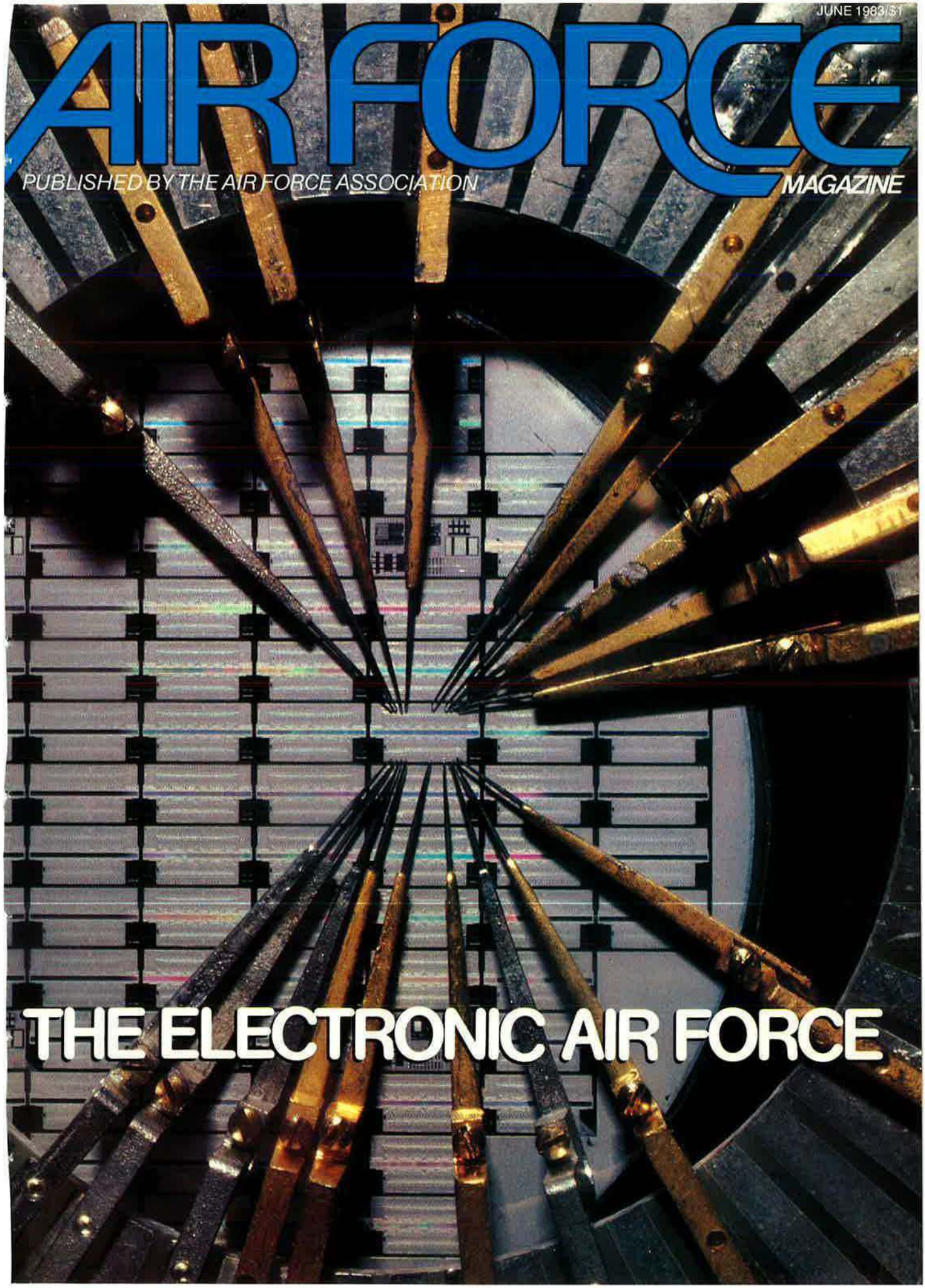
JUNE 1983/$1

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



THE ELECTRONIC AIR FORCE

The GE technology edge: durable fighter turbofans with turbojet characteristics.

GE engines — now in production or flight test — are truly setting new standards for fighter turbofans.

- **OPERABILITY:** Pilots report that F404 and F110 turbofans behave like General Electric's famed J79 fighter turbojet. As one pilot said, "I can really fly the aircraft up to its capabilities." And unlike competitive engines, both the F404 and F110 can operate throughout the entire flight envelope with no throttle restrictions.
- **DURABILITY AND RELIABILITY:** Because of preeminent hot section technology, including machined ring combustors and single-stage turbines, GE engines offer two to three times the hot section life of any other engine in service. An F110 test engine recently completed 5000 TAC cycles . . . the equivalent of 2500 F-16 mission hours!
- **OPERATING COSTS:** Simplicity — plus the durability that comes from advanced technology — provide low maintenance costs. General Electric engines have a preeminent record: The J79 removal rate in the F-4 is three per 1,000 flight hours. The TF34 in the A-10 is under two per 1,000. And the F404 and F110 are on track for two per 1,000 — three times better than competitive turbofans.
- **ENGINES OF CHOICE:** With performance like this it's no wonder General Electric engines are becoming a preferred source of power.

F404-powered McDonnell Douglas F/A-18 — Production

F110-powered Grumman F-14 — Flight Test

F404-powered Northrop F-20 Tigershark — Flight Test

The 16,000 lb. thrust class F404 is in service with the U.S. Navy/Marine F/A-18 and Canadian CF-18 and will power the Australian and Spanish F/A-18s. The F-20 Tigershark and Swedish Gripen aircraft are fitted with 17,000 and 18,000 lb. thrust class versions of the F404.

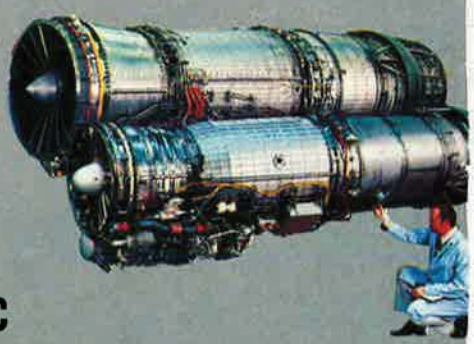
The F110, a derivative of the F101 developed for the U.S. Air Force B-1, is in the 27-29,000 lb. thrust class. Funded to provide competitive production in the large fighter engine class, this engine has participated in outstandingly successful flight test programs in both the USAF F-16 and USN F-14. It is now flying in a General Dynamics F-16XL aircraft, a two-seater.

F110-powered two-seat General Dynamics F-16XL — Flight Test

F110-powered General Dynamics F-16 — Flight Test

When you add it all up, it all comes down to a single word: performance.

Great Engines From General Electric's Advanced Technology



GENERAL ELECTRIC

JUNE 1983
VOLUME 66, NUMBER 6

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

Page 62

Page 110

About the cover: Advanced technologies, such as those embodied in this wire-bonding device by Westinghouse, will enable the Air Force to prevail in the electronic combat arena. The Electronic Air Force section starts on p. 38.

