsky, St. Hrozenkov 261, okr. Uh. Hradiste 687 74, Czechoslovakia.

Seeking contact with **SSgt. Joseph O'Hagen** of Brooklyn, N.Y., who was stationed with the 81st Fighter Maintenance Squadron at RAF Bentwaters, England, in 1955-59, and later at Moody AFB, Ga. **Contact:** MSgt. Lloyd "Rudy" Rutenber, USAF (Ret.), 712 Altura Dr., Cocoa, FL 32927.

Seeking contact with former **F-86 pilots**, crew chiefs, and technical reps who are interested in joining the Sabre Jet Historical Society. **Contact:** John L. Henderson, 1015 Horizon Dr., Ventura, CA 93003.

Seeking contact with **Col. John T. Shields**, who commanded the 69th Tactical Reconnaissance Group in 1945 and was stationed at the Pentagon in 1962. **Contacts:** Edwin A. Manos, P. O. Box 787, Abbeville, SC 29620. Art Fite, 630 Hillyer High Rd., Anniston, AL 36201.

Seeking information and photos pertaining to Pease AFB, N. H. I am particularly interested in aircraft flown by the **509th and 100th Bomb Wings**, including B-47s, KC-97s, B-52s, KC-135s, and FB-111s. I would be very interested in home movies or videos of open houses at the base. **Contact:** Mark Natola, 1 White Ave., West Lebanon, NH 03784.

Seeking contact with any surviving crew members of **B-17s that crashed in Yugoslavia** in January and April 1944 and were accompanied through Mihailovic territory by British Special Operations Executive Capt. George More. I am especially seeking pilot Al Romans, copilot Peter Reinhardt, and navigator John L. Camara. **Contact:** Henry More, 1436 Miramonte Ave., Los Altos, CA 94024.

Seeking contact with collectors interested in trading Air Force patches, insignia, and 35-mm slides of current aircraft. **Contact:** Jon W. Letzkus, P. O. Box 247, Bridgeport, OH 43912.

Seeking contact with members of the **445th Bomb Squadron**, 321st Bomb Group, which served on Corsica in 1944-45, especially Warren F. Ottinger, Robert H. Gifford, Richard W. Palmer, William A. Moore, and John A. Morgan. **Contact:** Lawrence J. Payne, 4434 Melissa Ln., Dallas, TX 75229.

Seeking contact with an American based at RAF Marston, England, in 1957-58 who knew **Doreen Sylvia Thompson**, a hotel domestic in Margate. **Contact:** Beverly A. Golden, 2 Burgess Rd., Aylesham, Canterbury, Kent CT3 3AU, England.

Seeking the whereabouts of **1st Lt. Robert Daniels**, a B-29 instructor navigator at Randolph AFB, Tex., in 1943-45. **Contact:** SMSgt. James V. Manglass, USAF (Ret.), USSAH Box 842, Washington, DC 20317.

Seeking contact with former advanced pilot students of **Capt. John J. Tepper**, at Aloe AAF, Tex., in 1943-45. **Contact:** Capt. John J. Tepper, USAF (Ret.), 4937 E. Windrose Dr., Scottsdale, AZ 85254.

Seeking copies of **Air Force Magazine Air Force Almanac issues** from 1971 through 1978. I am especially interested in the sections "Installations Worldwide" and structures of SAC and TAC. **Contact:** Robert E. Styger, 15 Genesee Ln., Willingboro, NJ 08046-3319.

For a book, I am seeking contact with **servicemen stationed in Hawaii** at the time of the Japanese attack on Pearl Harbor. **Contact:** Cadet Chris T. Johnson, AFROTC, 3104 E. 24th St., Sioux Falls, SD 57103.

Seeking a **USAF patch** for a bomb wing stationed in Florida. It had a shield with a bomb going through it and the words "Abundance of Strength." **Contact:** SMSgt. Austin C. Webb, USAF (Ret.), 2036 Lincoln Rd., Yuba City, CA 95993.

Seeking information on the whereabouts of **Ronald Baisdon**, who was stationed at West Malling Aerodrome in Maidstone, England, in the early 1960s. **Contact:** Jayne Power, 216 Station Rd., Aylesford, Maidstone, Kent ME20 7JH, England.

