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AIR FORCE

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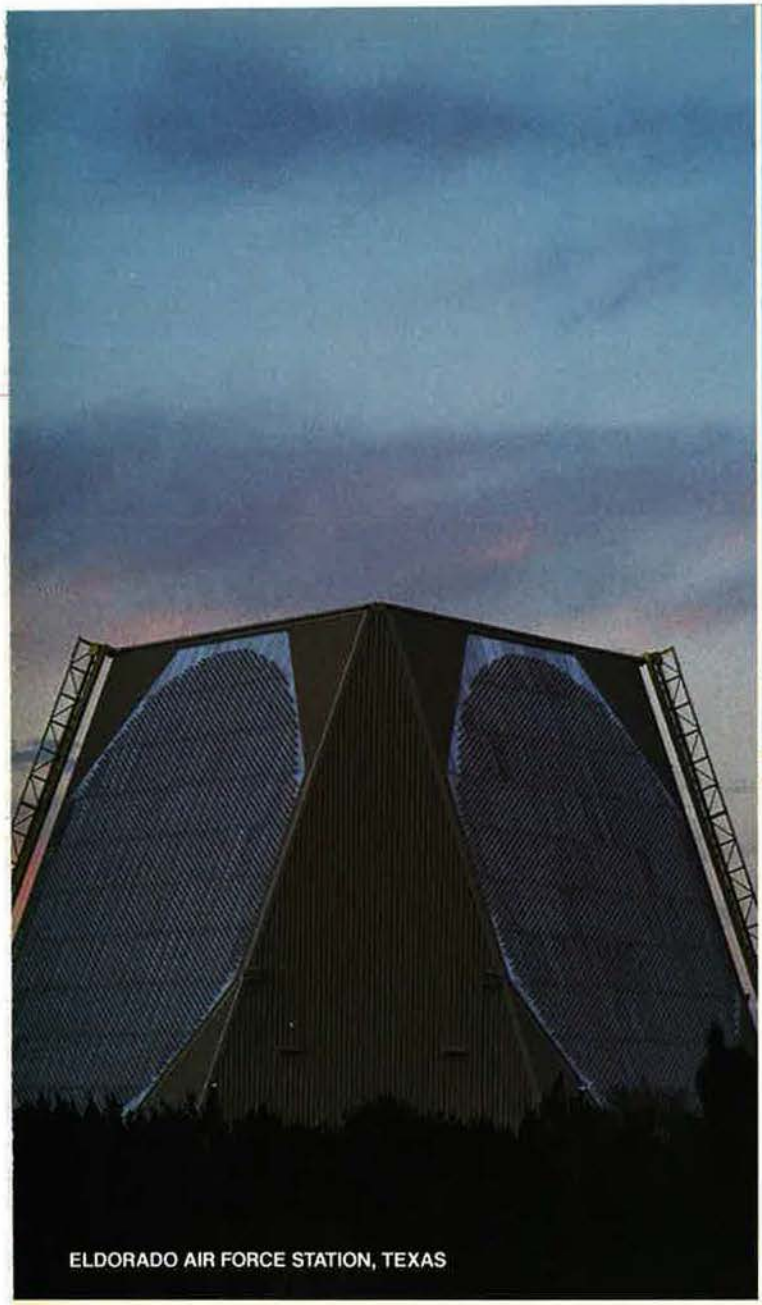

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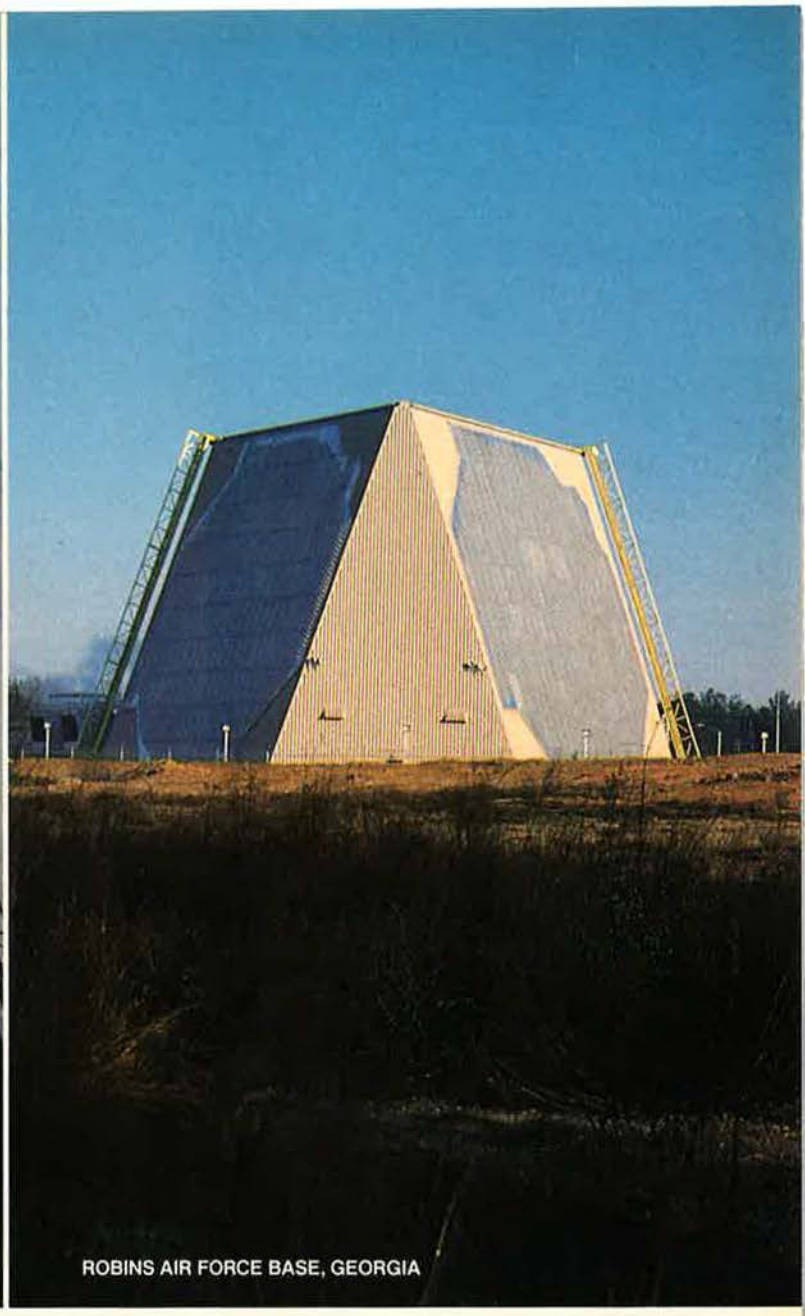

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AUGUST 1987
VOLUME 70, NUMBER 8

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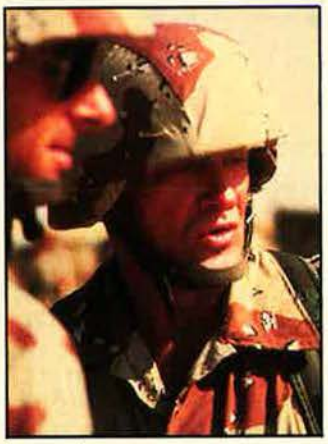

Page 66

Page 88

About the cover: An F-4E from the 51st TFW at Osan AB, Korea, is prepared for a sortie during a Cope Thunder exercise. A special section on "The International Perspective" begins on p. 38.

Special Section: The International Perspective

Features

Departments

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AN EDITORIAL

Midnight at the Ball

By John T. Correll, EDITOR IN CHIEF

HISTORICAL timelines are seldom apparent to us as we cross them. We were well into the 1980s, therefore, when the realization set in that the period we called "the postwar era" had ended in the 1970s. This distinction is more than playing around with words and labels. It recognizes fundamental change from the world order that prevailed in the decades following World War II, and it carries an implicit warning that we should take a fresh look at some of our long-held assumptions and arrangements.

The new US national strategy begins with acknowledgment that a different period has begun in world affairs, and it identifies several significant signs that the postwar era is over. Among these signs of basic change, four stand out: a decline in the relative influence and power of the United States, the economic resurgence of the war-torn nations of Europe and Asia, the achievement of strategic nuclear parity by the armed forces of the Soviet Union, and the emergence of threats to global stability from the Third World.

It is not much of an oversimplification to say that postwar thinking viewed the international balance of power as being essentially bipolar—the danger of aggression by the Soviet Union contained by the preeminent strength of the United States, with the other nations grouping around or behind one of the superpowers and hoping for the best. The world today is considerably more diversified. The United States no longer holds the dominant position it once did. The US and the Soviet Union are roughly equivalent in their military capabilities. The likely sources of trouble—and the potential power to respond to it—are spread around the world to a far greater extent than they were at mid-century.

The United States is still a strong global power with vast global interests. It cannot retreat into isolationism. Neither can it police the world alone. This leads to the inescapable conclusions that the US must conduct its international affairs in cooperation with allies and that its dependence on those allies is greater than it was in the past.

The major Atlantic nations are mutually pledged through NATO to the defense of Europe, and the US is party to a number of bilateral treaties in the Pacific. Even in the early postwar era, it was more or less assumed that allied forces would fight alongside Americans in any major conflict. Nevertheless, discord continues about broader responsibilities.

Japan and the West Europeans, for example, interpret their obligations in a regional sense—and often a limited one at that—even though their interests are manifestly global. These nations entered World War II thinking of themselves as global powers, but came out of it with their homelands in ruin and their holdings abroad either gone or going. They concentrated on rebuilding with American help and recast their ambitions on a smaller scale.

Germany and Japan were allowed to rearm only within specified restrictions. And in the early days, the US worked hard to keep NATO's focus on Europe. It did not want the new alliance embroiled in the breakup of European colonial empires in Africa and Asia. These events reinforced the concept of a limited role for the allies.

The postwar recovery of these nations was completed long ago. Japan and Germany are giants in world trade. International stability and access to foreign resources are as important to the Europeans and Japanese as they are to the United States. Despite this, global protection of free world interests is left substantially in US hands, just as it was in the postwar era.

The allies, having seen US foreign policy swing around over the years like a weather vane, are reluctant to heed American calls to join the crusade. Their deeper reluctance, however, is in financing of global forces. So far, the US has been willing to dig deeper into its pockets for defense than the allies have, but this willingness is wearing thin.

One nation that can and should do more for the common defense is Japan. Its postwar principles permit deployment of armed forces only in tightly prescribed roles close to home—but allow Japan to enjoy the benefits of a full global defense provided by the United States. Japan is finally raising its defense spending above one percent of GDP, which is still an inadequate contribution from the world's second-ranking economic power.

Then there is the so-called "nuclear allergy" problem. Some allies not only excuse themselves from global responsibility but also make a point of their distaste for the US strategic nuclear deterrent, which has kept Soviet military power at bay to the advantage of all. It has sometimes been convenient for Europeans to depict themselves as caught—almost as neutrals with no stake in the contest—in the middle of a power struggle between the superpowers. In this instance, we may be approaching midnight at the ball, the hour when the masks come off.

The possibility of sweeping theater arms reduction has exposed the degree to which Europe relies on nuclear weapons for protection. *(See "Why NATO Needs a Conventional Defense," p. 38.)* This has compelled the Europeans to take an unfiltered look at the threat posed to them by the Soviet Union and the Warsaw Pact and consider their options for response. In the future, it will be harder to pretend that nuclear weapons have been an abomination foisted on them by the Americans.

The concepts of the postwar era were good for their time. They worked. They kept the peace. But the circumstances of the new era in world affairs require a different set of concepts, reflecting the changes that have taken place. The United States, as the strongest and wealthiest of the allies, will have to carry the heaviest load in the new era. It cannot withdraw support from its alliances in either Europe or the Pacific. It is the obvious leader of the allies, but it cannot dictate policy to them. They must see on their own what needs to be done and then do it.

It will help if the allies unmask long enough to acknowledge their real interests in this new era and recognize their responsibility for involvement in defense of those interests. Their future, like that of the United States, lies in the mutual support of allied nations. ■

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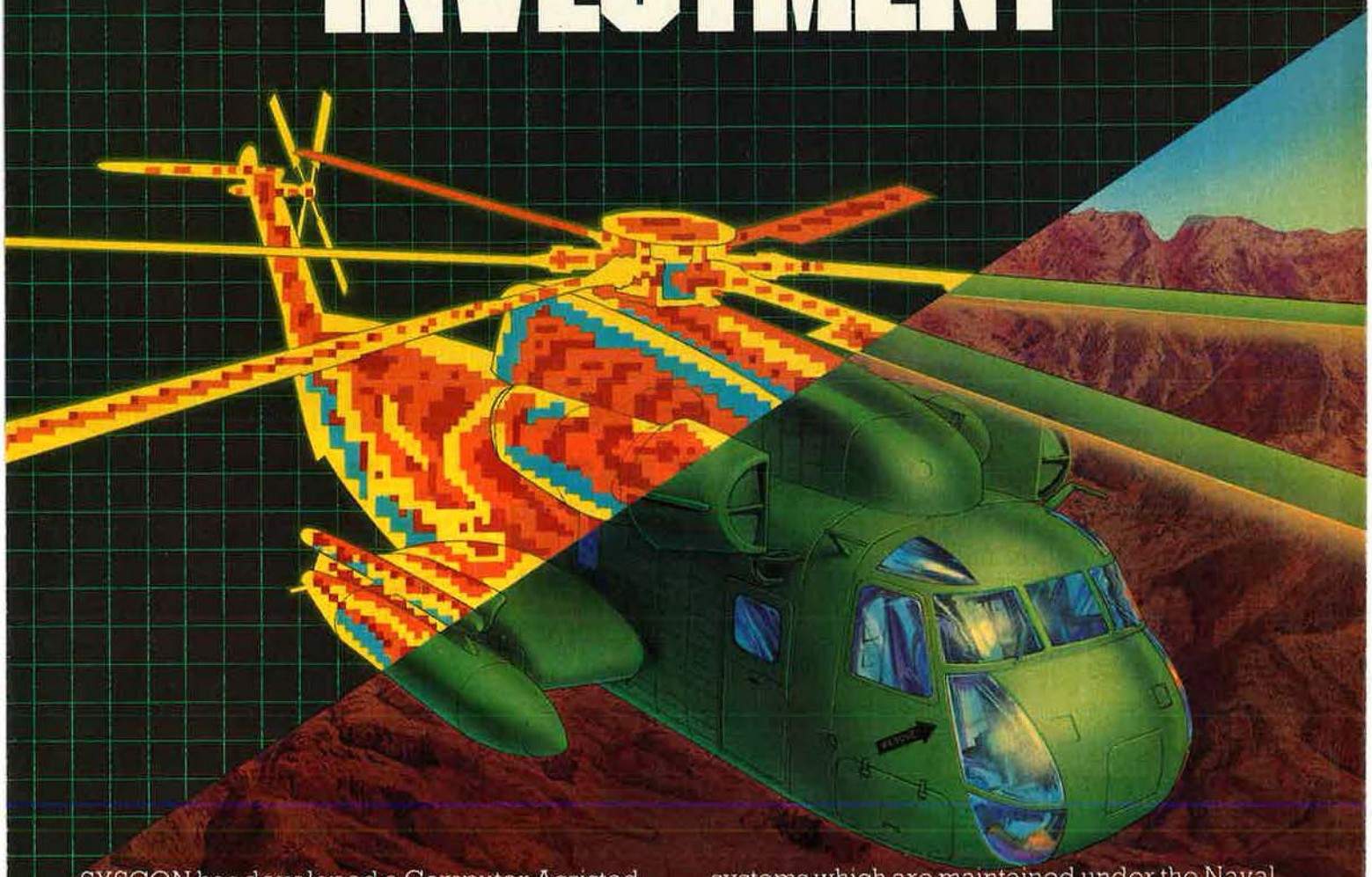

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AIRMAIL

It's Basic

It was with (thirteen and one-half years later) fond memories that I read your super article on Air Force basic training *(see "It's Basic," June '87 issue, p. 94).* I went through "basic" in 1973, right out of high school. I remember crying myself to sleep those first few nights—no macho act for me. I was scared! I was later assigned directly to the motor pool at Lackland AFB, Tex., so for the next year I never really left basic.

I have since returned to college on an AFROTC scholarship and have been flying helicopters for nine years. It's a far cry from Lackland in many ways, but BMTS prepared me for many ordeals to come in my Air Force career, not the least of which was getting through college.

Thanks for the memories, and thanks to all the "males and females" who make up the instructor corps at Lackland. Keep up the good work—the rest of the Air Force is counting on you!

Capt. Alan D. Resnicke, USAF
Hill AFB, Utah

Bob Titus

I enjoyed reading John Frisbee's account of Bob Titus's double kill in 1967, and it's good to know he is still thinking about the air-to-air problem *(see "Two Days in May," June '87 issue, p. 102).* However, I would like to correct the record on why there was no gun in the F-4.

It was a conscious USAF decision, made when they decided to embrace the Navy fleet-defense, all-weather interceptor designed for head-on engagement of nuclear bombers inbound to the fleet in a sterile environment at sea. It's true that many "whiz kids" did not know about the deficiency of such a system for close-in combat, but a lot of Air Force senior officers had written off air-to-air close combat and chose not to intervene. That there would never be another "dogfight" was popular wisdom when DoD embraced a nuclear-tripwire philosophy. I'm sure Bob remembers the memorandum from a famous conference at TAC, wherein it was decided to take the gun out of the F-105.

At that time, our Air Superiority Society campaigned in Washington to force a gun into the F-4E and the FX (F-15) and the VFX (F-14). Also, two whiz kids, namely Dr. Tom Cheatham and Dr. Alain Enthoven, embraced our logic and helped make it happen. . . . On the uniformed side, we had a bundle of help from Maj. Gen. Sailor Agan, Col. Bones Marshall, Lt. Col. Bob Pursley, Maj. Guy Hairston, and a host of others, including young Bob Titus.

The bottom line—the fighter folks did not stand and fight when they should have. Also, history may be repeating itself.

Chuck Myers
Chairman
Air Superiority Society
Arlington, Va.

We have just noted with interest the article in the June '87 issue regarding Brig. Gen. Bob Titus's double MiG victories. Readers may be interested to know that the aircraft involved in this incident (F-4C #64-776) is still flying with the Oregon Air National Guard's 142d Fighter Interceptor Group at Portland ANG Base.

The victories described in the article are not the only ones for -776. It was involved in an earlier victory over a MiG-21 on April 23, 1967, while being flown by Maj. Robert Anderson and Capt. Fred Kjer. This victory was with an AIM-7.

Upon its retirement, -776 has been requested for retention and historic preservation by the Oregon Military Museum. Display of the aircraft will be inside. If any readers have photographs of this aircraft while it was in service with the 389th TFS, we would like to hear about it.

Terrill M. Aitken
Curator
Oregon Military Museum
Camp Withycombe
Clackamas, Ore. 97015

Do you have a comment about a current issue? Write to "Airmail," AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should be concise, timely, and legible (preferably typed). We reserve the right to condense letters as necessary. Unsigned letters are not acceptable, and photographs cannot be used or returned.

The Campaign Hat

Re: The "Airmail" letter from Lt. Col. Claude C. Sturges, USAF (Ret.), in the June '87 issue concerning the article "Airing It Out at Edwards" in the April '87 issue.

I'm not sure Colonel Sturges was in the same Army Air Corps that I was when he says the campaign hat was discontinued in 1939. During the years 1939 and 1940, we "troops" at Kelly Field, Tex., were issued and wore the campaign hat, along with the regular garrison cap. A blue braid on the hat with an orange tassel indicated you were Army Air Corps enlisted. Gold braid with a gold tassel indicated you were an officer, and you "troops" had better not forget to salute.

CMSgt. Noble C. Wyninegar, Sr., USAF (Ret.)
San Antonio, Tex.

Insignia Error

I found your article "Stars on the Wing" *(June '87 issue, p. 78)* to be interesting, informative, and quite accurate, with one exception.

In 1940, the insignia was not "removed from the upper and lower left sides of the wings." More accurately, the insignia was removed from the upper right and lower left sides of the wings.

I always enjoy every edition of your magazine. Keep up the good work.

Maj. Walter W. Czerwinski, USAF (Ret.)
Colorado Springs, Colo.

• *Because of an editing error, the word "right" was inadvertently dropped from the text. The sentence should have read that the insignia was "removed from the upper right and*

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AIRMAIL

lower left sides of the wings," as Major Czerwinski points out.—THE EDITORS

Pinning the Colonel

Re: The "Airmail" letters from Col. Lawrence J. Cahill, USAF, and Lt. Col. J. Philip Ruhlman, USAF (Ret.), in the June '87 issue about the photo of Col. Raymond J. Bartholomew in the April '87 issue.

Colonel Cahill and Colonel Ruhlman objected to the "pinning" of Colonel Bartholomew with Soviet Air Force shoulder boards. I hope they were being facetious. If not, I feel sorry for them.

How can anyone take themselves that seriously?

Lt. Col. L. E. McCarthy, USAF (Ret.)
Camarillo, Calif.

Off the Mark?

Because I worked for a major airline for a number of years, I found C. V. Glines's article "What Has Happened to the Airlines?" to be a very interesting and essentially accurate assessment *(May '87 issue, p. 62).* However, I think that he is substantially in error on one point—the deterioration of aircraft maintenance quality. He attributes the heavy fines by the FAA against major airlines to "outright dereliction on the part of mechanics and ground crew supervisors." That is totally off the mark.

Colonel Glines should be aware that all airlines have a substantial aircraft management staff with a hierarchy of managers, directors, and vice presidents. These people draw substantial salaries to be responsible for organizing and controlling the resources to produce a safe and sound aircraft maintenance operation that complies fully with FAA regulations. This is where the dereliction has occurred, not at the mechanic and supervisor level.

A modern jet transport is a huge and highly complex machine. To keep it operationally safe requires thousands of specific, periodic inspections of structure and components to assure their sound condition. The way to know the status and due date of these inspections is to have a system of meticulous records, to forecast when inspections are due, and to plan aircraft routing so that the required maintenance can be scheduled and accomplished on time.

Many components on the aircraft have a legally limited life, after which they must be removed for overhaul or discarded as scrap. When these inspections or operational life limits are overflown because of poor records or poor scheduling controls, the maintenance safety and reliability of the aircraft is seriously jeopardized. These functions are the responsibility of aircraft maintenance management, not the mechanics. This is where the dereliction of duty has occurred, and this is why the FAA has levied such heavy fines for poor recordkeeping. Good records and accurate scheduling control of maintenance are the foundation of aircraft maintenance quality and reliability.

Deregulation and the resulting cost competition have put heavy pressure on aircraft maintenance management to cut costs. One means has been to reduce personnel in maintenance "administrative" areas—such "non-wrench-turners" as planners, schedulers, recordkeepers, and quality analysts. This is where the quality of records and the quality of scheduling and control begin their decline.

Another area subject to severe cost-reduction pressures is spare parts inventory. Spare parts and operating components for modern jet transports are extremely high-cost items. Maintaining a high inventory of spares at operating stations is a high-cost investment. When inventory is reduced to bare bones, often a part is not available when and where needed, and the delays and cancellations for maintenance rise substantially. Also, there is a heavy temptation to avoid changing the questionable part and to keep the aircraft flying in less than best operating condition.

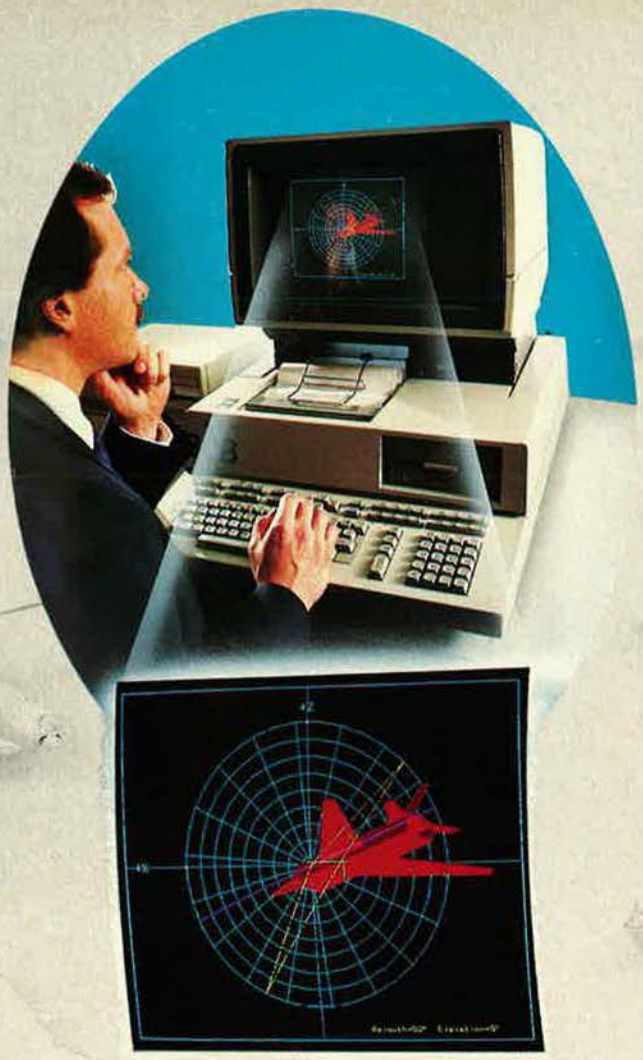
But this is a policy determined by management, not a mechanic. All of these factors put aircraft maintenance management in a severe squeeze to keep costs down, yet provide safe and reliable aircraft operation.

As with the air controller shortage, the system is safe, but the margin of safety and reliability is down significantly. . . .

Lt. Col. Harry H. Young, USAF (Ret.)
Portola Valley, Calif.

Chagrined Chaplain

Having read your very comprehensive Air Force Almanac *(May '87 issue),* I am a bit chagrined to find that the Air Force Chaplaincy has been recognized by total omission. It is the only action agency in your otherwise



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Belgium	116	160	188
Denmark	58	70	110
The Netherlands	155	214	238
Norway	72	72	98
Israel	97	150	150
Egypt	73	80	120
Pakistan	40	40	46
Venezuela	24	24	36
Korea	15	36	156
Turkey		160	160
Greece		40	60
Thailand		12	20
Singapore		8	20
Indonesia		12	12
Bahrain		12	12
Totals	1,774	2,975	4,207

GENERAL DYNAMICS

AIRMAIL

superb list highlighted by neglect. There is only a three-word reference to the strong, supportive moral presence of the Chaplaincy in the report on the Air Force District of Washington on page 165 of the May issue.

After twenty-eight years in the Air Force and well over half that time in support of AFA, I have a difficult time with what I perceive and hope is an oversight.

Col. John A. Doonan, USAF
Command Chaplain
Hq. ESC
San Antonio, Tex.

F-4 Display

A decision has been made to place F-4D-29-MC 66-7463 on permanent display at the Air Force Academy in Colorado Springs, Colo. It has been documented that six confirmed MiG kills were scored in this aircraft during the war in Southeast Asia. There is no other USAF aircraft that scored more than three confirmed kills during the war. Therefore, 66-7463 is of tremendous historical significance.

Since aircraft at the Air Force Academy are displayed outdoors, there is serious concern that 66-7463 will be subjected to deterioration from the elements. It is felt that an aircraft of this historical importance should be displayed at the Air Force Museum in Dayton, Ohio, where indoor display facilities are available for protection from the elements. This would also allow many more people to view the aircraft.

It is highly desirable that an F-4 MiG kill aircraft be on display at the Academy. There are currently six in storage at Davis-Monthan AFB, Ariz., that could be used for this purpose.

It is hoped that the decision to display 66-7463 at the Air Force Academy will be reconsidered and an appropriate substitute can be made.

William R. Peake
Addison, Ill.

Wright-Pat Fly-In

Wright-Patterson AFB, Ohio, and the Air Force Museum are helping the US Air Force celebrate its fortieth anniversary by cosponsoring an Air Force Anniversary Fly-In on Saturday, September 12, 1987.

Located at Wright-Patterson AFB, northeast of Dayton, Ohio, the Air Force Museum houses the world's largest collection of military aircraft. Plans have been made for aircraft to land, and transportation to the Air Force Museum will be available. There will be no charge for registration, landing, transportation, or admission.

Wright-Patterson AFB is not open for general aviation use and is not being opened for such use on a regular basis. An exception has been granted *for this event only.* Due to the complexities involved, no rain date can be established.

Specific details of arrival and departure routes will be sent to those pilots interested in attending. Wright-Patterson AFB will open its runways to the public from 9:00 a.m. to 7:00 p.m. All-day shuttle service will be available to and from Patterson Field and to and from the Air Force Museum. No aircraft maintenance will be available.

If you are interested in attending this special, truly memorable event, please contact the address below.

Air Force Anniversary Fly-In
2750th Air Base Wing/OTM
Wright-Patterson AFB, Ohio
45433-5000
Phone: (513) 257-2383

RFC Cemetery

Fort Worth, Tex., is unusual in that it has a cemetery for World War I aviators who were Canadian and British pilots in the Royal Flying Corps. Between October 1917 and April 1918, thirty-eight RFC pilots were killed in training accidents here, and twelve are buried in the Royal Flying Corps Cemetery.

In 1986, I organized a memorial service that received international attention from as far away as Paris, France. In 1988, our organization hopes to put on an even bigger memorial service as a tribute to these heroes on the seventieth anniversary of their deaths.

Although well maintained, the impressive main monument lost its large bronze RFC top because of vandalism shortly before last year's ceremony. We are interested in hearing from WW I aviation buffs who might like to attend and from British and Canadian officials in hopes that an honor guard might be provided. We also believe that the RFC bronze ornament may be a standard British military issue item that could be obtained through their war graves people, but we are in need of an address to contact. We also hope to locate biplane owners who would be interested in participating in a flypast.

The next ceremony is tentatively set for Memorial Day 1988. Interested individuals should write to the address below.

Griffin T. Murphey
Friends of the RFC
Cemetery
1124 South Lake, Suite D
Fort Worth, Tex. 76104
Phone: (817) 335-9440

Roll Call

I am trying to locate officers and airmen who served with the 7499th Composite Squadron at Wiesbaden, Germany, from 1951 through 1955.

I am a former member of the B section of that squadron and have already located several members. We would like to put together a reunion.

Please contact me at the address below.

Robert E. Brewer
10211 Lake Louise Dr., S. W.
Tacoma, Wash. 98498
Phone: (206) 584-3982

I am attempting to locate Sgt. Louie Otero. He was originally from Philadelphia, Pa. I served with him while stationed at Davis-Monthan AFB, Ariz., from 1950 until 1954. He is probably retired now.

Any help readers could give me in my effort to locate Sergeant Otero would be greatly appreciated.

Judge Bob Dunn
P. O. Box 1112
Nacogdoches, Tex. 75963
Phone: (409) 560-7755

I have access to a large frontal-view photograph of a B-17 that is inscribed *Little Orphan Okie* on the right side. Do any readers have any information about this plane?

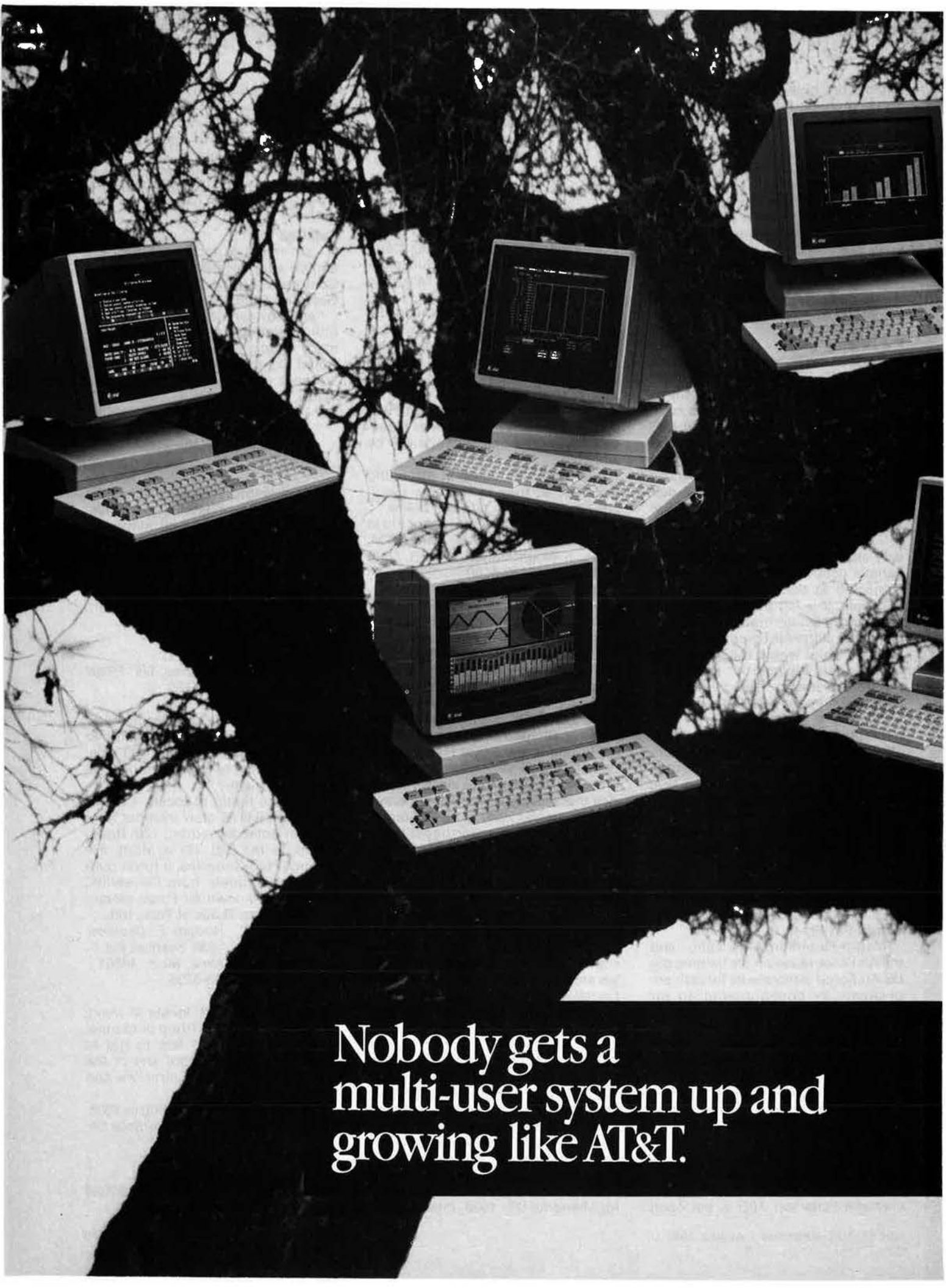
I am also trying to locate a fellow World War II B-25 crew member from the 81st Bomb Squadron, 12th Bomb Group, in the CBI. He is MSgt. Filomeno (Phil) Gonzales, a turret gunner/flight engineer from Floresville, Tex. His last known Air Force assignment was with B-58s at Peru, Ind.

Rodger E. Deckrow
3838 Seaman Rd.
Alma, Mich. 48801
Phone: (517) 463-3735

I am attempting to locate as many former 344th Bomb Group personnel as possible. I would like to get in touch with anyone from any of the four squadrons, both aircrews and ground crews.

We have a reunion pending in 1988. Please contact me at the address below.

John E. Scott
839 Bellaire Ct.
El Cajon, Calif. 92020
Phone: (619) 466-6967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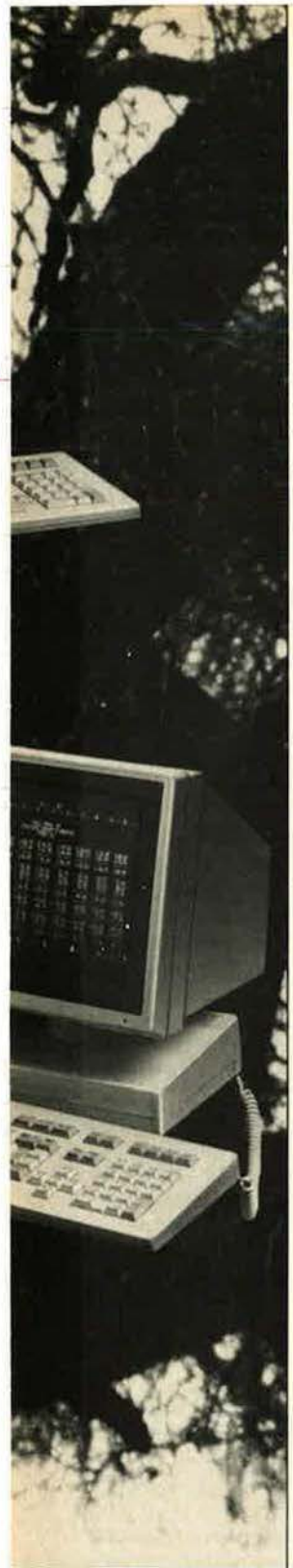

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CAPITOL HILL

By Brian Green, AFA DIRECTOR OF LEGISLATIVE RESEARCH

Washington, D. C., July 6

Budget Approved

By a vote of 215–201, the House of Representatives approved a compromise budget resolution that includes up to $296 billion in defense budget authority (BA) and $289.5 billion in outlays. The Senate approved the measure 53–46. The measure represents a small decline in defense BA over FY '87 spending levels—the third consecutive year in which defense funding has fallen. According to Congressional Budget Office estimates, the budget does not meet mandated deficit reduction goals, raising the possibility of further cuts in defense spending later in the session.

The compromise measure makes the defense figures contingent on Presidential approval of a tax package that will raise an additional $65 billion in revenues over three years. If the President fails to approve the taxes, the defense figure would fall to $289 billion in BA and $283.6 billion in outlays. President Reagan has repeatedly stated his opposition to tax increases and has threatened to veto any appropriations bills that reflect the budget resolution formulas.

Congress Stuck

The budget process on Capitol Hill, never smooth, seems to be rougher than usual this year.

- The *defense authorization bill* is apparently on long-term hold. Senate Republicans successfully filibustered the motion for the full Senate to consider the version of the bill approved by the Senate Armed Services Committee (SASC). They object principally to the language of the bill that would give either house of Congress a veto over a Presidential decision to move toward a "broad" interpretation of the ABM Treaty. Such an interpretation would allow development and testing of "exotic" SDI technologies.

Senate Armed Services Committee Democrats and the House Armed Services Committee are holding an informal conference to work out differences between the SASC bill and the House bill and thus provide some guidance to the Appropriations Committees. The Senate Republicans have been excluded from the conference because of their role in the filibuster, according to SASC Chairman Sam Nunn (D-Ga.).

- The defense subcommittees of the House and Senate Appropriations committees have no firm target dates for marking up *defense appropriations*. June 30 was the legal deadline by which the House was supposed to pass all appropriations bills.

Supplemental Unstuck

The FY '87 supplemental appropriations bill has long been stuck in conference, but differences have finally been resolved. House conferees agreed to drop arms-control provisions not in the Senate version that are unacceptable to the White House.

The compromise version also contains $75 million for the Advanced Launch System (ALS, formerly the Heavy Lift Launch Vehicle) and $122 million for Air Force Special Operations MH-53J Pave Low helicopters. The ALS funding will be fenced pending submission of a NASA/Air Force plan describing the ALS program more fully.

NASA Authorization Limits DoD

The House Science and Technology Committee has approved language limiting DoD use of the proposed Space Station. The NASA authorization bill states the Space Station may be used for "research, experimentation, and exploratory development," but it may not be used "by or on behalf of any department or agency for the purpose of conducting . . . the operational testing . . . or deployment of any offensive or defensive weapon or weapons system if in contravention of US laws or treaty obligations." DoD has not made public any specific uses to which it might put the Space Station, but seeks to leave its options open.

OTA Report

The congressional Office of Technology Assessment (OTA) issued a report that stresses the significance of the Joint Surveillance and Target Attack Radar System (Joint STARS) to the Follow-On Forces Attack (FOFA) concept for European defense. The FOFA concept envisions attacks on second-echelon Warsaw Pact forces before they have engaged NATO forces. Joint STARS is intended to detect and designate moving ground targets well behind enemy lines.

According to OTA, "[i]f operated as the Air Force now intends, the E-8A Joint STARS should be capable of providing frequent broad-area coverage to a depth of fifty to 100 kilometers beyond the FLOT" (forward line of own troops), a region OTA describes as rich in targets and more lucrative than deeper areas. Use of the E-8A, a modified Boeing 707, has been harshly criticized by some in Congress because of concerns over its survivability. But OTA pointed out that the Air Force would defend Joint STARS, suppress enemy air defenses, and adjust Joint STARS patrol patterns to reduce vulnerability. Stealthy surveillance platforms, often held out as an alternative to the E-8A by its opponents, would be less capable because reduced power emissions required for stealth would limit the information the radar could obtain.

The House approved $200 million for Joint STARS of the $338 million requested. The SASC approved $377 million.

DARPA on Superconductors

The Defense Advanced Research Projects Agency (DARPA), in response to the discovery of high-temperature superconductors, is aiming at quick development of an industrial technology base for processing, fabricating, and manufacturing the new materials, according to testimony by Dr. Craig I. Fields, DARPA Deputy Director for Research. Dr. Fields expects the development of small-scale pilot factories and hopes to see "some concept demonstrations aimed at defense applications within three to four years." He stated that DARPA is pursuing both bulk material applications (*e.g.*, magnets and motors) and thin film applications as well as computer-based tools. ■

DEFENSE DIALOG

HYBRID MICROCIRCUIT WIREBOND TECHNOLOGY. Rockwell International's Autonetics Electronics Systems (AES), in support of the AIRS IMU second source program, has implemented a fully automated "monometallic" aluminum wire bonding system. Bonding 150 wires per minute, the system meets the stringent MIL-STD-883 Class S requirements, survives a 2000-hour exposure to 250 degrees Centigrade, and is applicable for wires 1 to 10 millimeters in diameter. The system, used in conjunction with automatic device placement, yields a low-labor-content, ultra-reliable hybrid microcircuit applicable to all HI REL military and space applications.

PEACEKEEPER RAIL GARRISON. Rockwell has been an integral part of the Peacekeeper missile development team from its inception and will continue to support the ICBM in its new Rail Garrison basing mode. The Rockwell team is combining a unique set of technical skills and experience—railroad operations and control systems, rail security operations, guidance and control, land navigation, launch control system integration, nuclear hardness and survivability, and advanced strategic communications systems—directly applicable to the new ICBM basing concept.

SURVIVABILITY. The U.S. Army-sponsored Survivability Technology Development Program allows AES to develop weapon system hardening techniques against nuclear and other defense-suppressing threats. The Anaheim facility will define and support the development of survivability technologies for integration into ground-based SDI systems with minimal impact to their evolving designs. To achieve the overall objective, both systems-proven and state-of-the-art hardening techniques will be integrated through a combination of active and passive system designs and mechanizations.

THEATRE DEFENSE. Autonetics Electronics Systems is studying Theatre Missile Defense on the LTV team, defining a system architecture which could defend the European Theatre and other Theatres around the world from an attack—conventional, chemical, and/or nuclear. The Anaheim facility will analyze the mission architecture trade-offs, using the End-To-End Engineering Model (ETEEM) simulator. This facility also assisted in the mission definition and threat analysis.

For more information, please call: Science and Technology,
Rockwell International, Autonetics Electronics Systems,
(714) 762-7775.

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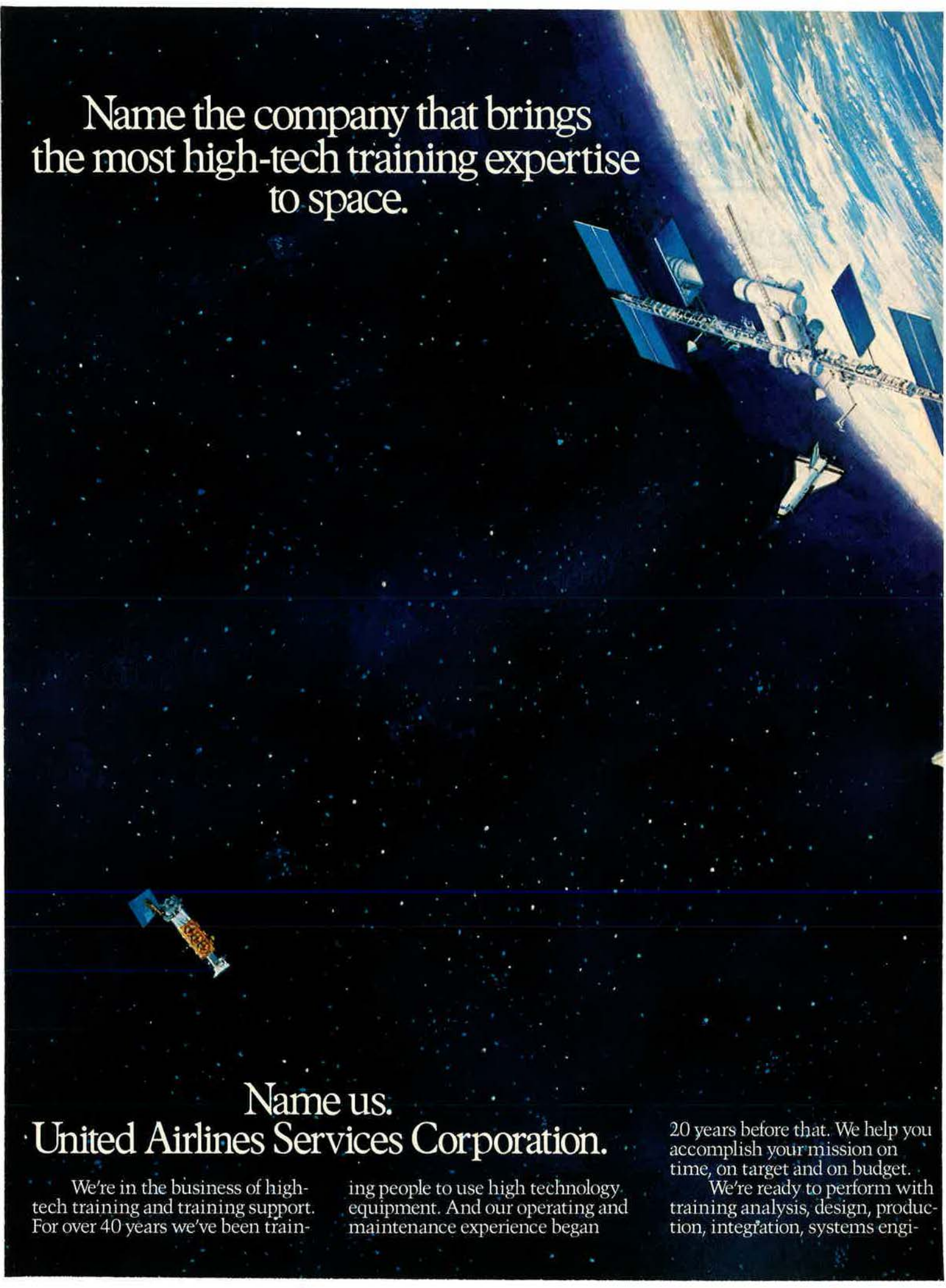

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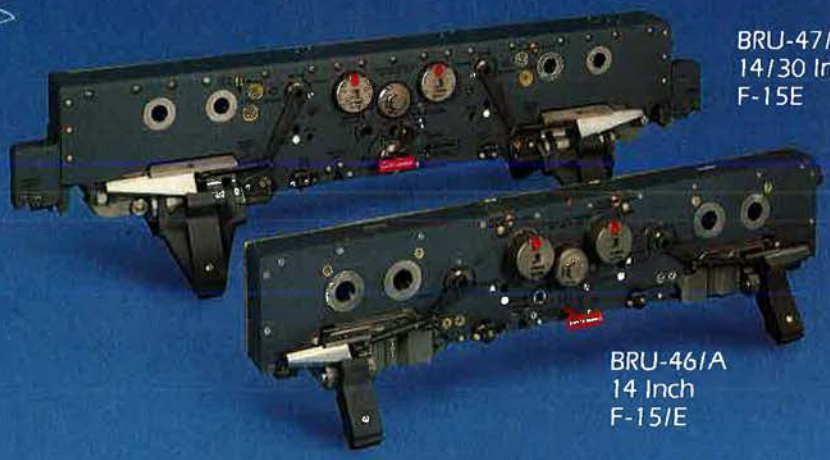

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IN FOCUS...

The Chernobyl Backlash

By Edgar Ulsamer, SENIOR EDITOR (POLICY & TECHNOLOGY)

The Energy Department foresees shortages in nuclear materials and warheads for the strategic stockpile as a result of congressional strictures and potential prohibitions against nuclear testing.

Washington, D. C., July 6

The core element of the US nuclear deterrent—the warheads and the special nuclear materials they depend on—may be headed for serious shortfalls and catastrophic failure because of congressional strictures triggered by the Chernobyl disaster and potential prohibitions against all forms of nuclear testing. The Department of Energy's Assistant Secretary for Defense Programs, Adm. Sylvester R. Foley, USN (Ret.), recently disclosed that unless present restrictions are lifted, "we will not be able to meet downstream known stockpile requirements."

The fifteen-year US nuclear "stockpile" plan, updated for certification by the President each year, reflects all foreseeable nuclear weapon requirements. The document is classified, mainly because it is based on the SIOP, the single integrated operational plan.

The most critical aspect of the stockpile's potential shortfall is the tritium supply, which requires regular replenishment. Tritium is a hydrogen isotope whose nucleus contains two neutrons and one proton. The material is marked by a short radioactive half-life of about 12.5 years. Almost all modern nuclear warheads require tritium for their fusion stage. Because of the short half-life, the material has to be replaced periodically in stockpiled weapons to ensure their long-term effectiveness.

But in the wake of the Chernobyl disaster, US nuclear materials production has been curtailed sharply, according to Secretary Foley. The so-called Hanford "N" (nuclear materials production) reactor at Richland, Wash., although quite different from the Soviet reactor that blew up in Chernobyl, shares a common trait with that design, namely a graphite core. While Department of Energy analyses show no hazards associated with the "N" reactor, safety enhancements were added in the aftermath of the Soviet accident on a precautionary basis, he said.

Adding these safety enhancements entailed a three-month standdown of the facility that—because of "political pressure"—was then stretched out further and, by congressional edict, may become a permanent condition, according to the DoE official. Admiral Foley acknowledged, however, that the "N" reactor's "finite" useful lifespan would probably come to an end somewhere between 1992 and 1995 if the facility continued operation. By that time, the graphite block would reach the top of the shielding and thus signal "the end of the 'N' reactor."

The only other facility in the US producing weapons-grade nuclear materials is the Savannah River complex. But this production reactor is operating at fifty percent of capacity because of safety concerns expressed by the National Academy of Sciences, which—at DoE's behest—reviewed the performance history of these production reactors. The Savannah facility's reduced production is being given over almost totally to meeting the nation's "absolute demand for tritium."

As a result, the US is producing only limited amounts of plutonium, another pivotal material without which modern nuclear weapons cannot function. Fortunately, this heavy radioactive element—which is fissionable when bombarded by neutrons and which is produced from uranium 238—does not suffer the half-life problems of tritium. Plutonium, therefore, can be "mined," or recovered, from nuclear weapons that are being decommissioned.

Concomitantly, the shortfall in plutonium production is not so critical as that of tritium, Admiral Foley pointed out. The current bootstrap arrangement, he pointed out, is insufficient to meet the stockpile requirements for tritium as well as plutonium. Further, even if the "N" reactor could be reactivated and the Savannah River facility cranked up to full power, the nation's weapons-grade nuclear production capability would remain "very fragile. It's old and has very little redundancy," according to the DoE official. The problem—which is acute—would take on critical or possibly even "catastrophic" proportions if changes in the SIOP necessitated the development of new nuclear weapon systems, Admiral Foley suggested.

Modernization and the development of "state-of-the-art" production capability are therefore imperative, "even if this means shutting down" some obsolescent facilities and cutting the size of the presently used production complex, the DoE official asserted. He added that at least one but preferably two new production reactors should be built and put into operation expeditiously to ensure a reliable, adequate, long-term supply of tritium. Putting a state-of-the-art production reactor on line will cost between $3 billion and $6 billion.