Special Section: The Electronic Air Force

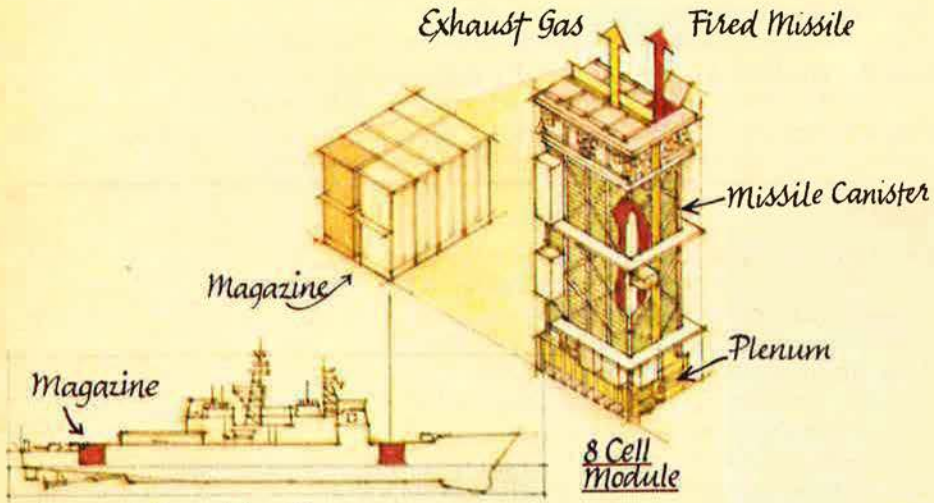
Features

Departments

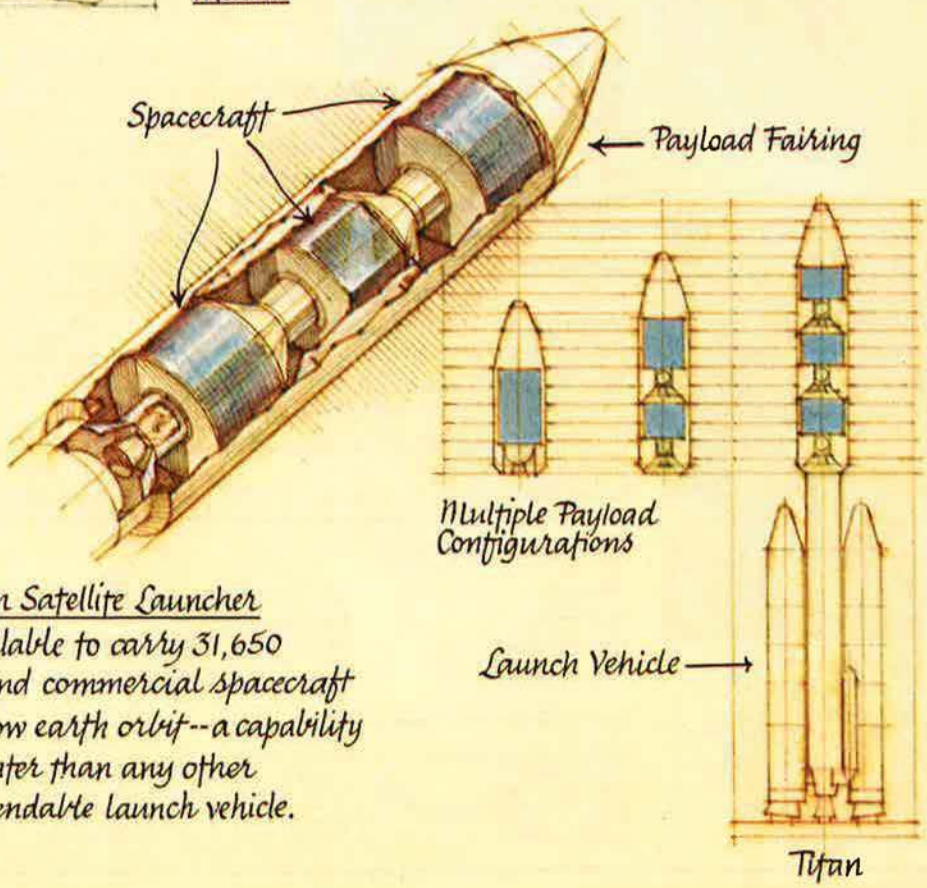
AIR FORCE Magazine (ISSN 0730-6784) is published monthly by the Air Force Association, Suite 400, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. **Phone:** (202) 637-3300. Second-class postage paid at Washington, D.C., and additional mailing offices. **Membership Rate:** $15 per year; $36 for three-year membership (includes $24 for subscription). **Life Membership:** $200. **Subscription rate:** $15 per year; $25 per year additional for postage to foreign addresses (except Canada and Mexico, which are $8 per year additional). Regular issues $1 each. Special issues (Soviet Aerospace Almanac, USAF Almanac issue, Anniversary issue, and "Military Balance" issue) $3 each. **Change of address** requires four weeks' notice. Please include mailing label. Publisher assumes no responsibility for unsolicited material.

What's needed to generate advanced space and defense systems?

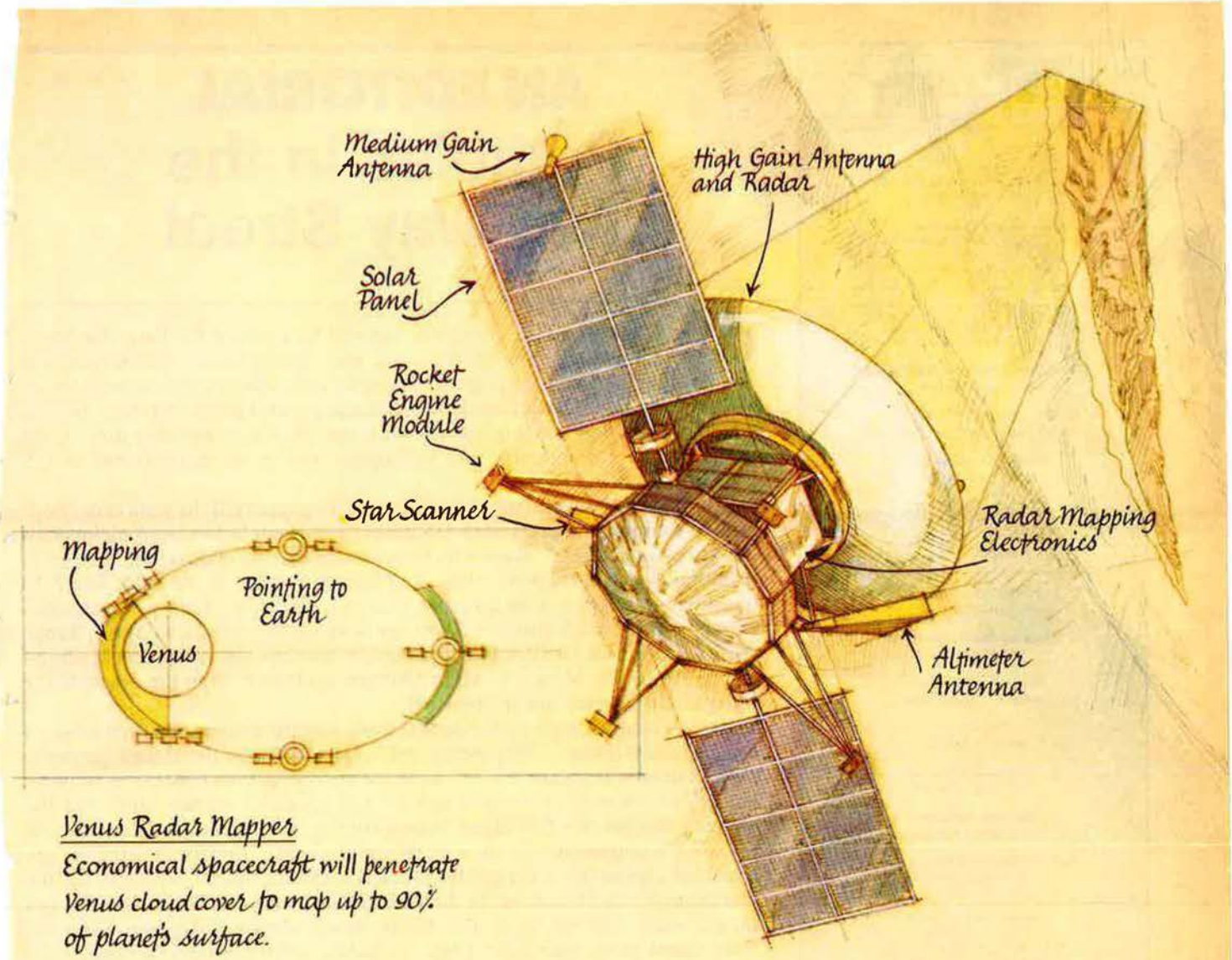
Generations of experience.



Vertical Launching System
Provides rapid fire launch capability for 61 missiles against air, surface and underwater targets.



Titan Satellite Launcher
Available to carry 31,650 pound commercial spacecraft to low earth orbit--a capability greater than any other expendable launch vehicle.



Venus Radar Mapper
Economical spacecraft will penetrate Venus cloud cover to map up to 90% of planet's surface.

Today's complex space and defense systems tax the resources of many organizations. Large systems developers are needed, with the generations of experience to marshal the many talents required for mission success.

Martin Marietta is a company with such capability. This capability is behind five generations of Titan space vehicles, the Pershing missile and many of this country's defensive weapons.

The same capability helps explain why we have participated in every major NASA program to explore the solar system, from building the Viking landers to developing key instruments for the Voyager spacecraft to Jupiter, Saturn, and beyond.

But organizational knowhow is only one reason these systems succeed. Their development and manufacture also require a formidable array of research and production technology.

Our technical staff is supported by 82 advanced research facilities, from vacuum chambers that simulate deep space to laboratories that model entire C^3 systems. These facilities are linked by a national computer network that can process two billion bytes of data a day. We're also using CAD/CAM techniques, automated testing programs, robotics, and computer controlled parts management and flow systems for volume manufacturing.

None of this came to pass overnight. Three decades of conceiving, designing, building and testing have led to these unique abilities. Abilities aimed at producing big systems that are affordable, producible and effective.

MARTIN MARIETTA

Martin Marietta Aerospace
6801 Rockledge Drive, Bethesda, Maryland 20817 U.S.A.

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PUBLISHED BY THE AIR FORCE ASSOCIATION MAGAZINE

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BPA Circulation audited by Business Publication Audit

AN EDITORIAL
Potholes in the Two-Way Street

On p. 94 of this issue, questions that will be asked at the Paris Air Show are highlighted. Among them are the related topics of international cooperation in aerospace projects and restrictive clauses that impede them. AFA members are better informed than the general public on these topics, which are just now seeping into the mass media. The issues bear directly on the health of US industry and its applications in so many facets of US military power.

Congress and several administrations have supported the notion of cooperative weapons projects with US allies. The process has been nicknamed the "two-way street." Among its benefits are sharing of development costs, economies of scale in production, and interoperability in the field. The F-16 multinational fighter is an example. Others include the "family of weapons" concept, whereby European countries develop the Advanced Short-Range Air-to-Air Missile (ASRAAM) and the US develops the Advanced Medium-Range Air-to-Air Missile (AMRAAM) and each buys from the other. Many other such projects are in the works.