Seeking patches and pictures pertaining to the following units: **3567th Flight Line Maintenance Squadron and 3566th Field Maintenance Squadron**, 3565th Navigator Training Wing, James Connolly AFB, Tex.; **1503d Organizational Maintenance Squadron**, 1503d Air Transport Wing, Tachikawa AB, Japan; **28th Air Transport Squadron**, 1501st Air Transport Wing, Hill AFB, Utah. **Contact:** Loren D. Curtis, 3863-1 California St., San Diego, CA 92110-2151.

Collector seeks squadron scarf, color patch, and sticker from the **530th Combat Crew Training Squadron**. Also seeking aircrew scarves from all F-111A/D/E/F/G, EF-111A, and FB-111A units. **Contact:** Curtis J. Lenz, 32 June St., Nashua, NH 03060-5345.

Seeking any pictures taken by the **1st Emergency Rescue Squadron**, stationed in Corsica on April 29, 1944, when Flight B of this squadron rescued the crew of a B-24 piloted by 2d Lt. Milton L. Munson of the 459th Bomb Group, stationed in Cerignola, Italy. Also seeking contact with crew members of the OA-10 that made the rescue. **Contact:** Jerry R. Holden, P. O. Box 2637, Gulfport, MS 39505-2637.

Seeking information on **Sgt. William Chester DePuy**, who was killed with his crew on March 23, 1944. **Contact:** Alex W. Dalglish, 645 Persons St., P. O. Box 637, East Aurora, NY 14052-0637.

Seeking a **USAF or USN pilot's jacket**, even a badly damaged one. **Contact:** Ernest Jude P. Madriaga, 24 Brgy. Rd. Garcia Tubao, La Union 2509, the Philippines.

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

For a book about **USAAF World War II training fields**, I am seeking anecdotes, information, and pictures of those fields. Especially interested in training fields located in Indiana, Kansas, Nebraska, and Florida. **Contact:** Lou Thole, 11263 Marlette Dr., Cincinnati, OH 45249.

Seeking contact with **Lt. Col. J. C. Brown** and **Lt. John Thurman**, stationed at Ladd AFB, Alaska, in 1954-57 with the 11th Air Defense Division. **Contact:** Don Birchum, 518 Evergreen Dr., Corpus Christi, TX 78412.

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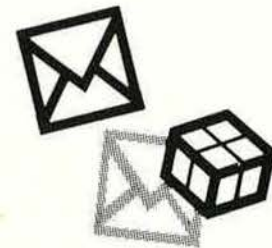


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Bulletin Board

Seeking **B-29 nose art action photos** and pictures of life and work in 20th Air Force during World War II. **Contact:** Early R. Hartley, 1310 Covington Rd., Colonial Heights, VA 23834.

For a feature on the B-66, author seeks contact with former air and ground crew associated with the **Douglas B-66 Destroyer** to share anecdotes. Interested in EB-66, RB-66, and WB-66 operations. **Contact:** Bob Archer, 36 Longacre Gardens, Bury St. Edmunds, Suffolk IP33 2DX, England.

For part three of a series of books on nose art, seeking photos and color slides of **Vietnam War aircraft** and helicopters with nose art or other personal markings. **Contact:** Larry Davis, 4713 Cleveland Ave., N. W., Canton, OH 44709.

Seeking information of the whereabouts of **John Owen(s)**, who served with USAF in the Middlesex area of England in the early 1950s. **Contact:** Robin Barker, Essex County Council, 283 London Rd., Westcliff-on-Sea SS0 7BX, England.

Seeking contact with former members of the **3380th Installations Squadron** who were stationed at Keesler AFB, Miss., in 1948. **Contact:** CMSgt. William J. Sutton, USAF (Ret.), 165 Haskill Dr., Whitefish, MT 59937.

Seeking contact with C-130 pilot **Capt. Roland H. Thomason**, USAF, and **Major Nedbaugh (or Nedbal)**, the USAF advance officer for President Kennedy's trip to Dallas, Tex., in 1963. **Contact:** Capt. Jake Shepherd, Unit 21701, General Delivery, APO AE 09080.

Seeking photos of **B-24s stationed at Westover Field**, Mass., during the summer and fall of 1944, especially any photos of Westover's natural aluminum B-24Js. **Contact:** Brian Lindner, R. R. #1, Box 4316, Waterbury Center, VT 05677.

Historian with Hq. 12th Air Force seeks **photos, war diaries**, letters, and other historical documents for the 12th Air Force archives. **Contact:** Dr. Robert Sligh, 12 AOG/HO, Bergstrom AFB, TX 78743.