One option under consideration would cut down the lengthy lead time associated with building such a facility. One of the nuclear power generating reactors of the ill-starred Washington Public Power Supply System (WPPSS) effort was mothballed several years ago for economic reasons when its construction was about two-thirds complete. This facility, Admiral Foley pointed out, could be brought on line as a modern tritium-producing reactor in about six years, provided that associated "formidable" legal hurdles and questions about compensation can be resolved. Arms accords resulting in drastic cuts of nuclear weaponry would ease the need for plutonium, but only marginally reduce the requirement for tritium, according to Admiral Foley.

Both the White House's Office of

Management and Budget (OMB) and relevant committees in both chambers of Congress have agreed tentatively to make available about $25 million in reprogrammed FY '88 funds as a "planning wedge" toward long-term modernization of DoE's nuclear production facilities. He added that the White House recognizes this task as one of the top priorities of the defense establishment.

Congressional initiatives that seek to commit the US to forgo all, or almost all, nuclear weapons testing portend grave risks for US deterrent capabilities, Admiral Foley pointed out. About one-third of the weapons in the US nuclear stockpile were found at one time or another to have "something wrong with them." These discoveries occurred after the weapons had been checked out originally and put into storage, he reported. Subsequent retesting of these weapons showed that "something unexpected had happened" and brought out the need to "put in some modifications or fixes," coupled with the requirement for retesting to make sure that the modified designs actually worked.

Members of Congress who are opposed to nuclear weapons and who want to "legislate arms control" by imposing a one-kiloton yield limit for underground testing need to recognize—and the public needs to recognize—that such strictures prevent adequate stockpile testing, Admiral Foley emphasized. The contention by self-styled experts that the testing of stockpiled nuclear weapons can be achieved solely by simulation, he added, is "foolish" and incorrect.

Holding nuclear tests to such an extremely low level, in effect, rules out any useful stockpile verification and precludes the development of new nuclear weapons. Because nuclear deterrence is intrinsically a "dynamic" process, allowing the present arsenal to atrophy without options to respond to future threat changes incurs monumental risks, he suggested.

The present underground test limit of 150 kilotons—set by theThreshold Test-Ban Treaty (TTBT)—is adequate to test eighty-three percent of the weapons now in the US stockpile, the DoE official disclosed. The primary stages of existing US nuclear weapons have yields below this threshold. By substituting secondary stages, it is possible to establish confidence in the reliability of even higher-yield nuclear warheads.

The reason, the DoE official explained to a group of defense writers, is that the weapons designers at the

IN FOCUS...

Department's nuclear laboratories "are comfortable if they can test at about half the level" of the specified, expected yield of a given warhead stage. As a result, it is possible to test with adequate confidence a weapon with a full-up yield of 500 kilotons while complying with the TTBT's 150-kiloton limit, he pointed out.

One of the specialized nuclear weapons that might not be developed or built with any degree of confidence in its effectiveness—if Congress forces the US into a posture of no testing or only token testing—is the "earth penetrator" warhead. Such a design is imperative because of Soviet moves to "superharden" more and more vital elements of the strategic target system in the USSR. Such targets include underground command centers, bunkers for the leadership, submarine pens, and submerged tunnels protecting their nuclear submarines.

The shape, size, and weight of such a specialized warhead would enable the weapon to penetrate the ground—rather than burst in the air just above the ground, as is the case with existing nuclear warheads—before it is detonated. By exploding underground—although not necessarily at anywhere near the depth of the target itself—the shock waves would travel downward and collapse whatever structure is within the range of the weapon's effects.

While no such weapon has ever been produced by the US—the US Army's Pershing ballistic missile was originally meant to carry an earth-penetrator warhead, but that plan was subsequently shelved—Strategic Air Command and other elements of the Pentagon recently indicated such requirements. Admiral Foley explained that DoE is conducting preliminary research and development to establish the feasibility of such a specialized warhead. ICBMs as well as SLBMs appear to be the primary candidates for carrying earth-penetrating warheads, he added.

While the primary and overriding priority of DoE's weapons branch is modernization of its nuclear production facilities, the "number-one R&D program . . . is SDI," the Strategic Defense Initiative, whose nuclear portion accounts for about ten percent of the total program money and by law has to be carried out by DoE. Only funds earmarked for SDI by Congress, he said, are being spent by the Department of Energy on NDEWs (nuclear directed-energy weapons). *(See also p. 82 of this issue.)* The bulk of all NDEW R&D is concentrated on two principal programs, the hypervelocity-pellets project and the X-ray laser. The latter would be "popped" into space on warning of an impending ballistic missile attack.

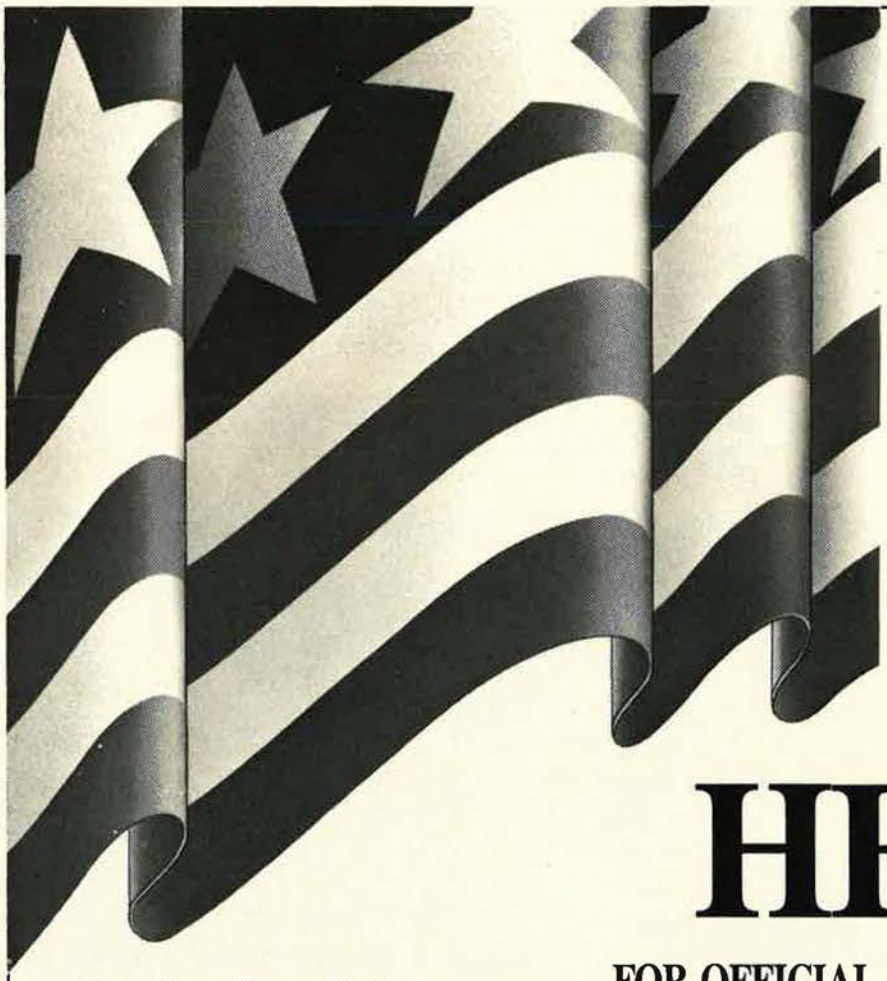
There are other promising NDEW concepts that DoE and its affiliated laboratories can't pursue energetically because of funding limitations, according to Admiral Foley. The Department's current NDEW work is confined to establishing by the mid-1990s—assuming that "we get the needed money"—the feasibility of these technological concepts. He stressed that "we are not interested in marketing and selling all those 'nifty' things" that may or may not work. He added that none of the nuclear-based SDI systems lend themselves for near-term deployment, including use in the so-called first phase of SDI.

In the case of the X-ray laser, Admiral Foley acknowledged that the associated research had not yet reached the point to support forecasts about the eventual feasibility of "weaponizing" this technology. Experiments conducted by DoE at its Nevada test site that were part of the X-ray laser development effort met specific technical milestones in terms of validating the notion of achieving X-ray lasing on the ground, according to the DoE official.

These technical milestones, however, are confined to the "nuclear side" and merely suggest that "the nuclear driver" required for X-ray lasing is technically feasible. He emphasized that there is no need to "violate" any existing arms-control agreements in order to determine the fundamental feasibility of the nuclear driver of an X-ray laser. DoE's work on X-ray lasers seeks to provide the background data needed to assess potential Soviet threats and, secondarily, to establish the theoretical feasibility of such a weapon by the early 1990s. In the case of the affirmative, the decision to actually build the weapon could come afterward.

Outrageous Claims Malign MX

Notwithstanding the fact that seventeen flight tests and stringent ground tests of the Peacekeeper ICBM confirmed the flawless, far better than contractually specified performance of this new weapon system, a panel of the House Armed Services Committee accepted without chal-



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lenge the allegation that this missile, once launched, would be as likely to "hit Washington as Moscow" or, alternatively, could fail catastrophically.

The new Commander of Air Force Systems Command, Gen. Bernard P. Randolph, stressed the superlative performance record of Peacekeeper to date by pointing out that "our operational [Peacekeeper] missiles at F. E. Warren AFB, Wyo., are monitored constantly, and reliability has been better than predicted by nearly fifty percent after eight months of operations." At the same time, he admitted that Northrop's Electronic Division, the builder of Peacekeeper's guidance unit, which is known as the Inertial Measurement Unit (IMU), has fallen behind the contractually stipulated delivery rate of these devices. This slower-than-expected delivery rate has not affected the Peacekeeper's performance, because the delivered IMUs, just like the rest of the system, demonstrated accuracies and other performance features in seventeen consecutive test flights "considerably better" than those set forth in the system specifications. But because of tardy IMU delivery, the Air Force has taken a number of actions to boost IMU production rates, including the withholding of more than $70 million in contract payments from Northrop.

Over the past year, General Randolph asserted, "there have been allegations of contractor mismanagement, fraud, waste, and abuse that have recently been the subject of the congressional hearings" by the Procurement and Military Nuclear Systems and R&D Subcommittees of the House Armed Services Committee. These allegations, he stressed, "are being investigated vigorously by the Air Force, the Defense Contract Audit Agency, and the Justice Department." At the time of the hearings, only thirty-nine of the sixty IMUs the contractor was to have delivered had actually been turned over to the Air Force.

Washington Observations

★ USAF Chief of Staff Gen. Larry D. Welch, speaking recently before Texan civic leaders, questioned "myths" about interservice rivalry and parochialism: "I can assure you that I work closely with the chiefs of the other services every day to the common end of adequate military strength. . . . Our forces train together every day and are ready to fight as a team whenever and wherever required."

In order to squeeze maximum value out of the increasingly scarce defense dollar, the Air Force is making every effort to push up mission readiness.

IN FOCUS...

By way of a benchmark, he pointed out that five years ago, half of USAF's F-16s were mission-ready. "Today, day after day, some eighty-five percent of our F-16s are constantly ready to go." In the case of SAC's B-52s, three years ago less than forty percent of these bombers were mission-ready at a given moment. "Today, that number is about seventy-five percent, and the remainder can be quickly generated to full capability in a crisis." Further, modifications to the avionics and weapons-carrying capacity have doubled the capability of the B-52.

In an even more dramatic transmutation, the F-16 evolved from a daylight, good-weather-only fighter to a far more versatile weapon system that can "meet the threat around the clock," according to the Air Force Chief of Staff. Because of an array of improvements, including in logistics support, "our fighter forces can fly almost twice the combat sorties they could just five years ago, and each of those sorties will be more effective."

★ Pentagon leaders are in the throes of an agonizing reappraisal of the tempo and direction of the Strategic Defense Initiative (SDI). Following a series of reviews involving, among others, a panel of high-powered outside experts headed by former MITRE chief William R. Everett, a planned Milestone I (initiation of demonstration and validation) decision was scaled back to less ambitious R&D activities. The general consensus appears to favor advancing some components into dem/val, but to delay such a step on a system-wide basis.

Reportedly, there is concern that advancing the program to dem/val on the basis of good progress in narrow aspects of SDI might backfire. Putatively, there is also concern among the Pentagon's senior leadership about the costs associated with the fielding of SDI's first phase, now conservatively and tentatively pegged at more than $100 billion.

★ In an end-of-tour interview with defense writers, the retiring Commandant of the US Marine Corps, Gen. P. X. Kelley, speculated that current adjustments in the Soviet system are likely to lead to a "younger, sharper" military leadership in that country in the wake of recent "shakeups."

Asked about the merits of drastic accountability on the part of senior US military leaders—akin to the draconian firings of Soviet marshals and generals following the landing of a German general aviation aircraft in Red Square—General Kelley suggested, "Go through some semblance of 'due process,' give us a fair hearing, make sure that there is an indictable charge, and then fire us." But such actions against senior military leaders need to be based on provable negligence of what went wrong down the line and shouldn't degrade into opportunities for any administration to "fire generals in a capricious manner. The military institution should be kept outside of the political system."

General Kelley's first concern, he said, "is with the growing attitude in Congress that places more credence in the views of staff members on matters dealing with national security than in the views of the service chiefs. This attitude is driving a wedge between the members of Congress and the nation's principal military advisors." Asked by this writer about the impact of the Defense Reorganization Act of 1986—known popularly as the Goldwater-Nichols Bill—General Kelley singled out the legislation's joint staff specialty provision as "manifestly wrong."

Suggesting that he was reflecting the views of all the service chiefs on this point, he warned that "this is going to distort and torque the whole chemistry of the officer corps in all of the military services. It's going to create a 'we-they' [schism, pitting the officer] who has joint staff . . . tours going back to Adam against all others." He stressed the importance of modifying the legislation to prevent the creation of an entrenched staff hierarchy with "little or no command experience in the field. . . . A good staff officer needs to have been out there in the brier patch to know what in the hell is going on."

Turning to the provision of the bill that strips seven specific functions—such as acquisition—from the portfolio of the service chiefs, he suggested that "only history will be able to tell whether this was the right or wrong approach."

In a broadly philosophical vein, the retiring Marine Corps Commandant bemoaned influences and trends that weaken the moral fiber of American youth. He suggested one way to counter this problem: "Since we have got an institute for everything else—we have got an institute for AIDS and all these things—why not have an institute for patriotic values?" ■

AEROSPACE WORLD

. . . PEOPLE . . . PLACES . . . EVENTS . . .

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C., July 6

★ The fifty-mission crush cap and leather flight jacket were two symbols that immediately identified servicemen as aviators during World War II and beyond. The cap (which took its name from its appearance after the grommet was removed to accommodate fit of a headset) has gone the way of the dinosaurs. The leather flight jacket, on the other hand, will make a triumphant return to the Air Force this fall.

The jackets will be issued as an incentive for aircrew retention to crews assigned to combat-ready operational units. The jacket initiative was suggested by field commanders of combat forces in response to aircrew perceptions that they are not adequately recognized. Reinstatement of the jackets, it was felt, would enhance *esprit de corps* within the aircrew force. The jackets can be worn during flight duties as well as on and off base.

The jackets will be purchased through the Defense Personnel Support Center in Philadelphia, Pa., the Department of Defense agency that purchases other uniform items. The Air Force expects the initial expense for the jackets to be less than $5 million, although the purchase contract has not yet been negotiated. It costs well over $1 million to train an operational F-15 or F-16 pilot, so the jackets will pay for themselves the first year if just five pilots who would otherwise have left the service decide to stay in the Air Force.

The US Navy has issued leather flight jackets to its aviators for the past sixty years. The Navy's jackets, similar to the ones the Air Force will buy, are obtained from the Defense Personnel Support Center for approximately $100 each.

The jackets—as well as other initiatives, such as increased Aviation Career Incentive Pay and increased moving-cost reinbursements for everyone in the service (both of which Congress must approve)—are part of an effort to stem the tide of pilots who are leaving for the airlines.

The flood of pilots getting out of the service will continue, since the airlines are expected to hire more than 9,000 new pilots this year alone, according to figures released by the Future Aviation Professionals of America (FAPA), an aviation career information service based in Atlanta, Ga. FAPA also reports that eleven of the twelve major airlines are currently hiring. The forecast for the next ten years calls for from 42,000 to 52,000 pilots and 50,000 maintenance technicians (as well as 100,000 flight attendants) to be hired.

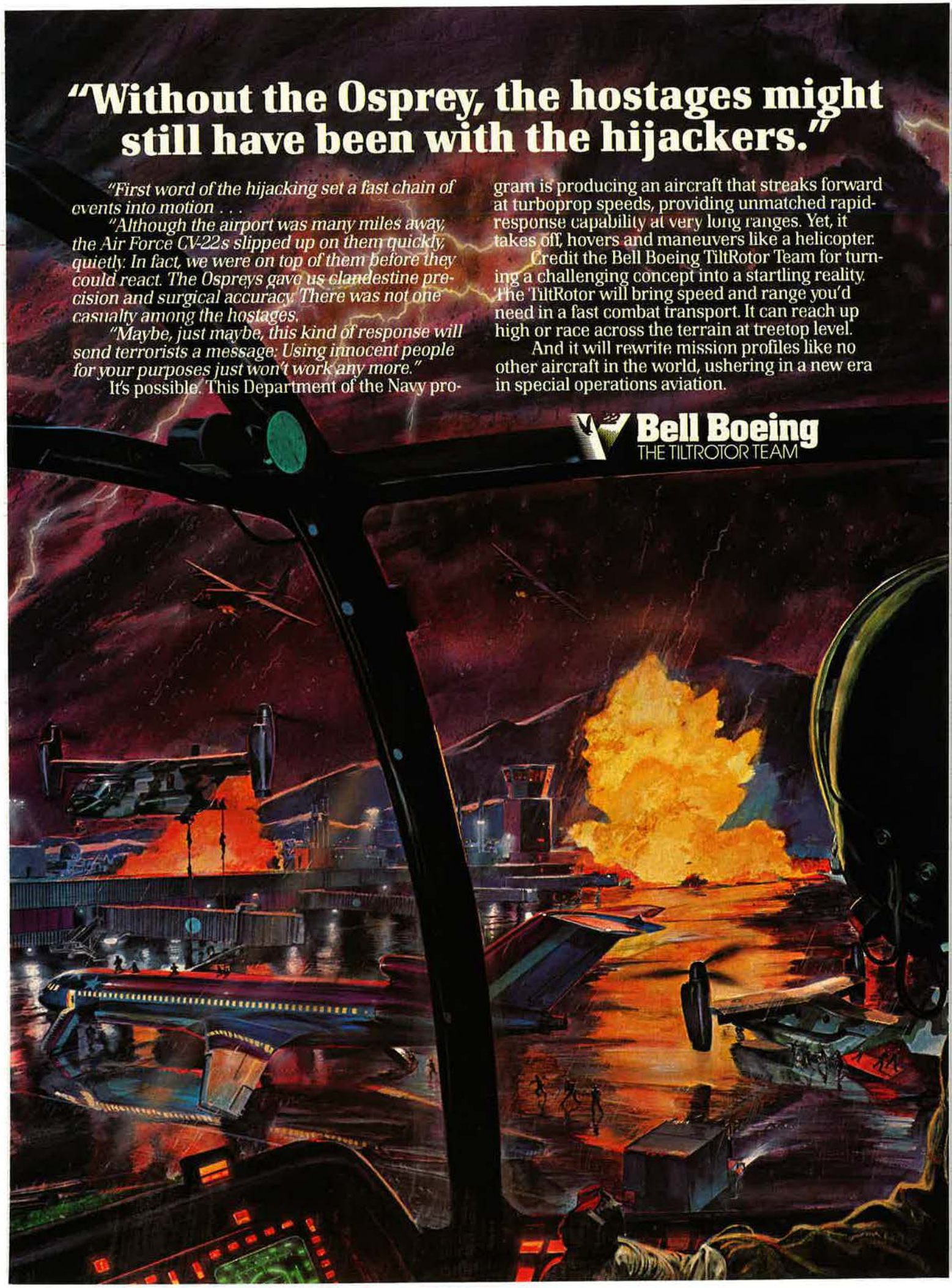
In early June, an AGM-45 Shrike antiradar air-to-surface missile was launched for the first time from an F-16. The test, part of a program to increase the F-16's defense-suppression capabilities, was conducted by the Air Force Flight Test Center at Edwards AFB, Calif. Maj. Tom Darner and Capt. Carl Walz crewed the mission, which was flown over the Naval Weapons Center at China Lake, Calif. (USAF photo by Tom Reynolds)

Another long-time pilot trademark, Ray-Ban metal aviator sunglasses, recently celebrated its fiftieth anniversary. At the request of the Army Air Service, Bausch & Lomb developed the distinctive green glass for aviator goggles as a means of reducing glare while still providing excellent visibility. Sunglasses equipped with the green glass appeared in 1937 and soon became standard military issue. During World War II, Bausch & Lomb supplied lenses for binoculars, rangefinders, and bombsights.

★ All of the parts, or at least the companies that will build the parts, are coming together for the C-17 as the new transport enters its final development phase. McDonnell Douglas, the airlifter's prime contractor, awarded the last of the major subcontracts for the C-17 program in late May to Lockheed-California Co., which will build wing components for the plane. A smaller subcontract award was also made to Gull Inc. to supply the control system for the On-Board Inert Gas Generating System (OBIGGS) for the C-17.

The OBIGGS will use engine bleed air from the plane's Pratt & Whitney F117-PW-100 turbofan engines to generate inert, nitrogen-enriched air to force into the fuel tanks as the fuel is depleted. The enriched air, which is nearly ninety-six percent nitrogen, prevents the accumulation of an explosive fuel-air mixture that could be ignited by enemy gunfire. The $1.5 million initial contract has a potential value of more than $25 million to Gull over the life of the C-17 program.

Lockheed-California, located in Burbank, was selected to build the wing components over Avco Aerostructures-Textron of Nashville, Tenn.,


"Without the Osprey, the hostages might still have been with the hijackers."
"First word of the hijacking set a fast chain of events into motion . . .
"Although the airport was many miles away, the Air Force CV-22s slipped up on them quickly, quietly. In fact, we were on top of them before they could react. The Ospreys gave us clandestine precision and surgical accuracy. There was not one casualty among the hostages.
"Maybe, just maybe, this kind of response will send terrorists a message: Using innocent people for your purposes just won't work any more."
It's possible. This Department of the Navy program is producing an aircraft that streaks forward at turboprop speeds, providing unmatched rapid-response capability at very long ranges. Yet, it takes off, hovers and maneuvers like a helicopter.
Credit the Bell Boeing TiltRotor Team for turning a challenging concept into a startling reality. The TiltRotor will bring speed and range you'd need in a fast combat transport. It can reach up high or race across the terrain at treetop level.
And it will rewrite mission profiles like no other aircraft in the world, ushering in a new era in special operations aviation.
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MOTOROLA INC.
Government Electronics Group

and Rockwell International's North American Aircraft Operations facility in Columbus, Ohio, after a seven-month open competition. Both the Air Force and the General Accounting Office monitored the source-selection process.

Lockheed, along with subcontractors Beech Aircraft of Wichita, Kan., Murdock Engineering Co. of Irving, Tex., and Reynolds Metals Co. of McCook, Ill., will fabricate the C-17's wing spars, stringers, and skins as well as build and assemble the wing leading edges and slats, wing ribs and bulkheads, the engine pylons, and the winglets. When assembled, these components will weigh about 45,000 pounds.

Reynolds Metals will machine the wing skins, which are the largest aluminum pieces ever produced for an aircraft. One skin section will extend from the center of the aircraft to the wingtip, a distance of nearly eighty-eight feet. Murdock Engineering will fabricate and assemble the wing pylons.

Beech will build the 9.2-foot-tall composite winglets. Each of these vertical surfaces, which by using the forces from the natural wingtip vortices effectively increases the span of the wing, has a surface area of 35.85 square feet and is canted outward at a 105-degree angle from the tip of the wing.

The wing-component contract has a potential value of more than $1 billion ($50 million to Beech alone) if the Air Force should decide to buy all 210 C-17 aircraft over the next twelve years as called for in current plans. The initial subcontract award calls for wing components for the first C-17 test aircraft and two nonflying structural test aircraft as well as components for the first forty-two production aircraft under five production options.

The selection of Lockheed and Gull brings the number of major C-17 subcontractors up to twenty firms or divisions located in ten states, plus Canada and England. Four of the subcontractors are located in New York, while three firms each are located in California and Arizona. Two Florida firms will be involved in the C-17 program.

First flight of the C-17, to be built at the Douglas Aircraft Co. plant in Long Beach, Calif., is scheduled for 1990. Initial operational capability (IOC) with the planes should be reached by Military Airlift Command units in 1992.

★ Blimps are coming back. The Navy awarded a $168.9 million contract on June 5 to the Westinghouse-Airship Industries consortium to build a prototype airship for fleet surveillance, airborne early warning, and communications. The other company vying for the bid was the Loral Systems Group, successor to the Goodyear Aerospace Co.

AEROSPACE WORLD

The airship will be large (more than 420 feet long) and will contain roughly 2,350,000 cubic feet of helium. The ship will loiter at altitudes up to 10,000 feet over battle groups for several days searching for sea-skimming cruise missiles. The airship will also be able to alert shipboard air defenses against hostile aircraft. The blimp will also be relatively fast, with a speed of eighty knots in level flight.

The airship, called an operational development model (ODM), will feature an advanced tear-resistant fabric, vectored thrust propulsion, fiber optic (or fly-by-light) flight controls, a gondola made of composite materials, and advanced avionics. The electronics suite that is used in the Grumman E-2C Hawkeye airborne warning and control system (AWACS) carrier-borne aircraft will also be fitted to the airship. Despite its large size, the airship will have a very low radar signature because of the fabric and composites.

The contract, which allocates $118,196,431 for the airship itself and the remaining $50,733,143 for the electronic systems, calls for a first flight within forty-one months, or sometime in 1990. After that, the blimp, the design of which is based on Airship Industries' Sentinel 5000 model, will be put through sixteen to eighteen months of operational-suitability trials, including a major fleet exercise.

The contract also contained price options for up to five additional airships, logistics, and maintenance support. The options may be exercised from FY '89 to FY '91 at FY '91 prices ranging from $83,183,000 for the one airship to $294,156,000 for five airships and the logistics and maintenance package. Pending the results of the ODM trials, these airships will likely be even larger than the prototype.

The Navy used blimps from 1917 to 1962, when the last Goodyear ZPG-2W (later redesignated EZ-1) blimp, which had search and height-finding radars, was retired. From 1921 to 1937, the Army Air Service conducted coastal patrol with blimps before turning over that mission to the Navy. The Air Force and the Coast Guard have also shown a great deal of interest in the Navy's new airship program. The new Navy blimp will likely be designated YEZ-2A.

★ Cowboys are prone to remark that their mount "was rode hard and put up wet" at the end of a long day on the range. The pilots of the 363d Tactical Fighter Wing's 19th Tactical Fighter Squadron were likely heard uttering that same descriptive expression on June 3 after the unit "rode the range" to the tune of 160 sorties that day to set a new sortie surge record for F-16s.

The herculean effort, which took slightly more than twelve hours, required each of the unit's forty pilots to fly four times. This surge also required the twenty aircraft belonging to the 19th TFS, based at Shaw AFB, S. C., to be flown eight times during the period.

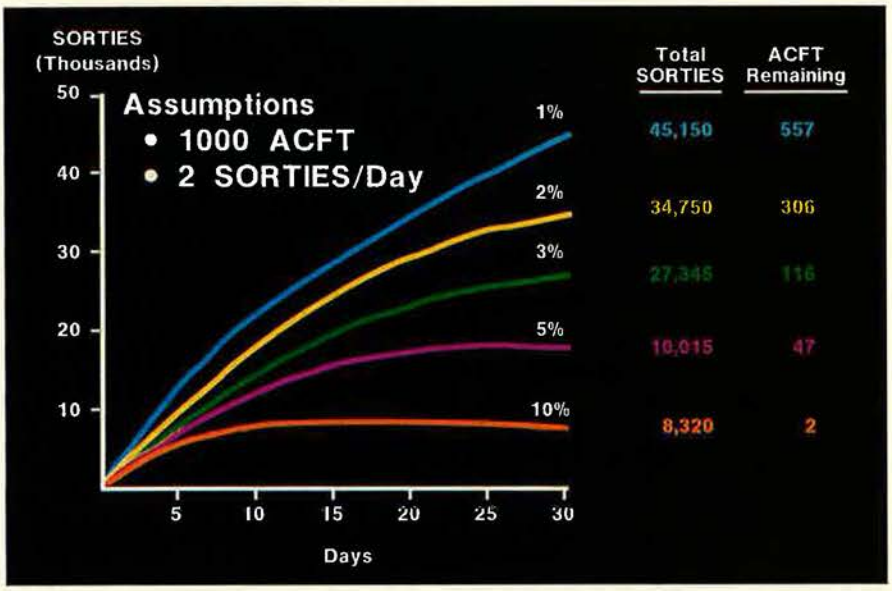
On each sortie, the pilots flew a low-level navigation route to Poinsett Range near Shaw, where a bomb run was made. On many of the sorties, the

Capt. James A. Trinka, an instructor pilot with the 311th Tactical Fighter Training Squadron at Luke AFB, Ariz., is the winner of the Aviators' Valor Award for 1986. Early last year, Captain Trinka's F-16 ingested a bird and flamed out, but because of his quick reactions, the Captain was able to save the aircraft. The award is presented annually for a conspicuous act of valor performed during flight in or out of combat. (USAF photo by SSgt. Jeff Simpson)

pilots also engaged in simulated air combat against "adversaries" from various other military units throughout the Southeast.

The maintenance crews and the unit's F-16Cs performed so well that the surge was completed one hour

AEROSPACE WORLD



WHAT ATTRITION MEANS—Attrition, or losses of aircraft and other forces, is a basic reality of combat. Two percent attrition may not sound like much, but over the first thirty days of a war, that rate would claim nearly seventy percent of a 1,000-plane force and reduce the possible number of sorties flown by nearly fifty percent.

sooner than expected. The sortie count started at 6:00 a.m. and finished about 6:10 p.m.

The surge record, which broke the old record of 144 sorties, was undertaken to mark the seventieth anniversary of the 19th TFS, one of the first four aero squadrons formed after the US entered World War I.

★ Many people enjoy model rocketry, a hobby in which small solid-fuel rockets are launched by an electrical charge from a battery. On June 9, a full-scale example of this kind of launching occurred when three rockets were inadvertently launched after lightning struck them on the pads at the National Aeronautics and Space Administration (NASA) facility at Wallops Island, Va.

Two were small test rockets that were to be fired later that night so that range personnel could calibrate and check their tracking radars. These rockets, four feet tall and two and three-quarters inches in diameter, were set at a seventy-five-degree angle and flew their normal course to 15,000 feet and two and a half miles down range after the strike.

The third rocket, a sixteen-foot-tall Orion carrying measuring equipment, had not yet been placed in a vertical launch position, and after the bolt struck the pad, the Orion shot forward 300 feet and splashed into the Atlantic. Ironically, the Orion was to have been launched several hours later to measure nighttime thunderstorms and their effect on the atmosphere.

A fourth rocket on a nearby pad had not been fitted with an igniter and so was unaffected by the lightning strike. The pads, which are 150 feet apart but connected by a common ground wire, had been cleared of personnel when the storm first came up, and no one was injured in the incident, nor was any damage done to the launchpad complex itself.

The value of the three lost rockets was placed at less than $50,000. This was the first time in more than 13,000 launches at Wallops that an incident of this sort had occurred.

The storm also knocked out a satellite ground receiving station operated by the National Oceanic and Atmospheric Administration (NOAA) three miles away. Three lightning bolts hit the station and overwhelmed lightning rods, grounding wires, and surge suppressors. Reception of weather images from the GOES-West and GOES-East satellites was interrupted until the next morning.

In a similar but better planned vein, Air Force Systems Command's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, recently acquired new equipment to simulate lightning strikes on airplanes and missiles.

The new generator, called the Multistage Impulse Generator, is eight feet tall and twenty-five feet long and can build up enough voltage to create a 4,000,000-volt discharge. The generator can be carried on a flatbed truck and thus can be transported to field-test sites to check out fully operational aircraft.

ASD's Flight Dynamics Laboratory built the generator, which consists of forty capacitors of 100 kilovolts each, to test and validate various methods of protecting aircraft and missiles from electromagnetic damage. Information obtained in the lightning "zaps" is also used to develop new techniques to "harden" aerospace vehicles against these strikes.

The new generator is currently being used to assess the vulnerability to lightning strikes of parts made of composite materials.

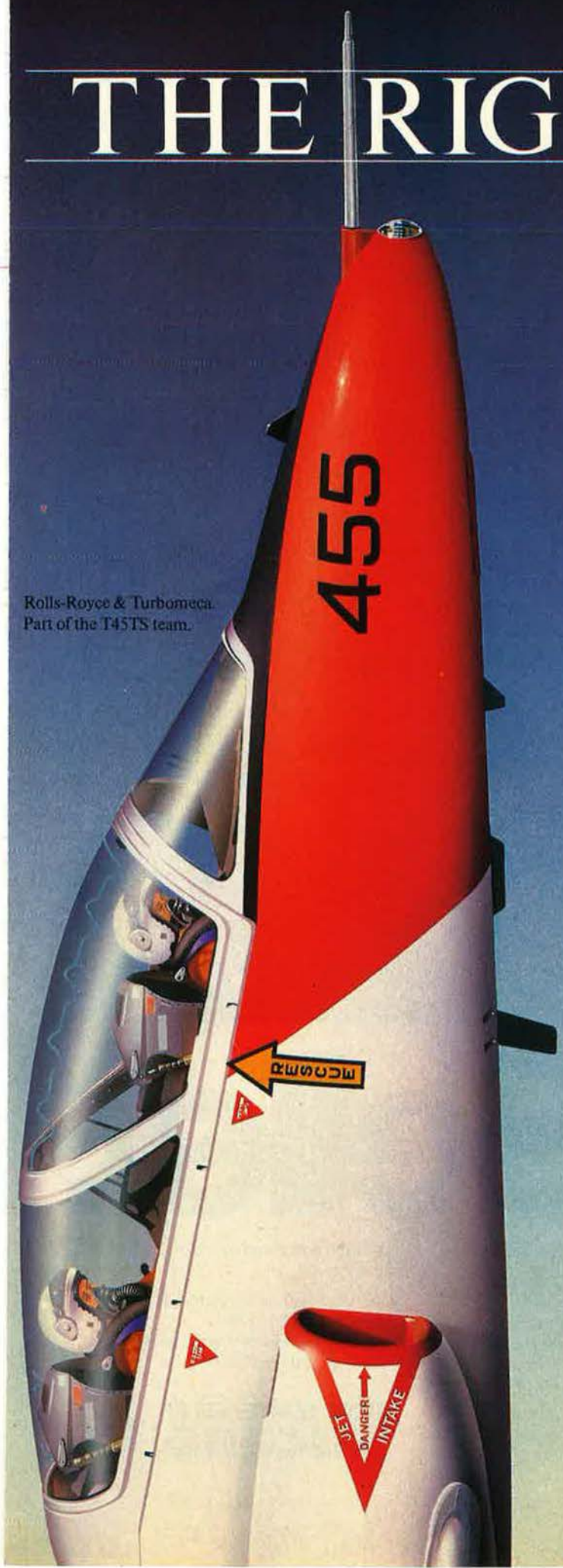
★ With the exception of the F-100F used in Vietnam, Forward Air Control (FAC) airplanes have usually been relatively small and armed with only marking rockets or a meager load of bombs. This fall, however, the FAC mission will gain a little more teeth and size when the 23d Tactical Air Support Squadron at Davis-Monthan AFB, Ariz., becomes the first unit to convert to OA-10 Thunderbolt II aircraft. This conversion is being done to modernize Tactical Air Command's FAC force.

The new FAC aircraft are not "new" in the strict sense of the word—only the designation has been changed. The planes are A-10 close air support aircraft that will be used in a new role providing forward air control, combat escort, search and rescue, and visual reconnaissance. The OA-10s, which have a span of nearly fifty-eight feet and are fifty-four feet long, will retain the 30-mm GAU-8/A gun. During their FAC missions, the planes will be armed as well with some or all of the 16,000 pounds of ordnance they can carry.

The first OA-10 will enter the inventory in October, and the 23d TASS will eventually receive twenty-four operational aircraft and two backups. Twenty of the OA-10s will come from the 355th Tactical Training Wing (the A-10 conversion wing) at Davis-Monthan and will be transferred to the 23d TASS by November 1988.

The 23d TASS will phase out its OA-37 Dragonfly aircraft over the next two years. Those aircraft will be sent

THE RIGHT STUFF



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to Air National Guard units and the 24th Composite Wing at Howard AB, Panama.

★ A diverse group of aviation notables will be inducted into the National Aviation Hall of Fame this July 25 in ceremonies at the Dayton, Ohio, Convention Center. The group includes Air Force astronaut Virgil I. "Gus" Grissom, two-term Chairman of the Joint Chiefs of Staff Adm. Thomas H. Moorer, former Lockheed Chairman of the Board Daniel J. Haughton, and entertainer and aviation promoter Arthur Godfrey.

Arthur Godfrey (1903–83) held an airline transport rating and logged more than 17,000 hours as a solo and command pilot in nearly fifty years of flying. He became such an ardent supporter of the Air Force that he resigned his commission as a commander in the Naval Reserve and accepted a retired commission in the Air Force Reserve. In 1966, he participated in a record-setting flight around the world in a Rockwell Jet-Commander business aircraft. The 23,333-mile flight, which included twenty separate flight legs, was completed in fifty-five hours and thirty minutes for an average speed of 423 mph. A popular radio personality, he hosted one of the most successful television programs of the 1950s—"The Arthur Godfrey Show."

"Gus" Grissom (1926–67) was one of three Air Force officers selected to be in the group of pilots tapped to be America's Project Mercury astronauts. On July 21, 1961, he became America's second astronaut when his *Liberty Bell 7* capsule was launched on a suborbital mission from Cape Canaveral. He flew again on March 23, 1965, when he and John Young flew on the first US two-man space mission, Gemini-3. Colonel Grissom was killed on January 27, 1967, along with astronauts Roger B. Chaffee and Edward H. White when the Apollo capsule they were testing caught fire while on the pad. Colonel Grissom is the fourth member of the original group of seven astronauts to be enshrined in the Aviation Hall of Fame.

Daniel J. Haughton (1911–87) began his career with Lockheed in 1939 as a systems analyst. Twenty-eight years later, he was elected to the board chairmanship, a position he held from 1967–76. Under his leadership in the 1950s, Lockheed's Georgia Division began development of what was to become one of the corporation's brightest stars, the rugged and versatile C-130 Hercules troop and cargo transport. He also received the Marketing Executive of the Year Award in 1968 from Sales and Marketing International for his direction of the successful marketing program for the Lockheed L-1011 TriStar airliner.

AEROSPACE WORLD

Adm. Thomas H. Moorer (born 1912) was the first naval officer ever to serve as Commander in Chief of both the Atlantic and Pacific Fleets. He was appointed Chief of Naval Operations by President Lyndon Johnson in 1967 and later reappointed by President Nixon. In 1970, he was nominated to serve as Chairman of the Joint Chiefs of Staff and was reappointed for a second term in 1972. On June 20, 1974, he retired as JCS Chairman after forty-five years of Navy service. During his military career, Admiral Moorer was awarded forty-two medals and unit awards, including the Distinguished Flying Cross.

This year's ceremony brings the total number of National Aviation Hall of Fame inductees to 118.

★ The new GI Bill, which had been implemented on an experimental basis, was signed into law by President Reagan on June 1. Under the new law, benefits will be available to personnel who initially entered active duty with no prior service on or after July 1, 1985. Personnel already in the military who are eligible for the Vietnam-era GI Bill may combine their benefits.

Members who participate in the

Arthur Godfrey

Virgil I. Grissom

Daniel J. Haughton

Thomas H. Moorer

program will have $100 deducted from their basic pay per month for one year. This $1,200 amount is not taxable, and the government will match this amount with $9,600 at the end of service.

In order to collect the $300 per month benefits, the participant in the program must serve three years of active duty or two years of active duty and four years of inactive service. A smaller benefit of $250 a month for three years is available for a two-year active-duty enlistment, but the $1,200 investment must still be made.

Members of the National Guard and Reserves can also participate in the program. These people will receive $140 a month for educational benefits for a six-year enlistment.

The benefits must be used within ten years of the participant's retirement or separation date.

★ The latest test of the AIM-120A Advanced Medium-Range Air-to-Air Missile (AMRAAM) proved to be a success, even though the missile wasn't fired at anything. This shot verified the missile could successfully separate from its launch rail while the carrier aircraft was executing a high-G maneuver.

The May 29 test was conducted over the Gulf Test Range near Eglin AFB, Fla. The missile carried no warhead, but was specially instrumented to measure launch and flight data.

An F-15 served as the launching aircraft, and it was flying at Mach 0.9 at 25,000 feet above sea level. The plane executed a 6.5-G turn as the AMRAAM Separation/Control Test Vehicle (SCTV) was launched. The SCTV then flew a predetermined flight path and performed programmed turns and altitude changes as well. The missile was also put through higher than normal accelerations. This was the first test of an SCTV from an F-15, and in addition to separation characteristics, the AIM-120's aerodynamics, autopilot response, and stability characteristics were also measured.

The shot was the third successful SCTV launch. Previous SCTV tests were conducted in December 1984 and March 1986. This test marked the thirtieth successful AMRAAM launch out of thirty-five attempts, a success ratio of nearly eighty-six percent.

The joint Air Force/Navy AIM-120A program is managed by Air Force Systems Command's Armament Division at Eglin. Prime contractor for the 335-pound AMRAAM is Hughes, while Raytheon is the second-source builder. Initial operational capability (IOC) is expected to be achieved with the missiles in FY '89.

AEROSPACE WORLD

★ With its unique ability to refuel aircraft on a single mission by using either the hose-drogue method or by means of a refueling boom, the Air Force's fleet of KC-10 Extender cargo/tanker aircraft has frequently been called on to support Navy and Marine Corps deployments and exercises. In an effort to service more "customers" at these flying gas stations, McDonnell Douglas was awarded a $9.9 million contract in early June to add two more "self-service lanes" to the planes.

These additions will consist of two hose-drogue refuelers contained in removable pods mounted near the wingtips of the KC-10s. This modification will give the tankers the ability to refuel three aircraft at one time (either three probe-equipped aircraft or one receptacle-equipped and two probe-equipped planes), thus reducing the amount of time it takes to refuel a given number of airplanes in flight.

Flight Refuelling Ltd. of Wimbourne, England, will develop the wing pods, while McDonnell Douglas

SENIOR STAFF CHANGES

PROMOTIONS: To be **Lieutenant General:** Robert D. **Beckel;** Hansford T. **Johnson.**

RETIREMENTS: M/G Gerald D. **Larson;** L/G Leo **Marquez;** Gen. Earl T. **O'Loughlin;** L/G Winfield W. **Scott,** Jr.; Gen. Lawrence A. **Skantze;** M/G Russell L. **Violett.**

CHANGES: M/G (L/G selectee) Robert D. Beckel, from C/S, Hq. SAC, Offutt AFB, Neb., to Dep. Chairman, NATO Mil. Committee, Brussels, Belgium . . . **B/G Billy J. Boles,** from Vice Cmdr., Hq. AFMPC, and Dep. Ass't DCS/Pers. for Mil. Pers., Randolph AFB, Tex., to Dir., Pers. Prgms., DCS/Pers., Hq. USAF, Washington, D. C., replacing M/G Anthony J. Burshnick . . . **B/G Edward R. Bracken,** from DCS/P&P, Hq. AFLC, Wright-Patterson AFB, Ohio, to Dir., Log. Plans & Prgms., DCS/L&E, Hq. USAF, Washington, D. C., replacing retired M/G Thomas A. LaPlante . . . **Gen. Duane H. Cassidy,** from CINC, Hq. MAC, Scott AFB, Ill., to CINC, Hq. MAC, and CINC, Hq. USTRANSCOM, Scott AFB, Ill. . . . **Col. (B/G selectee) Clifton C. Clark, Jr.,** from Ass't DCS/P&P, Hq. USAFE, Ramstein AB, Germany, to Dep. Dir., Ops., NMCC, J-3, OJCS, Washington, D. C., replacing B/G Vernon J. Kondra.

M/G Larry D. Dillingham, from Dep. Cmdr., 6ATAF, Izmir AS, Turkey, to Ass't DCS/Pers., Hq. USAF, Washington, D. C., replacing M/G Winfield S. Harpe . . . **Col. (B/G selectee) Howell M. Estes III,** from Spec. Ass't to C/S, SHAPE, Mons, Belgium, to Cmdr., 14th AD, SAC, Beale AFB, Calif., replacing B/G (M/G selectee) John R. Farrington . . . **B/G (M/G selectee) John R. Farrington,** from Cmdr., 14th AD, SAC, Beale AFB, Calif., to Chief, US Mil. Training Mission, Riyadh, Saudi Arabia, replacing retired M/G Russell L. Violett . . . **B/G (M/G selectee) Larry D. Fortner,** from Dep. IG, Hq. USAF, Washington, D. C., to Dep. Cmdr., 6ATAF, Izmir AS, Turkey, replacing M/G Larry D. Dillingham . . . **M/G Michael D. Hall,** from Cmdr., Hq. AFOTEC, Kirtland AFB, N. M., to Dir., Advanced Prgms., OSAF, Washington, D. C., replacing M/G John M. Loh.

M/G Jerry D. Holmes, from C/S, 4ATAF, Heidelberg, Germany, to Cmdr., NATO Airborne Early Warning Force, SHAPE, Mons, Belgium . . . **B/G Lawrence E. Huggins,** from Cmdr., 316th AD, and Cmdr., Kaiserslautern Mil. Community, Hq. USAFE, Ramstein AB, Germany, to Ass't C/S, Ops., Allied Forces Central Europe, Brunssum, the Netherlands, replacing M/G Thomas R. Olsen . . . **M/G (L/G selectee) Hansford T. Johnson,** from Vice CINC, Hq. PACAF, Hickam AFB, Hawaii, to Dep. CINC, Hq. USCENTCOM, MacDill AFB, Fla. . . . **B/G Vernon J. Kondra,** from Dep. Dir., Ops., NMCC, J-3, OJCS, Washington, D. C., to Cmdr., 834th ALD, MAC, and DCS/Airlift, Hq. PACAF, Hickam AFB, Hawaii, replacing B/G James J. LeCleir . . . **M/G Thomas R. Olsen,** from Ass't C/S, Ops., Allied Forces Central Europe, Brunssum, the Netherlands, to C/S, 4ATAF, Heidelberg, Germany, replacing M/G Jerry D. Holmes . . . **B/G William J. Porter,** from Cmdr., USAF Recruiting Service, and DCS/Recruiting, Hq. ATC, Randolph AFB, Tex., to Dir., J-8, Hq. US Special Ops. Command, MacDill AFB, Fla.

M/G Cecil W. Powell, from Dep. Cmdr. for RD&A, Armament Div., AFSC, Eglin AFB, Fla., to Cmdr., Hq. AFOTEC, Kirtland AFB, N. M., replacing M/G Michael D. Hall . . . **B/G Donald A. Rigg,** from Dir., Aerospace Safety, Hq. AFISC, Norton AFB, Calif., to Dep. IG, Hq. USAF, Washington, D. C., replacing B/G (M/G selectee) Larry D. Fortner . . . **B/G Joseph K. Stapleton,** from Dep. Dir., Ops., Hq. USREDCOM, MacDill AFB, Fla., to Dir., Aerospace Safety, Hq. AFISC, Norton AFB, Calif., replacing B/G Donald A. Rigg . . . **Col. (B/G selectee) William A. Studer,** from Cmdr., 81st TFW, USAFE, RAF Bentwaters, UK, to Cmdr., 316th AD, and Cmdr., Kaiserslautern Mil. Community, Hq. USAFE, Ramstein AB, Germany, replacing B/G Lawrence E. Huggins. ■

will do the development and installation work. The modification work, to be done at the Douglas plant at Long Beach, Calif., includes additional wiring to the flight engineer's station and the aerial refueling operator's (ARO) station plus installation of a new closed-circuit TV camera and viewing screen in the ARO station. Local structural work will have to be done in the wings so the pods can be attached, and new plumbing from the wing tanks to the pods will be added.

The new system will be installed first on the sixtieth KC-10, which is the last aircraft on order for the Air Force. The fifty-nine other KC-10s in the fleet are scheduled to be modified to accept the pods, and the Air Force plans to purchase thirty-nine other shipsets of the refueling equipment. Total estimated cost of the program is $83 million.

McDonnell Douglas will conduct the necessary testing and initial qualifications with receiver aircraft. The company will also train Air Force personnel for additional receiver qualification testing.

★ **NEWS NOTES**—Astronaut **Sally Ride,** America's first woman in space, announced in late May she **will leave the space program** in August. She will leave NASA to accept a two-year fellowship at Stanford University's Center for International Security and Arms Control. She holds a doctorate in astrophysics from Stanford. Dr. Ride flew on two Shuttle missions, STS-7 in 1983 and Mission 41-G in 1984, both of which were on board the Shuttle *Challenger.* She served on the Rogers Commission that investigated the *Challenger* disaster and is currently interim head of NASA's Office of Exploration. Dr. Ride is the tenth astronaut to leave the space program since the *Challenger* explosion in January 1986.

After several years of marketing the idea, **Lockheed has sold the first** airborne early warning and control **(AEW&C) variant of its P-3 Orion** patrol plane. The first plane will be delivered to the US Customs Service in 1988 at its base in Corpus Christi, Tex., for use in patrolling the Caribbean to detect and track drug smugglers. The $19.7 million contract, which is subject to approval by Congress, covers the purchase and modification of one P-3B with an option for three more aircraft. The APS-125 radar, housed in a twenty-four-foot diameter rotodome on the fuselage spine, will be government-furnished equipment.

In an effort to save man-hours and paperwork for base orderly rooms

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For further information, contact Wesley R. Stout, Director, Technical Services, Grumman Data Systems, 1000 Woodbury Road, Woodbury, NY 11797. (516) 682-8500.

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and consolidated base personnel offices, **Air Force Form 2095,** which for many years has been used to report changes in job title, supervisory changes, and other significant personnel actions, **is being retired.** Many of the actions reported on the Form 2095 will now be accomplished by telephone, while other actions will be incorporated into AF Form 2096, which is used for classification and on-the-job-training actions.

AEROSPACE WORLD

Air Force Col. Guion Bluford (right), a Penn State alumnus and America's first black astronaut, spoke at the school's May commencement exercises, during which Edgar Tucker (left), a mechanical engineering major, graduated. Now-Lieutenant Tucker was designated by Hq. Air Force ROTC as the nation's outstanding ROTC cadet for 1987.

The **Army Mutual Aid Society,** which for 108 years has served as a nonprofit organization dedicated to helping military members and their families understand and receive the government benefits they are entitled to, **changed its name to the Army and Air Force Mutual Aid Society** on June 1. The name change reflects the organization's broadened mission to help Air Force families. Both Army Chief of Staff Gen. John A. Wickham, Jr., and his Air Force counterpart, Gen. Larry D. Welch, took part in the name change ceremony.

A **new publication** called *Airpower Journal* is replacing the forty-year-old *Air University Review.* The new name, AU says, was chosen to emphasize that the publication is intended for the entire Air Force community. The old name apparently led many people to believe the *Review* was for Air University students. The reoriented journal, according to AU, "will concentrate on issues related directly to the operational level of war."

On May 27, Morton Thiokol successfully conducted **the first full-scale firing test of the Space Shuttle Solid Rocket Booster** (SRB) since the *Challenger* accident. Although the test booster did not have the redesigned field joints that were a mandated fix in the Rogers Commission findings, the booster did feature wraparound electrical joint heaters and external graphite reinforcing bands. No leaks were detected in the 120-second test at the company's Brigham City, Utah, facility. A second full-scale SRB test, with the redesigned field joints installed, is scheduled for late August.

★ **DIED—Dudley C. Sharp,** Secretary of the Air Force during the last years of the Eisenhower Administration, on May 17 at a hospital in Houston, Tex. He was eighty-two. A Houston native and resident, Mr. Sharp came to Washington in 1955 as the Air Force's Assistant Secretary for Materiel. After a brief stint in private business, he was named Secretary of the Air Force in December 1959. He served as Secretary until the Kennedy Administration took office in 1961. A 1927 Princeton graduate, Mr. Sharp served in the Navy during World War II. He served as vice president and later president of Mission Manufacturing Co., a family business that manufactured oil and gas drilling equipment. He retired in 1976. ■

INDEX TO ADVERTISERS

A nuclear drawdown in Europe would magnify the Warsaw Pact's huge advantage in tank armies and tactical airpower.