But the same Congress that directs transatlantic cooperation then forks its tongue and imposes "Buy American" restrictions on the armed services. Two examples from the FY '83 Defense appropriations process: a requirement that weapon systems use only US specialty metals, and that the ejection seat for the T-45 Hawk trainer for the Navy be opened for competition by US companies. In the specialty metals case, European suppliers see a market closed out unilaterally. The US specialty metals suppliers see the market protected for them. In the ejection seat case, the US Navy sees it as unnecessary and wasteful. The British-made Martin-Baker ejection seats have saved more than 5,025 lives, including 2,800 US aircrew. They have long been in front-line US aircraft, including the F-4, A-6, and F-14.

The Air Force and Navy, US and European industry, European legislators, and some US Senators and Representatives see the damaging effects of these restrictive clauses clearly. Not so their narrow-minded colleagues who slip them in. Those persons play a hypocritical game. On one hand, they flail the armed services for unnecessary spending and urge cooperation with US allies. At the same time, they insert special-interest pork-barrel clauses that raise costs without improving effectiveness, and that alienates allies. They can't have it both ways.

What should be done? It is naïve to expect that the hypocrites will change. Therefore, the appropriate course is to ensure that their colleagues in both House and Senate are informed about the implications of these restrictive and damaging clauses. Then Congress can sort out the true national benefits. Without such action, the "two-way street" will remain potholed and bumpy.

F. Clifton Berry

F. CLIFTON BERRY, JR.
EDITOR IN CHIEF

Collins GPS User Systems: The Force Enhancer

Collins Government Avionics and the Navstar Global Positioning System are powerful partners to increase U.S. and NATO military force effectiveness.

GPS increases the effectiveness of land, sea, and air forces dramatically. Air Force sponsored studies and field tests using GPS show success rates for tactical air missions are enhanced up to 60%, strategic weapons by 20% and indirect artillery by 50% by improved navigation. GPS is a survivable, all-weather, 24-hour, worldwide, jam-resistant system.

It all adds up to increased force effectiveness through advanced navigation technology for all users requiring highly accurate position, velocity and time information.

Collins GPS user systems make these advantages available through affordable GPS user equipment for air, sea, subsurface and surface applications. Our common modular architecture enables low acquisition and life-cycle-support costs for GPS user operations. Our modular design is the result of our long experience in ground, sea and airborne systems.

For more information, contact Collins Government Avionics Division, Rockwell International, Cedar Rapids, Iowa, 52498. (319) 395-2208.

Rockwell International

...where science gets down to business

These high-flying have a down-to-

They require expert operations

The NASA Space Shuttle is an epic aerospace achievement, and is now poised to enter the era for which it was intended—the age of regular, frequent operations.

More than ever, it will share a common need with other high-technology, specialized fleets. Expert operations management for between-flight processing will be critical. And that's where Lockheed's experience is unmatched.

Through projects like the SR-71, U-2/TR-1, America's fleet ballistic missiles, Agena, and classified programs, Lockheed has decades of operations management experience.

These vehicles join more than 100,000 other aircraft of various types processed to date by Lockheed specialists at bases and installations worldwide. Lockheed's involvement has run the gamut from systems management through depot

birds earth need.

management.

level maintenance, work control systems, integrated logistics, operations and maintenance analysis, and efficient processing.

That adds up to a proven record of safe, responsible, on-time operations.

All of Lockheed's broad operations management experience and invaluable knowledge of the orbiter's systems integration and cargo interface requirements gained from work on payload contracts, has now been focused on NASA and U.S. Air Force requirements to process the Space Shuttle. Lockheed is fully prepared to meet the critical demands of regular, frequent Shuttle processing, and will use its new Space Operations Company to get the job done safely, efficiently, and on time.

When it comes to operations management, Lockheed knows how.

Lockheed Space Operations Company

Titusville, Florida

AIRMAIL

April Issue

I just wanted to drop a quick line to say I thought the April issue was outstanding. The section covering Air Force people overseas—"From Andersen to Zweibrücken"—was superb. It certainly will provide our younger folks anticipating their first overseas tour with a better understanding of what to expect in a foreign country.

Again, it was a super job. Your efforts are greatly appreciated.

Brig. Gen. Richard F. Abel, USAF
USAF Director of Public Affairs
Washington, D. C.

I enjoyed the April 1983 issue of AIR FORCE Magazine so much that I had to write and congratulate you on a job extremely well done.

"From Andersen to Zweibrücken" was an interesting, well-written article. The photos were superb. . . .

Even though the article was devoted to overseas bases, the section on USOs was missing some pertinent information that might be of interest to those just going overseas. The James S. McDonnell USO at Lambert-St. Louis Airport sees more than 100,000 people pass through its doors yearly. The large majority of those people are there while waiting for MAC flights overseas. The USO is open twenty-four hours a day, and offers everything from a fully equipped nursery to an attended luggage storage area. (Incidentally, AFA donated $10,000 to this USO last year from proceeds from the AFA Ball of Mid-America. Thanks, AFA!)

My favorite part of the article was the part titled "You Know You're Overseas When . . ." *(p. 37).* The one about the MARS call could have been taken from the pages of my diary. My own additions to the list are:

(Philippines version): Typhoon conditions just mean rolling up your jeans and wearing flip-flops.

You can eat *balut* without getting sick.

You tie a gecko to your bed for luck.

You can bargain just as well as the locals.

(Alaska version): You can sleep even though it's light twenty-four hours a day.

You start singing along with the Cal Worthington commercials.

You refer to the States as the Lower Forty-eight.

You pass a moose on the way to work and you don't even look twice.

SSgt. Annette Ware, USAF
Scott AFB, Ill.

I predict you'll hit an all-time record in "Airmail" for additions to your list of "You Know You're Overseas When . . ." We enjoyed those. Here are some add-ons.

You know you're overseas when . . .

The door knobs aren't round.

Drinking water comes from a jug, not the faucet.

Regularly, *no* water whatsoever comes from the faucet.

You've got enough of the wrong kind and not enough of the right kind of money you need in the BX.

"Shot Day" ranks right up there with "Report Card Day" as a dreaded event in school.

The new kid is popular because he or she has the latest records and tapes.

You've got your passport handy instead of tucked away like it is when you're back home in the land of the big BX.

Maj. Christopher J. Hoppin, USAFR
Ramsey, N. J.

Submissions to "Airmail" should be sent to the attention of the "Airmail" Editor, 1750 Pennsylvania Ave., N. W., Suite 400, Washington, D. C. 20006. Letters should not exceed 500 words, and preferably be typed. We reserve the right to condense letters as necessary. Names will be withheld on request, but unsigned letters are not acceptable. Because of the volume of letters received, it is not possible to print all submissions. Please allow lead time of *at least* two months for time-sensitive announcements.

Two Great Books

Just recently I wrote to Lt. Gen. J. B. McPherson, USAF (Ret.), President of the Air Force Historical Foundation, to thank him for their involvement in a couple of books, and I wanted to share my comments with you and the members of the Air Force Association.

To quote my comments to General McPherson: "Those two books, *A Few Great Captains* and *Forged in Fire,* are the greatest books I've read on the story of the Air Force and airpower. They should become textbooks. They should be read by everyone, young and old, who has any interest at all in the subject of airpower.

"Thank God they've been published and thank you for all you're doing to help."

We desperately need to spread the word so that all Americans realize what the Air Force is all about and how it all began. The two books I've cited can do a lot to aid that educational process.

Sen. Barry Goldwater
Washington, D. C.

Ninth Air Force

Having been a member of AFA for lo these many years, I have read a bundle of issues of AIR FORCE Magazine.