In order to compile a complete list of students who attended **USAAF primary flight school at Douglas, Ga.**, I am seeking a copy of the orders that sent any of the following classes from Maxwell AFB, Ala., to Douglas: 42-E/G/H/I/J, 43-A/D/F/J, 44-A/C/G/H, and 45-A. **Contact:** Paul D. Schlundt, 3149 N. Winfield Ave., Indianapolis, IN 46222-1953.

Seeking contact with personnel who were at **Johnson AB**, Japan, in March and April 1952. **Contact:** Maki Hatae, 501 Fulle Dr., Valley Cottage, NY 10989.

Seeking **autographed black-and-white photographs** of the following individuals, all in golf clothes: Generals Vandenberg, Twinning, and Parks, USA, and Dan Kimball, USN. These photographs were among my personal effects that never caught up with me when I was evacuated from Narsarsuak, Greenland, in 1954. **Contact:** John W. Balchunis, P.O. Box 64055, Virginia Beach, VA 23464.

Seeking information on the whereabouts of **William Challinor**, who was stationed with USAAF in England in 1943. **Contact:** Brenda Patchett, 4708 N. Camino Aire Fresco, Tucson, AZ 85705.

Seeking contact with former members of Hq. Squadron, 2618th Squadron, 2696th Transport Squadron, or 329th Transport Squadron of the **Mediterranean Air Transport Service**, headquartered in Algiers, Algeria, from August 1943 to November 1945. **Contact:** Maj. Thomas E.

Calhoun, USAF (Ret.), 4027 New Copeland Rd., Tyler, TX 75701.

Collector seeks **blue nylon flight jacket**, 1940s-50s issue, with fur collar or knit collar. **Contact:** J. M. McGuire, P. O. Box 5178, Santa Monica, CA 90409.

Seeking information on the whereabouts of **Capt. (or Maj.) Frank J. Ryan**, who was stationed in Seoul, Korea, in 1960-62. His last known assignment was in Vietnam, where he was shot down and subsequently received a medical disability retirement. He may be residing in or near San Francisco. **Contact:** Capt. Brad V. Van Orden, USAF, 612 Stone Wheel Ct. E., Millersville, MD 21108.

Seeking contact with the following crew members of 483d Bomb Squadron **B-29 #79**, 505th Bomb Group, Tinian, in 1945: navigator 2d Lt. Jack Chiavoli, gunner TSgt. Ira Cline, tailgunner SSgt. "Stretch" Strekel, and flight engineer MSgt. Vincent J. LaScala. **Contact:** Lt. Col. James E. Romero, Jr., USAF (Ret.), 4475 Falcon Dr., Lompoc, CA 93436.

Patch collector seeks the following **patches**, preferably color: 177th FIG, 119th FIS, 150th TFG, 188th TFS, 89th TFS, 149th TFG, 113th TFW, and 121th TFS. **Contact:** TSgt. James Storie, PSC 226 Box 223, APO AP 96510.

Seeking information on the whereabouts of **Harvey Green**, who served at Keesler AFB, Miss., in 1953, Atterbury AFB, and Otis AFB, Mass., in 1954. We lost contact when he shipped to the Azores. **Contact:** Richard A. Vance, 1725 Hidden Pines Way, Nokomis, FL 34275.

Seeking information on the whereabouts of **Jerry W. Hale** and **Edward S. Grafton**, who served on the SAC Inspector General's team as supply inspectors in 1974-75. **Contact:** Pete Scheuermann, 453 Meadowhill Dr., Benbrook, TX 76126.

Seeking **color slides of military aircraft** for publication. Year and country do not matter. **Contact:** Sait Yorukel, Kanava Graphics, PK 103, 10200 Bandirma, Turkey.

Seeking information, unit history, patch, and other insignia from the **2d Ferrying Group**, New Castle, Del., during World War II. **Contact:** Jim Filkosky, 607 S. York St., Mechanicsburg, PA 17055.

Seeking **aviation pulp magazines from the 1930s**, especially *Battle Aces* (all copies, any condition) and certain *G-8* issues. **Contact:** Gil Burns, P. O. Box 2308, Framingham, MA 01701.

Seeking contact with members of the **11th Fighter Interceptor Squadron** or anyone else who served at Volk Field, Wis., during the Cuban Missile Crisis. **Contact:** Scott Sagan, Center for International Security and Arms Control, 320 Galvez St., Stanford, CA 94305-6165.