Why NATO Needs a Conventional

BY JOHN T. CORRELL, EDITOR IN CHIEF

For the past decade, no speech about NATO by a Western politician has been complete without a fervent appeal for nuclear arms control. There was great consternation in the 1970s when the Soviet Union targeted Europe with the new nuclear threat of its mobile SS-20 missiles. And in 1983, protesters took to the streets when the US, on behalf of the Alliance, started deploying intermediate-range missiles in response to the SS-20s.

NATO's other problem—its limited ability to mount a conventional defense of Europe—simmered in the background while most Americans and Europeans worried exclusively about nuclear weapons.

Now, however, NATO's undersupported conventional forces may get more attention for the most ironic of reasons. To the surprise of almost everybody, the United States and the Soviet Union have begun to talk seriously about removing entire categories of nuclear weapons from Europe.

The total denuclearization of Europe is not in prospect, but the "Double Zero" arms-control option would remove two complete categories of nuclear missiles, banning all those with ranges of between 300 and 3,000 miles. Both sides would still have nuclear weapons in the theater that they could deliver by aircraft, artillery, or missiles with "battlefield" range. When the NATO defense ministers met in May at Stavanger, Norway, the West Germans opposed the Double Zero option. They felt that it would leave their country, which has a long common border with the Warsaw Pact, uniquely exposed. Germany held out for a couple of weeks against political pressures from within and without and then agreed to go along with the Double Zero proposal.

Any nuclear drawdown would alter the balance of power in Europe to some extent. A growing number of Westerners believes that the superiority of the Warsaw Pact in conventional firepower would then become even more of an advantage than it is already. If so, NATO will have to find time to attend to one of its oldest problems at the same time it adjusts to the fast-developing opportunities for arms control.

"Disarray" Is Not New

The Stavanger conference was scarcely ended before press accounts were reporting NATO "in disarray" on arms-control policy. That phraseology had a familiar ring. According to a study done by a former US permanent representative to NATO, the Alliance has been declared "in disarray" for one reason or another on the average of once every fourteen months since its founding in 1949.

NATO will probably weather its current disarray, too, but 1987 may be remembered as one of the shakier years in its history. An extraordinary number of problems and concerns—some old, some new—have converged on the allied nations more or less simultaneously.

In addition to the turbulence on arms control, there are frictions within NATO about trade protectionism, continuing accusations that some allies are not paying their "fair share" of defense costs, and periodic calls to pull 100,000 or more US troops out of Europe. America's Strategic Defense Initia-

Defense

LEFT: F-16s of five NATO nations—the Netherlands, the US, Belgium, Denmark, and Norway—fly in formation over Belgium. ABOVE: The Pact has 32,000 main battle tanks in place in Europe. Many are late models, such as the T-72 shown here, and the new Soviet T-80.

tive, which promises security from ballistic missiles, has stirred fears that the US might "decouple" its own defense—and especially the extended protection of its strategic nuclear arsenal—from the defense of Europe. The allies complain that the US is eager to sell military goods to them, but is reluctant to buy anything of consequence in return. Nearly everyone admits that billions are wasted by duplication of effort in military R&D.

Anti-Americanism has been gathering steam in Europe for some time, and substantial numbers of Europeans profess to see little moral difference between the Soviet Union and the United States. The US is faulted for arrogance, recklessness in foreign affairs, and failure to consult fully with its allies before it acts. Opinion polls find a weakening of support for NATO. On the other hand, British voters stuck with Prime Minister Margaret Thatcher and the Conservative Party in the June elections, and the radicals in West Germany have not yet managed to unhorse Helmut Kohl and his center-right coalition. Thatcher and Kohl have stood staunchly with the United States on NATO military policy.

The United States has always been the dominant partner in NATO, partly because it is the strongest of the allies and partly because testiness between the European nations would deny the leadership role to any of them. Americans realize that a certain amount of the resentment that Europeans express, often caustically, goes along with such a relationship, but they are stung by it nevertheless.

Most Europeans disapproved of the 1986 US action against Libya. Their disapproval angered a good many Americans who figured the Europeans should have been helping instead of sniping from the sidelines. Europe's inclination to deal itself out of responsibility for defending Western interests around the world is a further cause of irritation.

The Europeans, chafed by Reagan Administration lectures on the evils of buying natural gas from the Russians and on the need for standing tough against terrorist states, took a dim view of the subsidized sale of US wheat to the Soviet Union and of America's covert arms sale to Iran. The Iran-Contra affair has also undercut the prestige of the United States in the eyes of the allies just when NATO is most in need of US leadership.

The most frequent source of tension, though, is disagreement about the size, upkeep, and relative responsibility for NATO's conventional force. The allies have been wrestling with this one for a while.

Holes in Flexible Response

In 1967, concerned that it had grown too reliant on nuclear weapons, NATO adopted a new strategy called "Flexible Response." In theory, Flexible Response should enable the Alliance to defend itself by conventional means, at least in the early stages of an attack on NATO. The next option, to be taken only after the most careful deliberation, is escalation to theater nuclear weapons. The ultimate backup is the strategic nuclear force of the United States, which is pledged to the defense of NATO.

For a variety of reasons, the allied nations have never fielded the army divisions, tactical fighter squadrons, or combat sustainability that a true Flexible Response strategy would require. NATO continues to rely almost as heavily as ever on nuclear weapons, which are supposed to be the fallback element in the strategy.

This is the cheaper approach, although it keeps the nuclear threshold dangerously low. The Soviet Union and the Warsaw Pact, in the meantime, have built up their own conventional forces to unprecedented levels.

The Pact has enough spare parts and supplies deployed forward in Central Europe to sustain combat for sixty to ninety days. By contrast, some of the NATO nations have only a few days' worth of critical supplies. The highly developed Soviet capability to wage chemical warfare would force NATO troops into protective suits, the best of which reduce their efficiency by thirty percent. NATO's obsolescing chemical weapons impose no similar burden on the enemy.

One of the clearest voices of warning has been that of Gen. Bernard W. Rogers, who retired in June after eight years as Commander in Chief of US European Command and Supreme Allied Commander in Europe. He says that the readiness and sustainability of US forces in Europe are better now than at any time since NATO was formed thirty-eight years ago—but that even so, the allied conventional forces would not be able to hold out for long against the Pact's tank armies, operational maneuver groups, and fighter-bombers.

Escalation or Capitulation

"If attacked conventionally today, NATO would face fairly quickly the decision to escalate to a nuclear response in order to try to cause the aggressor to halt its advance," General Rogers told the Senate Armed Services Committee in March. "We are in such a posture for several reasons, but primarily it results from NATO's inability to sustain its forces adequately with trained manpower, ammunition, and war reserve materiel."

General Rogers does not believe that NATO's military situation is beyond repair. "By improving our conventional forces, we would move away from a posture in which capitulation might be viewed as the most credible choice facing NATO," he told the Senate.

Nor does he think the Soviet Union will launch a direct attack on the West. The Soviet objective in Europe, he says, is to "have the fruits of victory without the pain of war."

His fear is "that the day will arrive when the military situation for our defensive alliance is beyond all restoration. We will know it, and the Soviets and the Warsaw Pact will know it. With the backdrop of that massive conventional force they have in the East, a force that threatens the taking and holding of territory, we'll find ourselves being subject to intimidation, coercion,

The Imbalance in Airpower

Force comparisons are never easy. As the arms-control process demonstrates regularly, the decision about what to count is inherently subjective when the contending forces are not identical. Estimates of the NATO-Warsaw Pact military balance often seem to contradict each other unless one is careful to check the assumptions and footnotes.

In his annual report to Congress last January, for example, US Secretary of Defense Caspar W. Weinberger said that the Pact outnumbers NATO by two to one in tanks and combat aircraft and by three to one in artillery, combat helicopters, and surface-to-air missiles. When both quality and quantity are considered, he said, the Pact's advantage in ground combat power is 2.3 to one, and in tactical airpower, 1.7 to one. It is easy to overlook his short qualifier, "within the NATO guidelines area," which means that these ratios depict only those forces facing each other in the central European zone—the two Germanies, Poland, Czechoslovakia, and the Benelux nations.

The airpower comparison in the chart above is based on the most detailed breakout the Pentagon has published, but even this is fuzzy around the edges. For example, it leaves out several air armies that are controlled by the Soviet Supreme High Command, but which would be available for combat in a European war. It does not count 900 French and Spanish aircraft, since those nations do not participate in the integrated NATO military structure. It also excludes Soviet strategic interceptors, 4,000 Soviet trainer aircraft that would be available, and Soviet transport helicopters that can be configured for attack roles.

The Military Balance 1986–87, published by the International Institute for Strategic Studies, computes the balance at 5,299 combat aircraft for the Pact and 3,243 for NATO (helicopters not included). It concludes that the Pact has an advantage in every category of theater airpower, with the margin widest in interceptors and fighters.

Both NATO and the Warsaw Pact have improved the quality of their air forces. The US is further along with its modernization program than its allies are. Today, forty-five percent of USAF's tactical combat fleet is new generation aircraft, and fifty-five percent is current generation. The allies field twenty-five percent new generation, sixty-five percent current generation, and ten percent older aircraft. By the end of the decade, new generation aircraft will be a sizable part of the allied inventory, with few older model aircraft in service except in the Southern Region countries.

USAF squadrons in Europe are achieving remarkable readiness rates with their F-15s and F-16s. The Panavia Tornado is in service with the British, the Germans, and the Italians. Canada and Spain are converting to variants of the F/A-18 Hornet. Five NATO nations—the US, Belgium, Denmark, Norway, and the Netherlands—fly F-16s. Greece and Turkey are acquiring F-16s. The NATO E-3 AWACS, operating with international crews, has added considerably to the Alliance's battle management.

On the other side, the Soviet Su-24 Fencer is a first-rate interdiction aircraft and can strike deep. The Su-27 Flanker has been compared to the US F-15 and would provide long-range escort. The shorter-range MiG-29 Fulcrum is replacing the Flogger series of air-superiority fighters. For the past ten years, the Soviet tactical air forces have emphasized ground attack in their modernization plans.

	NATO		Warsaw Pact	
	In Place	Reinforced	In Place	Reinforced
Fighter-bomber/Ground attack	2,100	3,450	2,550	2,600
Fighter-interceptor	900	1,170	2,700	2,800
Reconnaissance	260	430	650	690
Bomber	75	75	410	460
Attack helicopters	650	1,250	960	970

Source: *Soviet Military Power 1987*

blackmail, and accommodation with the East."

The situation is all the more distressing in view of the major improvements made in NATO conventional forces, the US components in particular. Maj. Gen. Thomas L. Craig, USAF Director of Plans Policy for US European Command, ticks off a list of gains achieved by USEUCOM between 1981 and 1986. Virtually every major land and air combat system in the theater has been modernized. Reserve stocks of Army munitions are up twenty percent. Spare parts to support fighter sorties have increased by eighty-three percent. The backlog of Army maintenance and repair is down by half. Stocks of "selected" modern air-to-air missiles increased by sixty-eight percent. Air Force in-flight refueling capacity is up by eighty-four percent. Strategic airlifters can deliver fifty percent more tonnage than before.

Deficiencies All Over

Despite this, NATO remains deficient in troop numbers, equipment, munitions, support structure, and more.

The US is short 100,000 troops in Europe for meeting its M-Day commitments. The Army support structure could not handle the arriving augmentation forces, so many of the mobilized units would stay at home awaiting support. The Air Force is better off, General Rogers says, but minimum essential facilities are available for only twenty percent of the deploying aircraft that plan to work out of collocated operating bases.

"Mobilizable forces vary considerably in levels of training, equipment, manning, and availability," General Rogers told the Senate. "Many, including some US forces, are inadequate for their tasks."

NATO, he continued, lacks adequate numbers of suitable aircraft and the modern munitions with which to arm them. Standing Army forces are insufficient in numbers and must depend on timely reinforcement. This limits their ability to defeat the Soviet lead echelons and prevent a breakthrough of the forward lines.

Stocks of the following items are below a five-day supply or at less than thirty percent of the level re-

The Transatlantic Link

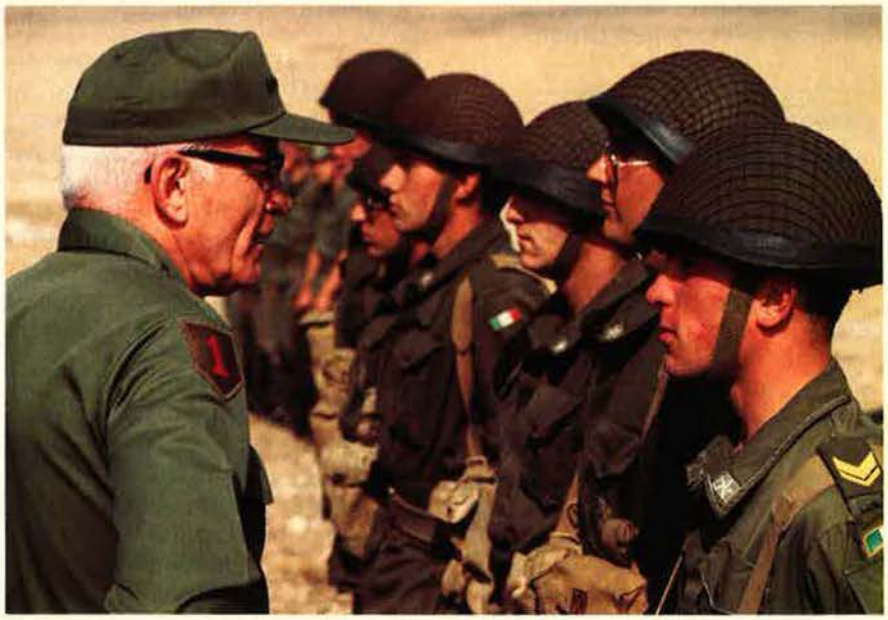
The primary US national interests are peace, freedom, and prosperity for ourselves and our friends around the world. The continued freedom of Western Europe from Warsaw Pact/Soviet aggression and intimidation/coercion is crucial to these interests. Currently, US defense policy places the defense of Western Europe as second only to the defense of North America itself. This is appropriate because the defense of North America begins not on the beaches of the Eastern seaboard, but at the . . . border [between the two Germanies]. Any other approach only makes it more likely that we will someday have to defend those beaches.

Our European allies are of strategic importance because *without* them the global balance of power would shift alarmingly in favor of the Soviet Union. Our NATO allies are strong and capable militarily, more so than the allies of the Soviet Union, and they contribute significantly to the global military balance so vital to American security. Control over Western Europe would take the Soviets a giant step along the path toward their goals of isolating the United States and eventually dominating the world.

In addition to the strategic importance of our NATO allies, we cannot forget the economic importance of Western Europe to our continued prosperity. Trade with our NATO partners in 1985 constituted more than twenty percent of the total US foreign commerce, totaling more than $120 billion, almost twice the amount traded with the Orient.

In addition, two-way investment between the US and Western Europe exceeds $830 billion, approximately forty percent of the US total. Europe has become even more important to our well-being in the past forty years as our economies have become increasingly interdependent. The combined economic power of the NATO nations is more than double that of the Warsaw Pact. If Europe were brought into the Soviet orbit, the balance would shift to the Soviets, to the great detriment of US interests. In addition to military and economic interests, there are the deep-seated political and cultural ties we have with our NATO partners. To allow the neutralization or domination of these democracies by the Soviet Union would call into question our commitment to freedom around the world and would isolate the US from potential friends and allies everywhere. As we examine US objectives, strategy, and forces, we must remember that our commitments as a member of NATO contribute directly and centrally to our own vital national interests. We are not in Europe solely because of an altruistic concern for their security; we are there because of a pragmatic concern for our own welfare as well as theirs.

—Gen. Bernard W. Rogers, SACEUR, in testimony to the Senate Armed Services Committee March 25, 1987.



Gen. Bernard W. Rogers says that NATO's readiness and sustainability are better now than at any time in the past—but that the Alliance would be confronted quickly with a decision on use of nuclear weapons in the event of attack. Manpower, ammunition, and war reserve materiel are too short to hold out for long otherwise.

—IDI/Mi Seitelman

"Fair share" contributions to allied defense include more than money. Germany, for example, hosts 400,000 foreign troops on its soil. Five thousand exercises and maneuvers are held there each year, causing considerable damage to land and surroundings. Some 580,000 sorties—many at low level—are flown in German airspace annually. Most allied nations also pay a political price to maintain a military draft.

quired to counter specific threats: modern artillery munitions, five-ton trucks, drive-train components for wheeled vehicles and tanks, air-to-air missiles, air-to-ship missiles, antiradiation missiles for attack of enemy radars, and antirunway munitions. The allies generally have less sustainability than does the US.

It sounds grim, but NATO isn't done for just yet. Events of the next few years will play out in the complicated crossing of strategies, requirements, political machinations, and perceptions of what claim defense should have on the economic resources of the allied nations.

Sticking With the Strategy

The Warsaw Pact, too, would have some disadvantages in a European war. Strategists from Clausewitz on have contended that it requires greater military strength to attack than to defend. And above all else, NATO is committed to the defense.

The reliability of Soviet allies is open to question. The Russians have had to use the threat—and sometimes the exercise—of military force to keep their East European empire in line. The allegiance to the Soviet Union of some Warsaw Pact nations is weaker than that of others, and the Soviets cannot be certain they would fight with total determination.

Soviet doctrine is inflexible and tied to centralized command and control. The Soviets made this same strategy work in previous wars, but they often took horrendous casualties because of their rigid stubbornness. Their dependence on an unbroken chain of command is a vulnerability that NATO might exploit.

Although NATO's lead in technology has narrowed, it is still ahead, and with improved defense funding its chances for stretching that lead out again are excellent. The quality of NATO military manpower is also judged to be better than that in Soviet and Warsaw Pact units.

Much depends on how long the Pact would take to prepare for an attack. Gen. Charles L. Donnelly, then Commander in Chief of US Air Forces in Europe, told an Air Force Association audience earlier this year that if the Soviets give NATO time to bring in its full complement of reinforcements, "we're going to crack 'em good." *(See "Thirty-Seven Wings of the Best," April '87 issue.)*

NATO plans to stick with its Flexible Response strategy, including the controversial option for first use of nuclear weapons. Former US Secretary of Defense Robert S. McNamara is one of many worried Westerners who argue that NATO should renounce the use of nuclear weapons unless the enemy uses them first. (McNamara, like most others offering alternative strategies, assumes a corresponding buildup of NATO's conventional forces.)

General Rogers has insisted that the first-use option is a key element in NATO's ability to deter an attack and that the West must never allow the Soviet Union to suspect that war without the potential use of nuclear weapons might be possible. However much the Soviets doubt that NATO would invoke the first-use option, they could never be sure.

"In essence," General Rogers says, "a no-first-use doctrine would make it appear that NATO would rather accept a conventional defeat than resort to nuclear weapons. . . . The answer to preventing nuclear war is not a no-first-use declaration. We cannot create an artificial firebreak between conventional and nuclear war where a natural one does not exist. . . . The only durable and meaningful firebreak is the one between peace and any kind of war."

Radical Strategies

The conventional-arms portion of NATO strategy is under challenge as well, especially that aspect of it that calls for a forward defense. Thirty percent of the West German population and industry is situated within 100 kilometers of the Warsaw Pact border. The Germans, understandably, insist that this area be defended.

Critics say that this strategy is un-

realistic and that a determined attack will punch through the line. They call, variously, for defense in depth, fortifications, or some sort of maneuver strategy. *(See Trevor N. Dupuy's "Strategy for Victory or Defeat?" April '83 issue.)*

There is no chance that NATO will abandon the forward defense, because the Germans would never stand for that. From a military perspective, General Rogers has said that he sees no point in conceding territory that will have to be retaken later. "Despite what many have been led to believe, we do not envisage deploying our forces in a thin defensive line along the border markers," he says. "Rather, commanders are expected to deploy their forces on the best defensible terrain near the border and to place covering forces between their defensive position and the border."

The most radical of the alternative strategies, appealing mostly to the pacifist-left in Europe, is the "defensive defense." It would do away with "offensive" forces and put large numbers of civilian reservists armed with antitank and air defense weapons in the path of the invaders. This approach has been ridiculed as the "defenseless defense." It might annoy the Russians or perhaps slow them down, but it would not stop them.

General Rogers observes that this strategy does not hold Warsaw Pact territory at risk in the event of attack. There would be no weapons that could reach their territory. "Further," he says, "the last thing we want to do is have our reinforcements have to fight their way ashore or into the nations they're supposed to reinforce."

Yet another group of alternative strategists wants NATO to be more aggressive. Their idea is "offensive retaliation," which would throw a conventional ground counterattack against Eastern Europe. General Rogers says that retaliatory invasion is not politically acceptable to some of the allies—and that NATO does not have enough conventional forces to hold its general position, defend its rear areas, and strike on the ground at the enemy second echelon all at the same time. If it did, he says, "defense and deterrence would be assured without the need to endorse a politically and operationally risky course."

This does not mean that NATO would not go after the enemy's second and third echelons with tactical airpower and long-shooting ground weapons. It would strike in both of these ways as part of the Follow-On Forces Attack (FOFA) concept, which the Alliance adopted in 1984.

NATO's first battle priority would be to block the enemy's initial air and ground attack. This includes disrupting the lead echelons of mechanized forces and destroying them if possible. Penetrating aircraft would pound Pact airfields and command and control centers. The forthcoming capability to operate at night and in bad weather will enable fighter and attack aircrews to find the Soviet lead echelons at any hour and to hit force concentrations or complicate their movement and supply.

Soviet follow-on forces are the second priority. Special operations forces, along with fighter squadrons, would try to prevent enemy reinforcements from reaching the battlefront. The objective of FOFA is to reduce to manageable proportions the attacking elements against which NATO must defend at its forward positions.

FOFA does not replace the nuclear option, but it does reduce NATO's early reliance on it. General Rogers has an answer for those who ask what conventional force is required to carry out allied strategy. Enough, he says, to "be perceived by the Soviet Union as having a reasonable prospect of frustrating a conventional attack by the Warsaw Pact. . . . The minimum required is [that] sufficient to ensure that when and if the time comes, political authorities do not have to react in panic with respect to the use of nuclear weapons, but can make a very determined and deliberate decision. And secondly, sufficient conventional forces [are required] to ensure that our nuclear assets are there when the time comes that we have to use them."

What's a Fair Share?

Burden sharing—the question of who's paying a "fair share" of the cost and who isn't—has become such a contentious issue that the Secretary of Defense is required by law to give Congress an accounting each year. The 1987 "Report on Allied Contributions to the Common Defense" is chock-full of tables and data and, among other things, demonstrates how difficult it is to establish what a nation's "fair share" actually is.

No single criterion is adequate, but on balance, the Defense Department and senior US military spokesmen say that the NATO allies contribute more than they usually get credit for. Prior to mobilization, Europe provides ninety percent of NATO's land forces and seventy-five percent of the air and naval forces. After mobilization, the Europeans still supply seventy-five percent of the land forces, fifty percent of the air forces, and thirty percent of the naval forces.

The most popular index of a "fair share" is the percentage of Gross Domestic Product (GDP) a nation allocates to defense. In 1985, the most recent year for which the Secretary's report had data, Greece led the NATO list with defense expenditures equal to 7.1 percent of its GDP. The US was second with 6.9 percent, followed by the UK (5.2), Turkey, (4.5), and France, (4.1). All others—including Germany—allocated 3.3 percent or less.

The Germans would appear as slackers by that measure alone, but as the report says, GDP doesn't tell the whole story. Germany, a nation geographically about the size of Oregon, hosts 400,000 foreign troops. Five thousand military exercises and maneuvers are conducted there each year, with damages to land and the surroundings amounting to about $100 million. Some 580,000 sorties a year—100,000 of them at low level—are flown in German airspace. The Germans register civil assets, such as trucks, that would be used for military purposes in an emergency, and Germany has 93,000 reservists standing by to provide logistics support for US forces in wartime.

Only four NATO nations—the US, the UK, Canada, and Luxembourg—rely on volunteer forces. The others pay a political price to maintain a military draft, and their conscripted manpower generally costs less than volunteers do.

The allied nations field about the same active-duty military manpower levels as a percentage of their populations as the US does—and their contributions of division-equivalent firepower and tactical airpower in relation to their economic strengths exceed those of the United States. Furthermore, there are more than 900 US installations in Europe provided by host nations that get no return in the form of taxes or rent. The value of such real estate in Germany and Britain exceeds $20 billion.

—Photo by Gerard Beerens

NATO continues to upgrade the quality of its tactical airpower. The Panavia Tornado is deployed in several variants, including the German Navy version shown here. US squadrons are achieving remarkable readiness rates with their F-15s and F-16s. Today, the allies field twenty-five percent new-generation aircraft and sixty-five percent current generation. The mix will improve even more in the decade ahead.

The Next Steps

In 1982, General Rogers told the NATO nations that they could have a good conventional capability by the end of the decade if they increased their defense budgets by an average of four percent. The allies soon concluded that such a program of growth was beyond their means. The prevailing trend is toward cutting defense budgets rather than raising them.

There are signs of promise, however, in the Conventional Defense Improvements (CDI) plan approved by NATO defense ministers in 1985. "The main focus of the CDI effort is on specific critical munitions that are identified, item by item, for each nation," Richard N. Perle, then Assistant Secretary of Defense for International Security Policy, said in March. "Among the objectives for all of these items for non-US NATO nations, roughly one-half will be fully implemented or virtually fully implemented within the current five-year planning period."

Another CDI objective is to increase cooperation in armaments. NATO spends more on defense than the Warsaw Pact does (although the USSR outspends the US by a considerable margin), but loses much of the benefit by wasteful duplication. The US is already working on a number of programs in partnership with allies, and the allies are working with each other on multinational developments. For example, Germany, Italy, Spain, and the United Kingdom have joined together to field a European Fighter Aircraft for the 1990s.

Congress voted $125 million in FY '86 and $190 million in FY '87 as venture capital for cooperative R&D. But legislators are ever watchful for international deals that might take business away from their districts. Some congressmen complained that the award of $9 billion in military contracts to foreign companies in 1986 both contributed to the trade deficit and hurt American companies that might have done the work.

In reply, Deputy Secretary of Defense William H. Taft IV pointed out that the military trade balance with industrialized NATO nations favors the US by about two to one. "The broad benefits of cooperation cannot be achieved if the United States, for domestic reasons, insists on defining cooperation as *buy American*," Mr. Taft said.

CDI technological initiatives em-

Cooperation in Arms

The US and its NATO allies are pursuing arms cooperation with unprecedented intensity. Formal agreements have been signed and developments have begun on eight projects. Funding for each is included in the budgets of the US and the allied partners. Agreement is near on still other projects.

- *Ada Project Support Environments.* Joint effort with six other nations to develop a common, NATO-wide programming support system for development and reuse of military systems software.
- *Enhanced Fighter Maneuverability.* Bilateral effort with Germany to build a technology demonstrator aircraft for advanced fighter maneuver technology. This aircraft has been designated as the X-31A.
- *Advanced Short Takeoff/Vertical Landing Systems.* Bilateral effort with the UK for STOL engine and vectored-thrust engine enhancements.
- *155-mm Autonomous Precision Guided Munition.* Joint effort with eight other nations to develop an artillery-delivered "smart" munition.
- *Standoff Airborne Radar Demonstrator System.* Interoperability effort with the UK and France to link the US Joint STARS ground station with airborne radars of the UK and France.
- *Advanced Sea Mine.* Bilateral effort with the UK to develop a bottom-sitting (Continental Shelf) mine for use against both submarine and surface ship targets.
- *Modular Standoff Weapon.* Joint development with six other nations to develop an air-delivered "smart" standoff weapon for use primarily against ground targets.
- *Multifunctional Information Distribution System (MIDS).* Joint effort with four other nations to develop a low-volume "downsized" Joint Tactical Information Distribution System (JTIDS) terminal for use in such smaller aircraft as the F-16 and European Fighter Aircraft.

phasize the "capability to both see and strike deep . . . regardless of weather or lighting conditions," says Donald N. Fredericksen, Deputy Under Secretary of Defense for Tactical Warfare Programs. Leading requirements include "low-observable technology, smart munitions for top attack of armored vehicles, new all-weather real-time target acquisition, and microprocessing for improved data handling," he says. Mr. Fredericksen identifies five major US programs in this category: the Joint Surveillance Target Attack Radar System (Joint STARS), the Army's Multiple Launch Rocket System (MLRS), the Army Tactical Missile System (TACMS), the Joint Tactical Cruise Missile System (JTACMS), and the Tacit Rainbow loitering drone for engaging enemy radar emitters.

The Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system, now in production, will provide unprecedented capabilities for air operations in darkness and bad weather. And the Mark XV Combat Identification System, a joint-service US development in cooperation with the allies, will soon begin relieving the problem of cumbersome and often ineffective procedures for distinguishing friends from foes.

Among the steps to improve coordination is the NATO decision to adopt JP-8 as the standard aviation fuel for ground-based aircraft in Europe. Conversion from JP-4 is in progress.

Nunn's Prescription

NATO has few supporters as supportive or critics as tough as Sen. Sam Nunn (D-Ga.), Chairman of the Senate Armed Services Committee. In 1984, he sponsored a legislative amendment—subsequently defeated—that would have pulled large numbers of US troops out of Europe unless the allies began spending more on combat sustainability. (Europeans refer to that one as the "bad" Nunn Amendment. A different Nunn Amendment in 1985 earmarked $200 million for NATO cooperative R&D.)

"America should not plan and pay for a robust conventional defense when our allies are planning and paying for a tripwire strategy," Senator Nunn says. He is encouraged by NATO's improvement efforts since 1984, but is far from satisfied with the Alliance's present conventional posture. NATO's nuclear-conventional dilemma is profound, he says, but not new: "We have depended on nuclear weapons to basically deter not only nuclear war but also to deter conventional war since the end of World War II."

Senator Nunn accuses Western politicians of mincing their words about the realities of allied defense. "Why should our citizens be conscious of conventional deficiencies when our political leaders and the news media spend ninety-five percent of their time talking about nuclear weapons?" he asks. "Why should our citizens believe there is a link between nuclear weapons and conventional weakness when NATO has not made bold arms-control proposals [that] require meaningful reduction in Soviet conventional power? And why should our citizens not be increasingly attracted to the Soviets' call for no first use of nuclear weapons when they have not been clearly told that the West's first-use threat prevents the Soviets from massing their overwhelming tank forces in a threatening and destabilizing fashion?"

His prescription calls for explaining these things clearly to the public and addressing the problems he describes as "automatic escalators" and "structural disarmament."

Automatic escalators are short-

Bringing Home the Troops

The threat that some sizable contingent of US troops—100,000 is the number mentioned most often—might be withdrawn from Europe has loomed as a possibility for the past several years. Some calls for withdrawal have been based on the perception that the US was carrying an excessive share of the NATO cost load already, but other proposals have been for different reasons.

Former Secretary of State Henry Kissinger and former National Security Advisor Zbigniew Brzezinski, for example, say that US troop strength in Europe should be drawn down to create a force held in reserve for crises elsewhere in the world. The Pentagon would like the allies to help more with the global defense of Western interests, and it certainly needs resources for worldwide contingency, but defense leaders are dug in hard against troop withdrawals from Europe.

The Defense Department claims that its present troop strength of 326,000 in Europe is insufficient for the US to meet all of its obligations there and has been seeking relief from congressionally imposed manpower ceilings for years. The economics of troop withdrawal are wrong, too.

One-time cost of transporting 100,000 troops home and rebasing them in the US would be $5 billion, according to official estimates. Procurement of airlift for their rapid deployment in case of crisis or war would be another $40 billion, with recurring annual operating and support costs of $3.5 billion.

Sen. Sam Nunn, shown here in the cockpit of an F-16 fighter, wants NATO to pursue revolutionary technologies to make Soviet tank armies, as they are presently constituted, obsolete. This will be possible, he says, with a concentrated effort.

A Split of Opinions

A public opinion poll of Britons, Germans, Italians, and French reported earlier this year illustrates Senator Nunn's point that citizens do not understand the relationship of nuclear weapons, conventional forces, and defense costs.

A majority of the Britons and Germans polled disapproved of US nuclear weapons on their soil. In fact—in contrast to previous indications of opinion—many Europeans disapprove of an American military presence on their soil, period. Only in Germany did the poll find a majority in favor of a continued US participation in NATO. The British (forty-nine percent to forty-one percent), French (fifty-five to twenty-six), and Italians (sixty-nine to nineteen) preferred some sort of Europeans-only arrangement. Of those who wanted Europe to go it alone, many (ranging from twenty-five percent of the French to seventy percent of the Italians) thought defense should be accomplished by nonnuclear means.

Apparently unaware of the military and economic consequences of their attitudes, most Germans and Italians wanted to cut their defense budgets as well. The British and French publics were inclined to hold their defense spending at about the present levels.

Meanwhile, a Gallup poll conducted for the Chicago Council on Foreign Relations and published in March 1987 was finding the American public rather favorably disposed toward the defense of Europe. Of those surveyed, sixty-four percent said the US should play a more active role in the world, seventy percent were for holding the line on or increasing support to NATO, and sixty-eight percent said the US should use its troops if the Soviet Union invaded Western Europe. (Only fifty-three percent favored defense of Japan, although seventy-eight percent agreed that the US has vital interests there.) At the same time, seventy-eight percent of those polled said that the top US foreign policy goal should be protection of American jobs.

comings in the conventional force that would predestine NATO to early use of nuclear weapons to meet an attack. One such automatic escalator is the ammunition supply. "The European allies give out of ammunition in Europe about the time our forces—that we pay for over here—arrive on the shores of Europe," Senator Nunn says. "When the European allies give out of ammunition, the conventional side of the war is over." He intended his 1984 amendment, he says, to send a strong message that "unless the allies agreed to eliminate these critical deficiencies, NATO's Flexible Response strategy was neither viable nor credible."

By "structural disarmament" Senator Nunn means the overlaps and inefficiencies that keep NATO from getting all the weapons it should from its defense procurements. A related consequence is that while the Warsaw Pact has a common range of equipment, allied forces have interoperability problems. "We all as sovereign, independent nations in NATO insist on building our own weapon system of every type," Senator Nunn says. "We have something like eleven or twelve antitank weapons being built in seven countries. Lord [Peter] Carrington [NATO Secretary General] summarized it well when he said that the only thing NATO allies have in common is the air in the tires of the jeeps. Now that's why it costs so much" and why the Western nations "get outproduced each and every year by the Warsaw Pact, a totalitarian system that supposedly doesn't have much efficiency in their overall industry."

Leapfrogging the Tank Armies

Senator Nunn wants NATO to pursue revolutionary—not gradual—technologies that might leapfrog areas of Soviet advantage. This would not only improve the conventional balance but also compel the Soviets to spend considerable time and money in countering the leap. In doing so, the Soviets would have to rechannel into defensive efforts some of the resources that might otherwise go to furthering their offensive capability. Senator Nunn, along with Sen. William S. Cohen (R-Me.), sponsored the Balanced Technology Initiative (BTI) to explore ways to increase the rate of obsolesence of the equipment, doctrine, and tactics of Soviet tank armies.

"We need to have a declared goal in our technological research to render tanks obsolete," Senator Nunn says. "This is an achievable goal in my view, but it will take an all-out, dedicated effort. If you could render tanks obsolete, you would do as much to change the balance of power in the world and you would do as much for your world peace, in my opinion, if not more than you would if you rendered missiles obsolete, because Soviet tank forces in Europe are the most destabilizing part of the overall operation."

Finally, Senator Nunn contends, the West ought to seek arms-control agreements that would remove the Warsaw Pact's capacity for a potentially decisive short-warning attack on NATO. Force reductions would have to be asymmetrical, he says, because the Pact begins so far ahead in conventional forces: "We cannot reduce equally with the Soviets. If we do, we'll end up with zero, and they'll end up with an overwhelming advantage."

The agreement he has in mind might require the Soviets to remove thirteen divisions—tanks, manpower, and artillery tubes—to every two removed by the United States. In addition, both superpowers would have to pull their divisions far enough back so that they would need equal time to redeploy to forward positions in Europe.

What's in it for the Soviets? First, Senator Nunn says, the benefits of a more stable peace. And second, an opportunity to reduce defense costs and reallocate the savings to improvement of the Soviet economy. This is consistent with what Soviet General Secretary Gorbachev has said he wants from his reform program. NATO should find out how serious he is.

As NATO ponders the other possibilities for arms control, Senator Nunn urges the West to remember that there is a connection between nuclear forces and conventional forces. He does not suggest trying to wrap conventional arms into agreements currently pending, but he does believe there should be a "supreme national interest" escape clause. Before withdrawing the final twenty or twenty-five percent of the missiles, NATO could look again at the conventional force balance and decide then how to proceed.

In his speeches, Senator Nunn recalls a particularly relevant piece of advice from Winston Churchill: "Be careful above all things not to let go of the atomic weapon until you are sure, and more than sure, the other means of preserving the peace are in your hand." ■

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Amid the sparkle and roar of the Paris Air Show, sleek fighters jockey for prestige and markets.

The Global View From Paris

The General Dynamics F-16C was a star performer at this year's Paris Air Show, which featured modern fighters and other aircraft showing their stuff.

BY JAMES W. CANAN
SENIOR EDITOR

THE General Dynamics F-16C leaped from the runway, climbed straight up, looped, did a vertical figure nine, climbed out of it much higher while accelerating, traced a vertical figure eight, and leveled off into a high-speed pass in front of the huge crowd of craning onlookers. There was more to come.

This was the scene at the Paris Air Show—the world's premier international aerospace extravaganza—last June at Le Bourget Airport. And the F-16C had special significance for the European setting in which it was showing its stuff. Unlike the F-16C that flew in the show for the first time in 1985, this fighter was powered by a higher-thrust General Electric F110 engine and, as a result, was just like the F-16Cs that are newly operational—supplanting older F-16As—at US Air Forces in Europe's Hahn AB in West Germany.

The F-16C that performed daily at this year's eleven-day, thirty-seventh biennial Paris Air Show also had special meaning for the international throngs of aerospace industry executives and military leaders who watched its every move in the sky. The Fighting Falcon was the only US fighter at the show, and it was the one against which all other fighters that flew were compared.

—Photo by Kirby Harrison

USAF's B-1B bomber is towed to its exhibit area at the Paris Air Show. In the background is the giant An-124 transport aircraft.

The only other aircraft at the show representing the US Air Force, which had an exhibit in the sprawling US pavilion at Le Bourget, was perhaps the biggest attraction of all amid the several hundred aircraft, weapons, and space systems on static display. It was the B-1B bomber of sleek, lethal silhouette and dusky paint job. It had been flown to Le Bourget nonstop for ten hours from Dyess AFB, Tex., by Lt. Col. Wayne Staley, along with Merv Evenson, chief test pilot for its builder, Rockwell International. Other members of the crew were Capt. Dan Hobbs, offensive systems operator, and Maj. Steve Fraley, defensive systems operator.

As Air Force Secretary Edward

C. (Pete) Aldridge described the occasion, "The B-1B's deployment to this international event clearly demonstrates to our allies and to any potential adversary the near-term readiness of this operational weapon system." Naturally, the Russians, heavily represented at the show, spent much time examining the B-1B at the required distance. They too had aircraft on display.

The giant Antonov An-124 heavy airlifter, said by the Soviets to be slightly more commodious than USAF's Lockheed C-5B, drew more than its share of crowds. Also on view were both the An-74 blown-flap, twin-turbofan STOL transport and the An-28 seventeen-passenger turboprop transport.

—Photo by Kirby Harrison

The air show's international flavor was exemplified by this Brazil-Italy AMX fighter. French Exocet missile is second from the right in the foreground.

The Biggest Ever

This was the biggest Paris Air Show ever, with nearly 1,500 exhibitors from thirty-one countries. About 400 US companies took part, their systems, subsystems, and components liberally distributed throughout the show's 850,000 square feet of exhibition halls.

There were seemingly endless rows of hospitality chalets bordering the airfield in which a great deal of international business was discussed and done during the week and a half of the show. Ford Aerospace, Hughes, Grumman, and Northrop bowed out of "chalet row" this year. Northrop, for example, is no longer trying to market its F-20 fighter, which USAF has declined, and claims that its Advanced Technology Bomber (ATB) and Advanced Tactical Fighter (ATF) programs are too classified to talk about overseas—or even in the US. Northrop executives were in Paris in force, however.

The story was different for the other US companies that took part in the show. All seemed intent on increasing their international business, and many were bent on forming industrial teams, if possible, with their European counterparts.

Those counterparts are hard at work in improving existing military and civil aircraft and in designing and developing future generations of them. The US companies must now do business in an increasingly competitive international arena. Their domestic turf is becoming increasingly competitive as well.

In its proliferation of systems, the Paris Air Show brought home this point. The show featured nearly 200 civil and military aircraft of all sizes and purposes—ultralights; commercial aircraft of jet and prop varieties; trainer aircraft from Brazil, Belgium, Britain, Switzerland, and the US; and helicopters from several nations, including the McDonnell Douglas/US Army Apache attack chopper and the Sikorsky/US Army Black Hawk troop helicopter, both of which flew handsomely. Textron's Bell Helicopter and Boeing Vertol exhibited a one-third-scale operating model of their revolutionary V-22 Osprey tiltrotor aircraft, which drew swarms of onlookers. Amid all the modernity, Teledyne's *Spirit of St. Louis* aircraft replica stood out, on static display and in the air, as an uncomplicated flying machine from aviation's simpler past.

The People's Republic of China was represented at Le Bourget for the first time ever with two combat aircraft on static display—the FT-7 fighter, an upgraded, two-seat variant of the Soviet MiG-21, and the A-5, a close-support aircraft based on the Soviet MiG-19.

The Sparkle of Fighters

All in all, however, the show got its brightest sparkle from the high-powered modern fighters that flew day after day, the roar of their afterburners summoning attention to their feats overhead. Especially arresting were Canada's McDonnell Douglas CF-18, France's operational Mirage F-1 and Mirage 2000 of more recent vintage, France's even newer Mirage 4000 yet to go into service, the sleek new Rafale, experimental aircraft for France's fighter of the future, the Brazil-Italy AMX strike fighter, and the British Experimental Aircraft Program (EAP) demonstrator fighter that is the technological forerunner of the European Fighter Aircraft (EFA).

—Photo by Kirby Harrison

This US Air Force exhibit drew its share of crowds in the US Pavilion at the Paris Air Show, which had 850,000 square feet of exhibition halls.

The EFA program is managed by a consortium composed of Britain, West Germany, Italy, and Spain. France declined to participate, favoring its own Rafale program instead.

Among military and aerospace-industry observers at the air show, the hottest topics of discussion centered on whether the Europeans can now match US fighter systems technologies best exemplified by those in the new F-16C and whether they will be able to match the systems technologies and systems integration technologies now being developed by the US Air Force for its Advanced Tactical Fighter. There was general agreement among US aerospace officials that the answer is yes to the first, but no to the second—that the Eurofighter to ensue from the British EAP aircraft and the French fighter to grow out of the Rafale will be at least a half-generation behind the ATF.

A pivotal consideration concerning the EFA program may be the extent to which US high-tech companies will be permitted—by Europeans, by the US government, or by both—to participate in Eurofighter development. Many such companies would clearly like to take part, given the prospective flattening out of US military aircraft business, and are seeking to team up on many fronts with European aircraft and electronics companies in the manner now increasingly fashionable within the US industry itself.

A Global Industry

At the air show, Robert L. Kirk, President and CEO of Allied-Signal Aerospace Co.—which is an amalgam of Bendix and Garrett—typified the approach taken by many of his fellow US aerospace executives in Paris. Mr. Kirk declared that "aerospace is now a global industry" and that his company "seeks growth in foreign markets via joint ventures and other arrangements."

V. William Souveroff, then President and CEO of ITT Corp.'s newly organized ITT Defense Technology Corp. in Washington, D. C., struck a similar note. While attending the air show, Mr. Souveroff called it "an excellent opportunity" for him to sound out the international market and to spread the word in the international aerospace community of "our decision to make a stronger commitment" to that market.

A case in point is the Airborne Self-Protection Jammer (ASPJ) that ITT developed jointly with Westinghouse for US fighter aircraft. The US ATF is destined to carry the highly advanced Integrated Electronic Warfare System (INEWS) and, thus, will presumably have no need of the currently state-of-the-art ASPJ. So the ASPJ could wind up overseas.

The Eurofighter could become a candidate for the ASPJ at some point in development. Sources at the Paris Air Show considered it unlikely that the European electronics industry will be able to come up with an integrated system the likes of INEWS in time for incorporation in the EFA, given that fighter's currently planned pace of development.

The USAF Advanced Tactical Fighter's avionics, including INEWS and the Integrated Communication Navigation Identification Avionics (ICNIA), will be based on very-high-speed integrated circuitry (VHSIC) of 1.25-micron size. VHSIC technology is not exportable and probably won't be for some years to come.

US sources at the air show said that the European electronics industry has done some wonderful things in recent years, but has yet to build microchips of the VHSIC variety's ultrasmall circuitry dimensions and processing proficiency. Moreover, US electronics companies, including ITT and Westinghouse, are at work on submicron VHSIC chips based on gallium arsenide rather than on silicon technology and are said to be well ahead of the Europeans in this regard.

The Europeans concede nothing, however. Britain's Ferranti claimed at the air show that its advanced ECR-90 main radar for the EFA is much better than any US fighter radar now in service. Westinghouse sources interviewed at the air show said that Ferranti is comparing its ECR-90 radar with US fighter radars now in operational service and is overlooking current US fighter radar developments.

Such developments have led to the Westinghouse AN/APG-68—now being incorporated in F-16C/Ds—that has greater range, sharper resolution, and better target-tracking capability, according to Westinghouse executives at the show. "We believe that the next radar we produce will be a little more advanced than the radar [to be expected] in the EFA," one such executive declared.

In terms of prospective EFA business, it may not matter. USAF prevented Westinghouse from dealing with the Eurofighter consortium in disclosing what the company could offer in the way of radar-identification modes for EFA electronic counter-countermeasures. As a result, the EFA's avionics development program may already have passed Westinghouse.

On the other hand, the US Navy gave Hughes, which builds the radar for the Navy F/A-18, permission to talk with the Eurofighter people about its radar identification modes. Consequently, Hughes may have an edge over Westinghouse if ever the Eurofighter consortium picks up on US industry overtures to take part in the program. As of now, European companies appear to be doing quite well enough on their own in bringing along new aircraft technologies.

On the civil aircraft side, the European Airbus 320 airliner, sporting fly-by-wire controls that are unique among all the world's airliners, put on an eye-popping performance at Le Bourget with its slow-speed handling and maneuverability in all flight regimes.

First-Rate Technologies

Moreover, on the military side, it was obvious at Le Bourget that European fighter aerodynamics technologies and flight-control technologies are first-rate by any standard. The delta-winged, deadly-looking Mirages, the Rafale, and the EAP all performed superbly. So did such older NATO stalwarts as the Panavia Tornado, now being ordered by West Germany for the Wild Weasel radar-suppression mission as well as for ground attack, and the French-German Alpha Jet. Panavia said at the show that it will propose the Wild Weasel Tornado as USAF's successor to F-4Gs now used for that mission.

Notable among upgraded military aircraft flying in the show were the British Aerospace Industries Hawk 200, the BAe/McDonnell Douglas AV-8B V/STOL Harrier, which hovered, pirouetted, accelerated horizontally out of its hovering mode, and quickly began to climb, and the Israel Aircraft Industry (IAI) Phantom 2000. The Phantom 2000—a desert-camouflaged F-4 reengined with two Pratt & Whitney PW1120 powerplants and modernized in other ways as well—put on thundering displays of acceleration, maneuverability, and rapid rate of climb. IAI's Lavi and Sweden's Saab-Scania Gripen, the newest fighters in the world, did not fly and were not displayed at Le Bourget.

Withal, the F-16C was seen, especially by the Americans at the show, as still the standard for all other fighters of whatever vintage—and it did not disappoint. Continuing its flight demonstration in typical style, the F-16C turned tightly on completing its high-speed pass, decelerated sharply, and made an exceptionally low-speed, low-altitude pass in front of the crowd at a high angle of attack that gave it a haughty profile.

Nose still steeply angled up, now on afterburner, the Fighting Falcon climbed out of its low-speed pass without so much as a dip or a waver, went high, spiraled over the top, dived, dashed, and then performed its *pièce de résistance*. Pulling more than eight Gs, the American fighter executed a "max performance" 360-degree turn, snapped into a tuck-under break, reversed direction, looped, and landed, having taken

less than ten minutes to fly its tightly disciplined show.

Having been coproduced and cooperatively upgraded by Belgium, Denmark, the Netherlands, and Norway, the F-16 already has a considerable corner of the European fighter market. The McDonnell Douglas/Northrop F/A-18 has also made inroads there. But this history of US penetration of Europe with modern fighter aircraft, dating back to Lockheed F-104s, may well come to an end in the 1990s if the new European fighters now in the works pan out as promised.

"Good Progress" on Eurofighter

At the air show, where a full-scale mockup of the EFA was on display, officials of the Eurofighter consortium called a press conference to outline what they described as "good progress" in the EFA program.

With a development go-ahead decision expected from each of the four participating nations by the end of this year, the Eurofighter consortium has now settled on which companies will do what.

Britain's BAe will design and manufacture the EFA's front fuselage and foreplane, Germany's Messerschmitt-Bölkow-Blohm, teamed with Dornier, will do the center fuselage and fin, and Italy's Aeritalia (AIT) and Spain's Construcciones Aeronauticas SA (CASA) will do the rear fuselage and share the wing with BAe.

Eight or nine EFA prototypes will be built. Final assembly "will be done in parallel at each of the four aircraft companies," said Carl-Peter Fichtmüller, chairman of Eurofighter Jagdflugzeug GmbH, headquartered in Munich.

F. G. Willox, the consortium's managing director, said that the design of the EFA's two engine intakes has been refined for less drag and in keeping with "extensive application of stealth technology throughout the [fighter's] design." To cut drag and keep weight under control, the fighter's fuselage has been slimmed, and its nose cone has been rounded, Mr. Willox said. Its fin has been enlarged for greater maneuverability, he added.

The EFA will be an outgrowth of BAe's EAP demonstrator aircraft, and the Eurofighter consortium in charge of the EFA is an outgrowth of Panavia, the British-German-Italian consortium that was formed in the 1970s to build the Tornado.

The EAP made its first flight one year ago (August 1986), made its 100th flight at the Paris Air Show this year, and has amply demonstrated its high maneuverability at Mach 2-plus. Its engines were produced by Turbo-Union Ltd., a consortium made up of Britain's Rolls-Royce, Germany's Motoren-und Turbinen Union (MTU), and Italy's Fiat Aviazione SpA. Now Spain's SENER engine company has joined them in the new Eurojet Turbo GmbH consortium to develop the advanced EJ200 engine for the EFA.

New engines being built by the Turbo-Union consortium for the Panavia Tornado feature full-fledged digital electronic controls without mechanical backup. Such controls are hallmarks of the advanced fighter engines currently being produced for US fighters by GE and P&W, which has now begun coproducing the F404 powerplant developed and long since produced by GE.

Comparing Fighters

The EFA's main competition for sales in Europe and abroad will come from the French fighter to spring from the Rafale, which is also now powered by GE F404 engines. France's SNECMA will build the engines for the Rafale follow-on fighter in development and production, however. The French fighter will be the product of a consortium called ACEI (for Avion de Combat Européen International), composed of Avions Marcel Dassault (AMD) for the airframe, Thomson-CSF for the multimode, pulse-Doppler radar, Electronique Serge Dassault for the avionics, and SNECMA.

Both the Rafale and the EAP aircraft that flew in the Paris Air Show this year had been much improved since they previously flew at the Farnborough Air Show in 1986. Fancier fly-by-wire controls and software were incorporated in each.

None of the Europeans involved in either fighter program claims that their aircraft will equal the USAF ATF. However, they do not mind spreading the word of their belief that the ATF will be too sophisticated, too heavy, and too expensive for foreign sales—and that it will give them no competition in such sales.