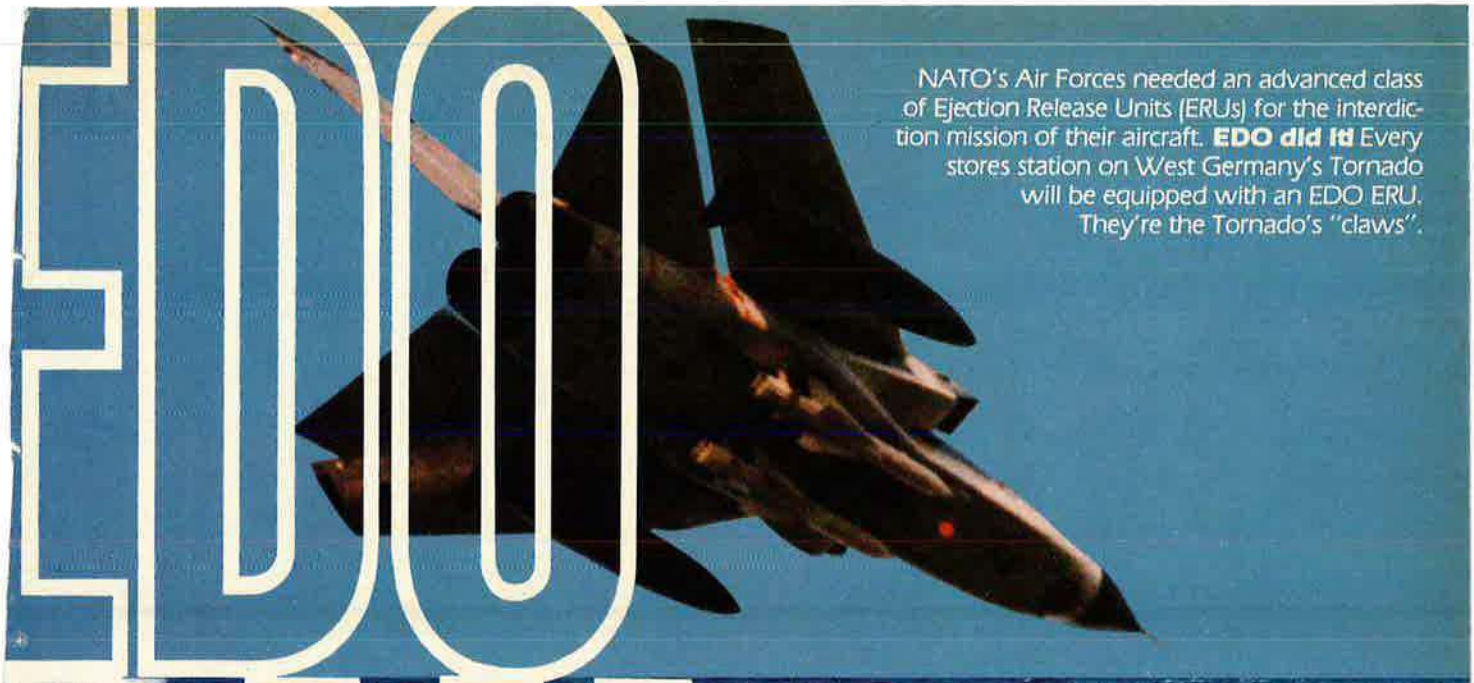
I have never seen too many references to what was an important part of the World War II air forces. I am referring to *Ninth Air Force,* the tactical air force in Europe.

Hey, you guys from the Eighth—we were there too! We lost people and aircraft. We contributed and helped bring about the final victory, so how about a little space for us? . . .

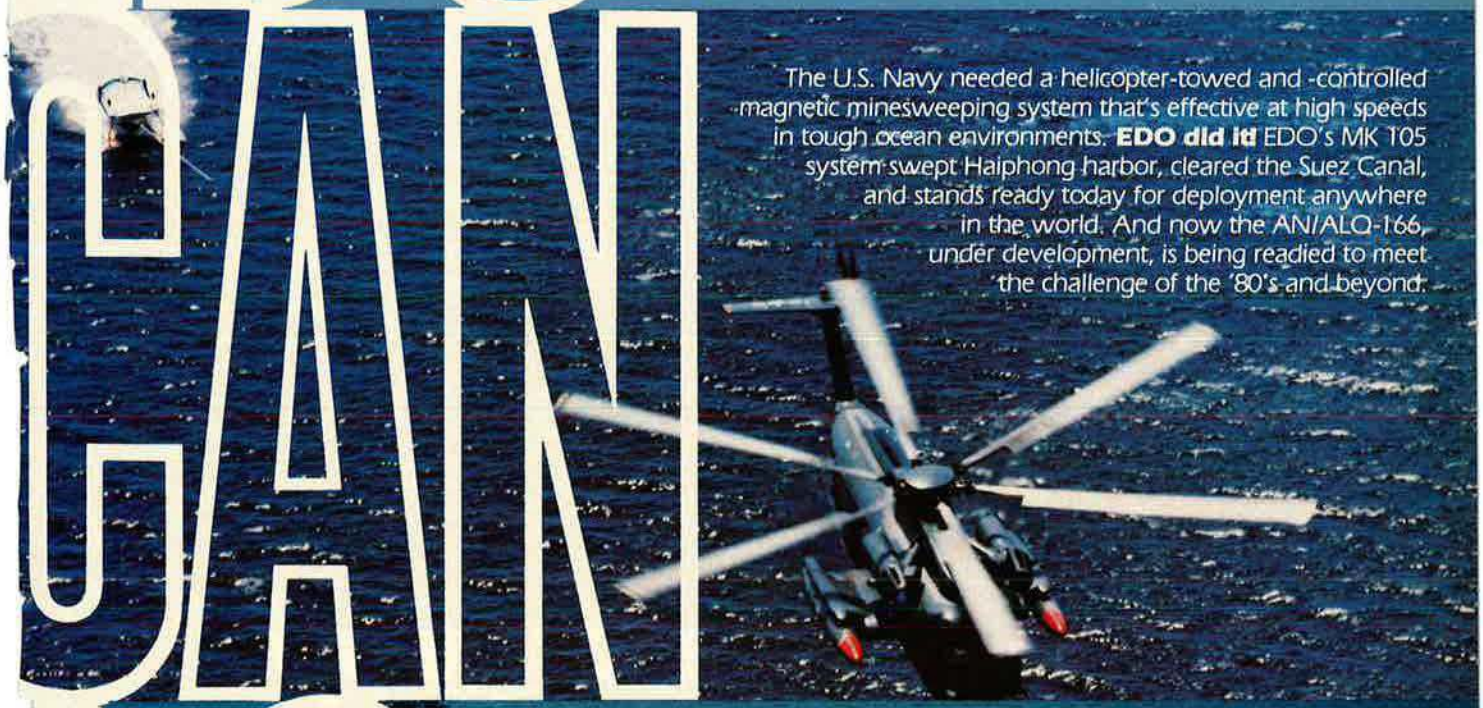
Since I was but a lowly "ground-pounder"—weather officer in the 21st Weather Squadron—it probably won't make much of an impression, but I do think you people at AIR FORCE Magazine should pay a little attention to the Ninth.

Incidentally, our CO of the 21st Weather Squadron was Col. (later Lt. Gen.) Thomas Moorman, who retired after serving as Superintendent of the US Air Force Academy. I had the

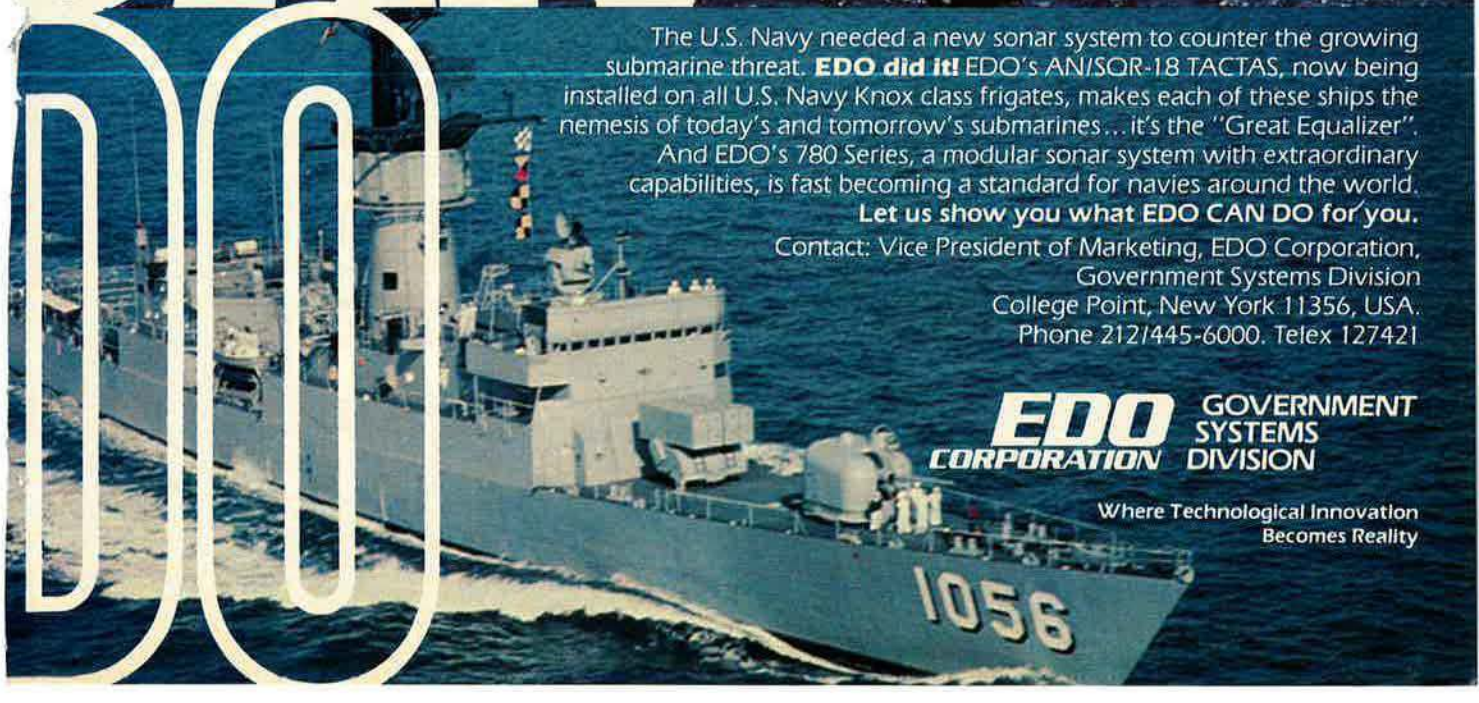
EDO CAN DO



NATO's Air Forces needed an advanced class of Ejection Release Units (ERUs) for the interdiction mission of their aircraft. **EDO did it!** Every stores station on West Germany's Tornado will be equipped with an EDO ERU. They're the Tornado's "claws".