Collector and historian seeks **USAAF memorabilia** from World War I through World War II. Especially interested in leather flight jackets, uniforms, flight equipment, and photo albums. **Contact:** Jon Cerar, 425 John St., Carlinville, IL 62626.

Museum seeks World War II USAAF Training Aids Division **Recognition Instructor Information Letters**. Letter one started March 10, 1944. Copies OK. **Contact:** Stephen D. Remington, CollectAir, 2555 Robert Fowler Way, San Jose, CA 95148.

Collector seeks **Military Payment Certificates** in denominations from five cents to twenty dollars issued from 1946 to 1973. Willing to buy or trade.

Contact: Nick Schrier, P. O. Box 60104, Sacramento, CA 95860.

Researcher seeks information on the **TR-3A**. **Contact:** Henry J. Schuren, 1 Debbie Dr., Stanhope, NJ 07874.

Seeking information on the whereabouts of survivors of **SSgt. John Vera McCarthy**, a member of a B-17 crew based in England during World War II. His last known address was in Los Angeles, and he died in 1968. **Contact:** Wilbur J. Larson, 1364 Stein Rd., Ferguson, MO 63135.

For an article on Mexican nationals serving in USAAF, seeking contact with squadron members who served with **Lt. Alejandro Cardenas Caranza**, 754th Bomb Squadron, 458th Bomb Group, 96th Bomb Wing, 8th Air Force, or **Capt. Luis Coppola Bonillas**, 526th Bomb Squadron, 379th Bomb Group, 41st Bomb Wing, 8th Air Force. **Contact:** Santiago A. Flores, P. O. Box 430910, San Ysidro, CA 92143-0910.

Seeking information on all squadrons stationed near St. Athan, UK, in 1943-45. Also seeking contact with any friends of **Chuck Campbell**, who went to Penarth during this time. **Contact:** Sharon Elward, 12 Verbena Close, Bell Green, Coventry CV2 1JJ, England.

Seeking radio equipment, accessories, and manuals relating to the **Eureka/Rebecca** pathfinder radio system of World War II. Seeking both ground and aircraft components. **Contact:** Terry Aitken, Air Force Museum, USAFM/PC, Wright-Patterson AFB, OH 45433.

Seeking contact with members of **Clyde G. "Speedy" Jones's** ground crew, 824th Bomb Squadron, 484th Bomb Group, 15th Air Force, from 1943 through 1945. **Contact:** Richard E. Jones, P. O. Box 1153, Brevard, NC 28712.

Seeking contact with graduates of **Det. 605, North Carolina A&T State University AFROTC**. To aid in updating the detachment directory, please send the following information: name, rank, duty station, home address, and phone number. **Contact:** Detachment 605, NCA&TSU, Greensboro, NC 27411.

Seeking a copy of **Hell's Hawks**, by Charles Johnson, a history of the 365th Fighter Group, 9th Air Force, World War II. The book is said to include an account of the incident in which **2d Lt. Stan Fish** crashed and was killed, April 7, 1944. **Contact:** Don Goodenow, 3128 Sunnybrook Dr., Charlotte, NC 28210.

Seeking contact with anyone acquainted with **Jerome J. Woyci** from Milwaukee, Wis., a B-17 crew member based in England in 1943-45. Also seeking information on a crew photo taken in front of a B-17 with #2771 on the nose and a small chalkboard with #8110 placed in front of the crew. **Contact:** James A. Fitzlaff, 411 S. Utah, La Porte, TX 77571.

Seeking information on the whereabouts of **George Taylor**, who served with USAAF during World War II and whose last known duty assignment was at Forbes AFB, Kan., in the 1960s. **Contact:** Jill R. Sorrell, 1347 Deerbrush Dr., Lacey, WA 98513.

Seeking contact with anyone who knew **F. O. Charles Nache**, who served with the 432d Fighter Squadron, 475th Fighter Group, and was declared MIA over the Gulf of Leyte on January 29, 1945. **Contact:** Betty Mahoney, 14914 Perthshire, Houston, TX 77079.