They expect that their competition will come from each other, with both the French fighter and the Eurofighter expected to go into production around the mid-1990s—about the same time as the ATF. Eurofighter officials claim that they are already assured of orders for 800 EFAs from the four nations in the consortium and that Belgium has expressed interest in joining the EFA project.

The consortium's Mr. Fichtmüller made it clear at Le Bourget that US companies will be welcome to take part in the technological grooming of the EFA—but only if the US responds by permitting "a *real* two-way street" in the transatlantic interchange of aerospace technologies and products.

US companies may be more receptive to that than ever before. As many of their executives noted at the air show, the leveling off of US military aircraft business makes it imperative that they do more teaming with their European counterparts, just as they are doing with one another on such advanced systems as the ATF.

In this, the Paris Air Show provided a portent. On display in Germany's MBB exhibit area, in mockup form, was the X-31A Enhanced Fighter Maneuverability (EFM) technology demonstrator—a STOL aircraft designed by MBB and Rockwell International to test "supermaneuverability" in the dogfighting mode by means of a thrust-deflecting GE F404 engine.

Some US observers at the show said that the X-31A is merely borrowing a page from the book of the ATF, which will incorporate thrust-reversing and thrust-vectoring nozzles in its highly advanced powerplants. Others said, however, that such an observation misses the main point of the X-31 program, to wit: American-European collaboration in an experimental fighter program that demands the best of both in a true transatlantic technological partnership.

From the evidence of this year's Paris Air Show, more of the same can be expected in the years to come. ■

Seven times a year, these intense training exercises in the Philippines teach aircrews how to survive and win in combat.

Thunder at Crow Valley

BY DAVE GRIFFITHS

TRUE to his profession, Col. Thomas A. Owens can't talk for ten minutes without jabbing at the air and "shooting off his watch." Colonel Owens is a fighter pilot, and what has him so animated is the nearest thing to actual combat that any of his fraternity could hope for.

The subject is Cope Thunder, the air-combat exercises at Clark AB in the Republic of the Philippines, which are similar to the famous Red Flag exercises at Nellis AFB in Nevada. And Colonel Owens, the Commander of the 6200th Tactical Fighter Group, which runs Cope Thunder seven times a year, doesn't even try to contain his enthusiasm.

He gave a short example of a mission commander briefing his Cope Thunder team in front of a map: "All right, F-15s will ingress at high altitude from the 'tooth,' and the F-16s will ingress at low altitude west of the 'spine.' The F-15s will sweep ahead of the F-16s and attempt to locate and engage all of the Red air, concentrating mostly on the ones west and north of Crow Valley. F-16s will feint south and then approach the target from the west."

That, of course, is the well-laid plan. But what happens over Crow Valley when the crack aggressor pilots flash into the picture? Colonel Owens again: "A big, turning fight can turn into a real furball. But sometimes, you're just one guy, being attacked from all over. We try hard to train the jocks to avoid this kind of no-win situation and, if they cannot, how to disengage. If we don't, it's a sure way to get shot down in a war."

Tactical fighter pilots use colorful phrases to describe the frenzy of modern air combat. But it's the message, not the language, that counts, and that's what sticks in the minds of hundreds of young Cope Thunder pilots who have never corked off a missile in anger or evaded a MiG by yanking their craft into a crushing, high-G defensive turn. More important, they'll remember both how to survive and triumph.

The First Ten Missions

"Analyses have shown that most air-combat losses happen in an aircrew's first ten missions," says Colonel Owens. "Cope Thunder,

During Cope Thunder, it's always a good idea to know what's behind you, because you just might be in the sights of one of the Aggressor pilots (inset). The 6200th Tactical Fighter Training Group's F-5Es are based at Clark AB in the Philippines.

—USAF photo by TSgt. Daniel C. Perez

therefore, has the goal of getting each crew on the steep slope of the learning curve by simulating the combat environment to the maximum in peacetime to avoid the historical loss rates we experienced in actual combat. And the improvement is there. We have data showing bomb scores tend to be better, and mistakes for the Blue [friendly] forces are fewer toward the end of training."

Both Red Flag and Cope Thunder exemplify the new style of air-combat training that began to emerge in the 1970s. The idea was to have the crews, especially the inexperienced ones, learn and refine their skills in a setting that resembled combat as closely as possible. This meant flying against "aggressor" aircraft and other threats—including radars, jammers, and ground batteries—real or simulated.

Each two-week Cope Thunder exercise begins with fairly simple scenarios conducted in "low-threat" environments but still complete with aggressor aircraft, communications jamming, "enemy" radars, and simulated antiaircraft artillery and small-arms fire. Threat levels increase as the exercise goes along. Jamming and deception, for example, set up a "communications-restricted" environment at first and build up to a "communications-denied" situation. The exercise culminates in a composite strike scenario that integrates nearly all of the Red and Blue forces in an intense combat simulation.

Much of Cope Thunder happens over the Crow Valley Range, home of the targets, SAM threat radars, and AAA simulators. The range's miles of hills and valleys enhance the realism of the target for aircrews, and for all they know, they could be shooting at the real thing. But the makeup of the range doesn't always stay the same. It can be tailored to meet specific combat scenarios, such as a high-threat composite force or a low-threat close air support battle. Each Cope Thunder focuses on a different aspect, from sophisticated electronic combat to search and rescue.

A unique aspect of the range is that its electronic defenses, operated by the 3d Tactical Electronics Warfare Training Squadron, are arranged in a way experts believe they will be found on a real battlefield. Mobile electronic devices accurately simulate enemy radar systems and communications jamming; other devices, such as Smokey Sam surface-to-air rockets and airburst simulators, are used to simulate surface-to-air missiles and flak.

The aim of the people who operate these simulators—ground threat radar operators—is to "kill" attacking aircraft or disrupt their plan. When they leave the range knowing they've lost, they feel good because it means "their" aircrews properly employed both their on-board systems and smart tactics to evade all the threats that could be thrown at them.

The training at Crow Valley is realistic. In addition to the Aggressors, there are simulated ground-to-air missile threats, electronic countermeasures, and small-arms fire. This Stinger missile crew (right) tracks an aircraft during a recent exercise, while an element of F-15s from the 18th TFW "breaks" before engaging an aerial adversary (below).

—USAF photos by TSgt. Daniel C. Perez

The Head-on Enemy

Providing the "enemy" air-to-air threat is the Northrop-built F-5 Tiger II, known in Cope Thunder as "aggressors." Mixing the newer fighters in with the old F-5s is fine with Colonel Owens. The F-5s turn hard and sharp, but their "lack of modern avionics and the sheer age of their hard-stressed airframes make them prime candidates for replacement," he notes firmly. Still, he's confident that the combination of front-line fighters and F-5s provides a realistic model of the modern air-combat environment. But the new threat of Soviet Su-27 Flankers, MiG-29 Fulcrums, and MiG-31 Foxhounds means that aircrews must adapt their tactics to a new era of all-aspect missiles. Armed with infrared weapons that can be employed from any aspect, an enemy need not maneuver into a tail chase position to shoot.

Colonel Owens and other air-to-

air tacticians spend much of their time thinking about that forward-hemisphere threat. In fact, dealing with the head-on enemy is what Colonel Owens calls the biggest change in fighter tactics in recent years. The schemes that Cope Thunder participants work on are designed to confuse the enemy and gain the tactical advantage in order to acquire the "kill."

And what about that fellow the surrogate enemy is trying to imitate at Cope Thunder? Is the guy with the red star on his helmet a predictable quarry or an aggressive hunter? The answer is neither clearcut nor simple.

On the one hand, the Soviet pilot is still under very close control from the ground, and he lags well behind US pilots in the amount of tactical flexibility he can exercise. But he does have the confidence that comes with flying technically superb aircraft that have gained much from copying technology obtained—often illegally—from the West. "They also tend to copy our tactics," says Colonel Owens. "But what that individual pilot will do on a day-to-day basis, and how he will react to us, is really an unknown."

Much more certain is what it would be like to fly and fight against North Korean pilots. Colonel Owens passes up the chance to be polite and circumspect about this adversary: "North Korean tactics tend to be stifled and unimaginative. Quite frankly, if the North Koreans ever started a traditional sort of a war and came up out of their caves to fight us, the war would end quickly."

A Day of Thunder

That's not bragging. That's rock-solid certainty. And it's a confidence bred in good part by Cope Thunder. Pilots get that warm feeling about themselves by flying ten days out of the fourteen that they're visiting Clark. Colonel Owens's staff, working from 5:00 a.m. to 7:00 p.m. on a typical day, is there to orchestrate the exercise. The participants train themselves, critiquing their own work in the eight to nine hours a day that include about one hour of actual flying. The mission commander may show up as early as 4:00 a.m. to prepare a briefing that takes in everything from taxi flow to order of takeoff to the actual "play" that his team will run. "It's easy to make a mistake," says Colonel Owens. "We want to give this mission commander a total experience, being responsible for everything."

After the mission, there's a mass debriefing with all participants, even including the AWACS crew. Then all the crews debrief among themselves, followed by smaller four-ship debriefings, and finally the "hall talk" where a pilot can seek out an "adversary" whom he engaged at 10:02 a.m. over High Peak.

Not surprisingly, things can get complex at Cope Thunder, what with fifty to sixty airplanes, seventy-five to eighty pilots and weapon systems officers, and 1,200 to 1,800 sorties per two-week exercise. And that's where a marvel of new simulation equipment comes in. Soon, Colonel Owens hopes to get the state-of-the-art Crow Valley Measurement and Debriefing System (CVMDS). Modeled on similar technology now in place at Red Flag, CVMDS is a follow-on to the Air Combat Maneuvering Instrumentation (ACMI) system.

CVMDS, a microwave tracking system that can track three dimensions in space, is the ultimate in reconstruction capability. In debriefing sessions, its picture can be tilted such that the trainees get what Colonel Owens calls a "God's-eye view." CVMDS will take the thirty-mile-diameter circle that ACMI covers and more than double it with more tracking, instrumentation, and weapons simulations. Says Colonel Owens, "You've heard fighter pilots

The REAL Red Force

The "Red" Force in Cope Thunder assumes a role for training purposes, but there is a *real* Red force to worry about in the Pacific: the Soviet Far East TVD (Theater of Military Operations). Its warfighting assets include fifty-seven divisions, 15,000 tanks, 1,300 tactical aircraft, and a major naval force.

The Soviets have been building up their Pacific presence for years and give this area a priority in their planning that is second only to the Western theater, which faces NATO Europe. As is the case in Europe, Soviet Far East air forces have been reconfigured to emphasize deep strike operations. The number of ground-attack regiments has increased from fifteen to twenty-one since 1978.

The Pacific point of view should be well represented in the Kremlin, too. Dmitriy Yazov became Defense Minister of the Soviet Union in May—and before that, he was commander of the Far East Military District.

—USAF photo by TSgt. Daniel C. Perez

While Cope Thunder is primarily geared toward training the pilots, the ground crews also gain valuable experience during the fast-paced exercises. The lessons learned apply to USAF and allied ground crews alike. This Australian Mirage is being serviced on the ramp at Clark AB. The RF-4 in the background is from the 18th Tactical Fighter Wing at Kadena AB, Okinawa.

—USAF photo by TSgt. Daniel C. Perez

Preparing for another day of hunting the "bad guys" over the Crow Valley Range, the pilots of these F-4Es from the 51st Tactical Fighter Wing at Osan AB, Korea, taxi their mounts. The Cope Thunder exercises are conducted seven times a year at Clark AB.

talk about the difficulty of determining who shot who after a high-dynamic mock dogfight at anywhere from minus 2 G to 9 G and from 200 knots to 600 knots with as many as fifty to sixty aircraft. Well, what ACMI did for two vs. two and two vs. one, CVMDS will do for a large-scale reconstruction of what really happens."

And an accurate reconstruction depends largely on time correlation. With a staff of ten analysts, under current conditions, it might take all day to determine that fighter No. 1 shot No. 2 before No. 2 claims to have shot No. 3. Therefore, No. 2 couldn't have made the shot in the first place. CVMDS will make a huge difference, thanks to a large video screen that allows pilots to watch the simulated flight of a missile. "CVMDS is going to settle a lot of arguments," promises Colonel Owens.

Training as a Team

This technological growth at Cope Thunder is obviously crucial to the far-flung Pacific Air Forces. But just as important, it will accommodate the hundreds of Navy, Marine Corps, and foreign pilots who depend on Cope Thunder for their most realistic combat training. Participation by Navy and Marine Corps F-4s, F/A-18s, E-2Cs, A-6s, and EA-6Bs has grown from nearly twenty percent of sorties to almost thirty percent in recent years. "The Pacific Command is big," Colonel Owens says. "If we get into a war out there, we'll have to fight as a team. Therefore, we train as a team with some of the same people we'd go to war with."

Cope Thunder also welcomes participation from many of its friends and allies in the Pacific, such as aircrews from Thailand, the Philippines, the Republic of Korea, and Australia. And Cope Thunder is not limited to just aircrews. Marine Corps and US Army Stinger air defense missile teams have honed their skills against the highly intense air-combat environment above Crow Valley. "They can't get that anywhere else," says Colonel Owens.

Rounding out the total Cope Thunder package is the maintenance and logistics training that parallels the flying exercises. In one ancillary exercise, called Aircraft Battle Damage Repair, maintenance crews work on old aircraft hulks in which holes have been blown by explosives. "The idea is to repair the aircraft enough to get it back [simulated] to the home station," says Colonel Owens.

There's only one part of Cope Thunder that Colonel Owens doesn't like to talk about—safety. His reticence stems not from fear of the subject but from superstition. Knocking on a wooden side table, he says: "There's always potential for a midair collision, but we haven't had one. Our safety record borders on the fantastic. Despite the inherent risk in such a dynamic and realistic exercise, we have not had a serious accident since 1982."

But there's even more inherent risk when the fellows shooting at you are a real enemy who are just as intent as you are on staying alive. And that's where Cope Thunder makes its indelible mark. Nothing teaches combat survival and victory as well as combat. For pilots in the Pacific, the next best thing—and it's not that far from the real thing—is Cope Thunder. ■

Dave Griffiths covers defense for the Washington bureau of Business Week *magazine. He served as an artillery officer in Vietnam and began his Washington journalism career with* Aviation Week & Space Technology *magazine.*

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US-Mexican relations are cool, and sometimes icy. Yet Mexico's stability is of immense importance to us. Its economic problems are staggering. And Central American Marxists may be eyeing it as the big prize.

Our Distant Neighbor

BY GEN. T. R. MILTON, USAF (RET.), CONTRIBUTING EDITOR

A FEW years ago, Gen. Paul Gorman, then Commander of the US Southern Command, made some disparaging remarks about Mexico and predicted that Mexico would be the next great threat to our security. While the Gorman remarks were given extensive, and hostile, coverage in the Mexican press, they attracted only passing attention in the United States—the United States of America, that is, for our southern neighbor has the official title of Los Estados Unidos de Mexico. It is a fair bet that most people north of the Rio Grande think that there is only one United States in this part of the world.

Mexico is something of a mystery to citizens of these United States. Jet-setters know Acapulco, retirees stretching their pensions have an enclave in Guadalajara, and everyone has seen the tawdry border towns, but Mexico itself intrudes very little on the consciousness of most Americans. It is simply the place where all those farm laborers, dishwashers, and other itinerant workers come from.

By contrast, there is keen awareness in Mexico of its neighbor to the north. At an early age, every Mexican is taught about the war of 1846 and the heroic last stand of the boy cadets at Chapultepec against the troops of General Winfield Scott. That war, the schoolchildren learn, cost Mexico half its territory, now the American Southwest. Diego Rivera's famous murals on the walls of Mexico City's National Palace depict the fallen cadets of Chapultepec, along with Spanish conquistadors and French interlopers. All in all, the centuries since the Aztec civilization at Tenochtitlán have been troubled ones, and the twentieth is no different.

It was Porfirio Diaz, Mexico's dictator President almost continuously between the years 1876 and 1911, who made the melancholy statement that every Mexican since seems to have memorized: "Poor Mexico! So far from God and so near to the United States." Diaz was overthrown in what is called the Revolution of 1910, but which, in reality, was only the beginning of some twenty years of strife and political turmoil. Such figures of that era as Emiliano Zapata and Pancho Villa became part of Mexican folklore, and Villa, at least, once again stirred up the gringos. General Pershing's 1916 expedition to punish Villa for his border incursions was an eleven-month exercise in futility, remembered by Mexicans as still another invasion from the north.

—Photo by Lou Jones/UNIPHOTO

This Guatemalan refugee's face mirrors the uncertainty of Mexico's future, while the brightness of its aspirations is illustrated by the photo on the facing page, which shows the glamor and grandeur of Mexico City's nightlife typified by the Folkloric Ballet Building.

—Photo by Richard Slade/UNIPHOTO

The Revolution came to an end in 1929, although there were still occasional bloody clashes with dissident elements and a continuing crackdown on the Catholic Church. José de León Toral, elected President in 1928 following the assassination of President Alvaro Obregón, then established the basis for one party rule; Mexico would henceforth be governed by a single political party. The National Revolutionary Party, now known as the Institutional Revolutionary Party, or PRI, emerged in sole control of Mexico's political fortunes.

The Source of Power

Any understanding of Mexico and its institutions, whether civil or military, must begin with the realization that the PRI is Mexico's unique source of power. The President, who serves one six-year term, is, in theory, elected by popular vote. Actually, he is chosen by his predecessor from among members of the PRI hierarchy. His election by an overwhelming majority is a foregone conclusion, although the anointed candidate does make an elaborate pretense at campaigning.

The Mexican presidency is, perhaps, the world's most powerful non-Communist chief executive office. Unlike his American counterpart, the Mexican President operates untroubled by constitutional squabbles or a recalcitrant congress. It is truly an imperial position and one that easily lends itself to abuse. President López Portillo, for instance, is reported to have left office a billionaire several times over. Corruption, in fact, has been endemic to the Mexican presidency. The man in the street seems to accept this, as well as other obvious examples of public figures on the take, as part of the system, military as well as civilian. If one reaches high position, one is set for life five or six years later.

Once in office, the new President selects, among other cabinet officers, his Secretary of Defense. This official comes from the ranks of Army general officers, and he, too, serves a six-year term. The Navy Secretary, plucked from the admiral ranks, reports separately to the President, an arrangement that must give rise to feelings of wistful envy in sailors from other lands.

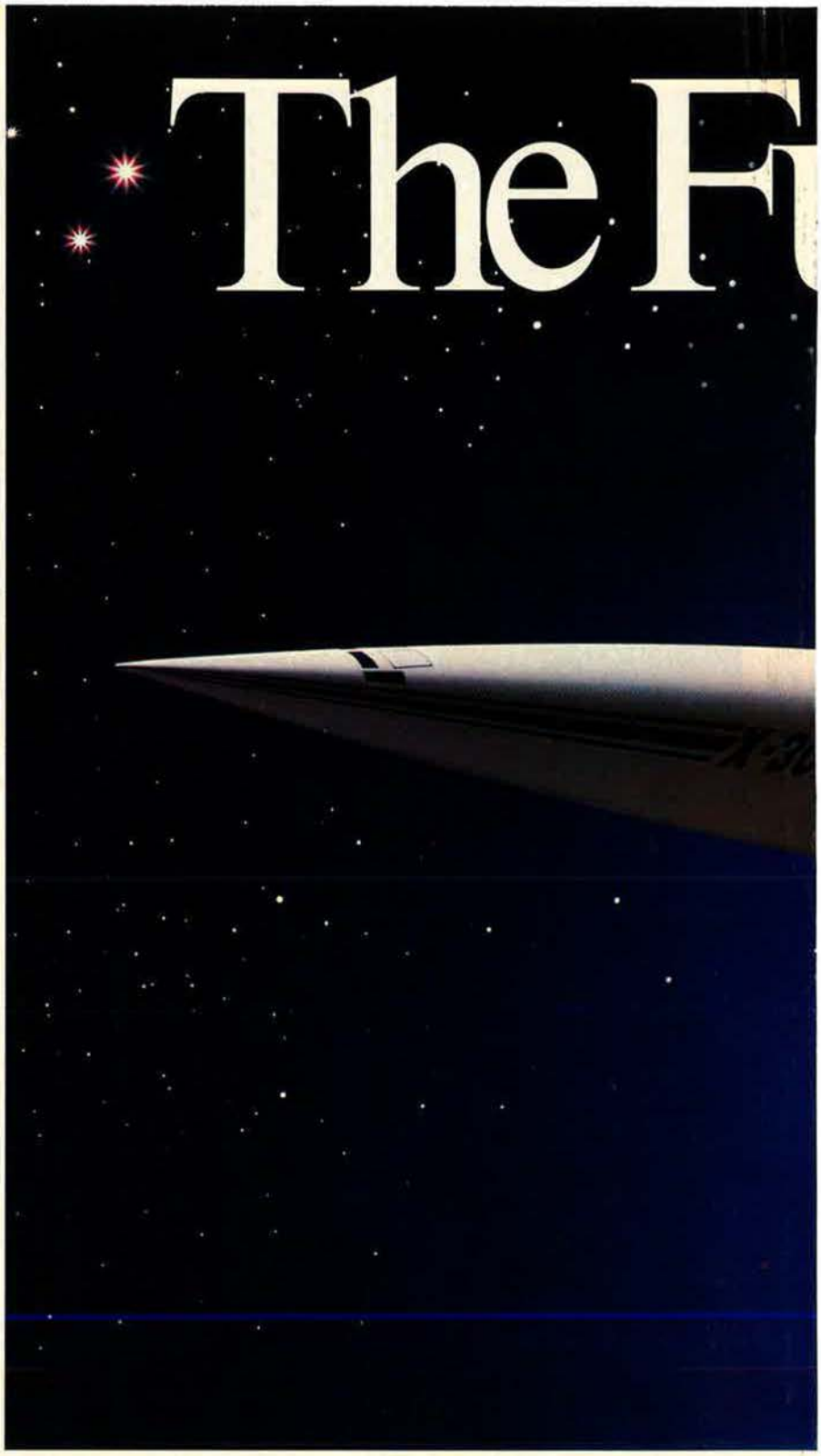
Because the Revolution, in its struggling days, was often threatened by rebellious generals, the military has long since been placed under tight control. During the 1930s, rebellious generals were executed; nowadays, the Army and its generals have become a part of the all-encompassing political system, a closely organized instrument designed for internal control and directed, in minute detail, by the Secretary of Defense.

Each of Mexico's thirty-one states has a military district commanded by a general officer. The Army of about 107,000 troops is parceled out, more or less, in that fashion. The most-feared potential enemy, it would appear, is to be found within Mexico's borders, despite history's record of past wars with the US. While this is a practical outlook, there seems to be more to the strategy than that. As a guess, given the heavy odds against any successful military encounter with the US, Mexico has ceded its protection against external threat to its northern neighbor. This has to be a guess, because military thinking, like most of what goes on behind the closed doors of the PRI hierarchy, remains a mystery. The guess is fortified, on the other hand, by a glimpse at the Mexican Air Force.

No Serious Air Defense

For a country the size of Mexico, with long coastlines, unprotected borders, and enormous oil resources, air defense would normally be a high priority. But, unless the Mexicans have discovered some magical

It's time to build a new-generation spacecraft.



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way of controlling their airspace without interceptors or a radar net, the air defense of Mexico is not being seriously pursued. The inventory of Mexican aircraft reads like a museum catalog, with some seventy-odd types for an air force of 7,000. As a further inhibiting factor, the Air Force is under the firm thumb of the Army.

From all accounts, this small air force could be a very good one, if circumstances were different. The Air Force Academy at Guadalajara turns out well-educated and competent officers after a three-year course. The problem would seem to lie in the apparent meaninglessness of their future careers. All of which tends to support the theory that air defense, should it ever be required, will be a US job.

The lone squadron of eleven F-5Es at Santa Lucia, a base near Mexico City, is a case in point. From what little one can gather, the unit is a good one and is manned by well-qualified people. The F-5E, however, can scarcely be called an interceptor, so the squadron's mission must remain speculative.

If Mexico viewed its southern border as a principal source of trouble, its Air Force would then have a legitimate tactical mission. Certainly, the threat to the United States is located in the volatile Central American region. There is, however, no indication that Mexico considers either the Marxist revolution in El Salvador or Nicaragua's announced intention to export its revolution to be threats to Mexican security. Some small deployments to the southern border have taken place, but the official Mexican line is conciliatory toward the Sandinistas and, by inference, toward the Marxist guerrilla movement.

Fear of Domination

The Contadora scheme for peace in Central America has been a Mexican initiative. To a considerable extent, it reflects not only Mexico's opposition to US policy in Central America but also a fear of Yankee domination in all of Latin America. At least that is what defenders of the Contadora solution say. President Arias of Costa Rica has proposed a more balanced peace plan, one that would come closer to US acceptance, which Mexico has opposed. Contadora or nothing seems to be the Mexican stand.

Why this neighbor of ours, so closely tied to us in so many ways, remains consistently opposed to US policies is not easily explained. Mexico's voting record in the United Nations is one of the worst from a US standpoint—right in there with Libya's. The Mexican rationale behind this hostile position is that Mexico has voted with the majority, which is just another way of saying it has voted with the Communist bloc and the radical Third World. Like so many other questions about Mexico, this political bias, which amounts to irrationality given Mexico's basic dependence on the US, must simply be written off as a show of defiance for want of a better explanation.

International politics, however, is at best a diversion for Mexico's leaders these days. The real crisis is at home, and it is building toward a climax. The roots of the crisis for this land poorly endowed with water and with more than its share of economic troubles and joblessness, with a consequent bleak outlook for the young—half the population is under seventeen—are clearly apparent.

Mexico's economic problems are staggering. The peso, twenty-four to the dollar a few years back, was over a thousand to the dollar last spring. And while the international debt of $105 billion has received the publicity and at least a temporary fix from the world banking community last March, Mexico's domestic debt may be an even greater problem. There are a number of reasons for this, but basically it stems from the fact that the government is all-pervasive, directly controlling thirty percent of industry and having a heavy hand in the remainder through licensing governed by favoritism.

The domestic debt has resulted in short-term interest rates approaching 100 percent. Put another way, domestic debt is more than three times the US domestic debt in terms of gross national product, and the US situation is not generally viewed as an economic model.

Belt tightening in Mexico will be a difficult process. When the oil money was coming in, the profits went into such programs as subsidies for food and gasoline and underwriting most of the cost of a Mexico City subway ticket. Beyond that, the government, during the years when it coopted the private sector, became Mexico's principal employer. More than 4,000,000 depend on the treasury for their pay checks.

The Maquiladora Scheme

One safety valve for this stricken Mexican economy is the maquiladora scheme, a cross-border manufacturing arrangement by which shirts, for example, are cut in the US and shipped across the border to be finished in Mexico. They are then returned to the United States and taxed only on a value-added basis. Since Mexican wages are roughly one-third US wages for similar work, whether for sewing shirts or assembling electric motors, companies engaged in the maquiladora arrangement enjoy an obvious competitive advantage. There are now more than 1,100 plants involved in this plan. The dollar value to Mexico last year was $1.5 billion.

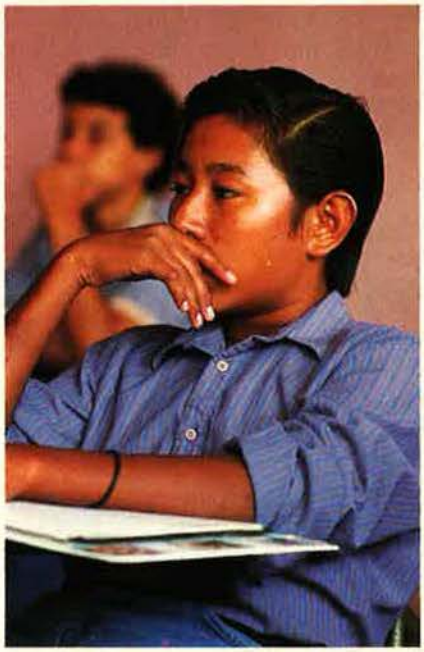
The maquiladora is popular in cities like El Paso and Laredo, and it has helped transform Juarez from a seedy tourist trap to a city with a small industrial base—not that Juarez isn't still seedy, but its old appeal for hidden pleasures has been lost to American permissiveness. Elsewhere, maquiladora is viewed as a threat to American jobs, and there is congressional opposition to the concept, somewhat reminiscent of New England's resentment when the textile mills left Massachusetts for Georgia.

Whatever comes of maquiladora, however, in the long run it is only an assist, not a solution for Mexico's ills. On the other hand, this joint enterprise does bring Mexicans and Americans together in a very practical way and provides a visual example of cross-border cooperation. There are not many others. The war against drugs entails a certain amount of superficial teamwork, but Mexico continues to be a prime source of both hard drugs and marijuana.

Destabilizing Elements

Without question, Mexico's stability is of immense importance to the United States, but it can't be

—Photo by Bruce Berman



—Photo by Daemmrich/UNIPHOTO

Amid all the uncertainty, there is some evidence of rising expectations in the border towns. The women pictured above (top) work for manufacturers involved in the maquiladora scheme (see text), which pumped a much-needed $1.5 billion into the Mexican economy last year and gives the border towns the kind of stability necessary for the children to attend regularly—in hope of a brighter future—schools such as the one in Nuevo Laredo pictured above.

Cuba's kind of stability. A Marxist state propped up by the USSR would be an intolerable southern neighbor. Although there is no indication Mexico would go that way, no one can argue that there are not serious destabilizing elements.

More than 80,000,000 people live in that arid and mountainous land. Mexico City, which has more than 17,000,000 inhabitants, has already become unmanageable in size, and yet it continues to attract a steady stream of migrants from rural areas. Municipal services, and most especially the water supply, will not be able to sustain many more, yet still they come. There is obviously nothing to keep them at home, even though Mexico City's slums rival in squalor those of Cairo or Rio de Janeiro.

The Mexican government under President Miguel de la Madrid has taken steps to hold down the birth rate, but the population will nonetheless reach 100,000,000 or thereabouts by the year 2000. With no more than fifteen percent of the country suitable for agriculture, it is plain that there are going to be a great many restive people looking for something to do. Revolution, of course, is something to do, and that is behind the worry expressed by General Gorman and many others.

Whether or not it is a legitimate worry is difficult to judge. The Mexican people have been accustomed throughout their history to low expectations. If things do not materially worsen, there may not be the kind of unrest that leads to revolt. And then, oil prices may well recover lost ground sooner or later, in which case the government could resume its subsidy of the populace.

But even if there should be genuine unrest resulting in a revolutionary movement, it could scarcely succeed unless the Army itself became disaffected.

The Military Professionals

The Mexican Army is the important military service and the principal keeper of internal security. Essentially, it is a professional army, although there is a form of national service that requires every young man to register and risk being conscripted for a period of one year. The hard core of the Army, however, along with the small Air Force and Navy, is professional. From the very beginning, officers are indoctrinated in the importance of political loyalty. Each year, in a ceremony, they reaffirm this fealty to the government. By the time an officer reaches a position of responsibility, he has been judged to be politically

reliable, and the rewards for such reliability are tangible.

A military attaché in Madrid, for instance, is far more handsomely paid than any Spaniard of comparable rank or, for that matter, an attaché from any other country. The system, in short, encourages team players, for only the team players get the plum assignments.

The system also discourages candor and association with foreigners. Mexican aloofness is not necessarily unfriendliness, although there is certainly some of that in academic and media circles, but it is rather a studied detachment, one that has kept Mexico out of any formal military ties with the United States or, happily, with anyone else.

Detachment, however, does not apply to the Mexican poor. The 2,000-mile border with the United States marks the beginning of the promised land for uncounted thousands every day. Or at least it did until the Simpson-Mazzoli Immigration Act changed the rules. What had been for generations a game played by illegal immigrants on the one side and US employers on the other has taken on a new aspect. The US employer now faces a stiff fine if he employs an illegal immigrant and a jail sentence if he persists. There are provisions for the temporary agricultural employment of aliens, but even that is more complicated than it was in the free and easy days before Simpson-Mazzoli. One grower told me of his former arrangement for securing melon pickers. The same Mexicans arrived at harvest time each year, picked his melons, then turned themselves in to the Immigration Service to save the price of a ride home. All very friendly and informal.

The new rules allow illegal immigrants who can offer proof of residency in the US since 1982 a chance for permanent status and citizenship, with the usual caveats against undesirables. According to Washington estimates, anywhere from 12,000,000 to 20,000,000 undocumented workers may qualify and take advantage of this one-time amnesty. The fact is that no one really knows how many illegals there are, and thus far, the number of applications has been well below expectations. For one thing, just the business of registering may frighten away some illegals. In any case, most of the aliens affected by this bill are undoubtedly Mexicans, and the bill has caused uneasiness on both sides of the border.

Lack of Understanding

A more important reason for uneasiness is the lack of understanding between the United States and its southern neighbor. We seem to be growing farther apart even as shared troubles multiply. A prime example of this distancing is the declining number of Mexican students in US universities, down fifty percent, to 50,000, from the 100,000 of a few years back. Cost appears to be a principal factor, but whatever the cause, there will be a distinct loss in mutual understanding in years to come, for even though to know us is not necessarily to love us, a shared education does make communication easier.

The Mexican military has a similar gap in its American education program, with few Mexican officers enrolled in US service schools—again, an inhibiting factor to closer military ties. A natural corollary is a shortage of English-speaking officers in the Mexican forces, although because of our own notorious deficiencies in language skills, perhaps this is not a point to belabor.

Some small progress in military cooperation, however, does seem to be taking place. They are little things, but not without significance. The Mexican Army, for example, says it has 25,000 troops engaged in the drug war. The Mexican Air Force has an exchange officer at the Air Force Academy, and we have a USAF officer at the Mexican Air Academy in Guadalajara, along with an F-5 pilot exchange officer at Santa Lucia. On that level, relations are constructive and friendly. As the level goes higher, relations become cooler and can become downright icy when well-meaning diplomatic initiatives, like those of President Jimmy Carter, go awry.

The Big Prize

The Central American revolution based in Nicaragua has, as its ultimate goal, a coalition, if not an actual federation, of Marxist states. This seems beyond argument. El Salvador is presently the target for the revolution, and a few years ago, success for the FMLN appeared imminent. Now that the Salvadoran revolution has been untracked, if not completely subdued, the timetable for Soviet-style Marxism in Central America is in need of revision. Nonetheless, should El Salvador fall, Guatemala, Honduras, and Costa Rica are next in line. And then, we can suppose the script reads, comes the big prize—Mexico.

The United States has a large embassy in Mexico City, a prominent if not a very stylish building on the elegant Avenue de la Reforma. There are obvious reasons why this American Embassy should be one of our largest, but it is not so clear why the Soviet Embassy in Mexico City should be one of that country's largest—not, that is, unless the purpose of such an establishment is to serve as headquarters for Central American subversion.

In the early part of this century, cavalry posts were dotted along the Mexican border, isolated little garrisons at places like Marfa, Del Rio, Brownsville, and El Paso. Because northern Mexico was itself isolated from the central region and sparsely populated, there was little to worry the cavalry squadrons—rustlers, the occasional bandit gang, perhaps, but no real menace.

The cavalry is gone, replaced by a thin line of civilian agents. There is still no threat today in the military sense, but if the United States and Mexico continue on their separate ways—distant neighbors, to use the title of Alan Riding's book on Mexico—the menace may, in time, develop. If that should ever happen, it is not likely the United States would have much left over for NATO or other international duties. ■

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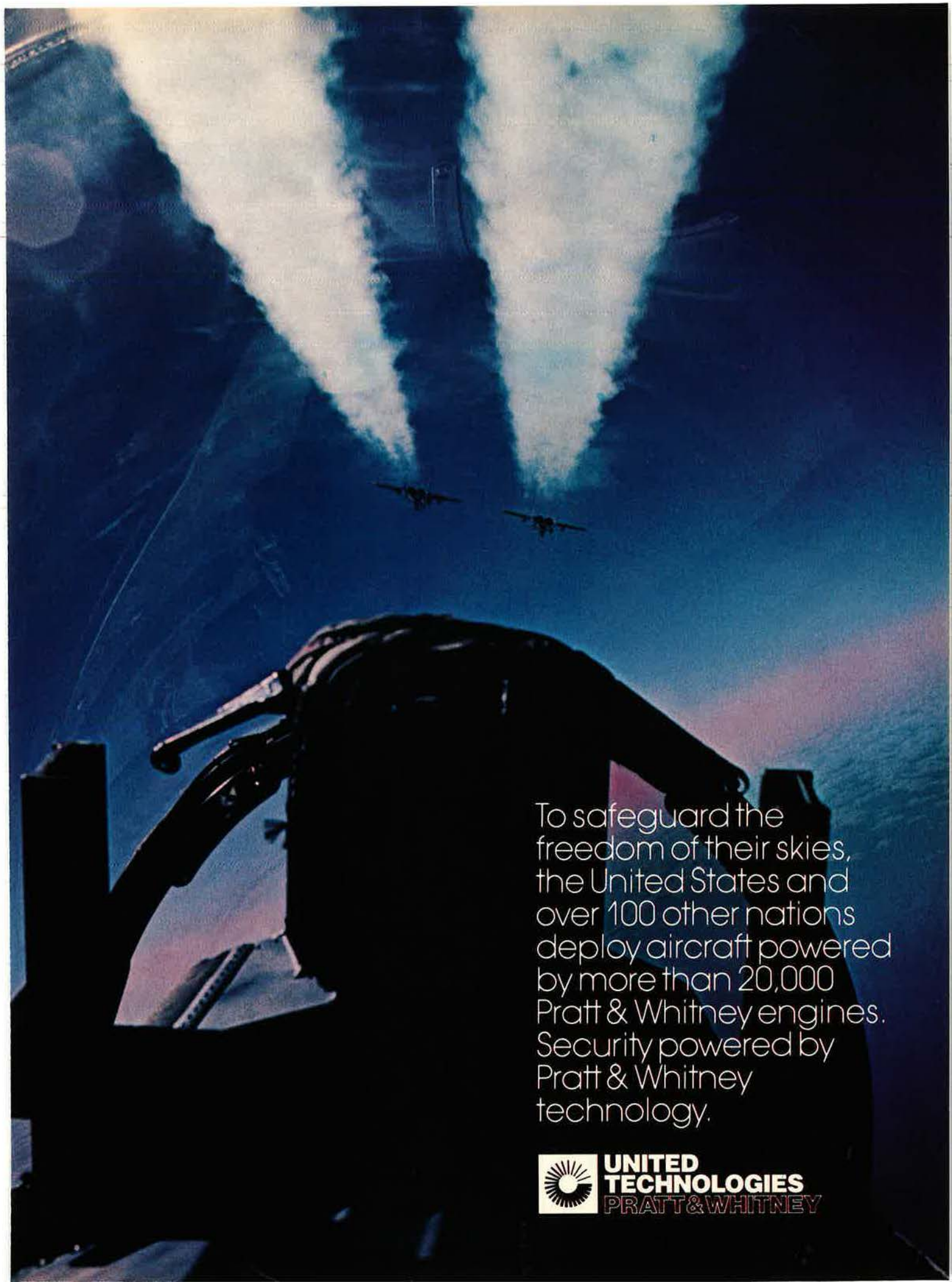
To safeguard the freedom of their skies, the United States and over 100 other nations deploy aircraft powered by more than 20,000 Pratt & Whitney engines. Security powered by Pratt & Whitney technology.
UNITED TECHNOLOGIES
PRATT & WHITNEY

Vast distances, harsh terrain, and lack of roads are among the reasons why tactical airpower tends to be the force of choice in the world's most troubled region.

Airpower in

BY MAJ. GEN. DAVIS C. ROHR, USAF
DEPUTY COMMANDER IN CHIEF, US CENTRAL COMMAND

The most volatile region in the world right now is southwest Asia and the Persian Gulf. The US interest and presence in the area are manifested by such joint exercises as Bright Star (above). Although Iran has technologically superior weapons, such as these Grumman F-14A Tomcats (right), the country has not been able to support or maintain them adequately, and consequently, only a handful are still operational.

THE most intense air war in the world today is the Iran-Iraq conflict, now in its seventh tragic year. In Afghanistan, Soviet airpower plays an important role in the struggle, now in its eighth year for control of that devastated nation. Both the Iran-Iraq war and Soviet aggression in Afghanistan are of special concern to the US in the conduct of international security affairs.

The Iran-Iraq and Afghanistan conflicts are being waged within the confines of the world's most politically tumultuous region. This volatile and incredibly diverse area, which really can be considered as a single geographical region only in the context of US security objectives, is outlined by the limits of the United States Central Command.

Ethnicity, tribalism, a patchwork of languages, religious differences, and political divisions superimposed across cultural boundaries all contribute to instability and confront US security interests in the area at all levels across the spectrum of conflict. The overland distances, rigorous terrain, and lack of warfighting infrastructure increasingly make tactical airpower the deciding factor in conflicts in the region.

The primary importance of this area to the free world is, of course, oil. Over the past year, the US has more than doubled its imports of Gulf oil, and many Asian and Western European states increasingly rely on the Gulf to satisfy a significant percentage of their requirements. Altogether, about one out of every three barrels of oil imported by the non-Communist world is pumped from the Gulf. More significantly, more than half of the world's proven oil reserves are located there. Over the longer term, beginning in the early 1990s, the area will increase in importance as domestic US and European sources of oil diminish and become increasingly expensive to recover.

Also significant are the area's strategic chokepoints, including the Strait of Hormuz, the Suez Canal, and Bab el Mandeb, the strait linking the Red Sea and the Gulf of Aden. The nations that control these routes of commerce have an importance for all of us far out of proportion to their size and gross national product.

Southwest Asia

Michael Coyne/Black Star

The Iran-Iraq War

The seven-year-old Iran-Iraq war is the result of both a centuries-old territorial dispute and a conflict of ideologies. This war is a curious hodgepodge of strategy and tactics, one being fought with a World War I mentality in the age of high technology. Iran's use of zealous Revolutionary Guards (*Basij*), attacking in human waves against strong fortifications, is reminiscent of the Russian Front in World War I. The Revolutionary Guards are essentially a light infantry force, often with little professional military training, but with audacity and a firm commitment to Islam. This, along with heavy (and continuous) artillery barrages against an entrenched enemy and the use of poison gas, has led to high casualties on both sides. There have been more than a million casualties so far. Iraq has lost fully three percent of its population and Iran 1.5 percent of its much larger population in this strange war of attrition.

When the war began in the fall of 1980, both states had large inventories of combat aircraft. Under the Shah, Iran was well equipped with more than 450 aircraft, including the F-14 (with the Phoenix missile), F-4, F-5, P-3, C-130 aircraft, and helicopter gunships. The Iranian revolution and the wave of imprisonments, executions, and exiles cost the Imperial Iranian Air Force its best officers. An arms embargo grounded most of the combat fleet. These factors reduced the Air Force of the Islamic Republic of Iran to little more than a static display. By 1986, the International Institute for Strategic Studies rated Iran's effective air strength at about eighty operational F-14, F-4C/D, and F-5E/F fighters.

In contrast, Iraq's air force was, and still is, equipped with large numbers of Soviet tactical combat aircraft and a smaller number of sophisticated French fighters. At the outbreak of hostilities, according to Institute figures, Iraq possessed slightly more than 330 combat aircraft, including MiG-19s, -21s, and -23s, Su-7s and -20s, and a small bomber force that included the Tu-22. By 1986, Iraq's air order of battle had increased to more than 500 combat aircraft and almost 100 armed helicopters. Iraq had also added MiG-25 aircraft and a small number of French-built Mirage F-1 fighter-bombers with Exocet missiles.

With these resources and the disparity in force structure, Iraq has held air superiority since early in the conflict despite problems with training, doctrine, and operational skills. Even so, Iraq used its air force timidly and ineffectively in the early stages of the conflict. Thus, tactical airpower on both sides contributed only modestly to the course of the conflict during the first five years, and neither side used its modern systems effectively.

Escalation With Airpower

Since 1985, however, Iraq has escalated the economic war through the use of its air force. It has struck oil export facilities, oil fields, and refineries by air, using its Russian and French fighter-bombers. Iraq's strategy appears to be to employ tactical airpower to strangle Iran economically. Iraq is enjoying some success, though it remains to be seen whether this will materially affect the outcome of the conflict.

It is unlikely that Iran will se-

riously be able to contest Iraq's control of the air anytime soon. Iran has to gain a military victory on the ground, and it must accomplish this before a deteriorating economy undermines the Iranian political structure. In the past several months, Iran has mounted a series of attacks, which apparently have met with some small success. To accomplish this, Iran has used its three-to-one population advantage, attacking with little sensitivity to losses, using massive artillery barrages coupled with waves of massed *Basij* volunteers.

Recent Iranian offensives (codenamed "Karbala IV" through "Karbala X") have taken their toll on Iraq, both in air and ground force losses. According to published accounts, these Iranian offensives have cost Iraq about ten percent of its total air strength—roughly again as many aircraft as Iraq had lost total since the war started in 1980. The losses underscore both improved Iranian air defenses and Iraq's increased willingness to use its air force to counter Iranian numerical superiority on the ground. Iraq does not have much more land it can yield to Iranian advances without incurring unacceptable political repercussions.

In addition, there are many—as yet unconfirmed—reports that Iran has purchased a number of Chinese fighter/ground attack aircraft (specifically the F-6, a Chinese derivative of the Soviet MiG-19). China, it appears, is emerging as a significant source of arms to the Islamic Republic of Iran, firm Chinese denials of an arms-transfer relationship with Iran notwithstanding. On the other hand, numerous reports say that the Soviets have moved quickly to replace Iraq's losses with some of their latest systems—including MiG-27 and MiG-29 aircraft, the latter having "look-down/shoot-down" capability.

An important corollary to the Iran-Iraq conflict has been a series of attacks on oil tankers and merchant shipping in the Gulf. Beginning in February 1984, more than 200 attacks had been mounted through 1986, most of them carried out by tactical fighters. This counternaval use of land-based tactical airpower is a continuing source of concern to those nations needing Gulf oil, since Iraq has targeted shipping that supports the Iranian oil export trade. Iran has targeted the ships of moderate Gulf states and other nonbelligerents that it felt to be supporting the Iraqi war effort. Kuwaiti flag carriers have been especially hard hit, which has prompted widely reported discussions on the need for protection of Kuwaiti and other nonbelligerent Gulf shipping.

A continuation of attacks on shipping as well as bombing raids on Iran's oil facilities in the Gulf (such as Kharg Island) can be expected. Iran, lacking an effective counter to Iraqi attacks on shipping, may retaliate against those Gulf nations appearing to aid the Iraqi war effort. This more effective use of tacair carries a danger of widening the number of participants in the war, to the detriment of the world's economy.

Both Iran and Iraq have employed aircraft extensively in the tanker war. Iraq has found a potent combination in the Mirage F-1 and the Exocet missile, as demonstrated by the tragic attack on the USS *Stark* in May. Iran has reportedly used its P-3 and C-130 aircraft to track maritime targets and then attack them with either F-4s (with Maverick missiles) or armed helicopters.

The widely reported Iranian acquisition of large, Chinese-made surface-to-surface cruise missiles has added a new and dangerous dimension to the Gulf crisis. It is unclear what use Iran may make of these weapons, which, unlike other munitions employed in the tanker war to date, have the capability to sink large oil tankers. This could lead to a *de facto* closure of the Strait of Hormuz and almost certainly would invite both intra- and interregional military involvement.

The Afghanistan Conflict

The war in Afghanistan has devastated and depopulated much of the countryside. A standoff remains between the Soviet/Afghan military and the freedom fighters (*mujahedeen*), with heavy losses on both sides. After nearly eight years of brutal occupation, the Soviet Union has failed to consolidate its rule and has been forced to revise its military tactics drastically. Today, Soviet military forces focus more on small unit operations with specialized (*Spetznaz*) units and air attacks and no longer rely as much on massive valley sweep operations. The military campaign has been ruthless and

Setboun/Black Star

The conflict in Afghanistan between the Soviet Union and the mujahedeen freedom fighters has been going on for eight years and has bogged down into a stalemate. While this "simple operation" has turned into a protracted struggle, Soviet crews, weapons, and tactics have been honed in this very "real-world" situation.

has included a "scorched earth" policy.

In the 1987 issue of *Soviet Military Power,* the US Department of Defense observed that "the mixed success of the Soviets in attaining their basic military objective is due largely to their inability to build the Afghan armed forces into an effective, independent fighting force." This is certainly true in the case of the Afghan air force, which has proven ineffective and which lost, reportedly to *mujahedeen* sabotage, a whole squadron of fighter aircraft in a single incident in 1985. However, the losses by the Afghan air force are being heavily backstopped by the Russians. *Soviet Military Power* further says that "some of the latest equipment in the Soviet inventory is being deployed to Afghanistan, not only for testing but also for improving firepower, mobility, and survivability of Soviet forces."

The Soviets have employed tactical airpower in the conflict with effectiveness and resourcefulness, using such improved ground attack systems as the Su-25 Frogfoot fighter and the Mi-24 Hind helicopter, and have placed greater emphasis on aggressiveness and independence of action by Soviet aircrews.

As a professional US airman, I cannot help but think how the conflict is giving a generation of Soviet pilots actual combat experience at a time when the US combat-conditioned aircrews of the Vietnam era are fast approaching retirement. With Soviet troop strength in Afghanistan continuously higher than 100,000 since December 1979, large numbers of Soviet military men, pilots included, have rotated through combat assignments, and there are now increasing indications that a tour in Afghanistan is an important step for professional officers. From our standpoint, this Soviet combat exercise has implications for US servicemen worldwide. They would now face a better combat-trained enemy than would have been the case in the 1970s.

The Afghan freedom fighters, the *mujahedeen*, remain committed to the struggle, which they view as a religious obligation. Soviet and Afghan MiG aircraft are not very effective against the resistance. The relentless bombing of civilian villages and destruction of crops have robbed the *mujahedeen* of some of their support, however, as the local inhabitants have fled the country. The Hind helicopter gunships, heavily armed and armored and each capable of carrying a squad of troops, have been harder for the *mujahedeen* to deal with.

Recent *mujahedeen* advances in air defense, with use of man-portable surface-to-air missiles said to be increasing, have driven Soviet aircraft to higher altitudes and have taken an increased toll on aircraft and helicopters. At the very least, these small, mobile missiles have made the Soviets revise their air tactics. The *mujahedeen* are holding their own against the Soviets—for now. The immediate future will be critical. While the war has been costly for the Soviets, there is little indication that the Soviet military occupation will be a short one or that final withdrawal of Soviet forces will be on terms other than favorable for the Soviets.

Across the Border

Just as the flexibility of airpower has contributed greatly to a broadening of the Iran-Iraq war, so too has tactical airpower extended the war in Afghanistan into Pakistan. Soviet aggression in Afghanistan has driven millions of refugees across the border, and threats against Pakistan for support of Afghan resistance and refugees have been thinly veiled. Pakistan remains strong in its support of the *mujahedeen*, despite a Soviet campaign of sabotage and subversion in the border areas. Soviet/Afghan air violations of Pakistan's territory to attack the refugee sanctuaries tripled in 1986, and cross-border artillery shellings increased by a factor of five.

Bill Foley/Black Star

The seven-year-old Iran-Iraq war is being fought with a World War I mentality in the age of high technology. Human wave tactics are not uncommon.

These violations have posed some real problems for Pakistan. Its air force has been equipped mostly with older Chinese systems, notably the F-6 (a twin-engine derivative of the Soviet MiG-19) and the A-5 (a twin-engine ground-attack hybrid, mating the F-6 and other technologies). Pakistan's air defense structure has not been up to dealing with the Soviet/Afghan air threat, and initial Soviet air incursions and bombing of border areas and refugee camps went unanswered.

More recently, US security assistance, including transfer of the F-16 multirole fighter, has strengthened Pakistan in this regard. The heightened tempo of the air war along Pakistan's border with Afghanistan has caused the Pakistanis to redouble their efforts to seek improvement of their command and control network, particularly their airborne early warning and control capabilities.

Challenges to Regional Stability

In intraregional crises short of overt Soviet aggression, US policy is based on the assumption that states should answer their own security challenges wherever possible. However, at the request of friendly states, the US has sometimes responded to contingencies with sized force packages. Given the great distances and the need for rapid response in such cases, the support has involved tactical air packages of fighters, tankers, and/or early warning aircraft—or tactical air assets on US Navy carriers. To date, such deployments have invariably been successful in defuzing potentially explosive situations.