The U.S. Navy needed a helicopter-towed and -controlled magnetic minesweeping system that's effective at high speeds in tough ocean environments. **EDO did it!** EDO's MK 105 system swept Haiphong harbor, cleared the Suez Canal, and stands ready today for deployment anywhere in the world. And now the AN/ALQ-166, under development, is being readied to meet the challenge of the '80's and beyond.



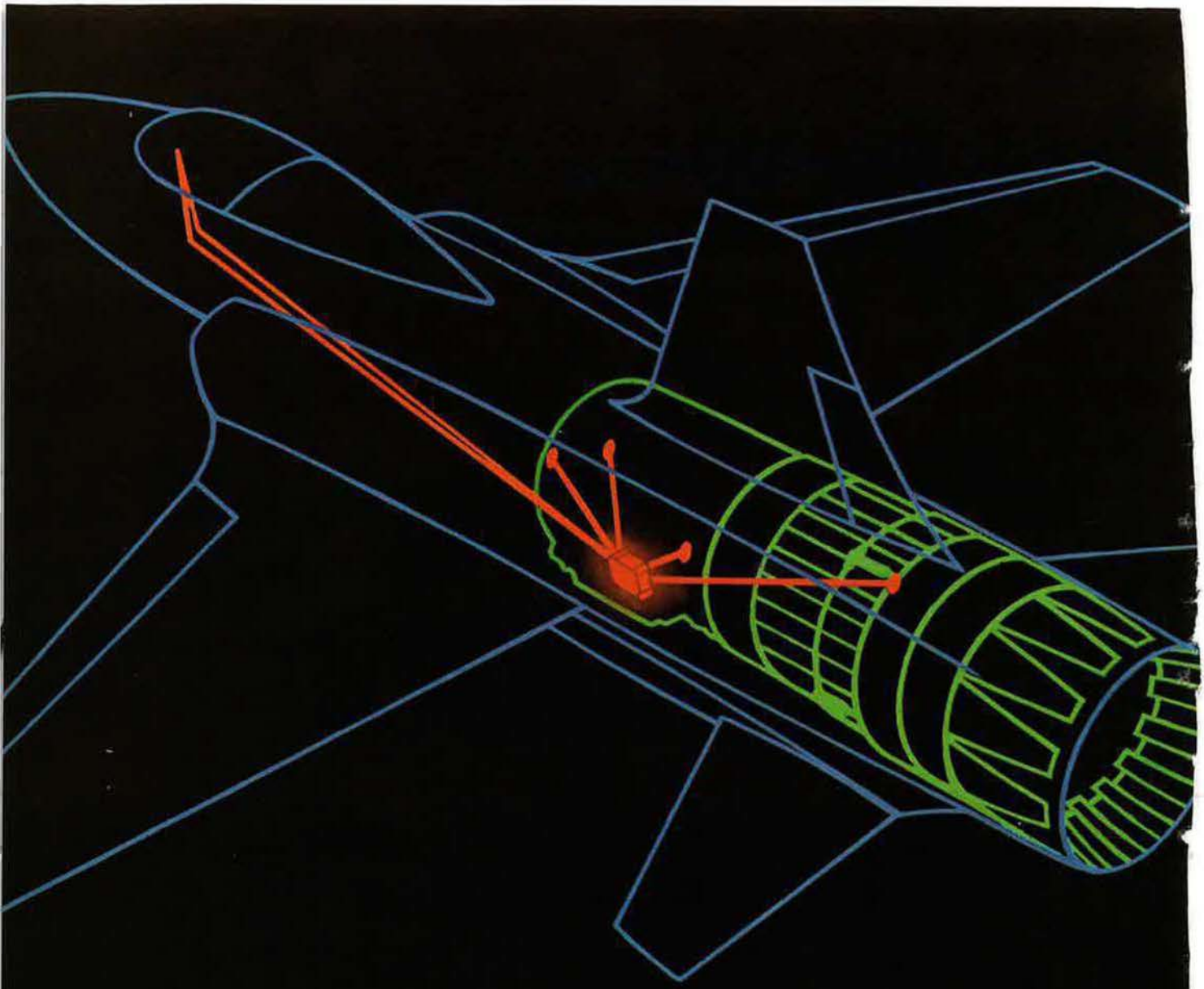
The U.S. Navy needed a new sonar system to counter the growing submarine threat. **EDO did it!** EDO's AN/SQR-18 TACTAS, now being installed on all U.S. Navy Knox class frigates, makes each of these ships the nemesis of today's and tomorrow's submarines... it's the "Great Equalizer". And EDO's 780 Series, a modular sonar system with extraordinary capabilities, is fast becoming a standard for navies around the world.

Let us show you what EDO CAN DO for you.

Contact: Vice President of Marketing, EDO Corporation,
Government Systems Division
College Point, New York 11356, USA.
Phone 212/445-6000. Telex 127421

EDO CORPORATION GOVERNMENT SYSTEMS DIVISION

Where Technological Innovation Becomes Reality



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The power of ingenuity

AIRMAIL

honor of serving as one of the liaison officers during his tenure at USAFA.

Lt. Col. Robert L. Hall, USAF (Ret.)
Harbor Springs, Mich.

Space A at Dover AFB

While reading through the Special Travel Section "Over Here & Over There" in the April 1983 issue of AIR FORCE Magazine, I noted that the telephone numbers listed for Space A information at Dover AFB, Del., are not correct *(p. 103)*.

The correct numbers to call are A/C (302) 678-6892 or 678-6893.

Capt. Shirley A. Vitale, USAF
Passenger Service Officer
Dover AFB, Del.

B-25 in Lake Greenwood

During World War II, a B-25C or D model went down in Lake Greenwood. This plane was flying out of Donaldson (Greenville, S. C.) or Columbia. What is now the Greenwood County Airport was known as Coronaca AAB, which was an auxiliary field to both Donaldson and Columbia.

Over the last thirty-nine years many attempts have been made to locate this plane. Through Sen. Strom Thurmond's efforts a Naval Reserve mobile and salvage unit out of Norfolk, along with three Naval explosive ordnance personnel, located this B-25. Efforts are now under way to try to salvage this plane for a static display.

There are two conflicting stories as to why this plane went down. The reported official one is that on a low-level training mission the plane was flying up the Saluda River, crossed the dam, made a ninety-degree turn up the lake, and then went in. The unofficial story is that the crew was buzzing some bathing beauties on a point in the state park and hit the water on the second or third pass. Local residents picked the entire crew off the plane, with one or two having some injuries.

We in Greenwood would appreciate hearing from anyone having any information as to the correct story on this B-25 and its crew.

W. M. Self
P. O. Box 1017
Greenwood, S. C. 29648

24th Composite Wing

The 24th Composite Wing is putting together a heritage hall photo display of previous commanders. Anyone having photographs or information on former commanders is urged to contact the Public Affairs Office at Howard AFB, Panama.

Information and photographs are needed on USAAC Col. George H. Steel, who commanded the 24th Composite Wing upon activation at Boriquen Field, Puerto Rico, in 1946; Col. Richard Jones, commander of the wing when it was reactivated at Howard AFB, Panama (then the Canal Zone), in 1967; Col. Leslie E. Gaskins, commander from June 1971 to March 1974 when it was the 24th Special Operations Wing; Col. Robert S. Beale, commander from March 1974 to August 1975 when it was the 24th Composite Group; Col. William E. Roth, August 1975; and Col. Robert E. Patterson, commander from January 1979 to June 1980, when it was once again designated the 24th Composite Wing.

Black-and-white, eight-inch by ten-inch photos are needed; however, any photos will be appreciated. Please contact the address below.

24th Composite Wing/PA
APO Miami 34001

376th/4252d Group and Wing

I'd like to enlist the aid of readers to trace former members of the 376th Bombardment Group and its absorbed unit, the 4252d Strategic Wing.

The 376th Bombardment Group has a terrific lineage dating back to the Halverson Project and the Brereton Detachment of early World War II days in Palestine and North Africa. A Capt. John Preble wrote a book called *Written in the Sand*. We have a microfilm copy of it, but can find no record of it being published. I would like to contact Captain Preble or anyone with knowledge of the book.

The mystery bomber, *Lady Be Good*, was a 376th B-24D. I'd like to hear from anyone with information about this bomber (or photos, memorabilia, etc.). . . .

The 376th flew EB-47 aircraft during the 1950s until inactivation in 1965. Personnel who had connections with the wing at Lockbourne AFB, Ohio, have a lot of history they could share with us.

Here on Okinawa, the 4252d Wing was vitally important in the buildup years for the Vietnam conflict. Former members of the wing who care to share anecdotes, memorabilia, photos, etc., are heartily encouraged to contact us. Official histories, especially during the furious activity and under the austere conditions the 376th personnel lived with daily, tend to lack the sort of color and action I would like to preserve.