To update our mailing list, seeking contact with former members of the **90th Bomb Squadron**,



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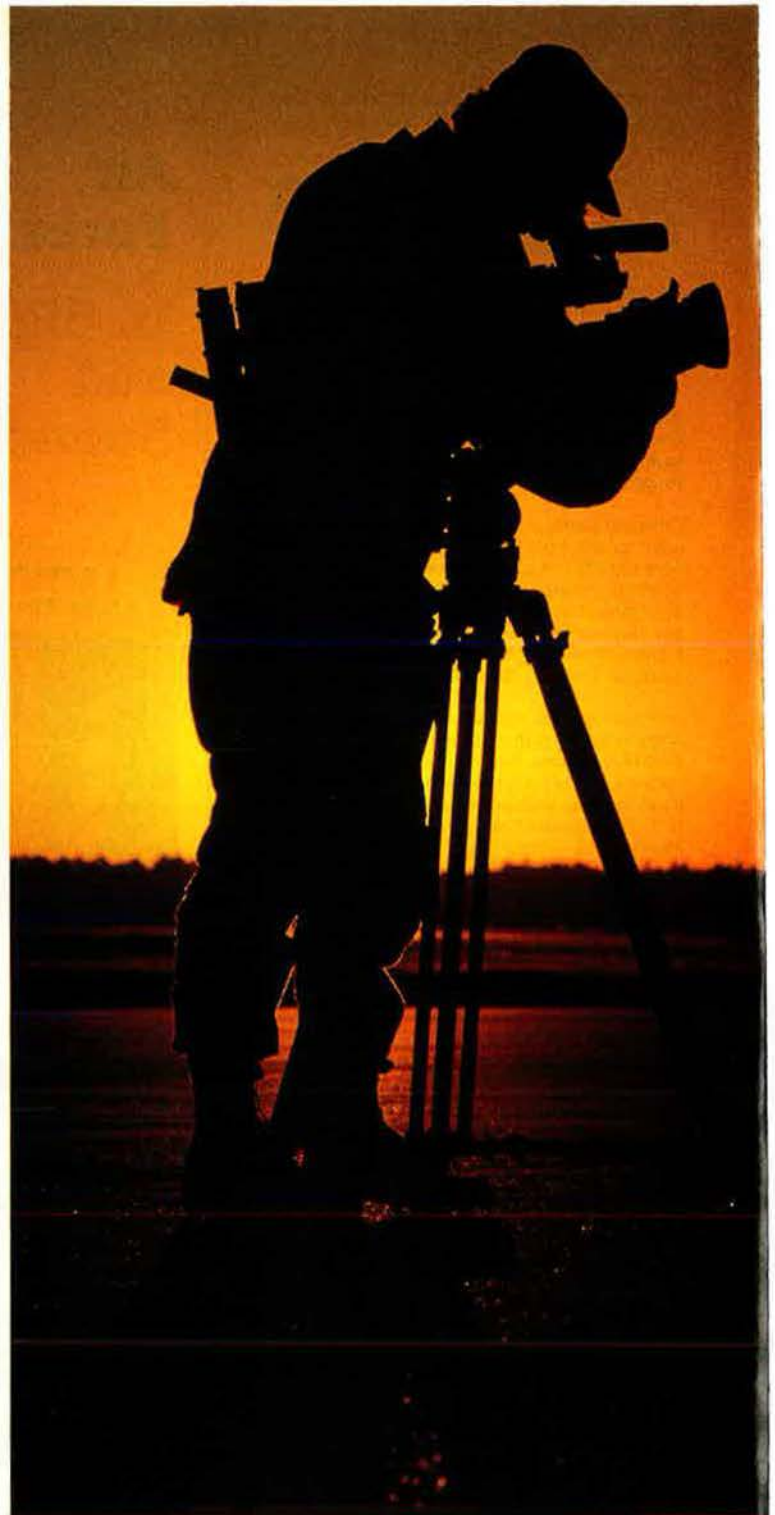
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40-44	10.80	14.55	13.26	17.01
45-49	18.06	25.56	22.20	29.70
50-54	27.00	37.00	33.18	43.18
55-59	38.70	53.70	47.58	62.58
60-64	59.82	84.82	73.56	98.56
65-69	135.00	172.50	166.02	203.52
70-74	216.00	291.00	265.68	340.68
75-79	270.00	345.00	332.10	407.10
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a. Cancer, leukemia, Hodgkins Disease, or other associated malignancies? Yes No

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3) Within the past two years, have you had persistent cough, pneumonia, chest discomfort, muscle weakness, unexplained weight loss of ten pounds or more, swollen glands, patches in mouth, visual disturbance, recurring diarrhea, fever, or infection? Yes No

4) Has any application made by you for life or health insurance been declined, postponed or issued other than as applied for? Yes No

5) Are you receiving, entitled to receive or would be entitled to receive upon timely application any benefits due to sickness or injury (other than medical expense benefits) under any private policy or plan or government program, whether insured or non-insured? Yes No

If you answered "Yes" to any of the above questions, please give the name of the person to whom your answer applies and provide details, dates, diagnosis, treatment and the names and address of the health care provider(s) and hospital(s). Use additional sheets of paper if necessary.