On several occasions in the 1960s and 1970s, fighter aircraft were dispatched to Saudi Arabia to demonstrate US support for Saudi sover-

Bill Foley/Black Star

There have been more than one million casualties in the Iran-Iraq war so far, and no end to the fighting is yet in sight. Iraq is well supplied by the Soviet Union, as this Iraqi-manned Russian tank indicates, but despite holding air superiority, the Iraqis cannot seem to deliver a knockout blow. The Chinese have now reportedly entered the fray by selling arms to Iran.

eignty and US resolve. The extended US E-3A AWACS deployment to Saudi Arabia, continuing since 1980, has helped send the same message: It is our intent to keep the Gulf war from spreading. On three occasions in 1983 and 1984, USCENTCOM deployed AWACS, tanker, reconnaissance, and other assets to friendly states in the Middle East to aid them in responding to actual or imminent aggression. With these few exceptions in which our friends asked for contingency help, moderate regional states have answered their security challenges successfully and without recourse to US force involvement.

To promote these successes, and in the absence of forward-deployed US forces, security assistance is an especially important tool for USCENTCOM. A comprehensive US security assistance effort to the moderate regional states, to include US arms transfers, may limit or obviate entirely the need for involvement of US forces in situations short of overt Soviet aggression. In any case, these security assistance efforts enhance military cooperation and interoperability with US forces and promote development of such regional defense organizations as the Gulf Cooperation Council, which seeks to reduce threats to stability.

There is no better single example of the impact and effectiveness of the US security assistance program in the region than the 1984 Saudi response to airspace violation by Iranian fighter aircraft—an intrusion that threatened critical Saudi oil facilities. US-built Saudi F-15 aircraft intercepted the intruders and downed at least one. This single, resolute act undoubtedly has had a containing effect on the Gulf war. It also bolstered the confidence of the Royal Saudi Air Force.

Faced with diplomatic constraints on US presence in the region, it is easy to understand that the security assistance effort has become a profoundly important aspect of US relations and interaction. In several cases, most notably Egypt and Pakistan, states that once relied on Communist support have "bought American" and are integrating US aircraft into air forces even though they are still predominantly equipped with Soviet or Chinese aircraft. In one other case—North Yemen—US and Soviet security assistance efforts coexist on the same airfield. US-built Yemeni F-5s compete daily in a not-so-friendly rivalry with Soviet-supplied Yemeni MiGs. This interesting situation may work to US advantage, since, from all reports, the Soviet assistance suffers by comparison.

The Russians Push South

While the challenges to regional stability are many, the main threat to US and free world interests in the area is that posed by the Soviet Union. While the Russian invasion of Afghanistan caught analysts off guard in December 1979, Soviet ambitions toward this entire region should not have come as a surprise. The Russians have tried to expand their borders and influence southward since the time of Peter the Great in the seventeenth century. This desire to expand to the south does not appear to have diminished during the Soviet era, as pre- and post-World War II Soviet machinations in Iranian Azerbaijan attest.

Today, in addition to bases in Afghanistan, the Soviets have the use of military facilities in Ethiopia and South Yemen. They also have a large advisory presence across Africa, providing access to a network of bases from which Soviet naval forces in the Indian Ocean could threaten critical sea lines of communication.

In the early 1980s, the Soviet forces that directly faced Iran and the Gulf were assigned to a new Soviet Southern Theater of Military Operations (or Southern TVD). These forces include more than thirty mechanized and armored divisions and nearly 1,000 tactical air-

craft. There are many questions yet unanswered about this southern theater, but the man in charge is General of the Army Mikhail Zaytsev, the former commander of the Group of Soviet Forces Germany. As commander of the Southern TVD, he is a combined-arms commander, directing all operations in the area, including those in Afghanistan. He reports directly to the Supreme Soviet High Command. The orientation of his TVD has evidenced a more aggressive character over the last several years.

Southern TVD air assets include all the primary, state-of-the-art Soviet fighters, including the MiG-29 Fulcrum (a very capable counterair fighter), the Su-25 Frogfoot (front-line close air support aircraft), Su-24 Fencer (highly versatile all-weather fighter-bomber), Su-27 Flanker (air-superiority interceptor), as well as the Mi-26 Halo (the world's largest heavy lift helicopter).

CENTCOM as Counter

The only effective counter to this threat from the Southern TVD would be the forces of US-CENTCOM. Born out of the realization that the Rapid Deployment Joint Task Force could only be a temporary remedy for a more permanent problem, the command was established in 1983 as a separate unified command at MacDill AFB, Fla. It reflects a growing US recognition of the importance of the region and its resources, the region's instability, and the threat of potential Soviet aggression.

The Gulf is more than 7,000 air miles from the eastern United States, and the sea lines around the Cape of Good Hope are more than 12,000 miles long. Challenges include the lack of transportation and communications infrastructures, an expansive and physically rigorous region, and diplomatic limitations on US military access that inhibit prepositioning of forces for deterrence. This latter factor slows, somewhat, US response to contingencies. The US must rely instead on the rapid deployment of CONUS-based forces.

Several carrier battle groups and a substantial number of tactical air force squadrons are part of the available planning force. Tactical airpower can disrupt and delay a Soviet invasion of Iran, should the Russians choose that route. It is the tactical fighters and attack aircraft of the US Air Force and Navy, coupled with the conventional bombing capability of the B-52, that could provide the hammer to blunt a Soviet advance. The rugged terrain awaiting advancing Soviet forces in northern Iran would support a successful US air interdiction campaign.

Given Iran's limited road network through these mountains to the south of the Soviet border and the many associated physical constraints and chokepoints facing vehicular traffic, air interdiction could be expected to degrade Soviet operations seriously. US tactical strikes could focus precisely on such constrictions and chokepoints. The employment of "smart" munitions is absolutely critical here, not only because of the nature of the threat and the need for precision delivery but also because of the long logistics tail that restricts the quantity of munitions that can be transported. The rapid introduction of US tactical airpower and the subsequent air interdiction campaign would provide additional time for major US ground forces to reach the area, if required.

To protect their interests, many countries are investing heavily in new weapons. This US-built F-16 belonging to Egypt symbolizes such investment.

The threat of rapidly deployable and combat-capable tactical airpower and conventional B-52s provides an effective deterrent to direct, large-scale Soviet military aggression. Our new national resolve in recognition of the region's importance has caused more than one analyst to remind us that where the US has marked an area as vital and has developed a military capability to intervene effectively, these factors have served as a deterrent and as a barrier to direct, overt Soviet military intervention.

The area stretching from Egypt eastward through Pakistan and south across the Arabian peninsula and the Horn of Africa to Kenya is an area in which the importance of tactical airpower is magnified. The intratheater distances, coupled with the lack of roads, harsh terrain, and lack of large standing armed forces and military supporting infrastructures, have caused regional states as well as the United States to lean toward tactical airpower as a problem-solver in crises.

Tactical airpower hasn't always been employed to full capacity in regional conflicts, as the Iran-Iraq war shows, but it remains a vital component in protecting the territorial integrity of moderate regional states and an important tool in promoting and defending US security objectives, particularly in this region almost devoid of other US forces. The hallmarks of tactical airpower, including speed, flexibility, power, and, in some cases, indications of serious intent, make tactical airpower—both land-based and sea-based—the cornerstone for responding rapidly to regional security challenges. Only airpower gives credibility to US security policy at such long distances and in such a difficult environment. ■

At the time this article was written, Maj. Gen. Davis C. Rohr, USAF (Ret.), was Deputy Commander in Chief, US Central Command, MacDill AFB, Fla. In this capacity, General Rohr was responsible for US military activity in a nineteen-country area in the Persian Gulf, Horn of Africa, and Southwest Asia. A West Point graduate, General Rohr flew 245 combat missions as an F-100 pilot during the Vietnam War. He assumed his position at US Central Command in August 1984. He recently retired.

True to the spirit of Giulio Douhet, the Italian Air Force takes pride in its heritage, but concentrates on the future.

Airpower, Italian Style

AIRPOWER has always been special in Italy. Perhaps it is the heritage of Giulio Douhet—an Italian version of Billy Mitchell who recognized the potential of airpower even before the Wright brothers visited Italy in 1909.

True to the legacy of Douhet, the Italians were the first of the NATO allies to make a concrete contribution to airpower on the Alliance's southern flank. In 1951, shortly after a small group of Italian and US Air Force officers met in Florence to lay the groundwork for air operations in the Southern Region, Italy contributed the first air tactical group to NATO. Equipped with F-47 Thunderbolts and F-51 Mustangs, that group was the foundation of what is now a sizable and capable allied air force in NATO's Southern Region.

The Italian Air Force is unmistakably a NATO air force. The Air Chief of Staff, Gen. Franco Pisano, makes that very clear when he summarizes his mission as simply, "Devoted to NATO." This dedication to NATO is also reflected in the official briefing, which describes the service's mission succinctly as being "to conduct the air battle and to concur, with the other services, to the defense of the national territory, the adjacent seas, and other areas of interest for the achievement of national and NATO military goals."

Like the Alliance it supports, the Italian Air Force (IAF) focuses on defense. In fact, IAF briefing officers describe two major missions: air defense in peacetime and implementing war plans by conducting air defense, counterair, reconnaissance, and interdiction operations. The IAF's missions also include "air support to the land and maritime battle" and supporting forces operating from Italian territory.

The importance of the air defense mission and of Italy's full support for the NATO military structure was confirmed in 1961 when the entire national air defense system was placed under NATO command and control. Unlike other Alliance air units and the IAF organizations that are not devoted to air defense—which "chop" (*ch*ange *op*erational control from national to allied command) aircraft and crews to NATO control only for alerts and exercises or during contingencies—Italy's considerable air defense assets are under allied command daily. Consequently, any discussion of the Italian Air Force must take into account the two chains of command—national and allied.

Two Chains of Command

Italian air defense forces are assigned to the commander of the Fifth Allied Tactical Air Force (5ATAF) headquartered at Vicenza in northern Italy, not far from Ven-

A flight of Italian Air Force Tornado aircraft streaks over the Alps. Italy is coproducing the swing-wing fighter-bomber with Germany and the UK.

Based on reports by Maxine Donnelly of New York State AFA

ice and the US air base at Aviano, which hosts rotational F-16 squadrons from USAFE.

Commanded by an IAF lieutenant general, 5ATAF is one of the two primary air commands under Allied Air Forces Southern Europe (AIRSOUTH). The commander of AIRSOUTH controls assigned air assets in support of the Commander in Chief Allied Forces Southern Europe (AFSOUTH), which is one of the three major allied commands under NATO's Supreme Allied Commander Europe. AFSOUTH and AIRSOUTH headquarters are collocated in Naples.

5ATAF's area of responsibility includes Italy itself and islands, adjacent areas, and a sizable portion of the Mediterranean. The commander of 5ATAF controls the IAF's air defense forces daily and other assigned forces—IAF attack forces and deploying squadrons from USAF or other NATO air forces. Command and control of all assigned forces is accomplished through an Air Operations Center.

Although assigned to 5ATAF for operational control, the IAF's seven air defense fighter squadrons, C^3 units, and missile groups are also integrated into the IAF structure. Air Chief of Staff General Pisano's headquarters near Rome controls the service's more than 70,600 personnel and the assigned aircraft.

The IAF is built around two discrete elements: a central organization that includes the Air Staff and a variety of specialized commands and what the IAF calls a "peripheral organization," which consists of three geographic commands with full administrative and operational control (except for air defense) over assigned units.

Within the "central organization" are "inspectorates" for specific functions. These organizations resemble major deputates in the USAF structure for functional management of specialties, but they have "direction and control" over their specific areas of responsibility, not just a policy or advisory function.

Among the major "inspectorates" is the one for naval aviation. The IAF owns and operates two squadrons of Breguet Atlantic aircraft for marine reconnaissance and antisubmarine warfare (ASW) missions.

The Italian Air Force counts three types of helicopters in its inventory, among which are Sikorsky HH-3Fs serving in a search-and-rescue role. This HH-3 is shown overflying the Colosseum in Rome.

These squadrons are under operational control of the Italian Navy, which uses them to complement its five ASW helicopter squadrons.

Another is the Training Command, whose service academy at Pozzuoli offers a four-year program that commissions officers for flight or engineering duty. The Training Command also operates a War College in Florence and oversees pilot training. Italian pilot training programs include participation in the Euro-NATO Joint Jet Pilot Training Program conducted by USAF Air Training Command's 80th Flying Training Wing at Sheppard AFB, Tex.

National programs are conducted by six training squadrons using the SF-260 light propeller aircraft for the introductory phase and the Aermacchi MB-339 (which is also flown by the IAF aero demonstration team, the Frecce Tricolori) for primary and a portion of advanced training. Additional advanced training and fighter lead-in are conducted using the G-91T. The IAF also has specialized flying training units. Among these are a helicopter training squadron, a conversion training detachment for Tornado pilots at the Trinational (UK, Germany, and Italy) Training Establishment at RAF Cottesmore in England, and an F-104G conversion squadron.

Command of the operational forces rests within the "peripheral" organization. Italy is divided into three air regions, each with a commander reporting directly to the Air Chief of Staff. These three commanders are responsible for "all operational, logistical, training, and administrative activities in their respective areas." In addition, there are two independent Regional Operational Commands (ROC) that provide command and control services and airspace management.

This organizational structure, with redundant and overlapping responsibilities and authorities, is confusing. IAF officials note that it "does not fully meet our operational needs." Consequently, the IAF has proposed a reorganization for a "simpler, more flexible, and well-reacting organization." They envision a new chain of command consisting of three functionally assigned commanders under General Pisano. Under this proposal there would be an operational commander with all air, missile, and ground environment units assigned, a training commander responsible for all flight and other training, and a logistics commander who would conduct all forms of logistics support and administration.

Iron on Target

The IAF has about 300 combat aircraft and flew about 41,000 hours in 1986, according to the Chief of

Staff. The IAF has shared in Italy's slightly enhanced defense budgets in recent years and, in 1986, managed to fly 4,000 more hours than it did in the previous year.

The pride of the IAF is three squadrons of the Tornado aircraft, which Italy coproduces with the UK and Germany. Assigned an air-to-ground mission, the Tornado has an extensive and highly capable avionics suite—including terrain-following radar, Doppler radar, and integrated computer system—plus diversity of ordnance and range. The Tornado squadrons, according to one Italian officer, satisfy "the most important requirement for counterair, interdiction, tactical support of maritime operations, and, if necessary, close air support."

Also in the air-to-ground force are two squadrons of Italian-built G-91Ys and a squadron of F-104S aircraft. Additionally, two reconnaissance squadrons are equipped with RF-104 and G-91R aircraft. Tactical forces carry an array of munitions and are equipped with the Kormoran and Maverick air-to-surface missiles.

The IAF's air defense forces still rely on seven squadrons (more than eighty aircraft) of the sleek but ancient F-104S, armed with Sparrow and Sidewinder missiles. Augmenting these squadrons in the high-altitude intercept role are Nike-Hercules squadrons, with almost 100 missiles deployed. Low- and intermediate-altitude and point air defense are handled by Italian Army HAWK and Spada battalions and antiaircraft artillery under the operational control of the Air Force.

Italy's three tactical airlift squadrons are equipped with the G-222 and Lockheed C-130Hs. Proximity to the Warsaw Pact relieves the Italian Air Force of the need for strategic airlift.

For electronic battle, the IAF deploys an ECM squadron with specially equipped G-222 and PD-808 aircraft. It also has a variety of communications aircraft for command and control.

Proximity to the Warsaw Pact relieves Italy of requirements for strategic airlift, but the Italian Air Force does have a tactical airlift mission. Moving forces and equipment around is the province of the nation's three airlift squadrons—two equipped with the G-222 and one with Lockheed C-130Hs. The IAF also has three different helicopter types—including Sikorsky HH-3s—assigned to its search-and-rescue squadrons.

The IAF is extremely proud of its Division for Research and Experimentation, located at Pratica di Mare Air Base outside Rome and commanded by Gen. Rolando Goldoni. Activities range from basic research to evaluation of modifications to existing aircraft and validation work.

The command works closely with the nation's industries. Current interests include nondestructive in-

The AMX light fighter-bomber aircraft is under development for the Italian Air Force. The IAF expects the AMX to fill close air support, battlefield interdiction, and low-level daytime air defense roles.

spection for defects and malfunctions within critical components and materials, advanced software packages for specific Air Force needs, new energy weapons and satellite defense systems, the San Marco space project, the man-machine interface, and the development of new vaccination techniques for military personnel.

Toward the Future

Force modernization is a very high priority in the IAF. General Pisano notes that "thirty-four percent of the budget [approximately the equivalent of $2.5 billion] is going toward updating and procuring new equipment."

General Pisano also said, however, that the 1987 budget forecast puts Italy on the low end of NATO investment in aerospace capabilities. It was reported that at a special briefing in Rome in February, the General contrasted such low spending with the variety of pressing defense requirements now facing the IAF. Among the highest priorities were the need for improved missile defenses, an airborne early warning aircraft, and a tanker fleet.

Another high priority is the acquisition of new air defense capabilities to replace the F-104 aircraft and aging Nike-Hercules missiles.

The IAF indicates it is pursuing a HAWK improvement program to satisfy some of its medium- and high-altitude requirements in the future. Additionally, the acquisition of more Spada batteries and modern radar-controlled air defense guns is planned.

As a replacement for the F-104 in the air defense role, the IAF is banking on the multinational European Fighter Aircraft (EFA) program. Together with the UK, Germany, and Spain, the IAF is developing the EFA to perform the full range of air-superiority missions—from ground air defense alert to combat air patrol.

Continued deployment and modification of the Tornado are also high on the IAF's list. Additionally, a replacement for the F-104 and G-91 in the fighter role is planned. The Italians have begun development on a new light fighter-bomber called the AMX. The IAF describes this program as "based on a precise requirement of the Italian Air Force . . . [to] cover the entire spectrum of offensive operations, being particularly effective in close air support and battlefield interdiction. Its maneuverability and armament will allow also a capability for low-level, daytime air defense operations." The AMX made its first flight in the spring of 1984.

Italy is pursuing other modernization initiatives through NATO's Conventional Defense Improvements (CDI) program, which seeks to focus technological expertise on a number of critical deficiencies. And in response to NATO's focus on cooperative R&D and acquisition, Italy has joined in a number of multinational efforts. Among these is the vital NATO Identification System, which aims to solve—at long last—the Alliance's severe difficulty in distinguishing airborne friends from airborne foes.

In the Advanced Medium-Range Air-to-Air Missile (AMRAAM) program, Italy is officially an observer nation, along with Canada. AMRAAM, designed to be autonomous shortly after launch and engage more targets more rapidly than currently deployed systems can, will be compatible with the Tornado. Italy is a full participant in the seven-nation Modular Standoff Weapons program, now in a preliminary phase. Italy leads a consortium of six European NATO nations to coproduce the AGM-65D Imaging Infrared Maverick air-to-ground missile. Other joint efforts involving the Italian Air Force include the Low-Cost Powered Dispenser for use against short-range targets and the Short-Range Antiradiation Missile program.

NATO and the Italian people are well served by an IAF that is clearly committed to fulfilling Douhet's challenge "that our country has a right to strictly require that air resources should be exploited in the best way." ■

The aging F-104S fighter, armed with Sparrow and Sidewinder missiles, still makes up the bulk of IAF air defense forces. The Italian Air Force is banking on the European Fighter Aircraft program to yield a replacement air-superiority aircraft.

OUTNUMBERED BUT NOT OUTMANEUVERED.

Warsaw Pact forces outnumber Allied troops in Europe by 4 to 1. But a highly sensitive airborne radar system now being developed will turn the odds in our favor. It's Joint STARS (Surveillance Target Attack Radar System), a Grumman-led team project for the U.S. Air Force and Army.

Housed in an E-8A aircraft, Joint STARS will detect, classify, and target enemy fixed and moving units, allowing air and battlefield commanders to launch weapons against them. With this "electronic high ground," airborne and ground forces can effectively counter armored thrusts and attack the enemy with less manpower—and less risk.

Grumman Melbourne Systems, Melbourne, FL 32904.

GRUMMAN

Strategic Connections in Space

The problem of mobile and hardened targets is growing. This puts increased importance on the manned bomber—and makes linkage to "overhead" sensors and cuing devices imperative.

BY EDGAR ULSAMER
SENIOR EDITOR (POLICY & TECHNOLOGY)

MORE and more, the job of deterring, or fighting, war on earth is carried out in space. The Air Force Association's national symposium "The Military Imperatives in Space," held on May 22, 1987, in Colorado Springs, Colo., documented this growing reliance of modern air, naval, and ground forces on space to warn, assess, command, detect, navigate, target, defend, and carry out a myriad of other military functions spanning the spectrum from strategic nuclear to low-intensity conflict.

In the case of the Strategic Air Command, this reliance on space—and support from space-based systems—is pervasive. SAC's ballistic missiles travel in space, its command and control apparatus is largely space-based, and the command's air-breathing weapons navigate and target with the help of space-based sensors. SAC's Commander in Chief, Gen. John T. Chain, Jr., told the AFA meeting that "our position in space today is not as good as I would like it to be," adding that "we are at about the same place now in terms of use of space that the first fragile observation planes were early in World War I in terms of the military use of the air."

The "toughest" technological problem confronting SAC stems from the Soviets' drive to make either superhard or "relocatable" the bulk of their strategic assets, which US strategic forces must be able to hold at risk to provide effective deterrence, General Chain told the AFA meeting. As more and more strategic targets in the Soviet Union become relocatable—"what they can't harden, they are making mobile"—SAC's dependence on "overhead" support increases correspondingly, he pointed out. Because "we don't have people on station watching what [the Soviets] are doing" with their relocatable strategic assets, "we [have] first got to find them before we can target them." Even in the case of relocatable strategic targets that can be detected and identified, SAC is up against a time crunch because of the question of whether or not these targets "will still be [where they were when the decision was made to attack them] by the time our weapon gets there." The best weapon against relocatable targets "we have today—and [it] has been for many years—is the manned bomber, because [the crew] is able to make on-site decisions."

In order to maximize the effectiveness of the bomber

against relocatable targets, the aircraft commander "is going to have special sensors aboard [as well as information from] special cuing sensors before he gets there." As a result, SAC must rely "on space systems to cue the bomber [in regard to] where he is going to have his initial look, and once he gets there, he will have to determine that this is the target he was sent after," General Chain explained. Next, the bomber will need a weapon to deliver against the relocatable target, and "that is SRAM II." Urging Congress to support the Air Force's funding request for SRAM II, the head of SAC emphasized that "we need a weapon that we can shoot over the shoulder over a significant distance so that we can hit" relocatable and other strategic targets.

Reiterating that the increasing numbers of mobile targets in the Soviet Union represent a "major, tough problem" that is pushing the ingenuity of the US defense community to the "outer limits," General Chain appealed to aerospace industry: "If you can break that code [of linking strategic bombers with the required overhead sensors and cuing devices], you will do well for your country and also for your company." SAC's Scientific Advisory Group, along with many other high-powered military and civilian organizations, is concentrating on this central challenge, he added.

Another symposium speaker, Maj. Gen. Robert A. Rosenberg, Director of the Defense Mapping Agency (DMA), reported that his agency, as part of the Defense Department's concerted RT (relocatable target) effort, is drawing up a "terrain analysis data base" for SAC that pinpoints areas in the Soviet Union "where these [mobile] weapons could and could not go." DMA also is compiling digital mapping data to facilitate calculation of target coordinates. DMA's work in the relocatable target area, he added, is focused specifically on the on-road/off-road mobile SS-25 ICBMs.

Bolt-Out-of-the-Blue Attacks

The effectiveness of space sensors affects strategic warfare doctrine broadly and is a key factor, for instance, in making a successful bolt-out-of-the-blue attack practically infeasible, according to SAC's Commander in Chief. Some elements in Congress profess profound concern over the possibility of a Soviet bolt-out-of-the-blue first strike and, by extension, insist on ICBM basing modes that are demonstrably impervious to such "no warning" attacks.

General Chain "rejected" this premise on grounds that the Soviets could not mount a surprise attack without bringing down on themselves US retaliation "in spades." As preconditions to such a Soviet attack, the "world would have to be in some sort of a crisis, and somebody on [their side would have to find reasons for assuming] that they could get away with a bolt-out-of-the-blue attack," he argued. But no such reasons exist. On the US side, about half of the SSBNs (the nuclear-powered submarines carrying SLBMs) are always at sea, about thirty percent of the strategic bombers are on alert around the clock, and invariably about ninety percent of ICBMs are ready for immediate launch. "So there is no way that the Soviets wouldn't get it back harder than they could possibly stand," General Chain concluded.

Moreover, in times of crisis, the alert level of the US strategic nuclear forces could be stepped up to the point where 100 percent of all the bombers would be on alert and almost all the SSBNs would be at sea and ready to retaliate instantly. In the future, General Chain added, any harbingers of a developing crisis would probably trigger the deployment of the fifty rail/garrison Peacekeeper ICBMs throughout the US railroad net to ensure the imperviousness of these weapons to any surprise attack without impairment to their prompt hard-target kill capability.

Another equally compelling factor militates against even a remote chance of successful Soviet bolt-out-of-the-blue attack, SAC's Commander in Chief told the AFA meeting: "We have people who are watching full-time the Soviet indicators." US authorities, as a result, know a "hell of a lot of what is going on in the Soviet Union."

If the Soviets were to plan a nuclear first strike against the US, they almost certainly would want to disperse their bombers, because "otherwise they are going to be destroyed on the ground." In similar fashion, Soviet war planners would be required to order some or all of the SSBNs to sea lest the submarines be destroyed in port, General Chain explained. As another precondition to an impending nuclear strike, major elements of the Soviet ground forces would have to be moved out of their garrisons, because "otherwise they are going to be blown up. Lastly, I assume that the Soviet leadership" would want to survive and would hence seek shelter. "Well, any time [they] are going to do any of these things, or a combination of these things, that's rather a large-sized warning." The only way that a Soviet bolt-out-of-the-blue nuclear attack scenario makes any sense at all, he suggested, is if the US were "to take all the bombers off alert, put all the SSBNs in port, [and] stood down all the ICBMs and told [the crews] to take the weekend off"—a truly implausible circumstance.

While General Chain seemed to reject the notion that in the foreseeable future the US could shift to a declared launch-on-warning strategic deterrence posture anchored in blind faith in sensor information—regardless how advanced and redundant—he acknowledged that improved data from a host of different sensors will make decision-making by the National Command Authorities (NCA) "much easier." Stressing that the US "really doesn't have a launch-on-warning strategy," he pointed out that the national strategy revolves around the President and the NCA making decisions "depending on how scenarios unfold."

Offensive Strategic Forces and SDI

Expressing his support of the Strategic Defense Initiative (SDI), General Chain suggested that the eventual deployment by both the US and Soviet Union of such prodigious, layered ABM defenses would probably curtail the role of the ICBM forces within the strategic triad, either through negotiations or by choice. At the same time, however, General Chain predicted concurrent, significant increases in the importance of the air-breathing element of the strategic triad, because "with SDI, we will have the door shut but the windows open."

Dramatic declines in US air defense forces over the past three decades resulted in a system that at present "is certainly penetrable." It follows, he suggested, "that

once we have built a shield against incoming missiles [on both sides], we then will have to worry about [building up the capability of] bombers [to generate and deliver] gravity bombs, standoff missiles, and cruise missiles" as well as about boosting cruise missile deployment on submarines and surface ships. With the "front door shut, we will have to nail the windows shut by stopping the air-breathers," he argued.

As a result, General Chain predicted that unless mutual "caps" can be negotiated, "the day we end up with an SDI system on both sides" the US will have to up its strategic bomber force to between 1,000 and 2,000 aircraft with a corresponding increase in advanced cruise missiles. "If the Soviets build an SDI, that means that [SAC] will have to have a larger bomber force with greater standoff capability because the bomber will have to be the penetrator. So the [Advanced Technology] 'Stealth' bomber, rather than [being acquired in the limited] numbers that we are looking at right now, will have to go up to very high numbers."

SAC's bomber force, General Chain said, "is keeping pace with Soviet air defenses through more capable warplanes and such improved standoff weaponry" as the air-launched cruise missile and the advanced cruise missile. The space-based Navstar Global Positioning System, by providing positional information accurate to within fifteen meters, will, "for instance, increase our conventional bombing accuracy fourfold," General Chain reported.

CHAIN: Given mutual strategic defense against ICBMs—and no cap on air-breathers—the US might need 1,000 to 2,000 manned bombers.

Rail/Garrison Basing

While completing the deployment of the first fifty Peacekeeper ICBMs in existing Minuteman silos, SAC and the Air Force are developing the rail/garrison basing for the second fifty missiles. This basing scheme combines accuracy with high survivability, "which equates to stability and [provides] a 'show of force capability' during times of crisis."

The Senate Armed Services Committee, however, has claimed that its investigations "found the Air Force unable as yet to answer many fundamental questions about rail/garrison operations after strategic warning has been declared." Specifically, the Committee claimed, "how the trains would be integrated into the existing railroad network—which may itself be undergoing the severe stress of a full-scale conventional force mobilization—and how the security of their locations can be preserved within a nonsecure railroad communications and signal environment are typical of the kinds of questions for which the Air Force lacks good answers." For good measure, the Senate Armed Services Committee report added that it would find relevant analytical research by the Air Force more persuasive than "engineering development."

Asserting that he "completely rejected" these contentions, General Chain told the AFA meeting, "I have no problem at all integrating [the rail/garrison deployment mode] into the railroad system. . . . The country has about 200,000 miles of usable track, unlimited spur lines, 1,500,000 railroad cars, and 3,000 train movements a day. Going out into this system is very easy. Once we are out on this system, [the Peacekeeper] train is not going to be detectable."

Explaining that the trains carrying the MX ICBMs won't bear any SAC markings or be distinguishable in other ways, General Chain suggested that "just like the submarines running silent, so [will] we. It's very easy to get lost in this maze" of teeming railroad activities. Through close liaison with the railroad industry, the Air Force has acquired a thorough understanding of this environment and has concluded that there are no significant integration problems: "It's much easier getting into the railroad system than [flying into civilian airports] or just flying across the country." The rules and regulations of the railroads are much simpler and the command and control capabilities are equal to or better than those of the air traffic control system, with the result that "integrating into the railroad system [poses] no challenge at all."

Problems With the Small ICBM

Various elements of Congress, including the Senate Armed Services Committee, are trying to apply the brakes to the other key component of the Air Force's ICBM modernization effort, the Small ICBM, or SICBM, program. The Senate Armed Services Committee recommended that the pace of this program "be significantly slowed . . . primarily for budget reasons." The Committee's report insinuated that the Air Force was pursuing unnecessarily expensive approaches to the SICBM's guidance system and neglecting reusability issues for the missile's Hard Mobile Launcher. General Chain told the AFA symposium that "as an operational commander, I strongly support the SICBM. Having a missile with one warhead and [high] mobility represents a major challenge to the enemy's war planner trying to figure out how to strike it."

If money were no object, General Chain pointed out, the SICBM would be in the operational inventory "today. In fact, I would rather have 1,500 SICBMs than I would have a blend between Peacekeeper and SICBMs." The price tag that would go with an all-SICBM force is, however, excessive, he acknowledged:

"The SICBM's cost per warhead is going to be four times as much as Peacekeeper's." Reiterating that it would be "great" to rush the SICBM into the inventory, he cautioned that this should be done only after Congress has "faced up to the [associated] costs." He pointed specifically at the double jeopardy of Congress impulsively committing to the SICBM, in the process scuttling the rail/garrison Peacekeeper program, and then professing, "Gosh, we didn't know that the SICBM is that expensive."

In order to forestall such gambits or misunderstandings, SAC's Commander in Chief is going to great pains to ensure that Congress knows about the cost picture with regard to both rail/garrison and the SICBM program. "So they can go ahead and vote against it, but they can't say they didn't know the truth. I am a strong believer in the SICBM and . . . in rail/garrison for Peacekeeper. The country needs both." If Congress decides that the ICBM force modernization is too expensive, "then somebody will have to tell us [so] and [indicate] what we should spend the money on," he declared.

While the Minuteman ICBM force has "many more years of good service left," there is no overlooking the fact that this weapon "has been in the hole for about twenty-five years, was designed to be a ten-year missile, and thus has already exceeded its service life by fifteen years." SAC has upgraded the weapon's warhead, guidance system, and various backup features, but is now at the "limit so far as modern upgrades go. It has to be replaced."

A pivotal upgrade of the ICBM force—the addition of active decoys—is gaining critical importance, according to General Chain. "The Soviets have [devoted a great deal of] effort and money [to] upgraded [ABM] defenses, and we need to counter them . . . as they develop their version of SDI." One of the prime counters involves advanced decoys. "I don't have enough warheads today," General Chain said, "to do the job that I am asked to do." SAC, therefore, must make sure that every one of its warheads can get through to its assigned target, which makes active decoys an essential element of the strategic modernization program, he stressed.

Third Generation of Nuclear Weapons

"If nuclear fission weapons [the A-bomb] were the first generation of the [nuclear weapons age] and the fusion weapons [the H-bomb] the second, we are now working on so-called third-generation weapon concepts," Richard D. Hahn, Director of the Energy Department's Weapons Research, Development, and Testing Division, told the AFA symposium. He defined this "third generation" as a nuclear weapon that, "by directing a fraction of its energy into a relatively narrow beam, can produce lethal effects at ranges of thousands of kilometers." These are known as nuclear directed-energy weapons, or NDEWs. This year, the Department of Energy is spending about $350 million on NDEW research, he reported. In line with an accord between DoD and the Department of Energy, NDEW research was formally launched in February 1985 for three specific and compelling reasons, according to the DoE official: burgeoning Soviet counterdefensive capabilities, Soviet capabilities "against our retaliatory deterrent," and as an SDI option, if needed.

Concern about potential Soviet breakthroughs in NDEW technologies is the prime force behind the US program, Mr. Hahn explained. "We can't ask them what they are doing in NDEW; all we can do is sort of mirror what we think they are doing [because] we need to know whether these concepts can be 'weaponized' [and] fielded against the US." The fundamental difference between existing nuclear weapons and the as-yet-conceptual third generation is that the former are weapons of mass destruction while the latter are primarily meant to be used in space to beam lethal amounts of energy over great distances in a focused manner, the DoE official explained.

The primary task envisioned for these new nuclear weapons centers on killing missiles from standoff positions in space. Among the specific questions that the DoE program is to answer is whether or not these technologies could enable the Soviets "to negate our ability to retaliate in case they attacked us." There is substantial evidence that the Soviets are "building all sorts of ABM defenses," Mr. Hahn pointed out, adding that the same applied also to counterdefensive technologies. In the case of counterdefensive designs, understanding their effectiveness against planned US nonnuclear SDI weapon systems would be crucial. By the same token, the DoE official suggested that the US might want to deploy counterdefensive weapons of its own if it turns out that this country can't field a nonnuclear SDI defense for whatever reasons.

HAHN: "Third-generation" nuclear weapons would beam lethal amounts of energy over great distances in a focused manner.

Four Concepts

The Department's nuclear directed-energy research program encompasses four individual concepts as well as associated countermeasures and systems support. The Department's goal—put in question by funding limitations and congressional resistance to a phased deployment approach to SDI—is to establish the feasibility of these technologies by the early 1990s, he

MYERS: The Space Station controversy notwithstanding, NASA reaffirms its commitment to work closely with the Department of Defense.

reported. The X-ray laser concept is one of the NDEW candidates. Its attractiveness is that such an ABM system could "kill many missiles at the same time many thousand kilometers away in a single burst." This technology, he pointed out, has "lots of problems with regard to [target] acquisition, tracking, pointing, beam divergence, et cetera."

The "hypervelocity-pellets" NDEW concept, if feasible, would "make an incredible weapon." The idea revolves around "grand particles" traveling at speeds of some 100 kilometers per second that "will penetrate fifteen inches of aluminum if you can keep them together." Some approaches under investigation by DoE have been likened to "nuclear shotguns." Whether or not such velocities are realizable in a practical sense is still under study, however. By way of a benchmark, Mr. Hahn pointed out that a rifle bullet travels at a speed of about one kilometer per second and a hypervelocity missile at about five kilometers per second. "So, obviously, a pellet moving at 100 kilometers per second would be lethal."

One of the potential payoffs of the hypervelocity-pellets approach would be its ability to negate the salvage fuzing features of nuclear ballistic missiles, Mr. Hahn told the AFA meeting. Warheads equipped with salvage fuzes contain sensors that "tell" the weapon that it is being attacked by a terminal defense weapon. This then causes the warhead to detonate before the defending weapon can intercept it. As a result, the prematurely detonating warhead could still retain some effectiveness against its assigned target. A hypervelocity-pellets NDEW appears capable of penetrating the electronics of the sensors and salvage fuze, thus preventing the weapon from detonating.

Electromagnetics, comprising microwaves and particle beams, makes up the third component of the NDEW program. While the US has no plans to field such a weapon, the DoE official pointed out there is hard evidence that the Soviets "are extremely interested" in these technologies. This makes it mandatory that the US understand the process in order to be able to "harden our systems" against these effects.

Lastly, optical lasers, powered by nuclear energy, show a great theoretical potential for disabling offensive as well as defensive weapons over great distances and appear capable of effecting "kills" through the atmosphere, according to Mr. Hahn. Ancillary activities of the NDEW program are focused on gauging the vulnerabilities of US systems to directed-energy weapons, predicting the potential lethality and operational value of US NDEWs, and determining the need for and the effectiveness of countermeasures. The sixth component of the program involves systems analysis that seeks to assess the utility of these weapons, both on the US and the Soviet side, Mr. Hahn reported.

Shadows Over NDEW Program

Moves in Congress to commit the US to a CTB (comprehensive nuclear test ban that precludes any kind of testing of even low-yield nuclear devices) are casting a pall over the future of the US NDEW program, according to the DoE official. While nuclear tests in space will not be needed to demonstrate the feasibility of these third-generation weapons, underground tests with a yield of up to 150 kilotons are imperative. Terming the CTB proposal "unconscionable," Mr. Hahn argued that giving up strategic deterrence "before you have arms reduction" jeopardizes essential national security requirements.

The House has passed a measure that would limit US testing to yields of no more than one kiloton, which is well below the level required for testing US strategic weapons in terms of their ability to function in a nuclear environment as well as for NDEW development, he emphasized. CTB, he added, would "severely impact our ability to understand the Soviet threat to our space-based assets" as well.

Another critical factor that threatens to impair the effectiveness of US nuclear systems is the dwindling stock of nuclear materials required to fabricate these devices, according to the DoE official. In the aftermath of the Chernobyl reactor's explosion in the Soviet Union, one of the production reactors supporting DoE's nuclear weapons programs has been shut down. Although quite different from the Chernobyl design, the Hanford "N" reactor at Richland, Wash., does share the common trait of having a graphite core. This facility was ordered shut down until this summer and, if some elements in Congress have their way, may be put on "permanent standby," Mr. Hahn disclosed. The other facility, the Savannah River reactor, is being operated at half its full power, also for safety reasons. As a result, the "number of neutrons" available to produce plutonium 239, other plutonium isotopes, or tritium is "limited."

Space Nuclear Power Programs

Space-based military systems are developing voracious appetites for power, especially high specific power generation without the drawback of high fuel consumption. Nuclear power is the only energy source meeting these criteria, according to Mr. Hahn. Three DoE programs are focused on this requirement.

The Dynamic Isotope Power System (DIPS) is meant to furnish low-output power generation in the one- to ten-kilowatt range, mainly for C^3I satellites. DIPS is a critical gap-filler for such missions as BSTS (boost surveillance and tracking system) for which solar power or other approaches are not practicable. The basic feasibility of DIPS was demonstrated in the 1970s. DoE is preparing an RFP (request for proposal) to select a lead contractor who will prepare requisite conceptual designs and perform ground-based engineering test. The DIPS program involves a development and demonstration as well as full production phase, he told the AFA symposium.

DoE's SP-100 Space Reactor Program, undertaken jointly with the Defense Department and NASA, is part of the Strategic Defense Initiative (SDI). The purpose of the program is to develop and demonstrate a space reactor power system in the "multihundred-kilowatt electric range in support of military and civil space missions in the early to mid-1990s and beyond." SP-100 will fit into the payload bay of the Space Shuttle and be able to operate for about ten years, Mr. Hahn reported. The feasibility of this thermal-electric system is to be demonstrated in the early 1990s.

The third and most ambitious DoE effort in the field of space power sources is MMW, for multimegawatt space nuclear power program. MMW is an integral long-term component of SDI and is meant to generate energy in the range of tens of megawatts over longer periods or high energy bursts—in the range of hundreds of megawatts—in short peaks. MMW's applications potentially include space-based neutral particle beam, free-electron laser, electromagnetic launcher, and excimer laser weapons, according to the DoE official. Current plans call for completion of the program's concept definition by 1992 so that two or three specific approaches can be reviewed and analyzed with an eye on selecting one for engineering development by the mid-1990s.

The two largest projects that DoE is carrying out on behalf of the Pentagon are the SDI-related ground-based free-electron laser funded at $80 million this year and the neutral particle-beam program that is absorbing $90 million this year, Mr. Hahn reported.

No Military Space Station

The suggestion by NASA's Deputy Administrator Dale Myers that the Pentagon develop its own space platform rather than use the US space station under development by his agency drew a pointed response from Air Force Secretary Edward C. Aldridge, Jr. The NASA official told the AFA meeting that "now is the time for a serious, sustained, long-term look at DoD's future manned requirements in space, and I believe that such a study will disclose the need for DoD's own facility."

Asked about this contention by AIR FORCE Magazine at a subsequent conference in Washington, D. C., Secretary Aldridge stressed that there were no plans or requirements for the Defense Department to build a separate space station, that the US space station is to serve the broad national interest, and that it should not be confined only to NASA's objectives.

Requirements emanating from SDI, the NASA official suggested, might—along with the fact that "an existing Soviet space station program seems primarily military in character"—make the case for building a separate military space station. If such a requirement materializes, he added, NASA contractors "would be able to utilize the experience gained from the development and deployment of the present NASA space station to produce a second for DoD at a very attractive 'discount.'"

The US space station program became entangled in political controversy because of concerns by foreign participants over potential use of the facility by the Pentagon. NASA's Deputy Administrator pointed out that the foreign partners planned to contribute hardware worth about $5 billion to the program, which he termed "the most complex international project we have ever undertaken."

The space station imbroglio notwithstanding, the NASA official reaffirmed his agency's commitment to close cooperation with the Defense Department. In the case of ELVs (expendable—read unmanned—launch vehicles), for instance, Mr. Myers said, "Our intent is to take advantage, if appropriate, of the Air Force buys for the first few and then to buy launch services from industry."

DUNCAN: DARPA is looking toward a "gigaflop" supercomputer the size of a soup can. This could mean a computer with Cray-like capability in space.

Turning to the trouble-plagued Space Shuttle program, Mr. Myers told the AFA meeting that resumption of flight operations won't occur until June of next year, a four-month slip from the previously announced schedule. Based on a first flight in June 1988, he added, "we are . . . planning three missions [that year], seven in calendar year 1989, and ten in . . . 1990. Beyond that, our goal is to build gradually to a launch rate of fourteen missions a year in 1992 and thereafter." National security payloads will continue to receive first priority.

In the case of ALS, the Advanced Launch System previously referred to as the Heavy Lift Launch Vehicle, NASA favors a double-track approach. NASA, he said, is "leaning" toward a Shuttle-derived design for the near term and an alternate approach "that would call for

development of a new vehicle . . . to be operational in the final years of this century." The Shuttle-derived ALS would serve as the workhorse in space station assembly beginning in 1994, could reduce the necessity for some in-orbit assembly, and would free up Shuttle launches for scientific payloads. The alternate ALS design, on the other hand, would be suitable for manned Mars or lunar missions in addition to supporting military requirements. NASA's long-range planning envisions manned missions to Mars as well as setting up a "lunar station," he said.

ROSENBERG: Precise three-dimensional maps are no problem for the Soviets. They can buy them freely from the US Geological Survey.

Putting a "Cray" in Space

"We are now developing microelectronics packaging technology that should make possible the development of a 'gigaflop' supercomputer in a 'soup can' and a trillion-bit memory in one cubic foot," DARPA Director Dr. Robert C. Duncan told the AFA symposium. In practical terms, he explained, this means "putting a Cray [the largest and most powerful existing computer] in space." Another potentially revolutionary technology DARPA is working on involves "applications of the new high-temperature ceramic superconductors in space systems."

A related DARPA goal is the development of a new technology base "to significantly reduce the weight of critical satellite components [to] get more bang for the kilogram." As yet in an inchoate state is a DARPA concept for assured access to space, the "LIGHTSAT," which would overcome the "precarious situation" that the current spacelaunch standdown created. "We have a very limited inventory of ELVs and a very low production rate; even when the Shuttle resumes service, our capabilities will fall far short of meeting our requirements," according to Dr. Duncan. DARPA's notion is to test the payoff potential of low-cost, lightweight satellites by launching several small technology-demonstration satellites.

Augmenting this concept—which is being viewed with reservation by the Air Force—will be work on new booster technologies, unconventional launch ideas, and advanced manufacturing methods for ELVs. In parallel, DARPA plans to probe the use of "rockets like modified Pershings to launch our new technology satellites." Acknowledging that "this is surely not the least expensive way to go on a dollars per kilogram basis," he argued that such an approach might make sense, nevertheless, "if the vehicle had a good shelf life and could be kept in the inventory, if it could be launched from anywhere by a very small staff with little warning, and if it were available from a running production line."

The National Aerospace Plane (NASP) program, which in its present phase is overseen by DARPA, is likely to reach flight-test status by 1993 when the X-30 experimental vehicle is scheduled to start flying. The X-30—a scaled-down test version of NASP—will have a cargo-carrying capacity in the 2,000- to 3,000-pound range, according to Dr. Duncan. Using a scramjet engine, the single-stage-to-orbit X-30 will take off horizontally in conventional aircraft fashion, he said.

On Target With Digital Mapping

The digital mapping information that the Defense Mapping Agency is acquiring laboriously and at high cost with regard to the Soviet Union is available to the Soviets about this country from the US Geological Survey, according to General Rosenberg. Extremely precise three-dimensional digital maps of all parts of the US required for cruise missile operations and other vital military functions can be bought freely by the Soviets from that US agency, in line with this country's free access standards, the DMA Director reported. DMA's own mapping efforts have been affected "dramatically" by the prolonged standdown of the US spacelauncher fleet because of the agency's dependence on overhead sensors, he pointed out.

In those areas of the world that DMA has been able to map in digitized form and translate into TERCOM (terrain contour matching) matrices, conventional cruise missiles armed with 1,000-pound warheads achieve twenty-five-foot CEPs and become "really smart weapons," he reported. DMA makes similar contributions to pinpoint accuracy in the case of Pershing II, he said. The missile's MaRVed (maneuvering reentry vehicle) warhead contains four digital radar maps. As the warhead approaches the ground, its radar cameras snap pictures of the earth and compare the scene with the stored information to "correct its course." Because of the resultant highly precise CEPs, the weapon's "small kiloton warhead [achieves] a high damage expectancy," according to General Rosenberg.

Other weapon systems that are highly dependent on DMA digital mapping data, he reported, include LANTIRN, the low-altitude navigation and targeting infrared for night system, the joint surveillance target attack radar system (Joint STARS), and the AV-8B's cockpit moving map display. This technology dramatically eases pilot work load and has been recommended by DMA for use on the B-1B and the Advanced Technology (or "Stealth") Bomber, according to General Rosenberg. ■

(The concluding installment of this report on AFA's Space Symposium will appear in the September issue.)

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L T V : L O O K I N G A H E A D

The Lavi Decision

By Gen. T. R. Milton, USAF (Ret.), CONTRIBUTING EDITOR

Israel cannot use a full production run of its new fighter. It will have to sell the Lavi abroad—in competition with US aircraft. We cannot afford to keep underwriting this program.

The Chairman of the Joint Chiefs of Staff, Adm. William G. Crowe, Jr., is an eminently sensible man, for which we can all be grateful. Perhaps as a result of—or even in spite of—his Princeton doctorate in political affairs, Admiral Crowe has few illusions. Washington, he says, is a dog-eat-dog town, one where many of the residents seem to be wearing "Milk Bone" underwear.

This year marks the beginning of our Presidential sweepstakes, so the dogfights are noisier than usual. Then we have the congressional quiz show, Irangate, which appears to be headed into the fall despite poor ratings from an indifferent public. These hearings, on the other hand, pushed the Pollard affair off the front pages, and with it, Israel's part in the Iranian arms business.

All of these things work in favor of the Lavi, Israel Aircraft Industries' fighter airplane now in the prototype stage; two have been completed and are in flight test.

The Pentagon wants the Israelis to cancel the Lavi for several reasons. One is cost, which translates into out-of-pocket money for the US taxpayer. The Lavi has already consumed more than $1.5 billion in US dollars, and if it goes into production, the price will be upward of $300 million a year, to come either from Israel's defense budget or from additional US grants.

The Israeli defense budget cannot afford an outlay like that without drastic cuts in other areas. Therefore, we can assume that Lavi advocates are looking toward increased US assistance. The facts that Grumman Aircraft Co. of Long Island makes the wings and Pratt & Whitney the engines and that many other US companies share in the production of the Lavi add considerable muscle to the lobbying effort.

But even should the Lavi be produced for Israel and the costs borne somehow, the Israeli Air Force can scarcely absorb more than 250, well short of an economical production run. The answer to that problem, of course, lies in foreign sales, and the Israelis are clearly entertaining that option.

In that case, the American taxpayer would not only be underwriting the airplane but would actually be paying for one that would compete with fighters produced by American companies. McDonnell Douglas has F-15s and F/A-18s for sale and General Dynamics the ubiquitous F-16. All of these aircraft are competitive with the Lavi.

Israel Aircraft Industries, or IAI, is a fascinating company with some of aviation's most innovative engineers. Over the years, IAI has been a key factor in Israel's survival. The Kfir fighter, for instance, was developed from the French Mirage when President de Gaulle cut off Israel from further French military weaponry, choosing instead to deal with the Arabs. The Kfir is, in fact, superior to the Mirage, not only because of its American engine, a General Electric J79, but because of improved aerodynamics.

Israel Aircraft Industries made the first long-range conformal tanks for the F-15 and refined the F-16 navigational gear for pinpoint accuracy in the Mideast. The company is currently experimenting with a modernized F-4 Phantom, having in mind the considerable number of Phantoms around the world. For $6 million and your old Phantom, they say, we will give you something equal to an F/A-18 Hornet.

On close inspection, the Lavi is undoubtedly a good airplane. The cockpit—the whole airplane, in fact—has benefited from a uniquely tight loop between fighter pilot and factory. There is little question it would do a good job in Israel's eternal war with her neighbors. So, too, would the American fighters now in Israel's inventory, which are of the same technical generation as the Lavi.

The decision as to whether or not to cancel the Lavi seems to be hanging fire. In theory, the decision is Israel's, but only in theory. Unless the US is willing to grant the additional money needed to produce the airplane, Israel could not afford to go it alone—a fact well understood by senior Israeli military officers who have openly voiced their concern.

Something will doubtless be worked out to keep IAI fully occupied should the Lavi be canceled. IAI is simply too important to Israel's security to allow for any other solution. But if the Lavi expires in the prototype stage, as did its rival, the Northrop F-20, there will inevitably be hard feelings. Projects like the Lavi, and the F-20 for that matter, develop strong and emotional attachments.

The fact remains that it makes little sense for the United States to continue to underwrite this Israeli airplane. What with a shrinking defense budget, a growing national deficit, and signs of trouble ahead for us in the Middle East, the Philippines, and Korea, we cannot afford major donations to another country's aircraft industry, even if that country is Israel. Besides, we don't need a new version of this generation's fighter. The ones we have are good enough to handle the current opposition.

One of these days, however, they won't be good enough, and that is why the focus is now on the Advanced Tactical Fighter, the ATF. That is where the money should go. ■

The first German jets entered combat in 1944. The Allies were well behind in fielding jets of their own, and they had limited success in impeding German production of the Me-262. This forced the AAF to look to tactics for possible solutions.

The Coming of the German Jets

BY LT. COL. DONALD R. BAUCOM, USAF

DURING World War II, American bomber formations constituted the *Brennpunkt,* or focal point, in the struggle between the Luftwaffe and the Army Air Forces. There were at least two reasons for this.