The 376th Strategic Wing was reborn in 1970, and it absorbed the honors and lineage of the 4252d (a very rare occurrence). In its nearly forty-one years of duty, the 376th has earned eleven Air Force Outstanding Unit Awards and numerous awards at the major command and numbered air force level.

I'm looking forward to corresponding with former members who built the heritage I'm trying to share with today's members through Project Warrior and other vehicles.

TSgt. Christopher B. Scharping, USAF
Wing Historian
Hq. 376th Strategic Wing
APO San Francisco 96239

2d Air Commando Group

I am an aviation enthusiast doing research on the history of the Royal Thai Air Force.

I would like to get in touch with former members of the Tenth and Fourteenth Air Forces who were involved in raids on Thailand during World War II. I am particularly interested in contacting former members of the 1st and 2d Fighter Squadrons, 2d Air Commando Group, who were involved in a series of long-range strafing raids on airfields in Thailand during March and April 1945, with a view to writing an article on these raids.

I would very much like to obtain photographs of actual bombing or strafing raids on Thailand, and I will gladly pay for prints to be made or to return any materials sent to me.

Edward M. Young
27 Berkeley Rd.
Millburn, N. J. 07041
Phone: (201) 763-1974

Guinea Short Lines

I am doing research for a book covering the history of the 25th Liaison

1st Space Division?

AIR FORCE Magazine inadvertently created a new unit designation in the May issue, where *(p. 97)* in the organization chart for Space Command we noted that the SPACECOM Vice Commander is also Commander of "1st" Space Division, Los Angeles AFS, Calif. The "1st" designation resulted from our misreading of a footnote reference on the source document. We regret the error and apologize for any inconvenience to our readers.

—THE EDITORS

AIRMAIL

Squadron ("Guinea Short Lines") in World War II. The official squadron records indicate the following from November 1944:

"On orders of the 13th Fighter Command, the 6th CCU (Combat Camera Unit) photographed a movie sequence of the 25th Liaison Squadron's Middleburg detachment which will be titled as the *Shortest Airline in the World.*"

I am looking for any members who served with the 6th CCU and may have worked on this film or have any knowledge of its title in the final form. The National Archives and DAVA Library at Norton have no record of a film by this name. I have a feeling it may have been part of a larger film, much like the *Air Force Now* films shown at Commander's Call.

Anyone who can furnish a lead as to where I might obtain a copy of this film is asked to please contact me as soon as possible. Your help will be deeply appreciated.

Gerald Asher
5500 Washington St., #113
Hollywood, Fla. 33021

314th Transport Squadron

I'm involved in research relating to the operations and personnel of the 314th Transport Squadron (31st Transport Group of the 302d Transport Wing, Ninth Air Force) in the ETO.

Specifically, I would like to contact former 1st Lt. James P. Freeborn and 1st Lt. Matthew Regan, who were with the unit for a short time at Chartres, France, in early to mid-December 1944. Neither was career USAF, but perhaps a reader may know where I can get in touch with these men. Any comments would be a great boost to my ongoing research effort.

Dale M. Titler
P. O. Box 7361
Courthouse Road Station
Gulfport, Miss. 39501

B-29 Downed Over Nagoya

I have been a reader of AIR FORCE Magazine for many years, and look forward to each new issue. The thought occurred to me recently that a reader might be able to clear up something that has been on my mind since 1945.

In 1945 I was in the occupation forces in Japan attached to Fifth Air Force bases at Irumagawa and Tachikawa outside of Tokyo. Later I moved to the Kamake AAF base outside of Nagoya, where I would explore the local countryside on weekends.

On one of these trips with my friend George Mullins, we stopped at a small town about seven miles from Nagoya. While sitting in our weapons carrier eating lunch, some boys came up and said that a B-29 had crashed in the area, and that the wreckage was still there. George and I went to the area and found the plane. The boys advised that the plane had been hit over Nagoya in early May and that some of the crew had bailed out and survived.

I couldn't find any serial number among the wreckage, but I did find a tail turret almost intact, with the name "Bird" written on it. The escape hatch for the turret was missing, and I couldn't find it at the crash site. It may well be that the gunner was able to get out.

Over the years I have often wondered about Bird and the rest of the crew. Can anyone shed any light on this B-29 lost over Nagoya in early May 1945?

William L. Myers
1453 Carolyn Dr.
Virginia Beach, Va. 23451

Florida Airfields

I am in the process of compiling a history of Army airfields in Florida between 1939 and 1945. According to known information, there was a total of thirty-eight Army airfields, as well as an additional thirteen Navy fields.

I would like to correspond with anyone who trained, instructed, or passed through Florida airfields during this period. Anyone having any maps, charts, or other pertinent information is invited to contact me at the address below.

Jay Wisler
3212 W. Robson
Tampa, Fla. 33614
Phone: (813) 933-3530

Northeast Air Command

Personnel who were assigned to the Northeast Air Command (NEAC) are requested by the author of a forthcoming book on NEAC to contact him. Personal experiences and photographs are needed to make the book a complete history of that command.

Please contact the address below.

John Bell
18804 Carreta Dr.
Rowland Heights, Calif. 91748

Loc Ninh and An Loc

I am writing an essay on the spring invasion of Loc Ninh and An Loc by North Vietnamese Army and Vietcong forces. I would like to hear from FAC, bomber, and fighter pilots and crew members, and pilots and crew members who flew resupply missions. I am mainly interested in the time period between April and June of 1972.

I would like to hear any stories you have to tell. Please send letters to the address below.

Donald M. Hensley, Jr.
1820 Thornton St.
Leavenworth, Kan. 66048

SS *Rohna*

I would like to hear from any survivor of the SS *Rohna*, which was attacked by German bombers in the Mediterranean on November 26, 1943, with great loss of life. The *Rohna* was part of a three-ship convoy sailing from Oran to Bombay. I witnessed the attack from the nearby SS *Karoa*, also loaded with Air Force and Army troops en route to India.

All letters will be answered. Please contact me at the address below.

Thomas W. Hooks
P. O. Box 14556
Baton Rouge, La. 70898

Moby Dick/Skyhook Balloons

I am a Norwegian historian currently studying the Moby Dick/Skyhook balloon operations in Western Europe in 1954–56.

I would be very interested in getting in touch with members of the US Air Force Weather Detachment or other US personnel who participated in the balloon launchings, particularly those from Gardermoen AB, Norway, in early 1956.

Roger W. Sørdahl
Maridalen
Oslo 8
Norway

27th Fighter Wing

I would like to hear from anyone who served in the 27th Fighter Wing while it was stationed in Japan and Korea during the Korean War.

The purpose of this project is to gather material for a series of articles on F-84s in Korea. Please contact me at the address below.

Warren E. Thompson
7201 Stamford Cove
Germantown, Tenn. 38138

Shot Down in Cambodia

I was an Army O-1 pilot in Southeast Asia during 1970–71. Of the many pilots unfortunate enough to have been shot down in SEA, relatively few (thirty-four) were shot down in Cambodia. Of that number, only fourteen survived from all services, according to a congressional report.

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AIRMAIL

Being one of the fourteen survivors, I am interested in hearing from or about any of the other thirteen pilots. I can be contacted at the address below.

Tim McDonald
P. O. Box 9
Arlington, Wash. 98223

Fifteenth Air Force

I am looking for veterans of the Fifteenth Air Force who were in Italy during 1943–45. I would like to hear from anyone interested in relating their experiences for a book I am writing about the Fifteenth.

If Fifteenth veterans will send me their names and addresses and bomb groups and squadrons, I will send them a questionnaire or contact them in person.

Please contact the address below.

Carol Rizzo
3305 Kenilworth
Kalamazoo, Mich. 49001
Phone: (616) 381-1323

Aviation Art

A forum on aviation art is being sponsored by the University of Virginia's School of Engineering and Applied Science. It is to be held on the Charlottesville campus on August 11–14, 1983.

The program is to include presentations by aviation artists, curators, gallery owners, and critics. Numerous exhibits, workshops, and other special events are on the agenda.

Those interested in attending are encouraged to contact the address below for more details.

Luther Gore
Room A-226, Thornton Hall
School of Engineering and Applied Science
University of Virginia
Charlottesville, Va. 22901
Phone: (804) 924-6119
296-9771

USAF and the Olympics

I am presently compiling research for an *Air Force Now* film production on the Air Force's role in the 1984 Olympic Games (both summer and winter).

Readers are asked to please send any information on the following: (1) Air Force personnel who participated in past Olympic Games; (2) Air Force personnel in training for the 1984 Olympics; (3) Air Force facilities being used for US Olympic team training; (4) Air Force facilities that have been used for US Olympic team training, or for actual events; and (5) any film, videotape, or literature available on the above topics.

Your help will greatly enhance the success of this film production. Please contact the address below.

1st Lt. Nelson W. McCormick, USAF
7510 Cienega Dr.
Highland, Calif. 92346

Nurse Corps History

The Office of the US Air Force Chief Nurse is preparing a comprehensive history of the Air Force Nurse Corps. The volume will be richly developed around historical incidents and illustrated with photos.