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Please retain this information for your records

MetLife's Consumer Privacy Notice - Information Practices

The Underwriting Process: MetLife (hereinafter "we") will evaluate the information given by you on this enrollment form and tell you if we cannot give you the coverage you asked for. We will also tell you in general terms the reason for our decision. Upon written request, more specific reasons will be given to you.

Information Collection: This enrollment form is our main source of information. To properly evaluate your request for coverage, we obtain additional medical data from third parties about any person to be insured. For instance, we may ask physicians, hospitals, or medical care providers to confirm or add to the medical data you have given us.

Information Disclosure: In most cases, the information we have about you will be sent to third parties only if you authorize us to do so. In some cases where disclosure is required by law or necessary to conduct our business, we may send the information to third parties without your consent.

Access and correct information: Upon written request, we will make information we have about you available to you. You have certain access and correction rights with respect to the information about you in our files.

Further information about our practices: Upon written request, we will send you more information about our underwriting process and your access and correction rights. Also, upon your written request, we will give you more information about the circumstances under which we will disclose the information about you to third parties without your authorization. Please write MetLife at the following address about these matters:

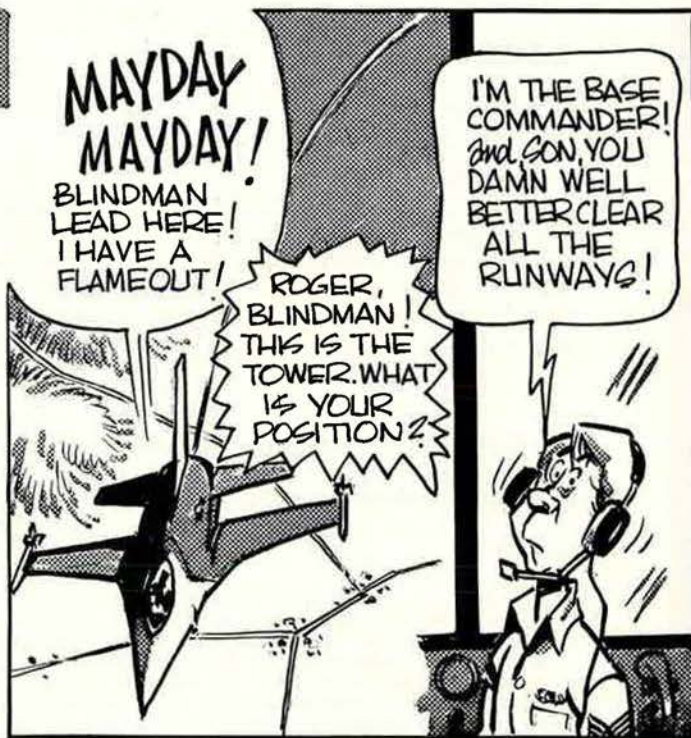
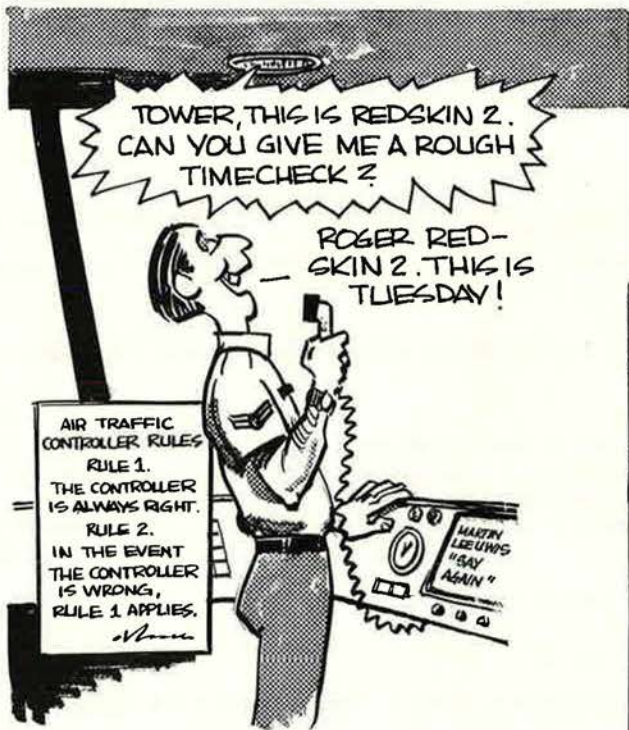
Metropolitan Life Insurance Company, One Madison Avenue, New York, NY 10010-3650

Bob Stevens'

"There I Was..."