First, AAF doctrine told American airmen that strategic bombing was the key to victory in modern war between industrialized nations. By bombing critical nodes in an enemy's industrial network, one might destroy his ability to make war and thus bring on his defeat. A successful bombing campaign would also demonstrate the unique role that airpower could play in war, thereby justifying organizational independence of the air arm and adding significance to the bombing campaign. Second, the damage that American bomber formations were inflicting on Nazi targets ensured that the Germans would do all in their power to drive American bombers from the skies.

In the face of determined defenses by German fighters, tight bomber formations were the key to the success of this bombing campaign. American airmen developed formations in which the guns of the individual bombers could be combined to produce withering defensive firepower. The basic formation was the combat box of about twenty bombers, this size being a reasonable compromise between the formation's needs for self-defense and for precision bombing. Too large a formation would spread the bomb delivery over too large an area, preventing concentration against such relatively small targets as factories, refineries, and railroad marshaling yards.

If the Germans could break up this formation, they could concentrate on individual bombers and destroy enough of them to make the strategic bombing offensive too costly for the Americans. The Germans tried to accomplish this in a number of ways. They bombed American formations from above, lobbed rockets with time-fuzed warheads into the formations from outside the range of the bombers' .50-caliber machine guns, and put heavier guns and armor on their fighters.

This increase in armament and armor presented the Germans with a dilemma once Americans began to employ long-range fighter escorts for the bombers. Powerful guns and enough armor to provide reasonable protection from the concentrated firepower of a bomber formation made the German fighters sluggish and easy prey for American fighters, which were only lightly armored. Germany's conventional fighters were inferior to the American P-51 and P-47 and were also outnumbered by six or eight to one by April 1944.

The solution to this dilemma was a revolutionary type of aircraft, the jet fighter, principally the Messerschmitt Me-262, which theoretically possessed the speed to slash through escorting American fighters and which carried enough armament—four 30-mm cannon and air-to-air rockets—to destroy the B-17s and B-24s with relative ease.

A little too little and a little too late. That's the story of the world's first operational jet fighter, the Messerschmitt Me-262. In this Keith Ferris painting, Luftwaffe Maj. Walter Nowotny, a 258-victory ace and commander of the first jet fighter unit, snaps violently to the left while being pursued by 1st Lt. Edward R. Haydon in his P-51D.

Jets in the Air

Allied air force leaders were not surprised in July 1944 when their airmen first encountered German jet fighters in air combat. The Germans had been flying jet aircraft for almost five years, the British for about three years, and the Americans for more than a year and a half.

Readers of AIR FORCE Magazine may recall from Lee Payne's article (*"The Great Jet Engine Race . . . And How We Lost," January '82 issue)* that the British and Germans developed turbojet engines independently of each other. Although the British were the first to begin work on a jet engine, it was the Germans who flew the world's first jet aircraft, a Heinkel He-178, on August 27, 1939. In fact, the Germans flew a second jet aircraft, the Heinkel He-280, before a British jet, the Gloster E28/39, made its maiden flight in the spring of 1941.

One of the early flights of the Gloster jet was observed by Maj. Gen. H. H. "Hap" Arnold, Chief of the AAF. When he returned to the United States, he immediately set the AAF to work developing its own jet. This was the XP-59A Airacomet, which flew for the first time on October 1, 1942, with General Electric Type I-A turbojets, developed from the British Whittle engine, as its power source. The XP-59A quickly showed itself unsuited for its intended role as a fighter. Not only was it slow, but it also had handling problems. To bring the aircraft out of a spin, the pilot had to deploy a drag chute. Furthermore, the controls had a tendency to freeze at high speeds. As if these problems were not bad enough, rearward visibility from the cockpit was poor.

About the time the problems of the XP-59 were recognized, the AAF had begun development of another jet aircraft, the Lockheed XP-80. On January 8, 1944, the prototype made its first flight, powered by the de Havilland Halford H-1 turbojet. American reliance on British engine technology pointed to a basic weakness in the American jet fighter program that would hinder the United States until the end of the war.

The He-280 that flew in April 1941 was a fighter prototype, Heinkel's entry for a competition with Messerschmitt. The Messerschmitt entry first flew on July 18, 1942. This was the Me-262, which achieved a speed of 530 mph in later trials. It was to become Germany's principal operational jet fighter.

Beginning of a Crisis

As the summer of 1944 approached, anxiety increased among AAF leaders. Their intelligence reports advised that the appearance of German jets in combat was imminent, but there would be no operational Allied jet for some time. Furthermore, jet prototypes had been pitted against conventional aircraft in development and testing, and AAF leaders knew the performance of the jets was superior.

The first contact with German jets in late July marked the beginning of a crisis that lasted until the end of the war. The jets gave the Luftwaffe technological superiority. These aircraft were seventy to 100 miles per hour faster than the Allies' best conventional fighters, and neither the United States nor Britain would have a true operational jet capability until just before the war was over.

The depths of this crisis were reached in January and February 1945, following the major, surprise counteroffensive that the Germans had launched in the Battle of the Bulge in December 1944. From their first battles with the jets, American airmen were afraid that the Germans might be able to build enough of these new aircraft to regain control of the skies over Germany and force an end to the American strategic bombing campaign. This fear was intensified by the surprising resilience the Germans had displayed in their Ardennes offensive. Now AAF generals like Carl Spaatz and Jimmy Doolittle believed that the war might last until the end of 1945. If so, General Doolittle thought that the Luftwaffe would have enough jets by summer to keep American bombers from making deep raids into Germany.

This appraisal by Doolittle throws into sharp focus the significance of Hitler's insistence that the Me-262 be used exclusively as a "Blitzbomber" to attack with impunity such Allied targets as cargo ships supporting the invasion of Europe. Who knows what might have happened if the Germans had begun concentrating on the air defense role for the -262 in July 1944 instead of in the early part of 1945?

Responding to the Crisis

To deal with the possibility that Doolittle's appraisal might be correct, General Spaatz sought and secured Gen. Dwight D. Eisenhower's approval for a two-pronged strategy. First, Spaatz enlisted the support of his superiors to accelerate America's jet program. P-80 production was given the same top priority accorded the B-29.

Spaatz also sought a higher bombing priority for jet targets, the goal being to place 10,000 tons of bombs on such German assets as jet factories and jet training facilities. This, AAF planners estimated, might set back enemy jet production about three months. Spaatz's strategy was to get an American jet into operation about the time the German jet threat matured in the summer of 1945. The AAF would accelerate its jet production program while retarding that of the Germans by three months. This should give the US a chance to catch up.

This strategy was only partially successful. Bomber attacks did reduce jet production somewhat, but measures taken by the Germans to protect their jet-manufacturing system made these targets very difficult to attack. By the beginning of 1945, jet factories had been dispersed or placed underground, and the jets were being assembled in temporary structures hidden in wooded areas and such places as road tunnels. Furthermore, the -262s could operate from grass strips, which made it hard to destroy their base structure. Not only did it prove impossible to impede German jet production to the extent desired, but the United States was also unable to accelerate its own jet program. The projected operational date for the P-80 remained late summer or fall of 1945, as had been predicted in 1944.

Information on German jet production was hardly consoling to AAF leaders. In January 1945, US intelligence estimated that production for the Me-262 would reach 125 to 150 for that month and that it would be 500 a month by June. The P-80 schedule called for monthly production to reach sixteen in June 1945, with thirty-one to have been produced by that time. The US was having trouble producing jet engines even in small numbers, but a captured German document indicated that production of the Jumo 004 engine for the -262 would reach 7,200 by July. By the end of the war, the Germans had produced more than 1,400 Me-262s, while the Army Air Forces had only forty-five P-80s seven months after the war was over.

The Allies reaped a bonanza when this Me-262A-1 was flown to Rhein-Main Airport near Frankfurt, Germany, by a surrendering Luftwaffe pilot. The pilot was supposedly making a test flight when he turned and dashed over the Allied lines. This was the first German jet captured intact.

In January and February 1945, AAF leaders were beginning to think of the American copy of the German V-1, the JB-2, as an alternative to strategic bombing. If the Germans succeeded in knocking American bombers out of the German skies, the AAF would continue the campaign by using these air-breathing, guided missiles against German targets. Plans called for as many as 500 JB-2s per day to be launched against Nazi Germany. Because of its heavy demands on shipping and resources, this ambitious plan was revised, specifying 1,000 missiles a month to be launched by January 1945. Even this scaled-down plan was not implemented.

Conventional vs. Jet Trials

The description of Spaatz's January strategy has taken us a little ahead in the story of the AAF response to the German jets. It is now necessary to return to the spring of 1944, about three months before the combat debut of the Me-262, to pick up another major thread of the story. Since AAF leaders knew they would not have an operational jet of their own with which to meet the German jet, they were forced to seek nontechnical solutions to their crisis.

In April 1944, General Arnold directed the AAF Board to use some of the few early American prototype jets for trials that would pit the prototypes against conventional fighters. The objective was to develop tactics for conventional fighters to use against jets.

When the test report appeared, Arnold was displeased. The report recommended that the conventional fighter "force the jet fighter into a slow speed bracket, where the standard aircraft should be superior in maneuverability, acceleration, deceleration, rate of climb, and initial rate of dive."

General Arnold ridiculed this finding. This was, he said, the same as saying that "the horse that finishes last in a race will force the horse that is winning the race to slow down until the last horse catches up and wins."

In Arnold's view, the jet had "one idea and mission in life and that is to get at the bombers, and he is going by our fighters so fast that they will barely see him, much less throw out a sky hook and slow him up." Arnold directed that the test be run again. In the meantime, however, he sent the report along to USSTAF (United States Strategic Air Forces in Europe) for whatever use could be made of it.

Arnold's perception of the mission of the jets was typical of that held by top AAF leaders. The bombers were the focus of their thinking on aerial warfare. American bombers posed the gravest danger to Germany and would naturally be the target for the jets. This explains why these leaders seem to have been unconcerned by the fact that the Germans used the Me-262 principally in the ground-support role until early 1945.

Results of the second test of jets vs. propeller-driven fighters became available August 12, about the time the German jets appeared in combat. Among other things, the report said that jets were clearly superior in virtually every way. The best answer to the German jet was an American jet. Thus, Spaatz's effort to raise the priority of the P-80 is not surprising.

There is one other aspect of the operational trials of jets vs. conventional fighters that is of interest here. Before the second set of tests, Generals Doolittle and Spaatz asked for three American jets so they could run their own operational trials in England. If this were not possible, then tests should be run in the United States using Eighth Air Force veterans who would return to Europe with their firsthand knowledge of the trials and help USSTAF get ready for the jets. Furthermore, Spaatz told Arnold, the Stateside trials in the summer of 1944 should be slanted toward the operational problems faced in the European theater and include test engagements between jets and conventional bombers. While Arnold could not furnish the requested jets, he did agree to Spaatz's suggestions on the Stateside testing.

Doolittle told Spaatz that it would definitely be better for Eighth Air Force to run its own operational trials. This would allow Doolittle's force to develop techniques that could be immediately tried in combat. Two YP-80s would eventually be sent to England and another two to Italy for use in operational tests. One of the jets crashed in England in January 1945, killing its pilot. Little seems to have been gained from this program.

Other Responses

In addition to conducting special operational tests, pushing the development of the P-80, and bombing German jet-related targets, AAF leaders settled on several other measures for dealing with the German jets. At least some of these derived from the jet-conventional fighter trials of the summer of 1944.

For one thing, American airmen decided to push their long suit—numbers. They would make minor modifications to existing aircraft, but would do nothing to disrupt production rates. Thus, Doolittle wrote to Arnold in August 1944: "Development of new equipment is extremely important, but should not interfere unduly with the production and improvement of existent equipment as we hope that we can win this war with continually improved conventional aircraft."

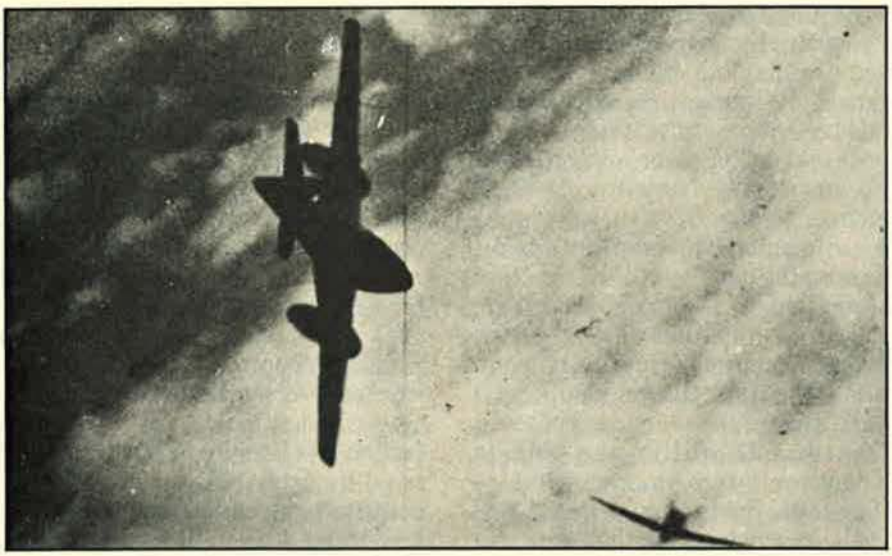
Similar sentiments were expressed by General Spaatz in March 1945. If the jets were used against American bombers before an American jet was available, he wrote to Gen. Barney Giles, "the German technical advantage must be countered by overwhelming numbers of conventional fighters manned by pilots trained to both outthink and outshoot the German."

One AAF tactic called for the use of a substantial number of conventional fighters, perhaps as many as ten for every jet engaged, to box in attacking jets so that they could not escape without passing through the sights of an AAF fighter or two. This method aimed to neutralize the jet's advantage in speed, which normally allowed the Me-262 to disengage from combat if its pilot found himself at a disadvantage.

Another tactic involved optimum positioning of escort fighters to defend the bombers from jet attacks. In general, the conventional fighters would have to fly close cover for the bombers. This meant that they should be no more than about 2,000 feet from the formations they were trying to protect. Otherwise, a jet might get through the fighter screen and attack the bombers before conventional fighters could intercept it.

Another measure called for some of the escorting fighters to be positioned about 3,000 feet above bomber formations to pick off jets that might try to zoom through the formations from below, strike and destroy some of the bombers as they passed through the formations, and then use their superior climb rate and speed to escape. If German jets tried this maneuver, they would find conventional fighters at full speed above the formation waiting for them as their speed dropped during their climb.

Also, American fighter pilots were instructed on how to cope individually with German jets. A conventional aircraft should never attempt to outrun a jet. Instead, the



The hunter becomes the hunted. In this gun-camera photo, an Me-262 is boring in on one P-51, while the pilot of another Mustang has the German jet in his sights. The action took place over Germany, and the Me-262 was destroyed. Had Adolf Hitler not been so vehement about the Me-262 being used first as a bomber, the air war over Europe might have had a decidedly different slant.

pilot of the propeller-driven aircraft should turn into the attacker and try for a head-on shot, since deflection shooting at such high speeds was difficult. Furthermore, because the conventional fighter could turn tighter than a jet at slower speeds, the propeller-driven fighter would wind up in an excellent firing position if the jet attempted to maneuver—an unlikely prospect, since the jet would almost surely break off the engagement.

Finally, when all else failed, an American fighter pilot might down a jet by catching it while it was landing or taking off. With its gear down and at a slow speed, a jet was an easy target, although as Brig. Gen. Chuck Yeager points out in his autobiography, antiaircraft defenses around enemy airfields made this a dangerous practice. It was in this manner that Yeager, then a captain flying a P-51, got his jet kill.

The Most Important Factor

Nevertheless, in spite of numerical superiority and tactical innovations, knocking down a jet remained at best a difficult task. The superior speed of the jets allowed German pilots to control engagements. However, once engaged, a German pilot, regardless of how good he and his machine might be, could become careless and forget to watch his own tail for enemy aircraft while he was pressing an attack. Such poor situation awareness seems to have been the downfall of no less a pilot than Adolf Galland during his last attack on a formation of B-26s.

While shooting down one of the B-26s, he failed to see a flight of P-47s that was closing on his rear until it was too late. Galland was seriously wounded, but did manage to land his badly damaged Me-262. The downing of a pilot like Galland points to a conclusion of special significance about the American effort to defeat German jets: The capabilities and alertness of pilots was an extremely important factor, perhaps the most important factor, in determining the outcome of air-to-air combat. At a January 1945 meeting, an intelligence officer remarked on the relative unaggressiveness of some German jet pilots in a particular engagement and said that the jets had knocked down an American fighter by attacking a formation that failed to see the jets coming. He added that "if our pilots see the jets, they do not have so much trouble."

German jets continued to take their toll of AAF aircraft right up to the end of the war. A concerned Gen. Jimmy Doolittle reported at a commanders' conference that German jets had already downed almost as many bombers (twenty-one) in the first eleven days of April as they had downed (twenty-four) during the entire month of March.

These statistics and Doolittle's continued anxiety make one wonder what might have happened had Hitler not intruded into the employment decision for the Me-262. Most likely, earlier deployment of this aircraft in its air-superiority role would not have changed the war's basic outcome. In the end, the extensive Allied land and air forces would still have combined with massive Soviet military forces to overwhelm Nazi Germany.

The story of the AAF response to the German jets suggests that success in war depends on a complex interaction among a number of factors, no one of which has a privileged position in the calculus of combat. A superior number of very good fighters and bombers, smart tactics and strategy, highly trained and experienced pilots, and solid leadership combined to enable the AAF to overwhelm the Luftwaffe, with its relatively small number of superior jet fighters, which were flown largely by inexperienced German pilots whose leadership was strife-ridden.

All other factors being equal, superior technology or better leadership does give an edge to the side that has it—but so does an advantage in any other area. What makes prediction so difficult is that "all other factors" are never equal. Success comes to the commander who best understands his strengths and weaknesses vis-à-vis those of the enemy and capitalizes on these while denying the enemy commander the opportunity to do the same. ■

Lt. Col. Donald R. Baucom received his B.S. degree from the Air Force Academy in 1962 and his Ph.D. in the History of Science from the University of Oklahoma in 1976. His primary career field in the Air Force has been communications-electronics. He has served as an associate professor in the Air Force Academy History Department and as a member of the Air War College faculty. Other important assignments have been Director of Research, Airpower Research Institute, and Editor of the Air University Review. *He is currently in the Office of Air Force History in Washington, D. C., where he is at work on a history of the Air Force and its response to research and development from 1941 through 1961. This article is a version of a paper presented to a seminar at the Air and Space Museum in November 1986.*

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AIRMAN'S BOOKSHELF

Symphonic Memoir of War

Those Who Fall, by John Muirhead. Random House, New York, N. Y., 1986. 258 pages with line drawings. $18.95.

"We had made it! We had made it to Regensburg!"

Lt. Jack Muirhead held that incredible thought as he lined up *Laura*, his battered B-17, for the bomb run against the Messerschmitt factories around the fiercely defended German city.

He had just about given himself up for dead. It had been a terrifying passage for the flight of Fifteenth Air Force Flying Fortresses from Italy deep into Germany. The formation had been butchered, and its remnants were still at high risk and far from home.

Mr. Muirhead, in his gripping book with its vivid imagery, recalls how it was on that mission of forty-three years ago. He recalls a lot more, too, about other missions, the men with whom he served, and the ways in which they managed or mismanaged their lives during months on end of tedium one day, terror the next, and, through it all, their continual striving for greater proficiency in the air as the means of getting through the war and going home.

The bombers bound for Germany on that February day in 1944 passed over the north coast of the Adriatic Sea, leaving the crews with "a sense of the irrevocable, like a door shut and locked behind us," Mr. Muirhead writes. "Nothing would turn us back now from the long corridor to Regensburg."

First came the swarm of Messerschmitt Me-109s, attacking at twelve o'clock. "My hands soothed *Laura* to the dangers, holding her close to the flight leader. But my mind held the vision of twenty Messerschmitts boring in, and I waited for the shock."

It quickly came and was violent. Machine-gun fire ripped into the bomber formation. The lead B-17 caught fire, dropped away, and went belly up. Its wing came off and struck another B-17, which went down. So did several others, as the German fighters struck again and again.

Having taken their toll and spent their fuel, the fighters finally flew away. Then, over Klagenfurt, came the flak.

"Crystal fragments of steel burned the air around us while we blundered through the greasy traces of brown and black smoke," Mr. Muirhead writes.

More bombers fell. The formation flew on. Then a string of Ju-88s appeared, standing off at about 1,000 yards. "It didn't seem possible," the author recalls, "that they were throwing these old bombers at us. They were slow and not heavily armed, easy targets for our packed firepower."

Then he understood. "They're turning—rockets! Jesus, they're shootin' rockets at us!" his top-turret gunner yelled over the intercom. Then came twin-engine Me-210s, assaulting the formation in two waves with machine guns and 20-mm cannon that blew away big chunks of metal from the bombers they struck.

"As the frenzy of battle raged, my terror faded, and I waited for my death," Mr. Muirhead writes. "I no longer saw them: the -109s, the -410s, the -210s, and the -190s, coming at us from all directions. I no longer saw the horror of my comrades burning and dying. I shut my soul to everything but the plane ahead of me. I held *Laura* steady under the tail guns as though she were nailed there.

"Sweat covered me; it ran down my back and between my buttocks; it streamed down my chest; my eyes burned with it. My crotch and thighs were soaked with urine. . . . Goggles shielded my eyes from the blasts of ice-cold air pouring through the ragged holes in the windshield. . . . The maelstrom roared around me."

The Luftwaffe fighters departed as the B-17s came up on Regensburg and were greeted with "murderous flak." *Laura* was "rocked by near explosions . . . vibrating, trying to fall off on her left wing." By main strength, Lieutenant Muirhead righted her and held her on course until bombs away.

It was almost as bad on the way home. The bombers, some barely flyable, were mauled again. The German fighters "slashed at our formation with an abandoned savagery to make us pay for the rubble and corpses of Regensburg, for their comrades blasted out of the air."

Laura was one of only ten B-17s, all of them riddled, that made it home that day. Twenty-one did not. And that wasn't the end of it, not by a long shot. The surviving crews knew that they would have to go back again to Regensburg, back to Ploesti's oilfields in Romania, back to Steyr, hoping that the number of missions would add up to fifty and a ticket home before they died.

Mr. Muirhead's descriptions of those men and of how they lived—with themselves, lonely and in constant apprehension of what may happen tomorrow, as well as with one another, in sharing tent duties on the muddy northern Italian plain, and in drinking, card-playing, and just walking around and talking—are as compelling as his accounts of them and their machines in air combat.

His characters are beautifully portrayed. Among them are Mike Salinas, the magician at getting beat-up B-17s back into action after test flights—sometimes hairy—by the author and others; Jim Ewell, the classy command pilot who drove himself and everyone else nutty during his fill-in stint as a squadron administrative officer; Mac McCarthy, the boisterous, life-loving navigator who accompanied the author on a memorable weekend pass in Bari, only to get shot down a short time later; Paul Leigh, the passive, tentative copilot who came into his own as a confident, competent aircraft commander, and Major Billings, the exec who worried about all of them and who finally let it get to him.

When Mr. Muirhead's characters die or succumb to their nerves, you, as reader, will hurt. When they do their jobs well and surmount their fears (they're never depicted as heroes, only as damn good men who got

lucky), you will take great satisfaction in their perseverance.

None of them had a rah-rah attitude or anything like it. They were always workmanlike amid their worries. They were angry with the Germans whom they fought in the air, because this was necessary to their survival and accomplishment of missions, but they were compassionate toward the Germans whom they bombed on the ground, often expressing this to one another on their homeward flights.

There is plenty of humor in this book, too, because humor was one of their main means of staying sane and steadfast. In one instance, a veteran gunner in Lieutenant Muirhead's B-17 crew implores him on the way back from the gunner's fiftieth and last mission to be sure to make a good landing on arrival at the base. He stood at Lieutenant Muirhead's shoulder on the approach, and the pilot, realizing how important the good landing really was to the gunner, quit joshing him about what a lousy lander he'd always been and set the bomber down ever so softly.

The author himself never made it through fifty missions. He had topped thirty when, on his last one, his engines faltered, and he could not keep up with the formation. True to form, the Messerschmitts pounced on his straggling B-17, which was too far behind the formation to be protected by its massed firepower, and shot it down.

As the last man to leave the falling bomber, he had to kick his copilot out of the hatch in order to bail out himself. On the ground in—to his surprise—Bulgaria, he caught hell from that copilot, who claimed that he had not been frozen in the hatch, as the author had suspected, but had only been waiting there to make sure that the pilot made it through the passageway.

Mr. Muirhead does a great job of describing what it was like for him and his crew, and for assorted other Americans and allied personnel, in the hands of the Bulgarians. In the main, it was deprivation, but the prisoners were up to it and made the best of the situation.

This memoir is uniformly excellent, as captivating as any, of any genre, that this reviewer has ever read. In its masterful changes of tempo and rich textures, it borders on the symphonic, and it deserves to go down as a classic.

One can only hope that Mr. Muirhead, now a retired shipyard engineer, writes many more books.

—Reviewed by James W. Canan, Senior Editor.

New Books in Brief

Air-to-Ground Operations, by Air Vice Marshal J. R. Walker, RAF. This second volume in Brassey's Air Power Series could serve admirably in any air force's academy as an introductory textbook on the meat-and-potatoes aspect of airpower: delivering munitions to the battlefield. The author surveys the art of "mud moving" in broad strokes, examining environment, aircraft design, tactics, weapons, and so on. The pace of technological advance, the author concludes, has brought airpower to the point where, "for the first time, [it] will have the tools to match its fundamentally sound doctrine." The elegantly written text is well supported by diagrams, and the author appends a set of questions so that the reader can test what has been learned. Military airmen are sure to benefit from this solid, professional work. With index. Brassey's Defence Publishers, London, UK, 1987. 152 pages. $27 hardcover; $14.95 softcover.

Managing Nuclear Operations, edited by Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket. The focus is on command and control of nuclear forces in this hefty compilation of essays by twenty-two experts on the subject. Addressing "an imbalance . . . in the study of security in the nuclear age," the contributors examine the oft-neglected assumptions underlying the organization and functioning of nuclear force management systems. Several general themes, as enumerated by the editors, emerge from and are scrutinized in this study: peacetime control, the command system at the brink of war and during the initial stages of conflict, and limitation and termination of nuclear battle. This thoughtful effort sheds considerable light on a frequently overlooked aspect of the nuclear dilemma. With tables, figures, and index. The Brookings Institution, Washington, D. C., 1987. 751 pages. $32.95 cloth; $12.95 paper.

The Servicemember's Legal Guide, by Lt. Col. Jonathan P. Tomes, USA. Men and women in military service are often unaware of their legal rights and the legal implications of particular situations. Their very status as service members puts them in a different legal category than their civilian counterparts. This sensible, straightforward guide to legal matters should go a long way in helping those who serve to understand their rights and duties under the law. The author, an experienced military lawyer and judge, covers not only military justice and legal affairs but also such broader topics as criminal, family, property, and financial law. Moreover, Colonel Tomes avoids the pitfall of legal mumbo jumbo and explains these topics in an easy-to-understand manner. The military services and individual members both stand to gain from the publication of this commonsense guide. With photos, glossary, and index. Stackpole Books, Harrisburg, Pa., 1987. 224 pages. $14.95.

The Soviet Perspective on the Strategic Defense Initiative, by Dmitry Mikheyev. Author Mikheyev, a Soviet physicist who fled his native land for political reasons and who has recently become a US citizen, argues in this work that "SDI holds the potential to exacerbate the major contradictions that already beset the Soviet regime and thus to have an all-encompassing impact on the US/Soviet relationship." Basically, the author contends that the military, economic, and technological challenge of SDI leaves the Soviets no choice but to respond to that challenge in ways that are certain to undermine "the ideological credibility of the communist regime directly," leading eventually to the downfall of the Communist Party. Mikheyev's faintly chiliastic thesis that "SDI could be the vehicle for such a defeat" makes for provocative reading. Published by Pergamon-Brassey's for the Institute for Foreign Policy Analysis, Cambridge, Mass., 1987. 95 pages. $9.95.

The Strategic Dimension of Military Manpower, edited by Gregory D. Foster, Alan Ned Sabrosky, and William J. Taylor, Jr. A conference held under the auspices of the Center for Strategic and International Studies in May 1985 attracted more than 100 students of national security to discuss one of the more glaring disconnects in considerations of military strategy—the relationship between strategic planning and manpower. The essays in this book, a result of that conference, examine such topics as manpower in traditional strategic thought, the effects of demographics, technology, and budgets, and issues of methodology and analysis. The contributors highlight the critical need for a more integrated approach to strategy and manpower, warning that "the linkages between strategic planning and manpower policy are . . . tenuous at best." The questions raised by this penetrating book merit special attention by US defense policymakers. With figures and tables, notes, and index. Ballinger Publishing Co., Cambridge, Mass., 1987. 240 pages. $24.95. ■

Teamwork at Its Best

Here's what made the Academy's Outstanding Squadron for 1987 outstanding.

BY JAMES A. McDONNELL, JR.
MILITARY RELATIONS EDITOR

This year's winner of the AFA-sponsored trophy is the Academy's 15th Squadron.

WHAT does it take to make an Outstanding Squadron outstanding? That was the question asked and answered by United States Air Force Academy Superintendent Lt. Gen. Winfield W. Scott, Jr., when he addressed the twenty-eighth annual AFA-sponsored salute to the 1987 Outstanding Squadron. This black-tie dinner, which took place in May, paid tribute to the cadets of the 15th Squadron—the War Eagles.

At General Scott's final such gathering before his summer retirement, he noted that although other awards given during June Week recognize individual skills or proficiency, this AFA trophy recognizes accomplishment across the full spectrum of academic, athletic, and military achievement.

He stressed that the criteria used to select the 15th were "stringent"—the academic competition took into account the "grade and quality point average of each member of the squadron." Athletic factors included not only physical fitness and aerobic test scores but also considered participation—and success—in both intramural and intercollegiate athletics.

Finally, he outlined the many elements that went into the military performance ranking, including competition in drill and ceremonies, grade point averages in military studies, results from professional competency evaluation, squadron safety standings, and others.

"Even more important," he summed up, "this squadron has provided the entire cadet wing with an example of teamwork at its best—a quality that predicts great success for its members as they pursue Air Force careers."

The Spring Squadron Commander, Cadet Lt. Col. D. Wayne Wingate, spoke on behalf of his 110 squadron mates after accepting the trophy from AFA President Sam Keith. Cadet Wingate modestly confided to the dinner audience that at the start of the year, the goal of the 15th was "just to keep the squadron out of trouble." However, as the year progressed, they discovered the individual strengths of each member of the squadron. "Our third classmen turned out to have the brains to go with our brawn," Cadet Wingate said.

As the high marks in academics and athletics piled up, the squadron realized that they had a good opportunity to reach number one. "We believe that if you develop pride in a squadron, you also develop leadership—not only at the top but in every cadet who is part of it. *That* is why we are here tonight," explained Cadet Wingate.

Saluting the 15th on "their night" at the event, which was jointly sponsored by AFA and its Colorado Springs/Lance Sijan Chapter, were some 500 guests, including many parents of cadets as well as AFA and community leaders.

The "returning graduate" who served as master of ceremonies was Col. Francis C. Gideon, Jr., Director of the Strike Systems Program Office at Hq. Aeronautical Systems Division, Wright-Patterson AFB, Ohio.

Colonel Gideon had been the Outstanding Squadron Commander in 1966.

Lt. Gen. Harley A. Hughes, DCS for Plans and Operations, Hq. USAF, congratulated the squadron on behalf of the senior Air Force leadership and also welcomed the graduating seniors to active duty. The determination and skill that made them winners in this competition, he stressed, would serve them and the Air Force well in the years to come. ■

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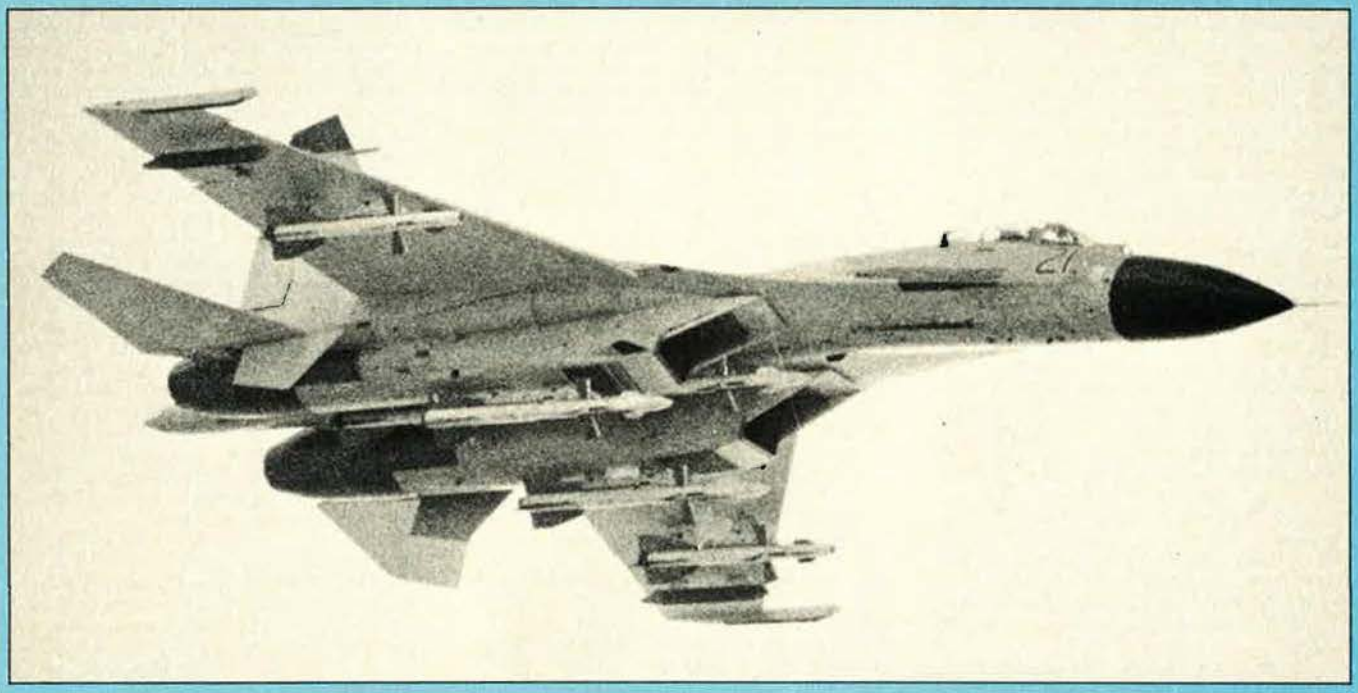


First photograph of an operational Sukhoi Su-27 (NATO 'Flanker') counter-air fighter *(Royal Norwegian Air Force)*

SUKHOI

PAVEL OSIPOVICH SUKHOI DESIGN BUREAU, USSR

Following deployment of Sukhoi Su-27 counter-air fighters to the Kola Peninsula, in the far northern Murmansk region of the Soviet Union, first photographs of the operational version have been taken by the crew of a Lockheed P-3B of No. 333 Squadron, Royal Norwegian Air Force. Two Su-27s were launched to identify the P-3B, each armed with six AA-10 air-to-air missiles.

SUKHOI Su-27

NATO reporting name: Flanker

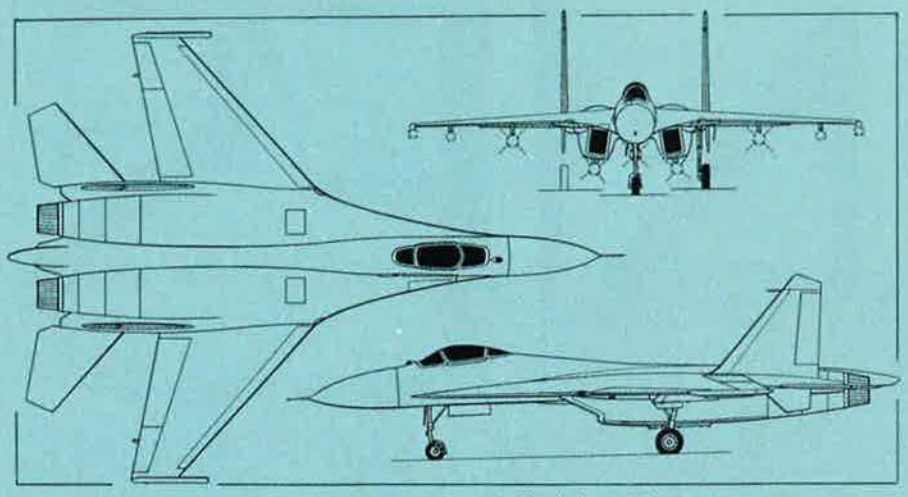
Responsibility for the larger of the Soviet Air Force's two new-generation single-seat fighters, equivalent to USAF's F-15 Eagle, was assigned to the Sukhoi design bureau. Its general configuration is similar to that of the smaller MiG-29, suggesting that the two aircraft evolved from a common research programme by a central authority, such as the famous TsAGI Central Aerodynamic and Hydrodynamic Institute.

The first prototype of the Su-27 began its flight testing in about 1977, and the photographs published in the 1985–86 *Jane's*, taken from an officially released Soviet TV documentary, may depict the first take-off. The same configuration, with curved wingtips, and tail fins mounted centrally above each engine housing, was observed in a satellite picture taken overhead Ramenskoye flight test centre in the late 1970s and published openly in a US government document.

The Soviet designation Su-27 was quoted by official sources in the West in 1982, and the fighter received the NATO reporting name of 'Flanker'. However, nearly ten years of development, and considerable redesign, were needed before the production version was able to achieve operational capability, with square wingtips carrying launchers for air-to-air missiles, outboard location of the tail fins, tailcone extension, and other changes evident in the photographs taken from the Norwegian P-3B.

Like the MiG-29, the Su-27 is described by the US Department of Defense as a supersonic all-weather counter-air fighter, with lookdown/shootdown weapon systems and beyond-visual-range air-to-air missiles, and with a possible secondary ground attack role. The Su-27's range, thrust-to-weight ratio, and manoeuvrability are all said to be improved by comparison with earlier Soviet fighters. Its large pulse-Doppler radar and heavy armament should give it formidable potential against low-flying aircraft and cruise missiles, particularly when it is deployed in partnership with the new Soviet AEW&C aircraft, based on the Il-76 transport and known to NATO as 'Mainstay'. DoD estimates suggest a combat radius as great as that of the Tupolev Tu-28P 'Fiddler', which is overdue for replacement, making the Su-27 capable of escorting missile armed bombers on sorties against the UK and western Europe.

Series production of the Su-27 is centred in a plant at Komsomolsk, Khabarovsk territory. With the MiG-31 it is expected to replace many of the



Sukhoi Su-27 single-seat twin-turbofan fighter *(Pilot Press)*

MiG-21, MiG-23/27, Su-21, and MiG-25 aircraft in the 17 tactical air forces assigned to Soviet military districts and groups of forces. It may also equip, in a navalised form, the large Soviet aircraft carrier now fitting out at Nikolayev.

There is reason to believe that the fighter designated P-42 by the Soviet Union is a specially prepared version of the Su-27. Flown by Viktor Georgiyevich Pugachev, a test pilot assigned to the Sukhoi design bureau, it set a record (subject to FAI homologation) by climbing to 3,000 m in 25.4 seconds in November 1986, beating by two seconds the previous record set by the F-15 *Streak Eagle*. In December the same pilot claimed three more records by taking the P-42 to 6,000 m in 37.1 seconds, 9,000 m in 47.1 seconds, and 12,000 m in 58.14 seconds. Data submitted with the claim for the November record gave the power plant as two R-32 turbofans, each rated at 133.25 kN (29,955 lb st) with afterburning, and the take-off weight as 14,110 kg (31,110 lb).

TYPE: Single-seat all-weather counter-air fighter, with secondary ground attack capability.

WINGS: Cantilever mid-wing monoplane. Basic wing sweepback approx 40° on leading-edge, with long and smoothly curved leading-edge root extensions. Anhedral approx 2° 30'. Full-span leading-edge manoeuvring flaps. Flap and aileron on trailing-edge of each wing.

FUSELAGE: Semi-monocoque all-metal structure of basically circular section, sloping down sharply aft of canopy. Cockpit high-set behind drooped nose. Large ogival dielectric nosecone. Long rectangular blast panel forward of gun on starboard side, above wingroot extension. Large tail fairing.

TAIL UNIT: Cantilever structure, comprising uncanted twin fins and rudders, mounted on narrow decks outboard of engine housings, and all-moving horizontal surfaces, all sharply sweptback. Fins have extensions beneath decks to form parallel but widely separated ventral fins.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Mainwheels retract forward into wingroots. Nosewheel retracted rearward on prototype, but production configuration may have changed. Mudguard on nosewheel unit. Brake-chute housed in fuselage tailcone.

POWER PLANT: Probably two Tumansky R-32 turbofans, each rated at 133.25 kN (29,955 lb st) with afterburning. Large auxiliary air intake louvres in bottom of each engine duct near primary wedge intake.

ACCOMMODATION: Pilot only, under rearward opening transparent blister canopy.

AVIONICS AND EQUIPMENT: Track-while-scan radar with reported search range of 130 nm (240 km; 150 miles) and tracking range of 100 nm (185 km; 115 miles). Infra-red search/track sensor in transparent housing forward of windscreen. Sirena-3 (or later) 360° radar warning receivers, outboard of each bottom air intake lip and at tail.

ARMAMENT: One 30 mm six-barrel Gatling type gun in starboard side of centre-fuselage, over wingroot extension. Up to ten air-to-air missiles, on tandem pylons under fuselage between engine ducts, beneath each duct, under each centre-wing and outer-wing, and at each wingtip. Aircraft illustrated has four radar homing AA-10 (NATO 'Alamo') medium-range missiles on fuselage and duct pylons, and infra-red homing AA-10s on the two centre-wing pylons. The four outer pylons are unoccupied, but are believed to carry either AA-11 (NATO 'Archer') or AA-8 (NATO 'Aphid') close-range infra-red missiles. Likely ability to carry up to 6,000 kg (13,225 lb) of external stores (*e.g.* twelve 500 kg bombs) for secondary attack role.

DIMENSIONS, EXTERNAL (estimated):

Wing span	14.70 m (48 ft 3 in)
Length overall, excl nose probe	21.60 m (70 ft 10 in)
Height overall	5.50 m (18 ft 0 in)
Tailplane span	9.90 m (32 ft 6 in)

WEIGHT (estimated):

Max T-O weight 20,000–27,200 kg (44,000–60,000 lb)

PERFORMANCE (estimated):

Max level speed: at height
Mach 2.0 (1,150 knots; 2,120 km/h; 1,320 mph)
at S/L
Mach 1.1 (725 knots; 1,345 km/h; 835 mph)
Combat radius 810 nm (1,500 km; 930 miles)

BAe

BRITISH AEROSPACE PLC, Brooklands Road, Weybridge, Surrey KT13 0SJ, England

As a successor to the BAe Super 748 twin-turboprop transport, of which production has ended, British Aerospace has developed a new regional airliner known as the ATP (Advanced Turboprop). Certification was nearing completion in mid-1987, with deliveries scheduled to begin in September of this year.

BAe ATP

The ATP programme was launched formally on 1 March 1984, and the prototype (G-MATP) flew for the first time on 6 August 1986. A second aircraft (G-BMYM) followed on 20 February 1987, in the markings of the first domestic customer, British Midland Airways.

Based on the BAe Super 748, the ATP retains the same cabin cross section but has a longer fuselage. Standard accommodation is for 64 passengers at a seat pitch of 79 cm (31 in), but various layouts are available for 60 to 72 passengers. There are separate forward and rear passenger doors, with integral airstairs at the forward door, and separate forward and rear baggage doors. The sill height of the forward passenger door allows the ATP to use jetways at regional airports. Certification will be to the latest JAR and FAR regulations.

TYPE: Twin-turboprop regional transport aircraft.

WINGS: Cantilever low-wing monoplane, with dihedral from centre-section. All-metal two-spar fail-safe structure, generally similar to that of BAe 748. Wing spars do not intrude into passenger cabin. Horn balanced ailerons and Fowler trailing-edge flaps; geared tab in each aileron. Pneumatic boot de-icing of leading-edges outboard of engine nacelles.

FUSELAGE: All-metal circular section semi-monocoque fail-safe structure, generally similar to BAe 748 but lengthened by 5.03 m (16 ft 6 in).

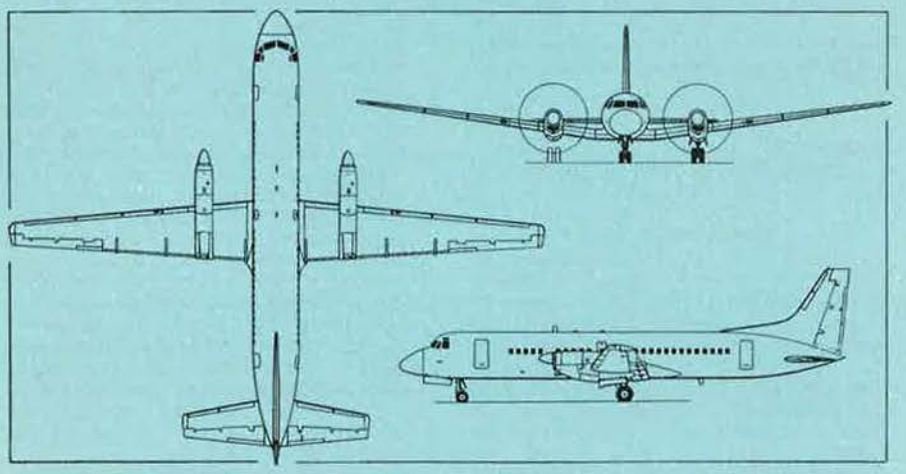
TAIL UNIT: Cantilever all-metal structure, with slightly swept vertical and non-swept horizontal surfaces. Power assisted rudder. Trim tab in each elevator; trim and spring tabs in rudder. Pneumatic boot de-icing of fin and tailplane leading-edges.

LANDING GEAR: Retractable tricycle type, of Dowty Rotol design, with twin-wheel main units and twin-wheel steerable nose unit, embodying oleo-pneumatic shock absorbers. All units retract forward, main units into bottom of engine nacelles. Mainwheels fitted with 34 × 11.75-14 tubeless tyres. Nosewheels fitted with 22 × 6.75-10 tubeless tyres. Mainwheels have fusible plugs operating at 199°C. All wheels have 'roll on rim' capability. Dunlop carbon brakes and Maxaret anti-skid units on mainwheels. Inner and outer brakes on each leg supplied from two hydraulically independent systems via engine driven pump or standby DC pump.

POWER PLANT: Two 1,864 kW (2,500 shp) Pratt & Whitney Canada PW126A or 1,790 kW (2,400 shp) PW124 turboprops. BAe/Hamilton Standard slow-turning propellers, each having six blades of advanced aerodynamic profile and lightweight composite construction. Fuel in two integral wing tanks, with combined capacity of 6,364 litres (1,681 US gallons; 1,400 Imp gallons). Single pressure refuelling point under starboard outer wing.

British Aerospace ATP in insignia of the first UK operator, British Midland Airways, flying with prototype

Above: The ATP is the only turboprop transport in its class able to use an airbridge. Right: Flight deck of the British Aerospace ATP



BAe ATP regional airliner (two Pratt & Whitney Canada PW126A turboprops) *(Pilot Press)*

ACCOMMODATION: Crew of two on flight deck; two cabin attendants. Main cabin has standard pressurised accommodation for 64 passengers, at seat pitch of 79 cm (31 in), in four abreast layout with central aisle. Alternative layouts provide 60 to 72 seats. Galleys at rear of cabin on starboard side, toilet forward on port side. Separate passenger doors at front (with airstairs) and rear of cabin on port side. Compartment for carry-on baggage on port side of cabin, forward of front row of seats. Two baggage/freight compartments, one forward on starboard side and one aft of main cabin, both with external access. Overhead lockers above passenger seats. Total available baggage volume per passenger, excluding overhead lockers, is 0.18 m³ (6.2 cu ft). Forward cabin bulkhead can be moved on seat rails to permit flexibility for multi-sector or mixed passenger/cargo operations.

SYSTEMS: Hamilton Standard environmental control system with twin ECS packs offering sub-zero delivery temperature capability. Automatic pressurisation system, giving altitude equivalent to 2,440 m (8,000 ft) at 7,620 m (25,000 ft). Pressure differential 0.38 bars (5.5 lb/sq in). Each engine drives an Abex variable delivery hydraulic pump providing hydraulic power at a regulated pressure of 172 bars (2,500 lb/sq in) for landing gear actuation, nosewheel steering, brakes, and airstairs. Auxiliary hydraulic power is supplied from a separate DC pump and reservoir for emergency operation of the landing gear and brakes. The system also provides hydraulic pressure for servicing when the engines are not running. Main system has a flow rate of 41 litres (10.8 US gallons; 9 Imp gallons)/min controlled to 169 bars (2,450 lb/sq in); emergency system has a flow rate of 2.25 litres (0.6 US gallons; 0.5 Imp gallons)/min controlled to 145 bars (2,100 lb/sq in). Air/oil reservoirs pressurised to 1.25 bars (18 lb/sq in). Electrical power provided by Lucas 200V 30/45kVA variable frequency alternators, mounted on each engine. 28V DC subsystem from either two TRUs or two 35Ah nickel-cadmium batteries. Second subsystem provides 1.5kVA 200/115V constant frequency power from two static inverters. Garrett Model GTCP36-150 APU for air-conditioning on the ground, and electrical power for battery charging, engine starting assist, and other tasks.

AVIONICS AND EQUIPMENT: Digital avionics system using ARINC 429 data transmission, Smiths SDS-201 four-tube EFIS, Bendix avionics. Twin VHF com, twin VHF nav, scanning DME with additional frequency under R/Nav control, ADF, ATC transponder, CVR, FDR, and digital GPWS. Bendix RDS-86 colour weather radar, with checklist facility, can display weather on EFIS nav display. Built-in test and recording facility. Dual AFCS, each with Litton LTR 81-01 AHRS and Smiths digital DADS. Options include second DME, second ADF, second transponder, R/Nav, MLS, and single HF.

DIMENSIONS, EXTERNAL:

Wing span	30.63 m (100 ft 6 in)
Length overall	26.00 m (85 ft 4 in)
Height overall	7.14 m (23 ft 5 in)
Wheel track	8.46 m (27 ft 9 in)
Wheelbase	9.70 m (31 ft 9¾ in)
Propeller diameter	4.19 m (13 ft 9 in)
Propeller/fuselage clearance	0.80 m (2 ft 7½ in)
Passenger doors: Height	1.73 m (5 ft 8 in)
Width	0.71 m (2 ft 4 in)
Height to sill: fwd door	2.09 m (6 ft 10 in)
aft door	1.71 m (5 ft 7½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	19.20 m (63 ft 0 in)
Max width	2.49 m (8 ft 2 in)
Max height	1.92 m (6 ft 4 in)
Volume	75.1 m³ (2,652 cu ft)
Baggage/freight compartment volume (three, total)	11.21 m³ (396 cu ft)

WEIGHTS:

Operating weight empty	13,595 kg (29,970 lb)
Max payload	6,726 kg (14,830 lb)
Max ramp weight	22,590 kg (49,800 lb)
Max T-O weight	22,450 kg (49,500 lb)
Max landing weight	21,773 kg (48,000 lb)
Max zero-fuel weight	20,320 kg (44,800 lb)

PERFORMANCE (provisional):

Cruising speed at AUW of 19,051 kg (42,000 lb) at 4,575 m (15,000 ft)
268 knots (496 km/h; 308 mph)

T-O field length:
at max T-O weight 1,539 m (5,050 ft)
for 150 nm (278 km; 173 mile) sector, 64 passengers, reserves for 100 nm (185 km; 115 mile) diversion, plus 45 min hold at 3,050 m (10,000 ft) 1,097 m (3,600 ft)

Landing field length at max landing weight 1,097 m (3,600 ft)

Range, with reserves for 100 nm (185 km; 115 mile) diversion and 45 min hold at 3,050 m (10,000 ft):
with max payload
575 nm (1,065 km; 662 miles)
with 64 passengers (5,806 kg; 12,800 lb)
985 nm (1,825 km; 1,134 miles)
with max fuel and 3,778 kg (8,330 lb) payload
1,860 nm (3,444 km; 2,140 miles)

Ferry range
2,198 nm (4,070 km; 2,529 miles)

ROCKWELL INTERNATIONAL/MBB

ROCKWELL INTERNATIONAL CORPORATION, NORTH AMERICAN AIRCRAFT OPERATIONS, 100 North Sepulveda Boulevard, El Segundo, California 90245, USA; and MESSERSCHMITT-BÖLKOW-BLOHM GmbH, Postfach 801109, 8000 München 80, Federal Republic of Germany

ROCKWELL INTERNATIONAL/MBB X-31A EFM

The X-31A is the first US 'X' series experimental aircraft to be developed jointly with another country. It was known previously by the programme title EFM (Enhanced Fighter Maneuverability), and was one of the first NATO co-operative efforts to be launched under the Nunn-Quayle research and development initiative, with a Phase 1 feasibility study which began in November 1984. This showed

Artist's impression of the Rockwell/MBB X-31A demonstrating its enhanced manoeuvrability

Model of the Rockwell/MBB X-31A, first aircraft of the 'X' series to be built in co-operation with a non-US contractor

that close-in combat may continue to be necessary for future fighter aircraft, and that enhanced manoeuvring capabilities could lead to significant exchange ratio advantages. The X-31A programme is, therefore, intended to produce an aircraft that will break the so-called stall barrier, to allow close-in aerial combat beyond normal stall angles of attack.