Older Nurse Corps military uniforms are also needed for the Air Force Museum.

Those wishing to contribute action stories, photos, and memorabilia that may be used in this research project should contact the address below.

Col. Dolores Jean Haritos, USAF
Nurse Corps Historian
Office of the Chief Nurse
AF/SGN
Bolling AFB, D. C. 20332
Phone: (202) 767-5074

Collectors' Corner

I collect pictures, posters, magazines, books, etc., about military jet fighters and helicopters of the US Air Force and USAFE.

Would readers be so kind as to send me any pictures, magazines, or anything else to do with USAF aircraft that they can spare? I am particularly interested in the F-15 Eagle and F-14 Tomcat.

Please contact me at the address below.

Jeroen Staal
Weberstraat 21
3816 VA Amersfoort
The Netherlands

I've been reading AIR FORCE Magazine for years, and have always found it good reading.

I am a collector of aviation badges and insignia of World War II vintage. I am interested in buying or trading AAF wings (any flight wings, especially flight engineer and technical observer). Any related information would also be appreciated.

I would like to correspond with fellow collectors.

William A. Short
55 S. Kukui St., D-1609
Honolulu, Hawaii 96813

I am a tactical fighter enthusiast. I am starting a collection of USAF tactical fighter wing and squadron patches.

I am especially seeking 8th TFW, 388th TFW, 405th TFTW, 57th FWW, 555th TFTS, 389th TFS, 430th TFS, and 421st TFS patches.

If readers have these or any other tactical fighter unit patches they would like to contribute, please mail them to the address below.

Jeff L. Davis
25473 Fleming St.
San Bernardino, Calif. 92410

I am an enthusiast of Air Force aviation, and am looking for some Air Force patches to add to my collection. Any help in obtaining these patches would be greatly appreciated. I am especially interested in World War II AAF patches.

Please contact me at the address below.

Ron Durling, Jr.
1429 Berkeley Dr.
Redlands, Calif. 92373

I have a 1942 A-2 jacket and would like any and all help in restoring it to authentic CBI theater configuration. I need a leather CBI shield (shoulder patch) and an AAF leather shoulder patch. I would be very interested in a leather "Blood Chit" for the back, as well as a Fifth Air Force, Tenth Air Force, Thirteenth Air Force, Fourteenth Air Force, or Twentieth Air Force leather squadron patch for the front. My particular favorite is the winged skull patch of the 490th Bomb Squadron, 341st Bomb Group—the "Burma Bridge Busters."

All reasonable offers will be considered, and any photos of the material will be helpful in my decision. Any other CBI articles are desired.

Please contact the address below.

George Dively
6208 Alamo St.
Springfield, Va. 22150
Phone: (703) 971-9299

During World War II I was a captain in the 434th Troop Carrier Group in the ETO. Just prior to the invasion of Normandy, this group, and several other troop carrier groups, were assigned to the "First Allied Airborne Army" commanded by Lt. Gen. Lewis H. Brereton.

As I recall, this was a "provisional" army. However, this unit had a shoulder patch or insignia. I have been trying to complete my collection of insignia that I was authorized to wear, and my insignia for this unit has disappeared.

I would appreciate any information

as to where I may find one of these items.

Henry L. Stewart, Jr.
409 Coharie Dr.
Clinton, N. C. 28328

I am trying to locate an AFA anniversary sterling platter offered to members a few years ago. I will pay a premium price for a platter in mint condition.

Please contact the address below.

William T. Camm
Rte. 1, Box 623J
Tarpon Springs, Fla. 33589

I am looking for a patch of the 11th Air Refueling Squadron, which was with the 341st Bomb Wing at Abilene, Tex. (Dyess AFB). The 11th AREFS was part of the 5040th Air Refueling Wing.

Any readers with this patch are invited to contact me at the address below.

Larry A. Paule
2653 Timberlake Dr.
Maryland Heights, Mo. 63043

Where Are You?

I am undertaking a historical research study concerning a crew that served with 576th Bomb Squadron, 392d Bomb Group, Eighth Air Force, based at Wendling, England, in 1944.

Of this crew, five members lost their lives in a midair collision on July 5, 1944. Five members survived the war, and two of them are known. I am trying to locate the other three surviving crew members.

They are: 2d Lt. John E. Walters, bombardier; SSgt. Chester Ellis, gunner; and SSgt. Donald H. Schumaker, gunner.

Any readers with any information about these men should contact the address below.

Grace M. Kimble
13 Ram Gorse
Harlow
Essex CM20 1PX
England

I would appreciate hearing from anyone who may have known my brother-in-law, 1st Lt. Clifford R. Oliver, Jr.

He was the pilot of a B-24 that took off from St. Eval Airdrome, Cornwall, England, on February 26, 1943, on a routine antisubmarine patrol in the Bay of Biscay. His plane was last contacted while over the English Channel. None of the crew was ever reported captured, and it is presumed they were lost.

Anyone with firsthand information is asked to contact me at the address below.

Col. K. D. Mertel, USA (Ret.)
103 Marvin Dr.
Hampton, Va. 23666

I am trying to contact anyone who might have known my father. He was lost on a "routine" flight between Japan and the Philippines only four months after my birth.

Col. Dwight B. Schannep was assigned to Headquarters Squadron, Fifth Air Force, at the time of his death. He was from Oregon and was a 1929 graduate of West Point. He was born in 1906 and died in 1946.

Anyone having any information is asked to contact the address below.

Gregory J. Schannep
94-035 Kuahelani, #121
Mililani, Hawaii 96789
Phone: (808) 625-0665

Could anyone tell me what became of MSgt. George W. Dunham? The last time I saw him, he was stationed at Holloman AFB, N. M., with the 6580th Air Base Group. That was in 1961.

Anyone with any information is asked to contact the address below.

Thomas J. Hayes
6157 S. Knox Ave.
Chicago, Ill. 60629

IN FOCUS...

Artful Compromise on Missiles

By Edgar Ulsamer, SENIOR EDITOR (POLICY & TECHNOLOGY)

At least the proposal avoids white elephants and keeps sacred cows on a short tether.

Washington, D. C., May 2

On April 19, President Ronald Reagan, complying with a request by Congress, sent a report to Capitol Hill that endorses the recommendations of the high-powered, bipartisan Commission on Strategic Forces. The President urged prompt congressional approval of the measures and policies advocated by the Commission he convened at the beginning of the year.

Among the members and senior counselors of the Commission were two former Secretaries of State and four former Secretaries of Defense. Lt. Gen. Brent Scowcroft, USAF (Ret.), a former Presidential Assistant for National Security Affairs, chaired the group, which held a total of thirty-one meetings, heard from 203 experts, and spent 47,616 man-hours analyzing the facts and writing its unanimous conclusions.

The Commission's artfully crafted document—which was approved without change by the White House—embraces essential military requirements without slighting political necessity. The result is a consensus solution—arrived at through consultation with pivotal elements of Congress—that is likely to receive the cachet of Capitol Hill, the Joint Chiefs of Staff, and even most of the news media. So far, that seems to be the case.

Although by intent a compromise that accommodates a range of political goals and technical approaches, the Scowcroft Commission's recommendations include no white elephants and even manage to keep obligatory sacred cows on a short tether. The effects of political influences seem to be most evident in the weight that is given to arms-control considerations. In turn, they color the Commission's recommendations for molding the strategic forces. As a consequence, military requirements at times seem to take a backseat to arms-control goals in the Commission's recommendation concerning the size and nature of the US strategic arsenal. The attendant presumption that the US, by setting a "good" example—by shifting to small, single-warhead ICBMs, for instance—could coax the USSR into relinquishing its towering advantage in superlarge, multiple-warhead ICBMs is probably optimistic.

Still, the Scowcroft Commission did not overlook the fact that the Soviets might have no incentive for such a trade-down. Therefore, it constructed such incentives by suggesting that "arms-control limitations and reductions [should] be couched, not in terms of launchers, but in terms of equal levels of warheads of roughly equivalent yield. Such an approach could permit relatively simple agreements, using appropriate counting rules, that exert pressure to reduce the overall number and destructive power of nuclear weapons and at the same time give each side an incentive to move toward more stable and less vulnerable deployments." Why the Soviets would be willing to accept rule changes that outlaw their ICBM advantage is not explained.

There is no arguing, however, with the Commission's conclusion that "if the Soviet Union chooses to retain a large force of large missiles, each with many warheads, the US must be free to match this by the sort of employment it chooses. Any arms-control agreement equating SS-18s and small single-warhead ICBMs—because each one is a missile or because each is on one launcher—would be destabilizing in the extreme."