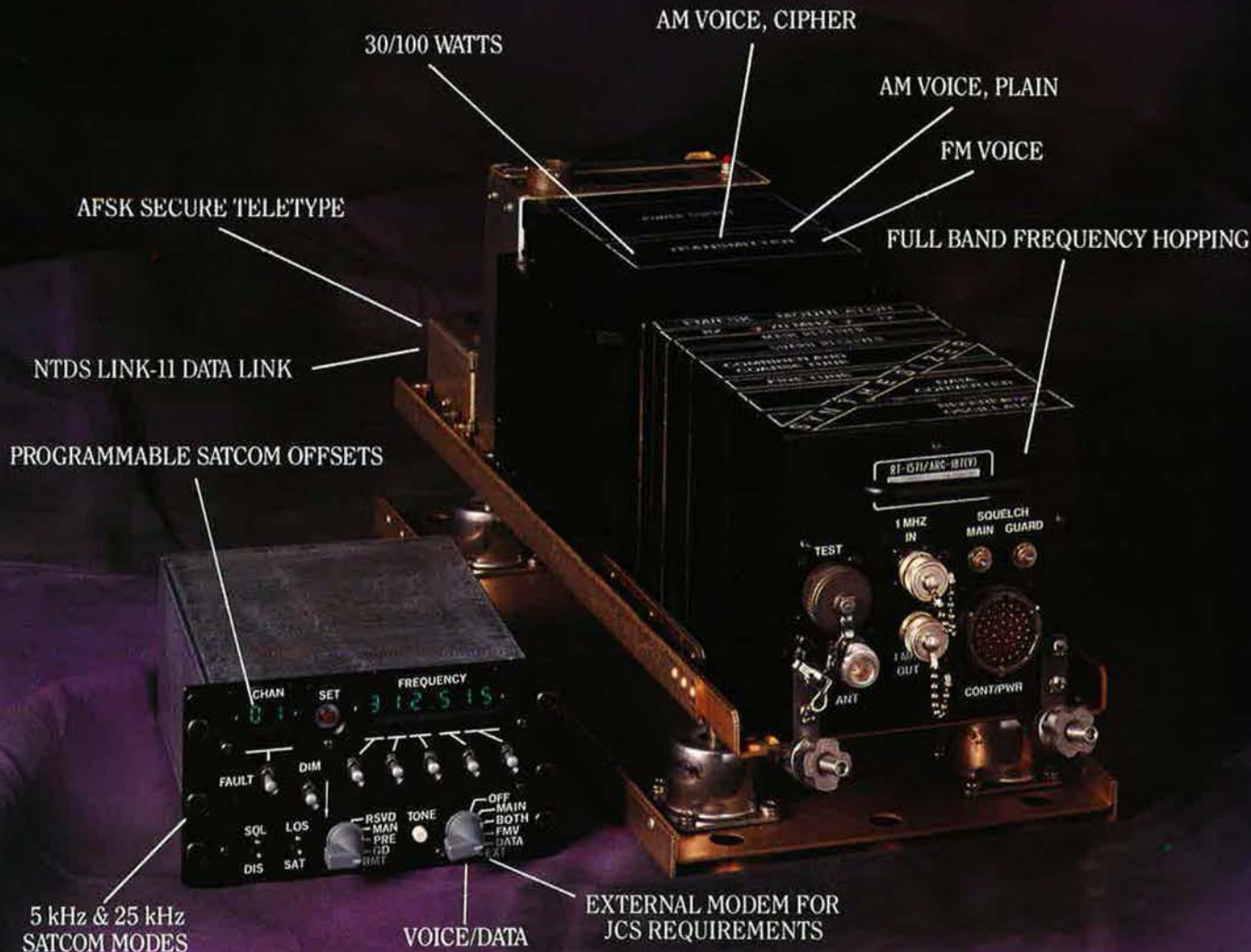


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