The US Defense Advanced Research Projects Agency (DARPA), acting through US Naval Air Systems Command, is working with the German Federal Ministry of Defence to manage the X-31A development programme. An international memorandum of agreement was signed between the two countries in May 1986, and work on the year-long Phase 2 (vehicle preliminary design) started four months later. In the USA, Rockwell International has primary responsibility for the aircraft's configuration, aerodynamics, and construction, while Messerschmitt-Bölkow-Blohm (MBB) in Germany will develop the control systems and thrust vectoring design. General Electric is propulsion subcontractor, and its Aerospace Business Group will assist in cockpit development.

The X-31A design will integrate several technologies to expand the manoeuvring flight envelope, including vectored thrust, integrated control systems, and aircrew assistance. These advanced concepts are expected to enable extremely rapid target acquisition and fuselage pointing for addressing future low-speed, transonic, and supersonic engage-
...s. Earlier programmes, such as the Rockwell
...PRV and MBB's TKF-90, are expected to
... useful data to the X-31A's design
...visaged at the mid-point of
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...h a cranked-
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LAN.../
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POWER PLANT: ...
turbofans, each ...
with afterburning ...
louvres in bottom of ...
ry wedge intake.
ACCOMMODATION: Pilot ...
opening transparent blist...
AVIONICS AND EQUIPMENT: ...
with reported search range ...
150 miles) and tracking range o...
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at $75 million. Funding between Rockwell and MBB is expected to split approximately 80/20 per cent.

CHADWICK

CHADWICK HELICOPTERS INC, PO Box 6179, Aloha, Oregon 97007-6179, USA

CHADWICK C-122S

Chadwick Helicopters Inc is a subsidiary of Chadwick Incorporated, which was founded in 1964 and manufactures a number of helicopter accessories including auxiliary fuel systems, electronic underslung load indicators, external cargo racks, firefighting and aerial applications equipment, a high-pressure wash system for aerial cleaning of insulators on high tension power transmission lines, and computerised weighing devices for aircraft.

Work began on a single-seat ultralight helicopter design in 1983. The development programme included building and flight testing of a 'flying platform' to test and confirm dynamic components. The prototype **Model C-122S** was completed during 1985 and made its public debut at the 38th Helicopter Association International convention at Anaheim, Calif., in January 1986. The C-122S is intended for commercial and sporting applications including farming, forestry control, traffic watch, training, and news gathering, and for paramilitary missions such as border and coastal patrol, drug enforcement, observation, armed reconnaissance, radio relay, command and control, target acquisition and artillery control, limited photo reconnaissance, and pilot training.

To meet specialised requirements Chadwick Helicopters is also developing a two-seat trainer version of the helicopter designated **C-122T**, an agricultural model **C-122AG**, a 'police interceptor' variant to be known as the **C-122PI**, a **C-122R** RPV version, and the **C-122W** weapons platform. A Helicopter Training Platform (HTP) has also been developed which enables a C-122S to be attached to a scissor arm so that a pupil pilot may gain experience of handling the helicopter in tethered flight. The scissor arm is raised by the C-122S's rotor power and permits vertical and tilting movement, the tilt feature being lockable for the early stages of pilot training.

The C-122S has been designed to meet FAA FAR
... 103 certification requirements for ultralight air-
...ft. Work on finalising production design and
...t testing was proceeding in early 1987, with
...duction deliveries scheduled to begin in the Au-
...mn.

TYPE: Single-seat ultralight helicopter.

ROTOR SYSTEM: Four-blade fully articulated main rotor with offset flapping hinges. Blades are of metal construction with two extruded aluminium spars, one forming the forward portion of the aerofoil section, with the flush riveted aluminium skinning forming the rear section. Leading-edge coated with abrasion resistant polymer material. Blades feature ogee tip design claimed to increase efficiency and reduce noise. One fixed trim tab on each main rotor blade. Blades fold after removal of a single locking pin per blade. Two-blade teetering tail rotor of flush riveted and bonded aluminium alloy construction.

ROTOR DRIVE: Vertically mounted idler shaft driven by cog belt from engine, with final stage reduction pulley driving main rotor hub via a second cog belt. Overrunning clutch disengages automatically for autorotation and engine shutdown. Rotor hub supported on non-rotating rotor mast. All controls and oscillating components are mounted on sealed, life-lubricated bearings. Tail rotor driven by V belt.

FUSELAGE: Monocoque structure of glassfibre/polyester composite formed around truss bulkhead supporting engine, main rotor mast, idler shaft assembly, control mixer, pilot's seat, and landing gear. Attachments for cargo hook, agricultural equipment, navigation lights, landing light, anti-collision light, and armament standard.

TAIL UNIT: Single boom supports tail rotor, rotor ring guard, stub horizontal stabiliser, and swept-back ventral fin.

LANDING GEAR: Fixed aluminium alloy tube skids with shock absorber units. Replaceable skid shoes. Ground handling wheels, float gear, and tundra pads optional.

POWER PLANT: One 47 kW (63 hp) Rotax 503 two-cylinder aircooled two-stroke engine, mounted vertically at rear of cockpit area. Power plant has tuned venturi-less carburettors and tuned exhausts, and is controlled by microprocessor and linear stepper motor to provide constant rotor rpm. Auto rewind rope starting system. Single fuel tank in lower fuselage area below and to rear of pilot's seat, total capacity 18.9 litres (5 US gallons; 4.2 Imp gallons).

ACCOMMODATION: Single seat for pilot integral with cabin floor and primary bulkhead. Seat belts standard; provision for inertia reel harness. One-piece windscreen. Transparent cabin doors optional. Centrally mounted instrument panel incorporates flight and engine instruments and warning and caution lights. Conventional cyclic and collective pitch controls, and tail rotor control pedals.

SYSTEM: Electrical system, powered by 12V generator. Nickel-cadmium batteries for microprocessor are charged by engine's electrical generating system.

AVIONICS AND EQUIPMENT: Standard equipment includes airspeed indicator, altimeter, engine and

main rotor tachometers, engine power limit, low fuel warning and generator charging lights, pitot tube cover, and main rotor tiedowns. Optional equipment includes lighting kit, electric starting system, battery and voltage regulator, cabin doors, cabin heating, rotor brake, engine compartment doors, tinted windscreen, fire extinguisher, first aid kit, engine running time meter, utility floats incorporating luggage compartment, cargo hook, auxiliary fuel system, agricultural spray system, inertia reel harnesses, emergency locator transmitter, VHF antennae, tundra pads, outside air temperature gauge, custom paint scheme, compact tool kit, ignition lock, ground handling wheels, quick blade folding kit, blade stowage rack, and armour protection for pilot and engine compartments. (Some optional equipment is not permissible under FAA FAR Pt 103 certification requirements for ultralight aircraft.)

DIMENSIONS, EXTERNAL:

Main rotor diameter	5.64 m (18 ft 6 in)
Tail rotor diameter	0.90 m (2 ft 11½ in)
Main rotor blade chord	0.23 m (9 in)
Tail rotor blade chord	0.13 m (5 in)
Distance between rotor centres	3.53 m (11 ft 7 in)
Length overall (rotors turning)	6.86 m (22 ft 6 in)
Length overall (main rotor folded)	5.79 m (19 ft 0 in)
Fuselage: Max width	0.79 m (2 ft 7 in)
Height overall	2.19 m (7 ft 2¼ in)
Skid track	1.22 m (4 ft 0 in)

AREAS:

Main rotor blades (total)	2.27 m² (24.42 sq ft)
Tail rotor blades (total)	0.08 m² (0.87 sq ft)
Main rotor disc	24.97 m² (268.8 sq ft)
Tail rotor disc	0.64 m² (6.87 sq ft)
Horizontal stabiliser	0.15 m² (1.6 sq ft)
Ventral fin	0.31 m² (3.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	115 kg (253 lb)
Max T-O weight (normal)	227 kg (500 lb)
Max design weight	317 kg (700 lb)
Max disc loading	12.69 kg/m² (2.6 lb/sq ft)
Max power loading	6.74 kg/kW (11.11 lb/hp)

PERFORMANCE (at max T-O weight of 227 kg; 500 lb):

Never-exceed speed	100 knots (185 km/h; 115 mph)
Max cruising speed:	
at S/L	82 knots (151 km/h; 94 mph)*
at 1,220 m (4,000 ft)	80 knots (148 km/h; 92 mph)*
at 2,440 m (8,000 ft)	76 knots (142 km/h; 88 mph)*
Econ cruising speed at S/L	64 knots (119 km/h; 74 mph)*
Vertical rate of climb at S/L	288 m (945 ft)/min
Rate of climb at S/L, T-O power:	
ISA	357 m (1,170 ft)/min
ISA + 20°C	317 m (1,040 ft)/min
Hovering ceiling OGE:	
ISA	2,875 m (9,440 ft)
ISA + 20°	2,469 m (8,100 ft)
Hovering ceiling IGE:	
ISA	3,860 m (12,670 ft)
Service ceiling	4,110 m (13,480 ft)
Range, 2 min warmup, no reserves:	
at S/L	104 nm (193 km; 120 miles)
at 1,220 m (4,000 ft)	91 nm (169 km; 105 miles)

To meet FAR Pt 103 requirements, speed is limited by electronic microprocessor to 55 knots (101 km/h; 63 mph).

PZL Turbo Orlik basic and advanced trainer (Pratt & Whitney Canada PT6A-25A turboprop)

WSK-PZL WARSZAWA-OKECIE

WYTWORNIA SPRZETU KOMUNIKACYJNEGO-PZL WARSZAWA-OKECIE (Transport Equipment Manufacturing Centre, Warsaw-Okecie), Al. Krakowska 110/114, 02-256 Warszawa-Okecie, Poland

The piston engined PZL-130 Orlik (Spotted Eaglet), which was described in the August 1985 *Jane's Supplement*, continues under development for use by the Polish Air Force. For the export market, PZL Warszawa-Okecie is undertaking, with the assistance of a Canadian company, development of a turboprop version known as the Turbo Orlik.

PZL TURBO ORLIK

This turboprop version of the Orlik was designed in 1985 by Mr Andrzej Frydrychewicz, the chief designer of WSK-PZL Warszawa-Okecie, in collaboration with the Canadian company Airtech Canada of Peterborough, Ontario. In January 1986 work began to convert the third prototype PZL-130 (SP-PCC) to take a Pratt & Whitney Canada PT6A-25A engine. The wings were modified to receive four hardpoints for external stores, and other changes were made to the landing gear, internal systems (including replacement of the two pneumatic systems by a single hydraulic system), avionics, and instrumentation. The dorsal fin was also enlarged.

Re-registered SP-RCC, this aircraft made its first flight as the Turbo Orlik prototype on 13 July 1986, piloted by Mr Jerzy Wojnar. Subsequent test flying was undertaken by Canadian test pilot P. Hartman and by Mr Bogdan Wolski, the president of Airtech Canada. The Turbo Orlik received a provisional type certificate under FAR Pt 23 in January 1987, but later that month, while being demonstrated by Mr Wolski to a representative of the Colombian Air Force, the aircraft and both occupants were lost. It is understood that a second prototype will be converted to complete the certification programme.

TYPE: Tandem two-seat basic and advanced trainer.

WINGS: Cantilever low-wing monoplane. Wing section NACA 64_2215 (modified). Dihedral 5° from roots. Incidence 0° at root, −3° at tip. One-piece all-metal (light alloy) multi-spar box structure. Torsion box, stiffened by riveted omega formers, forms integral fuel tanks. Trailing-edge skin panels are stiffened by L formers, electrically spot welded. Tapered planform, with raked tips of glassfibre/epoxy. Leading-edges are detachable. All-metal constant chord three-position single-slotted trailing-edge flaps, actuated electrically. Frise differential ailerons are also all-metal and of constant chord, aerodynamically and mass balanced, and actuated mechanically via pushrods and torque tube in fuselage. Electrically actuated trim tab on port aileron. No slats, spoilers, or airbrakes. Provision for anti-icing system in leading-edge.

FUSELAGE: All-metal (light alloy) unpressurised semi-monocoque structure, with skin panels stiffened by electrically spot welded L formers.

TAIL UNIT: Cantilever light alloy structure, with sweptback vertical and non-swept horizontal surfaces. Fin integral with rear fuselage. Large dorsal fin; shallow ventral strake under fuselage tailcone. One-piece two-spar fixed incidence tailplane. Elevators aerodynamically and mass balanced, controlled by rods and cables; electrically actuated trim tab on port elevator. Aerodynamically and mass balanced rudder, also with electrically actuated trim tab, is cable controlled.

LANDING GEAR: Hydraulically retractable tricycle type, all three units retracting into fuselage (mainwheels inward, nosewheel rearward). PZL Warszawa-Okecie oleo-pneumatic shock absorber in each unit (nosewheel on semi-fork with shimmy damper and centring device). Low pressure tubeless tyres (2.0 bars; 29 lb/sq in in all three), size 500 × 200 mm (nose) and 400 × 140 mm (main). Differential hydraulic disc brakes and parking brake. No anti-skid units.

POWER PLANT: One 410 kW (550 shp) Pratt & Whitney Canada PT6A-25A turboprop, driving a

Prototype of the Chadwick C-122S single-seat ultralight helicopter

Hartzell HC-B3TN-3B/T10173K-11R three-blade constant-speed metal propeller with feathering and reverse pitch. Four integral fuel tanks (two of 110 litres; 29 US gallons; 24.2 Imp gallons and two of 100 litres; 26.5 US gallons; 22 Imp gallons capacity) in wing torsion box, plus a 9 litre (2.5 US gallon; 2.0 Imp gallon) collector tank in fuselage; total usable internal fuel capacity 420 litres (111 US gallons; 92.4 Imp gallons). Overwing refuelling point for each wing tank. Provision for four 150 litre (39.6 US gallon; 33 Imp gallon) auxiliary tanks on underwing stations. Fuel and oil systems adapted for aerobatics, including up to 30 s of inverted flight.

ACCOMMODATION: Tandem seating for pupil and instructor under one-piece canopy, which opens sideways to starboard. Rear (instructor's) seat slightly elevated. Both seats are adjustable electrically, can accommodate back type and seat type parachutes, and are fitted with seat belts/harnesses. Full dual controls standard; rudder pedals are adjustable (three positions). Windscreen and canopy frames are of glassfibre/epoxy; windscreen is removable, canopy jettisonable. Cockpits heated (electric heater with blower) and ventilated. Baggage compartment aft of rear seat.

SYSTEMS: Hydraulic system for landing gear extension/retraction and brakes. No pneumatic system. Electrical power (115V/400Hz) supplied by 6kW starter/generator and two 24V 15Ah nickel-cadmium batteries, with three-phase 36V/400Hz AC converters. External DC power socket. Oxygen bottles and crew masks.

AVIONICS AND EQUIPMENT: King VHF and UHF com, intercom, and ADF. First aid kit and fire extinguisher.

ARMAMENT: No installed armament. Four underwing pylons for practice bombs, gun and rocket pods, or other weapons training stores; stressed for loads of 200 kg (441 lb) each inboard and 160 kg (353 lb) each outboard. Provision for gunsight, gun camera, and armament control system.

DIMENSIONS, EXTERNAL:

Wing span	8.00 m (26 ft 3 in)
Wing chord: at root	2.00 m (6 ft 6¾ in)
mean aerodynamic	1.62 m (5 ft 3¾ in)
Wing aspect ratio	5.2
Length overall	8.68 m (28 ft 5¾ in)
Fuselage: Max width	0.90 m (2 ft 11½ in)
Height overall	3.53 m (11 ft 7 in)
Tailplane span	3.50 m (11 ft 5¾ in)
Wheel track	3.10 m (10 ft 2 in)
Wheelbase	2.22 m (7 ft 3½ in)
Propeller diameter	2.29 m (7 ft 6 in)
Propeller ground clearance	0.30 m (11¾ in)

DIMENSIONS, INTERNAL:

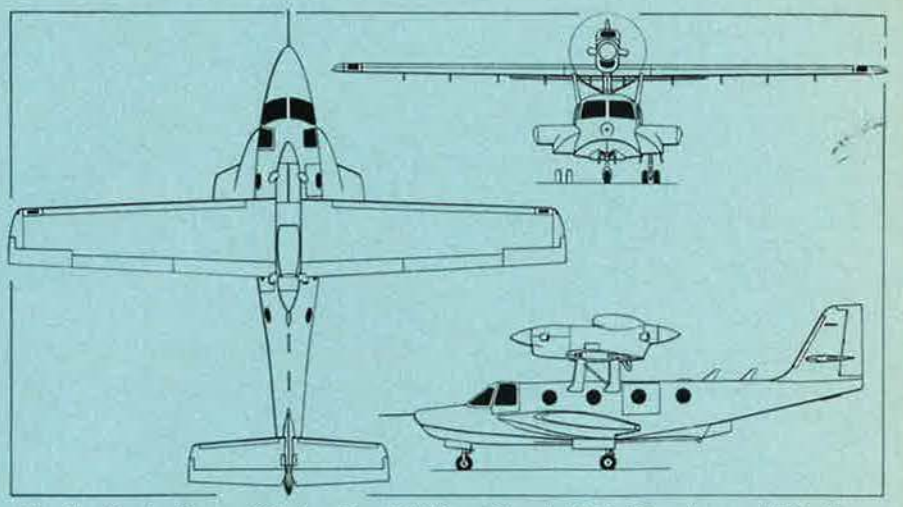
Cockpits: Length	2.95 m (9 ft 8¼ in)
Baggage compartment volume	0.17 m³ (6.0 cu ft)

AREAS:

Wings, gross	12.28 m² (132.2 sq ft)
Ailerons (total, incl tab)	1.38 m² (14.85 sq ft)
Trailing-edge flaps (total)	1.37 m² (14.75 sq ft)
Fin (incl dorsal fin)	1.20 m² (12.92 sq ft)
Rudder (incl tab)	0.65 m² (6.97 sq ft)
Tailplane	1.81 m² (19.48 sq ft)
Elevators (total, incl tab)	0.94 m² (10.12 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic; U: Utility):

Weight empty equipped, standard	1,150 kg (2,535 lb)
Max usable fuel (internal)	366 kg (807 lb)
Max T-O and landing weight:	
A	1,580 kg (3,483 lb)
U (no stores)	1,750 kg (3,858 lb)
U (with external stores)	2,155 kg (4,751 lb)
Max wing loading:	
A	128.66 kg/m² (26.35 lb/sq ft)
U (no stores)	142.51 kg/m² (29.19 lb/sq ft)
U (with external stores)	175.49 kg/m² (35.94 lb/sq ft)
Max power loading:	
A	3.85 kg/kW (6.33 lb/shp)
U (no stores)	4.27 kg/kW (7.01 lb/shp)
U (with external stores)	5.26 kg/kW (8.64 lb/shp)



Claudius Dornier Seastar CD2 (two Pratt & Whitney Canada PT6A-112 turboprops) *(Pilot Press)*

PERFORMANCE (at max Aerobatic T-O weight except where indicated):

Max permissible diving speed	302 knots (560 km/h; 347 mph)
Max level speed at 4,575 m (15,000 ft)	269 knots (499 km/h; 310 mph)
Max cruising speed at S/L	236 knots (438 km/h; 272 mph)
Stalling speed, flaps and gear down, power off:	
A	63 knots (115 km/h; 72 mph)
U (no stores)	66 knots (122 km/h; 76 mph)
U (with external stores)	73 knots (135 km/h; 84 mph)
Max rate of climb at S/L	954 m (3,130 ft)/min
Service ceiling	10,060 m (33,000 ft)
T-O run	250 m (821 ft)
T-O to 15 m (50 ft)	410 m (1,345 ft)
Landing from 15 m (50 ft)	570 m (1,870 ft)
Landing run	370 m (1,214 ft)
Range with max internal fuel, AUW of 1,600 kg (3,527 lb):	
U at 248 knots (460 km/h; 286 mph)	603 nm (1,117 km; 694 miles)
U at 140 knots (260 km/h; 161 mph)	694 nm (1,287 km; 800 miles)
Endurance with max internal fuel, AUW as above:	
U at 248 knots (460 km/h; 286 mph)	2 h 26 min
U at 140 knots (260 km/h; 161 mph)	4 h 57 min
Range with max internal and external fuel, AUW of 1,977 kg (4,358 lb):	
U at 245 knots (454 km/h; 282 mph)	1,166 nm (2,161 km; 1,343 miles)
U at 147 knots (272 km/h; 169 mph)	1,198 nm (2,220 km; 1,397 miles)
Endurance with max internal and external fuel, AUW as above:	
U at 245 knots (454 km/h; 282 mph)	4 h 46 min
U at 147 knots (272 km/h; 169 mph)	8 h 10 min
g limits:	
A	+6/−3
U	+4.4/−1.76

CLAUDIUS DORNIER

CLAUDIUS DORNIER SEASTAR GmbH & Co KG, Werksflugplatz Oberpfaffenhofen, 8031 Wessling, Federal Republic of Germany

Prof Dipl Ing Claudius Dornier Jr, who died on 30 April 1986, was the eldest son of the aviation pioneer Prof Claude Dornier. He worked closely with his father until the latter's death in 1969, and was Chairman of the Board of Dornier GmbH until 31 December 1981. The first product of this new company which he founded is the Seastar utility amphibian, design of which was initiated in January 1982. Construction of the VT 01 first prototype (D-ICDS) began in January 1983, at the Lufthansa facility in Hamburg, and this aircraft was described in the October 1983 *Jane's Supplement*. It made its first flight on 17 August 1984, and more than 80 hours of flying had been logged by mid-1985, when the aircraft was retired after being damaged. In October 1985 the company moved from Friedrichshafen to Oberpfaffenhofen where, with an initial development team of ten people, design and construction began of an improved version known as the CD2. By March 1987 the company's workforce numbered 100.

CLAUDIUS DORNIER SEASTAR CD2

The only portion of the VT 01 prototype to suffer serious damage was the strut braced metal wing, and this has been replaced in the CD2 Seastar by a larger wing manufactured entirely from composites materials, with carbonfibre reinforcement in two spars, which eliminates the need for strut bracing of the outer panels. Hull design has been improved by a flatter planing bottom, enlarged cockpit, reprofiled nose, and extended sponsons, and the original PT6A-11 turboprops are replaced by PT6A-112s driving four-blade instead of three-blade propellers. The virtually all-composites airframe thus offers both light weight and a high degree of corrosion resistance.

As a basic transport aircraft the Seastar provides accommodation for two pilots and up to 12 passengers. It is suitable for a variety of missions, including feeder transport from water bases to airports; missions for which helicopters would be restricted by range, economics, or safety factors; search and rescue; law enforcement; air ambulance; and civil or military special missions, accommodating four people over a range of 1,000 nm (1,850 km; 1,150 miles). Its ability to operate from land, water, snow, or ice enables it to perform such other roles as aerial surveillance, sightseeing and hunting tours, fire control, and firefighting.

The first pre-production CD2 (also registered D-ICDS) was rolled out on 19 March 1987 and made its first flight on 24 April, with a second flight four days later. Sea trials in the Baltic, off Kiel, were due to follow in the Summer, and a second pre-production aircraft is due to fly in the Spring of 1988. Certification by the German LBA is expected in mid-1988, to be followed by FAA type approval under FAR Pt 23 at the end of that year and initial deliveries in the first quarter of 1989. By June 1987 the company held paid options for 12 Seastar CD2s, and was negotiating options for several more.

TYPE: Twin-turboprop utility amphibian.

WINGS: Cantilever parasol monoplane, with modified NACA 23015 aerofoil section. The high-lift glassfibre wing is a three-spar structure, with carbonfibre reinforcement of the front and rear spars, and is fitted with single-slotted trailing-edge flaps and horn balanced ailerons.

HULL: Conventional unpressurised flying-boat hull, constructed almost entirely of glassfibre and

other composite materials. Large chined sponson on each side.

TAIL UNIT: Conventional unit, constructed of composite materials and incorporating a variable incidence tailplane. Horn balanced elevators and rudder, each with trim tab.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels on each main unit and single nosewheel. All wheels size 6.00-6. Main units retract forward into hull sponsons, nose unit forward into bow.

POWER PLANT: Two 373 kW (500 shp) Pratt & Whitney Canada PT6A-112 turboprops, mounted in tandem above wing in continuous nacelle and driving one tractor and one pusher propeller. Each is a four-blade McCauley constant-speed propeller with spinner. Fuel tank in each sponson, combined max usable capacity 1,869 litres (494 US gallons; 411 Imp gallons).

ACCOMMODATION: Max accommodation for two pilots and 12 passengers in four rows of three with single aisle. Dual controls standard. Alternative layouts for six executives in VIP seating, with lavatory at rear of cabin and toilet in part of baggage compartment; or nine passengers, with lavatory and toilet optional. By utilising entire baggage compartment space, aircraft can accommodate six stretchers plus two attendants and medical equipment; or can be configured for all-cargo use with front and rear loading access, able to transport items up to 5.50 m (18 ft 0½ in) in length. Crew door on port side. Passenger doors at front of cabin on starboard side and at rear on port side; latter has an optional airstair incorporated in the adjacent sponson structure. Baggage compartment at rear of cabin, with external door on starboard side. All accommodation heated and ventilated; air-conditioning optional.

SYSTEMS: Hydraulic system for landing gear actuation. Electrical system. De-icing for wing and tail leading-edges and engine intakes.

AVIONICS: Complete IFR installation standard.

DIMENSIONS, EXTERNAL:

Wing span	15.50 m (50 ft 10¼ in)
Wing chord, mean	1.89 m (6 ft 2½ in)
Wing aspect ratio	8.4
Width over sponsons	4.20 m (13 ft 9½ in)
Length overall	12.46 m (40 ft 10½ in)
Fuselage: Max width	1.90 m (6 ft 2¾ in)
Max depth	1.80 m (5 ft 10¾ in)
Height overall (on land)	4.60 m (15 ft 1 in)
Tailplane span	5.56 m (18 ft 3 in)
Wheel track	2.45 m (8 ft 0½ in)
Propeller diameter: front	2.40 m (7 ft 10½ in)
rear	2.35 m (7 ft 8½ in)
Crew door: Height	0.85 m (2 ft 9½ in)
Width	0.70 m (2 ft 3½ in)
Passenger door (fwd, stbd):	
Height	1.00 m (3 ft 3¼ in)
Width	0.80 m (2 ft 7½ in)
Passenger door (rear, port):	
Height	1.15 m (4 ft 11 in)
Width	0.95 m (3 ft 1½ in)
Baggage compartment door:	
Height	0.50 m (1 ft 7¾ in)
Width	0.90 m (2 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck:	
Length: excl baggage compartment	5.00 m (16 ft 5 in)
incl baggage compartment	5.50 m (18 ft 0½ in)
Max width	1.65 m (5 ft 4 in)
Max height	1.45 m (4 ft 9 in)
Floor area: excl baggage compartment	6.30 m² (67.8 sq ft)
Volume: excl baggage compartment	8.30 m³ (293.1 cu ft)
Rear baggage compartment volume	1.70 m³ (60.0 cu ft)

AREAS:

Wings, gross	28.48 m² (306.6 sq ft)
Vertical tail surfaces (total)	3.15 m² (33.9 sq ft)
Horizontal tail surfaces (total)	6.32 m² (68.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped (standard)	2,400 kg (5,291 lb)
Max payload	1,460 kg (3,218 lb)
Max usable fuel	1,495 kg (3,296 lb)
Max T-O and landing weight	4,200 kg (9,259 lb)
Max wing loading	147.5 kg/m² (30.2 lb/sq ft)
Max power loading	5.63 kg/kW (9.26 lb/shp)

PERFORMANCE (estimated at max T-O weight):

Max cruising speed at 3,000 m (9,840 ft)	182 knots (338 km/h; 210 mph)
Touchdown speed at S/L, flaps down, ISA	62 knots (115 km/h; 72 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
Rate of climb at S/L, one engine out	150 m (492 ft)/min
Service ceiling	8,535 m (28,000 ft)
T-O distance (land or water)	410 m (1,345 ft)
T-O to and landing from 15 m (50 ft) on land or water	580 m (1,905 ft)
Landing from 15 m (50 ft) on land	470 m (1,545 ft)
Landing distance (land or water)	270 m (886 ft)
Range:	
with max payload	135 nm (250 km; 155 miles)
with 454 kg (1,000 lb) payload	831 nm (1,541 km; 957 miles)
with max fuel	1,000 nm (1,850 km; 1,150 miles)
Max endurance: two engines	8 h
one engine	9 h 12 min

Claudius Dornier Seastar CD2 has an all-composites cantilever wing, instead of the strut-braced metal wing of the VT 01 prototype

BOEING

BOEING MILITARY AIRPLANE COMPANY, 3801 South Oliver (PO Box 7730), Wichita, Kansas 67277-7730, USA

Brave (Boeing Robotic Air VEhicle) is the generic name of a series of low-cost, multi-purpose drones, of which the YCGM-121A Pave Tiger (February 1985 *Jane's Supplement*) was the first announced variant. This programme was later terminated by USAF, but in late 1986 BMAC was awarded an Air Force contract for prototype demonstration of a tactical radar jamming system, for which Pave Tiger air vehicles are to be used as the payload platform. The generally similar Brave 200 (see 1986–87 *Jane's*) is currently under consideration by the West German Ministry of Defence, in a version designated Brave 210, to fulfil that country's DAR anti-radar drone requirement. If successful, Bodenseewerk of Germany would select and integrate German subsystems in the air vehicle, of which up to 3,000 could be required.

Latest member of the family is the Brave 3000, of which details follow.

BOEING BRAVE 3000

BMAC announced this second member of its Brave family in July 1986. It is a jet powered, container launched expendable drone for battlefield use, designed for easy and rapid deployment coupled with low cost and low maintenance requirements, having a five-year storage life and needing minimal logistic support.

Development of the Brave 3000 began in 1981, and the prototype was flown for the first time in May 1983. The large payload compartment in the forward fuselage is capable of accommodating sensors for electronic warfare, decoy, or reconnaissance missions, but the drone is seen primarily as a 'fire and forget' vehicle carrying a destructive warhead.

In this connection Boeing drew attention in April 1987 to the fact that the Brave 3000 is physically compatible with the US Army's Multiple Launch Rocket System now being deployed in Europe, and that 12 of these drones will fit as a unit into the MLRS launch module. Container launch and ripple firing of the Brave 3000 at 5 second intervals have already been demonstrated successfully, and service interest in the system is expected to be followed by a request for proposals later this year. Demonstrations to other armed forces, including navies, were also under way in 1987.

TYPE: Expendable multi-purpose battlefield drone.

AIRFRAME: High-wing monoplane with cruciform tail surfaces. All-metal fuselage is of mainly rectangular cross-section, with skins of formed aluminium sheet; central portion forms pressurised fuel tank(s), forward of which is blunt nosed warhead/payload bay. Rear half of fuselage comprises a forward portion (containing fin actuators) made from two formed aluminium skins divided on a 45° plane; and a rear portion, also of aluminium, containing fin deployment mechanism and attachment for rocket motor. The one-piece wing is a non-swept, constant chord structure of moulded glassfibre and epoxy, having 3° 30′ incidence but no anhedral or dihedral, and no moving control surfaces. Inside launch container it is aligned fore and aft along top of fuselage, pivoting through 90° when deployed for flight mode. Beneath fuselage, slightly forward of wing, is a retractable, 30° sweptback side-force generating fin, positioned to improve vehicle control by reducing roll and yaw coupling during skid-to-turn manoeuvres. Engine inlet and fairing, on top of fuselage towards rear, is constructed of laid-up glassfibre/epoxy to achieve a serpentine inlet shape; it is deployed at launch by coil springs and locked in position by a torsion spring-loaded over-centre linkage. Cruciform tail surfaces, all sweptback 10°, are fully movable to perform elevator and rudder functions, being operated by Spiroid electromechanical actuators. Landing gear not required.

POWER PLANT: One 0.76 kN (170 lb st) Noel Penny Turbines NPT 171 turbojet (with growth potential to 0.93 kN; 210 lb st) for cruising flight. Sealed

Boeing Brave 3000 in flight configuration, after jettisoning booster rocket

fuel compartment(s), pressurised by engine bleed air, are in centre-fuselage with capacities (according to mission requirements) of 17 litres (4.5 US gallons; 3.75 Imp gallons) minimum and 60.6 litres (16 US gallons; 13.3 Imp gallons) maximum. Solid propellant rocket motor, for launch boost, is jettisoned approx 5 s after launch; turbojet reaches full thrust in about 8½ s.

LAUNCH AND RECOVERY: Zero length launch by rocket booster from ground or trailer mounted container, transitioning to jet powered flight by deploying engine air inlet, wing, and fins, and starting turbojet. Thermal battery provides initial electric power for vehicle launch (output voltage 26–34V DC; nominal 25A load, with peaks of 46A). After engine start, power is generated by an alternator providing 1.5kW continuously and peak loads up to 2.2kW. Capability for multiple launch (ripple firing). Drone is non-recoverable.

GUIDANCE AND CONTROL: Drone is pre-programmed before launch and totally autonomous once in the air, completing its assigned mission without further commands or directions. Autonomous navigation system employs a Doppler radar velocity sensor, two-axis vertical gyro, and three-axis strapdown magnetometer. Aerodynamic control by all-moving tail surfaces and side-force ventral fin.

MISSION EQUIPMENT: Large bay in forward fuselage for single or submunition warhead, or other payloads according to mission.

DIMENSIONS, EXTERNAL:

Wing span	2.26 m (7 ft 5 in)
Wing chord, constant	0.249 m (9.8 in)
Wing aspect ratio	9.2
Length overall:	
excl booster	3.44 m (11 ft 3½ in)
incl booster	3.94 m (12 ft 11.15 in)
Fuselage: Max width	0.295 m (11.6 in)
Max depth	0.30 m (11.8 in)
Tail-fins span	0.854 m (2 ft 9.64 in)

AREAS:

Wing, gross	0.557 m² (6.0 sq ft)
Ventral fin	0.087 m² (0.94 sq ft)
Tail-fins (total)	0.174 m² (1.868 sq ft)

WEIGHTS AND LOADINGS:

Fuel: min	15.9 kg (35 lb)
max	56.7 kg (125 lb)
Payload: min	74.8 kg (165 lb)
max	102 kg (225 lb)
Max launching weight:	
excl booster	238 kg (525 lb)
incl booster	285 kg (629 lb)
Max wing loading	427.2 kg/m² (87.5 lb/sq ft)
Max power loading	315.3 kg/kN (3.09 lb/lb st)

PERFORMANCE:

Never-exceed speed	500 knots (926 km/h; 575 mph)
Max level and max cruising speed at 3,050 m (10,000 ft)	380 knots (704 km/h; 437 mph)
Econ cruising or loiter speed at 3,050 m (10,000 ft)	245 knots (454 km/h; 282 mph)
Max rate of climb at S/L	1,006 m (3,300 ft)/min
Service ceiling	7,620 m (25,000 ft)
Range:	
max payload and min fuel	65 nm (121 km; 75 miles)
83.9 kg (185 lb) payload and 47.6 kg (105 lb) fuel	224 nm (415 km; 258 miles)
min payload and max fuel	269 nm (499 km; 310 miles)

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, 400 Maryland Avenue SW, Washington, D. C. 20546, USA

NATIONAL AERO-SPACE PLANE

US Air Force designation: X-30

In his State of the Union address on 4 February 1986, President Reagan announced plans for an "aerospace plane" that "could shrink travel time between Washington, D. C., and Tokyo . . . to less than two hours."

NASA and the US Department of Defense then initiated plans for a joint National Aero-Space Plane (NASP) research programme that could lead to a new generation of economic, re-usable aerospace vehicles for the 21st century. The programme brings together hypersonic research programmes undertaken separately by DoD and NASA over a number of years and follows an initial research phase of concept studies for a Transatmospheric Vehicle (TAV) that was conducted by aerospace manufacturers during 1984–85 under the direction of Air Force Systems Command's Aeronautical Systems and Space Divisions.

The Aero-Space Plane concept is based on an air-breathing hydrogen-fuelled aircraft, which would probably embody hybrid power plants combining rockets for take-off with supersonic combustion ramjets (scramjets) and be capable of horizontal take-off and landing. As a space vehicle it would be able to make single-stage entry into space and achieve orbital speeds up to Mach 25. As an aeroplane, it would cruise in the upper atmosphere at sustained hypersonic velocities of Mach 6 to Mach 12 (6,440 to 12,880 km/h; 4,000 to 8,000 mph) at altitudes around 32,000 m (105,000 ft).

Research already conducted in the areas of hypersonic propulsion, advanced materials and structures, fluid dynamics, supersonic combustion, ramjet theory, development of lightweight, high strength, high temperature structural materials, and the availability of supercomputers for engine and airframe design integration suggests that such aircraft could be operational by the year 2000.

Aero-Space Planes, in various configurations, are expected to have both military and commercial applications. They could serve as low-cost satellite and orbital payload launch vehicles, long range air defence interceptors, and space platforms for laser and rocket systems of the kind proposed for the Strategic Defense Initiative (SDI) programme. NASP 'airliners', operating within the atmosphere at speeds up to Mach 12, would reduce dramatically the transit time on intercontinental routes, while operating from existing airport sites.

Within the Department of Defense, the US Air Force has been assigned overall responsibility for the NASP research programme. NASA is responsible for overall technology maturation and commercial applications. The current technology development phase of the NASP programme began in April 1986, when NASA and the DoD announced the award of seven contracts with a total potential value of $450 million for propulsion and airframe development. The propulsion contracts were awarded to General Electric and Pratt & Whitney; airframe contracts were awarded to Boeing Military Airplane Company, General Dynamics, Lockheed-California, McDonnell Douglas, and Rockwell International.

In the third phase of the programme, an experimental subscale aircraft, designated X-30, will be used to develop, prove, and demonstrate Aero-Space Plane technologies throughout the flight envelope for hypersonic cruise and acceleration to low earth orbit. Final selection of contractors for prototype manufacture is expected in late 1989, with a first flight of the X-30 anticipated in the mid-1990s.

Artist's impression of the National Aero-Space Plane approaching a space station

Giant in a Jug

Gen. George Kenney described Neel Kearby as short and slight, but in the air he was a giant among fighter pilots.

BY JOHN L. FRISBEE
CONTRIBUTING EDITOR

ON JUNE 30, 1943, Lt. Col. Neel Kearby arrived in Australia with his 348th Fighter Group, the first P-47s assigned to the Southwest Pacific. His first question to Fifth Air Force Commander Lt. Gen. George Kenney was, "Who has shot down the most Japanese planes?" Kearby aimed to become the leading ace in the Pacific, but that goal would have to wait a while.

Almost no one except General Kenney and Kearby's boys thought the P-47 would do well in combat. Kenney surreptitiously arranged a mock combat between Kearby and an experienced P-38 group commander. Kearby won hands down, but the Jug could not be sent into action in that theater of vast open-water distances until its range was extended by drop tanks. General Kenney had them manufactured in Australia. The 348th was moved up to Port Moresby, New Guinea, but saw no combat until August 16, after the tanks arrived.

Neel Kearby scored his first two victories—a bomber and a fighter—on September 4, followed by a single eleven days later. Then, on October 11, came a combat that, up to that time, set him apart from all other American aces.

Kearby was leading a flight of four P-47s on a reconnaissance sweep in the Wewak area, about 450 miles northwest of Port Moresby. Shark-infested waters lay on one side and jungle on the other, peopled by enemy troops and natives of questionable appetite. In his flight were Capt. Bill Dunham, who ended the war with sixteen victories; Capt. John T. Moore, a seven-victory ace; and Maj. Raymond Gallagher. Kearby sighted a Japanese fighter below them at about 20,000 feet. Diving on the Zeke from seven o'clock, Kearby fired at 1,500 feet, sending the enemy flaming into the sea.

Colonel Kearby took his flight back up to 26,000 feet. In the nearly cloudless sky below, the flight spotted twelve bombers at 5,000 feet escorted by thirty-six fighters. With the numerical odds only twelve to one—not bad in Kearby's estimation—he gave the signal to attack. In the space of a few seconds, Kearby shot down one Zeke and two Hamps while Dunham and Moore each got one Tony.

With the element of surprise gone, Kearby climbed to 20,000 feet, intending to call the flight together and head for home. Then he saw one of his P-47s below with two Tonys on its tail. Diving at 400 miles an hour, Kearby shot down both Tonys. Dunham and Moore, who had become separated from Kearby in the battle, saw him fighting six more Tonys, one of which Kearby probably downed. Unfortunately, his gun camera ran out of film after showing hits on the enemy fighter.

With six confirmed and one probable, an American record for a single engagement, Kearby assembled his flight and led them to an emergency field at Lae, where they landed with less than seventy-five gallons in their tanks.

Generals MacArthur and Kenney immediately recommended Kearby for the Medal of Honor. When it was presented by MacArthur early in January 1944, Kearby had nineteen confirmed victories and was tied with Dick Bong for the lead. Kenney advised Kearby not to get in a race with Bong, who was soon to return from leave in the States, but to be satisfied with one enemy plane in each engagement. Kearby agreed that that was good advice, but it didn't fit his goal of fifty victories before he went home.

Neel Kearby—a fierce competitor.

When Bong returned a few days later, he ran his score up to twenty-one. Kearby, with two confirmed on January 9, again tied Bong, and there things stood until March 5, when Kearby, accompanied by Maj. Sam Blair and Dunham, decided to break the tie.

On the way to Wewak, always a good hunting ground, they picked up a formation of fifteen Japanese aircraft. Kearby got one on his first pass and then, against General Kenney's advice, climbed back to shoot down at least one more. This time, three enemy fighters latched on to his tail. Dunham and Blair each got one of Kearby's assailants, but the third put a burst into Kearby's cockpit from close range before Dunham blew him apart. Kearby's P-47 went straight into the jungle. There was no parachute.

As with several other great fighter pilots, the drive to excel that made Neel Kearby a leading ace of World War II was also his undoing. He was a superb pilot and shot, a great tactician, an outstanding combat leader, and a fierce competitor.

Eighteen months later, when the war ended, only three Pacific aces, all with many months of combat, had more kills than Neel Kearby had scored in six months. He lived on the razor's edge, but those months of eagerly sought combat left for the men who followed a spirit and a tradition that made victory in the Pacific inevitable. ■

The AFA Nominees for 1987-88

BY CATHERINE A. STORM
AFA SECRETARY TO THE ASSISTANT EXECUTIVE DIRECTOR/FIELD ORGANIZATIONS

AT A meeting on May 23 in Colorado Springs, Colo., the Air Force Association Nominating Committee selected a slate of candidates for the four national officer positions and the eighteen elective positions on the Board of Directors that will be presented to the delegates at the National Convention in Washington, D. C., on September 14. The Nominating Committee consists of the five most recent past National Presidents, the twelve National Vice Presidents, and one representative from each of the twelve regions.

Nominated for his second term as National President of the Air Force Association was **Sam E. Keith, Jr.,** of Fort Worth, Tex. He is a retired General Dynamics executive and former executive vice president of Geoscience and Services, Inc., an energy firm specializing in remote-sensing satellite technology. He currently serves as senior consultant to Arrowhead Associates, an aviation-related firm, and he is also an independent oil and gas developer and investor. A combat veteran of World War II, he later served in Korea. Mr. Keith attended Texas Christian University and Texas A&M and has taken part in numerous national defense forums.

Mr. Keith is an active leader in charitable and civic endeavors, including Goodwill Industries (past president), serves as cochairman of the Fort Worth Military Ball, and is vice president of the Greater Fort Worth Civic Leaders Association.

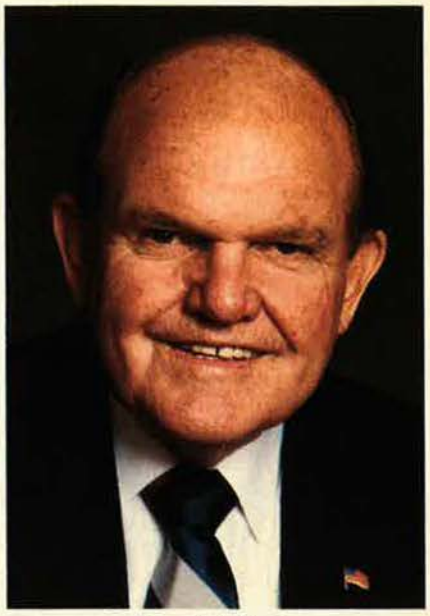
Mr. Keith served previously on the Executive, Finance, Audit, and Organizational Advisory Committees of AFA. He has also served as National Vice President (Southwest Region), elected at-large AFA National Director (eight times), Texas State President, Fort Worth Chapter President, and Chairman of the Fort Worth Airpower Council, an official AFA organization. Currently, he serves as a permanent member of the Board of Directors, as Chairman of the Executive Committee, and as trustee of the Aerospace Education Foundation and is a Doolittle Fellow. He has received AFA's Presidential Citation, Exceptional Service Plaque (twice), and Medal of Merit. He received AFA's Man of the Year Award in 1968 and is a Life Member of the Air Force Association. He is also a Charter Sustaining Life Member of the Aerospace Education Foundation.

Martin H. Harris of Winter Park, Fla., was nominated for a second term for the office of Chairman of the Board. Currently an aerospace industry executive, he received his bachelor's degree in aeronautical engineering from New York University in 1953. Mr. Harris later earned his master of science degree in systems management from the University of Southern California. He is a veteran of both the Air Force and the Air Force Reserve.

Mr. Harris is active in community affairs and holds memberships in the American Management Society, the American Helicopter Society, the Army Aviation Association of America, and the Retired Officers Association. He has served as National Vice President of the American Defense Preparedness Association.

Mr. Harris was Chairman of the first AFA/SAC Strategic Requirements Symposium in 1971, has served as AFA's National President and Secretary, and chaired AFA's Resolutions Committee for five years. He has also served AFA as State President, Chapter President, National Vice President (Southeast Region), Chairman of the Executive Committee, Organizational Advisory Council member, and a trustee of the Aerospace Education Foundation.

Currently, Mr. Harris serves as a permanent member of the Board of Directors and a trustee of the Aerospace Education Foundation. He received AFA's Man of the Year Award in 1972 and is a Life Member of the Air Force Association and a Charter Sustaining Life Member of the Aerospace Education Foundation.



Sam E. Keith, Jr.

Nominated for his first term as National Secretary is **Thomas J. McKee** of Waldwick, N. J. Mr. McKee is a Director of Air Force Requirements for the Aircraft Systems Division of Grumman Corp. He has been with Grumman since 1977 and is responsible for coordinating efforts to identify potential new Air Force business opportunities through the development and implementation of an overall Air Force marketing strategy and associated plans. He is also responsible for ensuring the maintenance of effective customer liaison and contacts with appropriate corporate departments.

Mr. McKee was born in Montgomery, Ala., and traveled extensively as a dependent in an Air Force family. He earned a bachelor of arts degree in political science from Southeast Missouri State University in 1970 and completed the Emerging Executives Program at Pennsylvania State University in 1983.

Mr. McKee entered the United States Air Force in July 1970 and received his commission on completion of Officer Training School. He completed undergraduate pilot training at Reese AFB, Tex., in October 1970. During his seven years of active duty, he served as a T-38 instructor pilot and check pilot in Air Training Command. He attended USAF Squadron Officer School at Maxwell AFB, Ala., in 1975 and subsequently transitioned to Tactical Air Command as an assistant flight commander in A-7D aircraft at Myrtle Beach AFB, S. C. In March 1977, he separated from the Air Force and joined Grumman.

Mr. McKee previously served on AFA's Communications Committee and has been Chairman of the National Air Force Salute Committee for AFA's Iron Gate Chapter in New York City since 1983. Currently, he serves on the National Board of Directors as a member of the Executive and Resolutions Committee and serves as a member of the Aerospace Education Foundation's Board of Trustees. He is a Life Member of the Air Force Association and a Charter Sustaining Life Member of the Aerospace Education Foundation.

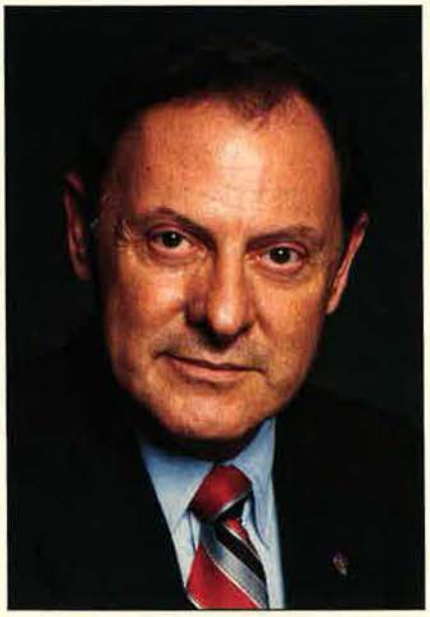
Nominated for his first term as National Treasurer was **William N. Webb** of Midwest City, Okla. He is an advisor on Air Force Association matters for the commander of the Oklahoma City Air Logistics Center.

Mr. Webb was born in western Oklahoma and completed schooling at Burns Flat, Okla. He attended Southwestern State Teachers College in 1945. After moving to Midwest City, Okla., in August 1950, he worked at the Oklahoma City Air Materiel Area, which is now known as the Oklahoma City Air Logistics Center at Tinker AFB, Okla. He completed his career in April 1981 as the Chief of the Management Organization for Distribution. His responsibilities during his career included accounting, manpower, funding, data systems, and engineering.

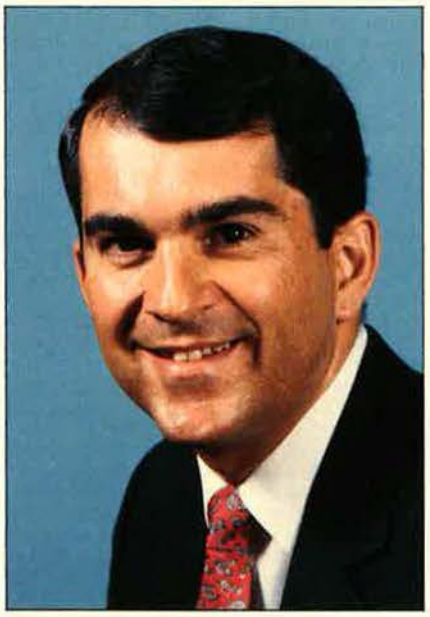
Mr. Webb became a member of the Air Force Association in 1960 and has held a variety of offices, including National Vice President of the Southwest Region, and has served on the Finance Committee for nine years. Currently, he is serving on the National Finance Committee and is the State Treasurer and a member of the Central Oklahoma Gerrity Chapter and the Oklahoma AFA Executive Committee. He has received AFA's Exceptional Service Award twice, and he received the first Storz Award for membership.

The following are permanent members of the AFA Board of Directors under the provisions of Article IX of AFA's National Constitution: John R. Alison, Joseph E. Assaf, William R. Berkeley, David L. Blankenship, John G. Brosky, Daniel F. Callahan, Earl D. Clark, Jr., R. L. Devoucoux, James H. Doolittle, Russell E. Dougherty, George M. Douglas, Joe Foss, Jack B. Gross, George D. Hardy, Alexander E. Harris, Martin H. Harris, Gerald V. Hasler, John P. Henebry, Robert S. Johnson, Sam E. Keith, Jr., Arthur F. Kelly, Victor R. Kregel, Thomas G. Lanphier, Jr., Curtis E. LeMay, Carl J. Long, Nathan H. Mazer, J. B. Montgomery, Edward T. Nedder, J. Gilbert Nettleton, Jr., Jack C. Price, William C. Rapp, Julian B. Rosenthal, Peter J. Schenk, Joe L. Shosid, C. R. Smith, William W. Spruance, Thos. F. Stack, Edward A. Stearn, James H. Straubel, Harold C. Stuart, James M. Trail, A. A. West, Herbert M. West, and Sherman W. Wilkins.

The twenty-one people whose photographs appear on the following page are nominees for the eighteen elected Directorships for the coming year. Asterisks indicate incumbent National Directors.



Martin H. Harris



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AFA INTERCOM

By Robin Whittle, AFA DIRECTOR OF COMMUNICATIONS

Aerospace and Arizona Days

For the twenty-seventh consecutive year, AFA's Tucson Chapter sponsored the kickoff luncheon for the area's "Aerospace and Arizona Days" celebration on March 13–14 at Davis-Monthan AFB, Ariz. The event lets the community view dramatic flying demonstrations and on-base static displays. Booths sponsored by base units and community groups are set up in a "carnival" atmosphere that delights both young and old.

This year's luncheon helped celebrate the "A&A Days" theme, saluting the fortieth anniversary of the Air Force and the achievements of "Wright Flight," an innovative local program begun by Capt. Robin Stoddard and a group of Davis-Monthan company-grade officers. The program encourages excellence at the junior and senior high school levels by providing the opportunity for hands-on flying experience for those students who excel academically.

This year's luncheon, held at the Holiday Inn/Holidome, featured Sen. Dennis DeConcini (D-Ariz.) as the keynote speaker. He set the tone by outlining the critical role that aerospace power has played in the nation's development and defense. More than 500 people turned out for the luncheon, including active-duty and Air Guard personnel who, along with members of the USAF Thunderbirds team, were seated throughout the room to maximize "person-to-person contact" and allow AFA members and guests to rekindle old friendships.

"We purposely had no head table so that everyone would have a chance to socialize at this annual family affair," said Tucson Chapter President Jack Sherlock.

During the luncheon, Chapter officials presented an AFA medal to the outstanding AFROTC Cadet, Capt. Matt P. Etzelmiller, Detachment 20 of the University of Arizona, and honored the Arizona Civil Air Patrol Cadet of the Year, 2d Lt. Brock Moore, 111th Tucson Squadron. Hughes Aircraft was inducted as the Chapter's newest AFA Community Partner.

Sen. Dennis DeConcini (D-Ariz.) holds up the AFA plaque he has just received from Tucson Chapter President Jack Sherlock, left, after the Senator addressed the more than 500 people at the Chapter's kickoff luncheon for the area's "Aerospace and Arizona Days" celebration in March. See accompanying article for details.

Once again the Chapter sponsored a popular booth during the A&A Days, taking more than 600 instant photos of guests seated in a Fairchild A-10. The Military Affairs Committee of the Tucson Chamber of Commerce sponsored a booth featuring the aviation art of Dutch Snow. They joined countless food concessions sponsored by the base units to raise money. AFA members were encouraged to arrive with a hearty appetite to help base units raise funds to offset planned MWR budget cuts.

Flying demonstrations, including the Thunderbirds and the Army's Golden Knights Parachute Team, rounded out two thrilling days for Tucsonians, Chapter officials said.

This year's luncheon capped three months of hard work by Chapter President Jack Sherlock, who, according to Communications Director Frank Smith, spent forty hours a week on AFA work while maintaining his full-time job of managing five auto-parts stores in southern Arizona. His active leadership of the Chapter has resulted in many successful events and activities.

For instance, Arizona AFA President Bob Munn asked Mr. Sherlock to ride herd on an effort to bring the National Security Briefing Team from the Air War College at Maxwell AFB, Ala., before as many chapters in the state as possible. Mr. Sherlock orchestrated the participation of the team at key events by every chapter in Arizona. In Tucson, the team was featured at a Chapter luncheon at the Hilton East Hotel that attracted nearly 200 people from throughout the community. During the full week of briefings throughout Arizona, the team addressed nearly 1,000 Americans and generated publicity on key defense issues.

Anthony Chapter Salutes the Services

This year's "Salute to the Armed Forces" sponsored by AFA's Thomas W. Anthony Chapter in Maryland lived

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up to its title for the first time in the several years it has taken place at Andrews AFB. All the services were represented, and the event was a resounding success despite a change in Chapter presidents in late January.

Taking the reins with only three months in which to plan the event, Chapter President Toby duCellier, an Under-40 AFA National Director, called her leadership team together for some brainstorming.

"We decided to combine several elements to attract the active-duty military and the community to this event. Traditionally, the banquet has served to honor the visiting Air Force Thunderbirds and the Army Golden Knights Parachute Team," Mrs. duCellier said. This year, Chapter officials decided to celebrate the Chapter's tenth anniversary by emphasizing the role of the enlisted ranks of all four services in honor of the Chapter's founder, a retired chief master sergeant.

The first order of business was to invite the Army's Golden Knights, who are all enlisted, and the enlisted crew members from the Thunderbirds. By working with the Enlisted Chiefs Council of the Military District of Washington, the Chapter was able to ensure representation from all branches of the armed forces.

Other program elements started to fall in line as well. Local radio personality Walt Starling agreed to be master of ceremonies for the evening. The Air Force Band Combo and the Singing Sergeants were contacted and scheduled to provide the music. Chapter officials contacted the seven former presidents of the Anthony Chapter to ensure their participation. Chapter officials also purchased seven Scott Associate plaques from AFA's Aerospace Education Foundation (AEF) to present to the former Chapter presidents during the evening for their critical roles in the Chapter's formative years. Another Scott plaque was presented that evening to Base Commander Col. Wesley Bean for his support of the Chapter.

Former CMSAF Don Harlow presented the AEF President's Award to Chapter founder and active AFA leader Thomas W. "Tony" Anthony. Mrs. Ruth Eaker was contacted and accepted an invitation to present a General Ira Eaker Fellowship to Anthony Chapter founding member Robert J. Beatson, who had served in the Eighth Air Force under Gen. Ira C. Eaker and is an enthusiastic fan and admirer of the General.

"The presentations to our founder and founding member were a surprise and really came off well," Mrs. duCellier said.

The Military District of Washington provided a multiservice color guard, and Sergeant Major Walter C. Knauss, Post Sergeant Major from Fort Lesley J. McNair, introduced the Golden Knights.

The most poignant part of the evening came when the lights were dimmed and representatives from each service went on stage. Each branch was represented by one soldier in dress uniform and another in working uniform flanking their respective service flags. As each branch was spotlighted, Mrs. duCellier read a brief history of that service. Then the representatives on stage were introduced. After the last introduction, the audience stood, and all joined in singing "America the Beautiful."

"The other branches of the armed forces were pleased that AFA wanted

"Civic Leaders Day" gave the Tacoma, Wash., Chapter a chance to show members of that metropolitan community what airpower is all about. Shown here are some of the thirty-two community leaders who took part in the gathering at nearby McChord AFB. The event was hosted by the 62d Military Airlift Wing, one of whose aircraft makes a striking backdrop for this photo.

During his recent visit to Maxwell AFB, Ala., AFA National President Sam Keith, Jr., right, was welcomed to AFROTC headquarters by Commandant Brig. Gen. Richard Hearne. AFROTC, with 132 detachments on college and university campuses throughout the country, is the source of about fifty-five percent of the new Air Force officers commissioned each year.

to include them in this program. They told me this many times and went out of their way to be helpful," Mrs. duCellier said.

"Even though we had such a short time to prepare for this dinner, we wanted it to be memorable. Most important, we were in the midst of our base membership drive and wanted to let the enlisted people know that AFA is for them, too. Judging from the comments we received, I think we succeeded in doing that," she said.

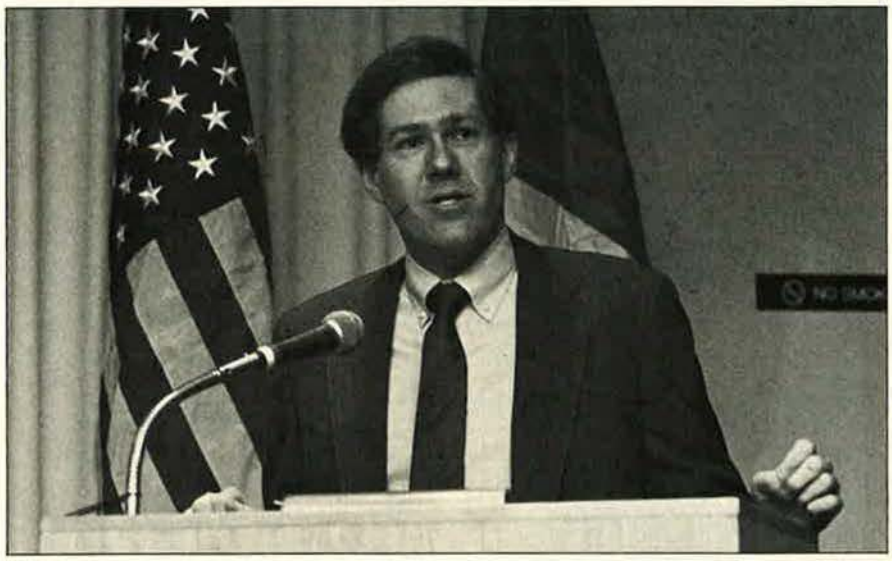
That message wasn't lost on the community, either. Nearly 300 people turned out for the Anthony Chapter Salute and anniversary celebration.

Attendees included a number of the Tuskegee Airmen; Mrs. Noel Parrish; Col. and Mrs. Fred Cherry; Prince Georges County Police Chief Michael Flaherty; Prince Georges County Sheriff James Aluisi; VFW Post 9619 Commander Dave Watt; Maryland AFA President Bill Reynolds; National Vice President/Central East Bill Ryon; Ron Resh, AFA Central Maryland Chapter President; John Kelly, AFA Baltimore Chapter President; local AFJROTC cadets, who served as escorts; AFROTC cadets from the University of Maryland, who counted the event as their first AFA function; and local business and community leaders.

As for the most difficult part of coordinating this successful Salute, Mrs. duCellier cited the critical importance of getting representatives from all four services. "But I was fortunate in that I contacted USO World Headquarters, and a woman there put me in touch with the various Chiefs, who took it from there. Our own base Senior Enlisted Advisor, CMSgt. Joe Hardy, was a big help, too, and he attended the dinner."

On the Scene

Television star **Edward James Olmos,** who plays Lieutenant Castillo on the top-rated "Miami Vice" television series, helped AFA's Homestead Chapter raise more than $4,000 toward its goal of establishing 400 Young Astronaut Chapters in the Dade County public school system, reports Chapter President **Rudy Gossman.** The actor agreed to serve as Honorary Chairman of the Chapter's fund drive to raise $10,000 to establish local Young Astronaut Chapters because of his belief in the importance of academics in young people's lives. "In his twenty years as an actor, he has been an inspiration to many young people throughout the country," Mr. Gossman noted.



Frank Kendall III, from the Office of the Under Secretary of Defense for Research and Engineering, here addresses a symposium on the Air Defense Initiative (ADI). The event was cosponsored by the Air Force Systems Command's Electronic Systems Division, Hanscom AFB, Mass., and AFA's Paul Revere Chapter.

In other Florida AFA news, Jerry Waterman Chapter President **Joe Lampariello** seized the opportunity to affiliate **Col. (Brig. Gen. selectee) James L. Jamerson,** incoming 56th Tactical Training Wing Commander, with the Chapter at a reception welcoming the new Commander to his assignment at MacDill AFB, Fla., earlier this year.

"Target for Today," a film documentary of the famed "Mighty Eighth" Air Force, was the carrot that attracted members and guests to the Florida Highlands Chapter meeting in March. The event was publicized in an article in the Sebring, Fla., *News,* which encouraged attendance by former Eighth Air Force members as well as those interested in viewing authentic footage shot during the war, reports Chapter President **Charles Crouch.**

Florida AFA Vice President **Roy Whitton** showed AFA's on-base membership-recruiting slide show to the Avon Park Kiwanis Club, and the reaction was good, he reports. In his introduction, Mr. Whitton highlighted local Chapter activities and made a pitch for the Club to join as an AFA Community Partner.

AFA's Paul Revere Chapter in the Boston area has been riding high with many excellent activities. Chapter President **Bill Lewis** and his officers and executive council developed a year-long plan that has included mission-oriented activities every month. Meetings have featured **Col. J. J. Colligan,** who gave an update on the Joint STARS program, and **Col. J. R. Johnson,** Commander of USAF Geophysics Laboratory, who discussed the Laboratory's responsibilities and key programs. In cooperation with AFSC's Electronic Systems Division (ESD), the Revere Chapter cosponsored the annual awards ceremony at Hanscom AFB, Mass., which honors top military and civilian professionals. The Chapter provided $100 savings bonds and AFA Citations to all honorees.

The event was well-attended by both the military and civilian sectors, including officials from the Boston Area Chambers of Commerce. Another distinguished guest was AFA Under-40 National Director **Maureen Gavin.** Among other activities, the Re-

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vere Chapter cosponsored a symposium with ESD on the Air Defense Initiative (ADI), a concept that involves a layered network of surveillance, tracking, and engagement systems to counter the threat posed to the US by strategic bombers as well as by air- and sea-launched cruise missiles.

More than 300 people turned out to hear one-time CINCSAC and former AFA Executive Director Russell E. Dougherty, right, address AFA's Montgomery, Ala., Chapter during the Chapter's kickoff luncheon for its local membership drive. Here General Dougherty is shown with Air University Commander Lt. Gen. Truman Spangrud, far left, and Chapter President Bowen Ballard.

More than 300 people turned out to hear former CINCSAC and AFA Executive Director **Gen. Russell E. Dougherty, USAF (Ret.),** address AFA's Montgomery Chapter during its kickoff luncheon for the local membership drive, reports Chapter President **Bowen Ballard** . . . **H. Lake Hamrick,** AFA National Vice President/Southeast Region, recently presented the National Security Affairs/Force Employment Award for Class 87-C to **SMSgt. James E. Craig III** of the Air Force Inspection and Safety Center, Norton AFB, Calif.

Mobile Chapter officials recently honored three outstanding cadets as the best in 1987 at an awards banquet. Selected by their respective organizations for the Mobile Chapter honors were **Cadet 1st Lt. Michael A. Stegner,** Mobile Civil Air Patrol Squadron, **Cadet Lt. Col. Kevin Kearney,** Baldwin County Civil Air Patrol Squadron, and **Cadet Maj. Vern Cresap,** Foley High School AFJROTC detachment. "We present these honors each year to generate public awareness and appreciation for young people here who devote much time and effort to improve their skills and education to better serve our nation in the future," said Mobile Chapter President **Bobby Case,** who served as banquet master of ceremonies.

The guest speaker for the event, reports **Dr. Frank Lugo,** longtime national and local AFA leader, was **Lt. Gen. Truman Spangrud,** Air University Commander. General Spangrud described the multipurpose educational mission of the Air University and highlighted the many achievements of the Air Force in developing in its personnel the technical and professional skills that are so essential to the defense of the nation.

AFA's Far West and Rocky Mountain Regions sponsored a "Salute to Peacekeeper" that included a symposium on the ICBM systems and technologies and a banquet. The Peacekeeper team, including the Ballistic Missile Office of Air Force Systems Command, Peacekeeper associate contractors, and related government agencies and contractors, was honored with the "National Defense Distinguished Achievement Award" in

James P. Grazioso, 1915–87

James P. Grazioso of West New York, N. J., a permanent member of AFA 's Board of Directors, died June 12 after a heart attack. He was seventy-one. A veteran of three and a half years of service in the AAF as a radio operator during World War II, he joined AFA in 1953, subsequently serving as Chapter President, New Jersey AFA President, National Vice President for the Northeast Region, and—for twelve years—as a member of AFA's Board, becoming a permanent member in 1983. A roofing and sheet-metal contractor, Mr. Grazioso headed his own firm, Paramount Roofing Co., Inc.

SMSgt. James E. Craig III, left, from Hq., Air Force Inspection and Safety Center, here accepts AFA's National Security Affairs/Force Employment Award for Class 87-C from H. Lake Hamrick, AFA National Vice President for the Southeast Region. AFISC, one of USAF's separate operating agencies, is headquartered at Norton AFB, Calif.

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Address by:
Hon. Bill Chappell, Jr.
Chairman, Subcommittee on Defense Appropriations
United States House of Representatives

— ***Secretary's Luncheon***
Hon. Edward C. Aldridge, Jr.
Secretary of the Air Force

— ***Annual Reception***

— ***AEF/NSIC Roundtable***
"The USSR's New Look: Implications for the Free World"

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Gen. Larry D. Welch
Chief of Staff, US Air Force

— ***Air Force Anniversary Dinner Dance***
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Coming Events

August 7–9, **Arkansas State Convention,** Fayetteville . . . August 7–9, **Virginia State Convention,** Fredericksburg . . . August 19, **Delaware State Convention,** Dover AFB . . . August 20–23, **California State Convention,** Vandenberg AFB . . . August 21–23, **Utah State Convention,** Salt Lake City . . . August 28–30, **Arizona State Convention,** Sedona . . . August 29, **Illinois State Convention,** Glenview NAS, Chicago . . . August 29, **Indiana State Convention,** Fort Wayne . . . September 14–17, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C. . . . September 25–26, **North Dakota State Convention,** Minot.

UNIT REUNIONS

Air Rescue
Air Rescue members will hold their reunion at Waikiki Beach, Hawaii, on September 22–25, 1987. **Contact:** Shad Shaddox, 222 Greycliff, San Antonio, Tex. 78233. Phone: (512) 656-0306.

Lockbourne AFB Officers
Officers assigned to Lockbourne AFB, Ohio, during the 1950s (SAC era) will hold their twelfth reunion on October 8–11, 1987, at the Twin Bridges Marriott Hotel in Arlington, Va. **Contact:** Col. Harry E. Ford, Jr., USAF (Ret.), 205 Yoakum Pkwy., #1212, Alexandria, Va. 22304. Phone: (703) 751-7152.

Retired Air Force Musicians
Retired Air Force musicians will hold a reunion on September 7–9, 1987, in San Antonio, Tex. **Contact:** Bill LaBrutta, 1111 Bayhorse, San Antonio, Tex. 78245. Phone: (512) 674-6317. Jim Lantz, 1202 Bayhorse, San Antonio, Tex. 78245. Phone: (512) 675-2424. Jim Roland, 914 S. Duane, El Reno, Okla. 73036. Phone: (405) 262-0118. Herman Vincent, 4126 Heyd, Lake Charles, La. 70605. Phone: (318) 478-6091. (When writing for details, please enclose a self-addressed stamped envelope.)

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Stalags Luft IV and VI
Former prisoners of war of Stalags Luft IV and VI will hold a reunion on October 9, 1987, in Charlotte, N. C. **Contact:** Leonard E. Rose, 8103 E. 50th St., Indianapolis, Ind. 46226. Phone: (317) 546-1860.

USAFSS/ESC Alumni Ass'n
The annual meeting/reunion of the Air Force Security Service and Electronic Security Command Alumni Association is scheduled for September 25–26, 1987, in San Antonio, Tex. **Contact:** USAFSS/ESC Alumni Association, Hq. CESD/CC, San Antonio, Tex. 78243-5000.

8th Air Force Historical Society
World War II units of the Eighth Air Force will hold a combined reunion on October 14–18, 1987, in Pittsburgh, Pa. The units are the 2d Strategic Air Depot, 8th Air Force Flying Control, 18th Weather Squadron, 20th Fighter Group, 92d Bomb Group, 96th Bomb Group, 303d Bomb Group, 339th Fighter Group, 361st Fighter Group, 379th Bomb Group, 381st Bomb Group, 392d Bomb Group, 398th Bomb Group, 446th Bomb Group, 447th Bomb Group, 448th Bomb Group, 457th Bomb Group, 466th Bomb Group, 492d Bomb Group, 493d Bomb Group, and 1915th Ordnance Aviation Company. **Contact:** The 8th Air Force Historical Society, P. O. Box 3556, Hollywood, Fla. 33083. Phone: (305) 961-1410.

10th Combat Cargo Squadron
The 10th Combat Cargo Squadron, 3d Combat Cargo Group, will hold a reunion on September 10–13, 1987, in Scottsdale, Ariz. **Contact:** Thornton Rose, 2614 Mirror Lake Dr., Fayetteville, N. C. 28303.

13th Bomb Squadron
Veterans of the 13th Bomb Squadron, Fifth Air Force, who served in World War II will hold a reunion on October 15–18, 1987, at the Holiday Inn in downtown Norfolk, Va. Veterans of the 8th, 89th, and 90th Bomb Squadrons are also invited. **Contact:** Dave Pennington, 254-B McKnight Circle, Pittsburgh, Pa. 15237. Phone: (412) 364-5111.

24th Combat Mapping Squadron
The 24th Combat Mapping Squadron of World War II, based in Guskhara, India, and Peterson Field, Colo., will hold its first reunion on September 10–13, 1987, at the Ramada Hotel in Wichita, Kan. **Contact:** Howard F. Fleischer, 5749 Palm Beach Blvd., Lot 247, Fort Myers, Fla. 33905. Phone: (813) 694-0318.

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UNIT REUNIONS

Reunion Notices

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.

Class 43-A-1
Pilot Class 43-A-1 of Mather Field, Calif., will hold a reunion on September 25–27, 1987, at the Beverly Garland Hotel in Sacramento, Calif. **Contact:** Jay Craddock, 1448 Fallen Leaf Lane, Los Altos, Calif. 94022. Phone: (415) 968-5040.

43d Bomb Group
Members of the 43d Bomb Group, including the 63d, 64th, 65th, and 403d Bomb Squadrons, will hold a reunion on September 2–6, 1987, at the Bossier Sheraton Motel in Bossier City, La. **Contact:** Bob Beaudean, 307 Jacquelyn St., Bossier City, La. 71111. Lloyd Boren, 102 Beechwood, Universal City, Tex. 78148. Phone: (512) 658-5978.

56th Troop Carrier Squadron
The 56th Troop Carrier Squadron will hold a reunion on November 5–8, 1987, at the Airport Hilton Hotel in Nashville, Tenn. **Contact:** Lt. Col. James V. Tucker, USAF (Ret.), 418 Spaceway Dr., San Antonio, Tex. 78239.

58th Air Service Group
Members of the 58th Air Service Group, Fifth Air Force, will hold a reunion on August 28–30, 1987, in Waycross, Ga. **Contact:** Ray A. Wilkins, 1304 Heritage Pl., Morgantown, W. Va. 26505. Phone: (304) 599-4145.

58th Bomb Wing Ass'n
The 58th Bomb Wing, Twentieth Air Force, will hold a reunion on August 31–September 4, 1987, at the Landmark Hotel in Las Vegas, Nev. **Contact:** Ray Tolzmann or James W. Robinson, Rte. 2, Box 2802, Melrose, Fla. 32666. Phone: (904) 475-2035.

97th Bomb Group
The 97th Bomb Group will hold a reunion on September 23–26, 1987, at the Stouffer's Hotel in Dayton, Ohio. **Contact:** 1st Lt. James P. Brown, USAF, 340th Bomb Squadron/CCE, Blytheville AFB, Ark. 72315, or Clarence Hammes at (501) 794-2615.

310th/311th/312th Ferrying Squadrons
Members of the 310th, 311th, and 312th Ferrying Squadrons will hold a reunion in October 1987 in San Antonio, Tex. **Contact:** Paul F. Shorts, 1903 22d St., Lake Charles, La. 70601.

339th Fighter Squadron Ass'n
The 339th Fighter Squadron will hold a reunion on September 10–12, 1987, in Reno, Nev. **Contact:** Richard Cowles, 745 Harrison, Belding, Mich. 48809. Phone: (616) 794-2083.

353d Fighter Group
The 353d Fighter Group, Eighth Air Force, comprising the 350th, 351st, and 352d Fighter Squadrons, 440th Air Service Group, and the 1260th Military Police, will hold a reunion on September 16–19, 1987, at the Clarion Hotel in Colorado Springs, Colo. **Contact:** Charles J. Graham, The Army and Navy Club, 901 17th St., N. W., Washington, D. C. 20006-3098. Phone: (202) 628-8400.

529th AC&W Group
The 529th Aircraft Control and Warning Group has scheduled a reunion for October 22–25, 1987, at Offutt AFB, Neb. **Contact:** Col. Nester Cole, USAF (Ret.), 2732 Warwick Dr., Bloomfield Hills, Mich. 48013.

Berlin Airlift
I am looking for individuals from all services who participated in the Berlin Airlift and who would be interested in holding a fortieth anniversary reunion in the Frankfurt, Germany, area.

Please contact the address below.
Col. O. Thomas Hansen, USAF
Commander
435th Combat Support Group/CCE
APO New York 09057-5000

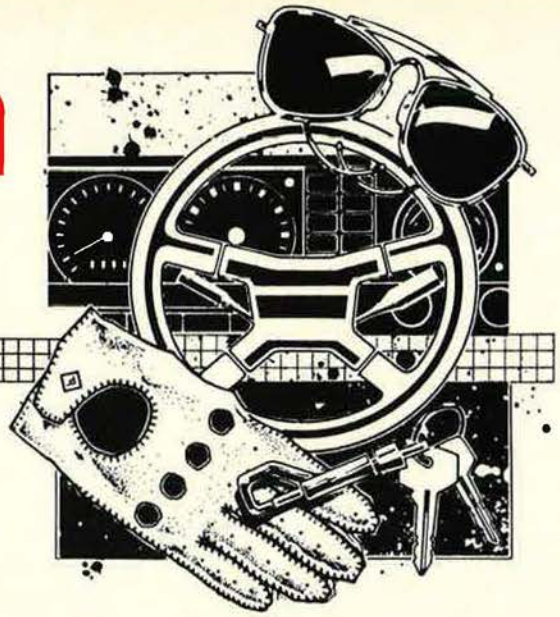
301st Veterans Ass'n
The 301st Veterans Association would like to hear from former members of the 301st Bomb Group and Wing who served in World War II (England, North Africa, and Italy) and also from post-World War II members based at Barksdale, Lockbourne, and Smokey Hill AFBs. We would like to locate individuals who would be interested in joining the association and attending a reunion scheduled for July 1988 in San Antonio, Tex. Widows of former members are also eligible for membership in the association.

Please contact the address below.
Billy S. McCarty
301st Veterans Association
P. O. Box 47843
San Antonio, Tex. 78265-8843

556th/6091st Reconnaissance Squadrons
I am trying to locate members of the 556th and 6091st Reconnaissance Squadrons for a third annual squadron reunion to be held in Las Vegas in 1988.

Please contact the address below.
Lt. Col. William T. Wilson,
USAF (Ret.)
2980 Stanford Lane
El Dorado Hills, Calif. 95630
Phone: (916) 933-2898

Save Money on Your New Car



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The PES plan provides savings, convenience and flexibility over retail purchasing and individual leasing. PES will deliver to the dealer of your choice or work with the dealers in your area for the lowest price. Imports cannot be ordered from the factory, but PES will assist you in leasing or price costing a new foreign car, truck or van.

The **New Vehicle Cost Request** form can be used to order your new domestic vehicle with all the standard and requested optional equipment or to work with a dealer for the best price. **Those who complete a New Vehicle Cost Request form also will receive a lease-purchase quotation without cost or obligation.**

Write or call for free brochure on direct purchase of a vehicle through PES, an AFA-sponsored service.

Mail the **New Vehicle Cost Request** form and $7 for each new car inquiry to: **AFA Auto Program, % PES, Box 208, Wauseon, OH 43567, (800) 227-7811,** or in Ohio, **(419) 335-2801.**

☐ Check enclosed for $_____ *(make check payable to PES—$7 for each new car inquiry)*

I wish to pay by credit card

☐ AFA-VISA ☐ VISA ☐ MasterCard

Card Holder Signature

Card Holder Name (Please Print)

Account Number

MasterCard Interbank No. Card Expires Mo./Yr.

Name Rank

Address

City State ZIP

Phone: ( ) Home ( ) Office

New Vehicle Cost Request

Year _____ Make _____ Model _____ Body Style _____

Equipment Selection

☐ 4 cyl. engine ☐ 6 cyl. ☐ Other _____
☐ Automatic transmission ☐ Manual ☐ Power steering ☐ Power brakes
☐ Power antenna ☐ Power door locks
☐ Power mirrors ☐ Power windows
☐ Power tailgate/trunk release
☐ Power seats: ☐ Driver ☐ Passenger ☐ Bench ☐ Reclining
☐ California emission ☐ High altitude emission
☐ Air conditioning ☐ Auto. temperature control
☐ Battery, H.D. ☐ Cooling H.D.
☐ Bumper guards ☐ Impact strips
☐ Cruise control ☐ Console
☐ Defogger, rear window
☐ Door edge guards
☐ Floor mats (F&R)
☐ Glass, tinted
☐ Gauges ☐ Electronic gauges
☐ Headlamp control ☐ Light group
☐ Luggage rack
☐ Mirrors, remote LH ☐ RH manual ☐ Other _____
☐ Visor, vanity, illuminated
☐ Moldings, bodyside ☐ Rocker panel ☐ Other _____
☐ Paint stripe ☐ Two-tone paint
☐ Radio, AM ☐ AM/FM stereo ☐ AM/FM stereo w/ cassette ☐ AM/FM stereo w/cassette & premium sound
☐ Roof, full vinyl ☐ Other _____
☐ Seat trim ☐ Cloth ☐ Vinyl ☐ Leather
☐ Seats, bench ☐ Notchback 55/45 ☐ 45/45 ☐ Bucket ☐ Other _____
☐ Steering wheel tilt ☐ Telescopic
☐ Tires, WSW ☐ BSW ☐ Other _____
☐ Wheel covers, STD ☐ Wire ☐ Other _____
☐ Wheels, aluminum ☐ Other _____
☐ W/S wipers, intermittent ☐ Rear window wipers

Additional Equipment

_____

_____

Based on _____ 36 _____ 48 _____ 60 months with

_____ down payment

☐ I will pay total in cash

AFA's CHAMPLUS® . . . With the

Exceptional Basic Benefits

1. Four year basic benefit. Benefits for most injuries or illnesses are paid for up to a four-year period.

2. Up to 45 consecutive days of in-hospital care for mental, nervous or emotional disorders. Outpatient care for these disorders may include up to 20 visits by a physician or $500.00 per insured person each year.

3. Up to 30 days per year for each insured person confined in a Skilled Nursing Facility.

4. Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Residential Treatment Center.

5. Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Special Treatment Facility.

6. Up to five visits per year for each insured person to Marriage and Family Counselors under conditions defined by CHAMPUS.

And the New 'Expense Protector' Benefit

While CHAMPUS Supplement coverage was originally intended to cover the cost of medical services not provided by CHAMPUS, practitioners and service institutions may charge fees that are considerably greater than those approved for payment by CHAMPUS. And, because Supplement policies traditionally base their payments on the amount paid by CHAMPUS, the insured can be left with sizable out-of-pocket expenses. AFA's ChamPLUS® coverage includes a special feature which places a limit on these out-of-pocket expenses.

Called the 'Expense Protector' Benefit, this program limits out-of-pocket expenses for CHAMPUS covered charges in any single calendar year to $1,000 for any one insured person (or $2,000 for all insured family members combined). Once those out-of-pocket expense maximums are reached, ChamPLUS® will pay 100% of CHAMPUS covered charges for the remainder of that year.

An example of the way the 'Expense Protector' works follows. Assume you are hospitalized for 35 days, that the hospital charges you $330 per day and that this is $75 per day *more* than allowed by CHAMPUS. This would mean that you have an out-of-pocket expense of $2,625. With AFA's 'Expense Protector' benefit, your cost would be limited to $1,000. All covered costs over this amount—for the whole calendar year—would be paid by ChamPLUS®!

It's an important benefit that can mean significant savings to you and your family.

Who Is Eligible?

1. All AFA members under 65 years of age who are currently receiving retired pay based upon their military service and who are eligible for benefits under Public Law 89-614 (CHAMPUS), their spouses under age 65 and their unmarried dependent children under age 21, or age 23 if in college.

2. All eligible dependents of AFA members on active duty. Eligible dependents are spouses under age 65 and unmarried dependent children under age 21 (or age 23 if in college). (There are some exceptions for older age children. See "Exceptions and Limitations.")

Renewal Provision

As long as you remain eligible for CHAMPUS benefits and the Master Policy with AFA remains

AFA ChamPLUS® Benefit Schedule

Care	CHAMPUS Pays	AFA CHAMPLUS® PAYS
For Military Retirees Under Age 65 and Their Dependents		
Inpatient civilian hospital care	CHAMPUS pays 75% of allowable charges	CHAMPLUS® pays the 25% of allowable charges not paid by CHAMPUS . . . plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year.
Inpatient military hospital care	The only charge normally made is a $7.55 per day subsistence fee, not paid by CHAMPUS.	CHAMPLUS® pays the $7.55 per day subsistence fee.
Outpatient care	CHAMPUS covers 75% of outpatient care fees after an annual deductible of $50 per person ($100 maximum per family) is satisfied.	CHAMPLUS® pays the 25% of allowable charges not paid by CHAMPUS after the deductible has been satisfied . . . plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year.
For dependents of Active Duty Military Personnel		
Inpatient civilian hospital care	CHAMPUS pays all covered services and supplies furnished by a hospital less $25 or $7.55 per day, whichever is greater.	CHAMPLUS® pays the greater of $7.55 per day or the $25 hospital charge not paid by CHAMPUS.
Inpatient military hospital care	The only charge normally made is a $7.55 per day subsistence fee, not paid by CHAMPUS.	CHAMPLUS® pays the $7.55 per day subsistence fee.
Outpatient care	CHAMPUS covers 80% of outpatient care fees after an annual deductible of $50 per person ($100 maximum per family) is satisfied.	CHAMPLUS® pays the 20% of allowable charges not paid by CHAMPUS after the deductible has been satisfied . . . plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year.

NOTE: Outpatient benefits cover emergency room treatment, doctor bills, pharmaceuticals, and other professional services. There are some reasonable limitation and exclusions for both inpatient and outpatient coverage. Please note these elsewhere in the plan description.

New 'Expense Protector' Benefit!

in force, termination of your coverage can occur only if premiums for coverage are due and unpaid, or if you are no longer an AFA member. Your certificate cannot be terminated because of the number of times you receive benefits.

Exceptions and Limitations

Coverage will not be provided for conditions for which treatment has been received during the 12-month period prior to the effective date of insurance until the expiration of 12 consecutive months of insurance coverage without further treatment. After coverage has been in force for 24 consecutive months, pre-existing conditions will be covered regardless of prior treatment. Children of active duty members over age 21 (age 23 if in college) will continue to be eligible if they have been declared incapacitated and if they are insured under CHAMPLUS® on the date so declared. Coverage for these older age children will only be provided upon a) notification to AFA and b) payment of a special premium amount.

Plan 1
For Military Retirees and Dependents
QUARTERLY PREMIUM SCHEDULE

In-Patient Benefits Only

Member's Attained Age*	Member	Spouse	Each Child
Under 50	$22.97	$ 45.12	$16.34
50-54	$34.33	$ 56.21	$16.34
55-59	$50.32	$ 60.17	$16.34
60-64	$62.98	$ 69.27	$16.34

In-Patient and Out-Patient Benefits

Under 50	$33.90	$ 61.02	$40.84
50-54	$46.59	$ 69.87	$40.84
55-59	$64.41	$ 96.11	$40.84
60-64	$77.38	$102.15	$40.84

*Note: Premium amounts increase with the member's attained age

Plan 2
For Dependents of Active Duty Personnel
ANNUAL PREMIUM SCHEDULE

In-Patient Benefits Only

	Member	Spouse	Each Child
All Ages	None	$ 9.68	$ 5.94

In-Patient and Out-Patient Benefits

All Ages	None	$38.72	$29.70

CHAMPLUS®

Coverage After Age 65

Upon attainment of age 65, the coverage of members insured under CHAMPLUS® will automatically be converted to AFA's Medicare Supplement program so that there will be no lapse in coverage. Members not wishing this automatic coverage should notify AFA prior to their attainment of age 65.

Exclusions

This plan does not cover and no payment shall be made for:

- routine physical examinations or immunizations
- domiciliary or custodial care
- dental care (except as required as a necessary adjunct to medical or surgical treatment)
- routine care of the newborn or well-baby care
- injuries or sickness resulting from declared or undeclared war or any act thereof
- injuries or sickness due to acts of intentional self-destruction or attempted suicide, while sane or insane
- treatment for prevention or cure of alcoholism or drug addiction
- eye refraction examinations
- prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses
- expenses for which benefits are or may be payable under Public Law 89-614 (CHAMPUS)

APPLICATION FOR AFA CHAMPLUS®

Group Policy GMG-FC70
Mutual of Omaha Insurance Company
Home Office: Omaha, Nebraska

Full name of Member _____
Rank Last First Middle

Address _____
Number and Street City State ZIP Code

Date of Birth _____ Current Age ____ Height ____ Weight ____ Soc. Sec. No. _____
Month/Day/Year

This insurance coverage may only be issued to AFA members. Please check the appropriate box below:

☐ I am currently an AFA Member. ☐ I enclose $18 for annual AFA membership dues (includes subscription ($14) to AIR FORCE Magazine).

PLAN & TYPE OF COVERAGE REQUESTED

Plan Requested (Check One)	☐ AFA CHAMPLUS® PLAN I (for military retirees & dependents) ☐ AFA CHAMPLUS® PLAN II (for dependents of active-duty personnel)	
Coverage Requested (Check One)	☐ Inpatient Benefits Only ☐ Inpatient and Outpatient Benefits	
Person(s) to be insured (Check One)	☐ Member Only ☐ Spouse Only ☐ Member & Spouse	☐ Member & Children ☐ Spouse & Children ☐ Member, Spouse & Children

PREMIUM CALCULATION

All premiums are based on the attained age of the AFA member applying for this coverage. Plan I premium payments are normally paid on a quarterly basis but, if desired, they may be made on either a semi-annual (multiply by 2), or annual (multiply by 4) basis.

Quarterly (annual) premium for member (age ____) $_____

Quarterly (annual) premium for spouse (based on member's age) $_____

Quarterly (annual) premium for ____ children @ $ $_____

Total premium enclosed $_____

If this application requests coverage for your spouse and/or eligible children, please complete the following information for each person for whom you are requesting coverage.

Names of Dependents to be Insured	Relationship to Member	Date of Birth (Month/Day/Year)

(To list additional dependents, please use a separate sheet.)

In applying for this coverage, I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed drugs or medicine within 12 months prior to the effective date of this insurance coverage will not be covered until the expiration of 12 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such pre-existing conditions will be covered after this insurance has been in effect for 24 consecutive months.

Date _____, 19 ____ _____
Member's Signature

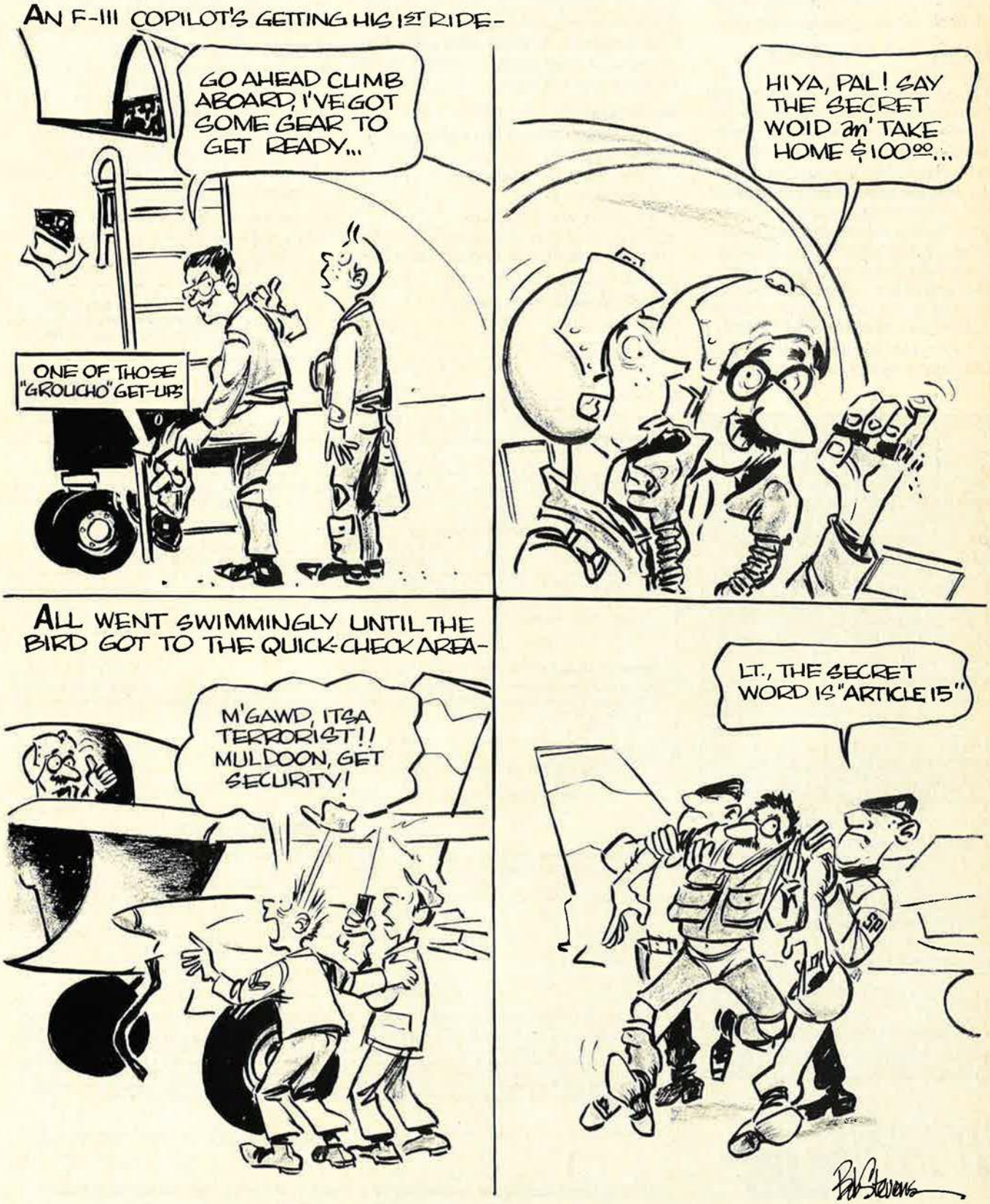
Form 6173GH App.
8-87

Application must be accompanied by a check or money order. Send remittance to: Air Force Association, Insurance Division, 1501 Lee Highway, Arlington, VA 22209-1198

Bob Stevens'

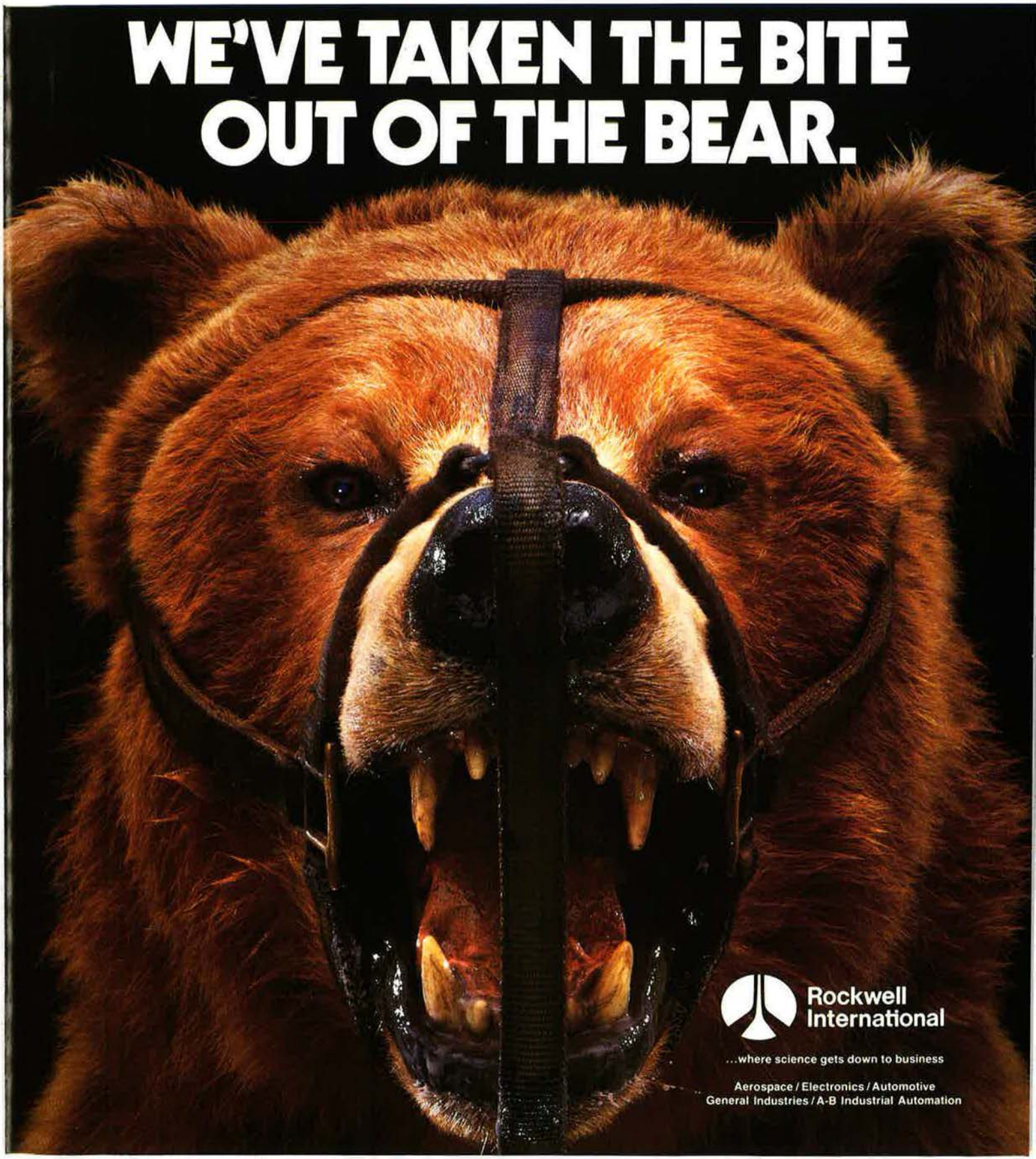
"There I was..."

HISTORY REPEATS ITSELF. ***MANY*** YRS AGO WE TOLD THE STORY OF NELLIS AFB's "DUSTY" RHOADS (HE WORE A FISHBOWL IN LIEU OF A HELMET IN AN UNANNOUNCED LANDING DURING AN ORI AT BIGGS) NOW, 20+YRS LATER AN-OTHER MASKED MAN STEPS FORWARD. FROM NELLIS, OF COURSE.



The new Collins GRC-171A(V)4 is a colocatable ECCM multi-channel transceiver with space-saving frequency agile filter built right in. ■ This frequency agile UHF AM / FM Have Quick radio eliminates the need for external assets, which allows the use of multiple radios in transportable shelters, control towers, command posts and other space-limited installations. ■ Since the basic GRC-171 is already the standard air traffic control radio for the Air Force, the new GRC-171A(V)4 minimizes additional logistic support costs. This new GRC-171 is also wave form adaptable for international use. ■ For details contact: Collins Defense Communications, Rockwell International, 350 Collins Road N.E., MS 120-131, Cedar Rapids, Iowa 52498, U.S.A. (319) 395-1600, Telex 464-435. **Collins ACCD: The Electronic Combat Specialists.**

WE'VE TAKEN THE BITE OUT OF THE BEAR.



Rockwell International

...where science gets down to business

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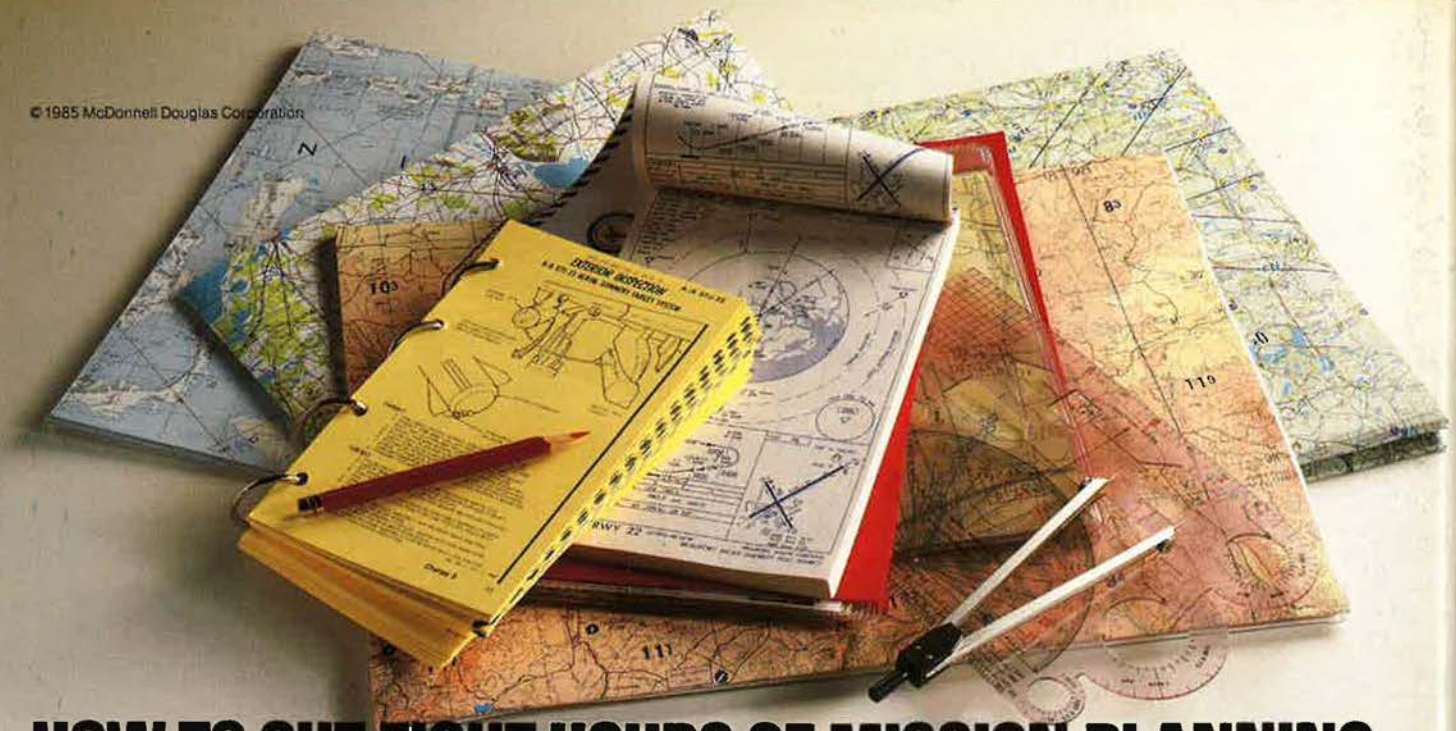

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Now there's a better way. Our computer-based Military Aircraft Planning System lets aircrews plan every aspect of a combat or training mission anywhere in the world in a fraction of the time previously required.

The reference data needed is in the computer. Interactive color graphics show basic geography with contours and population centers; navigation aids, corridors and checkpoints; even hostile defenses with radar terrain masks. As the mission planner develops the route, he gets a comprehensive analysis of his aircraft's performance, necessary navigation information, and an evaluation of the plane's ability to penetrate. Within minutes he can revise the route to minimize exposure to hostile defenses.

The system not only cuts hours off planning time, it can cut attrition rates as well. Operational simulations in Europe predict a 31% increase in mission success with the system.

The Military Aircraft Planning System. We've needed it for a long time, and now it's here. It's ready to improve our training and our ability to fight and win.

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