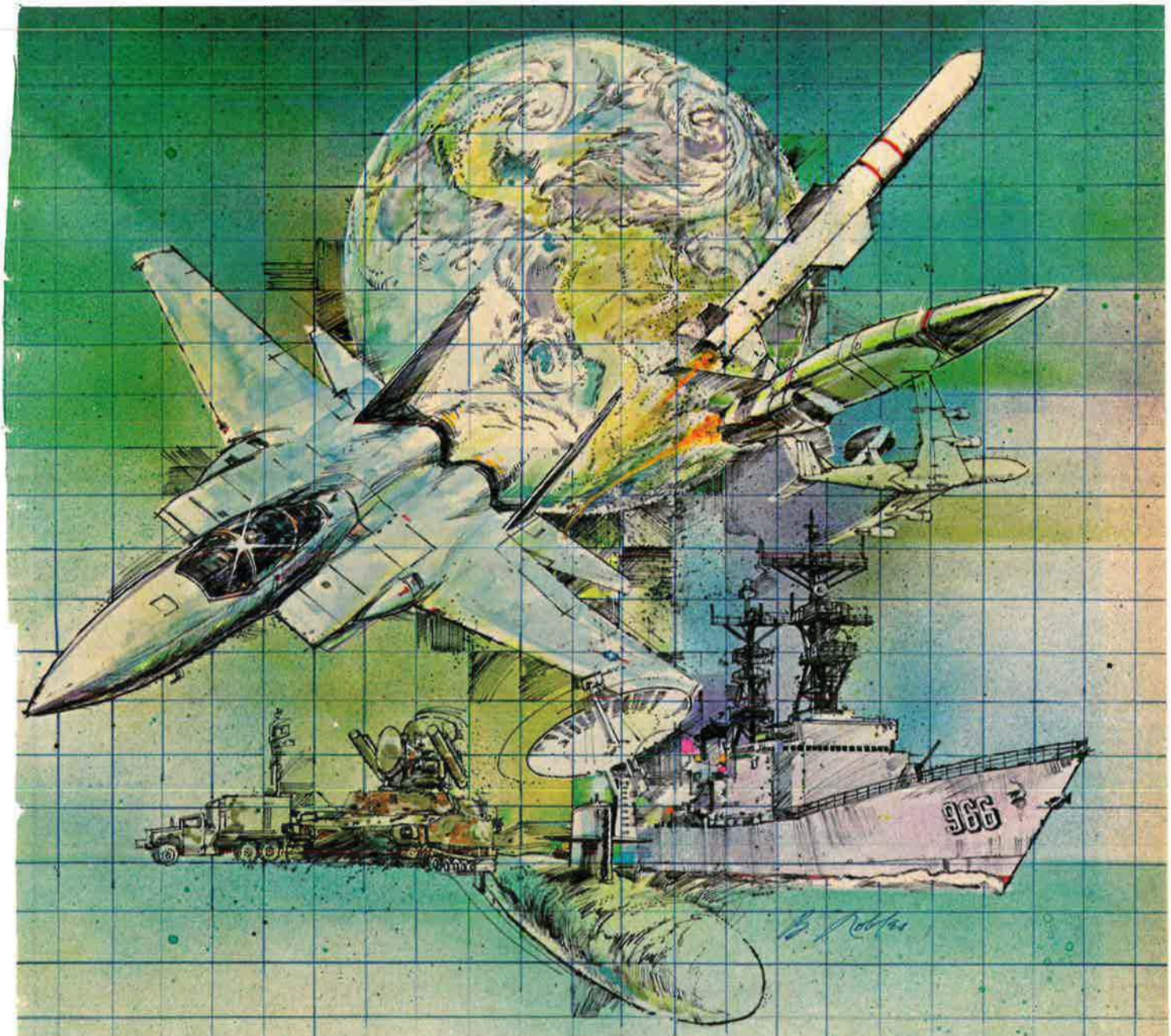
President Reagan, in a statement accompanying the release of the Commission report, provided further balance when he said that "in the past, our one-sided restraint and good will failed to prompt similar restraint and good will from the Soviet Union. They also failed to produce meaningful arms control. But . . . when the United States has shown the resolve to remain strong, stabilizing arms control can be achieved."

In specific terms, the Commission's recommendations center on a broad endorsement of the five-part strategic force modernization program announced by the President on October 1, 1981. At that time, he called for modernization of all triad elements, as well as of strategic defense capabilities and strategic command and control. No major changes in the plan to modernize strategic command and control, in the bomber and air-launched cruise missile programs, and in the ballistic missile research and development effort are recommended by the Commission.

In the area of the Commission's primary concern, ICBM modernization, the first recommendation is that engineering design should start at once on "a single-warhead ICBM weighing about fifteen tons." Full-scale development of such a weapon ought to get under way by 1987, and an initial operational capability should be attainable by about 1992. There is the implied recommendation that "deploying such a missile in more than one mode would serve stability." Also, the Commission says, "hardened silos or shelters and hardened mobile launchers should be investigated now."

The second recommendation in the area of ICBM modernization is that "one hundred MX missiles should be deployed promptly in existing Minuteman silos as a replacement for those 100 Minutemen and the Titan II ICBMs now being decommissioned and as a modernization of the force." Such a deployment, the Commission argues, would not threaten stability:

"The throw-weight of and megatonnage carried by the 100 MX missiles is about the same as that of the fifty-four large Titan missiles now being retired, plus that of the 100 Minuteman III missiles that the MX would replace. Such [an action] would thus represent a re-



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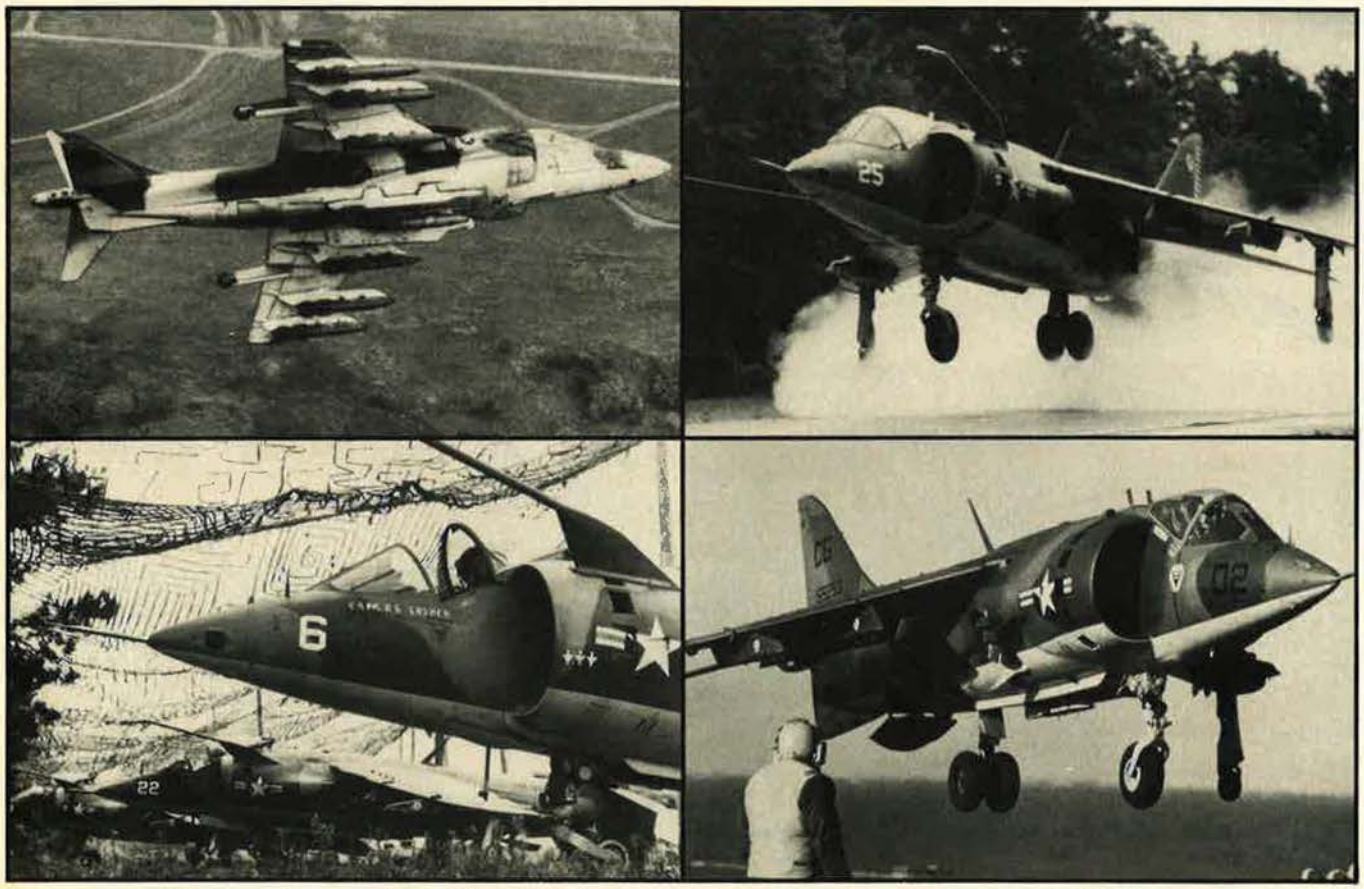

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placement and modernization of part of our ICBM force. It would provide a means of controlled limited attack on hardened targets, but not a sufficient number of warheads to be able to attack all hardened Soviet ICBMs, much less all of the many command posts and other hardened military targets in the Soviet Union. Thus it would not match the overall capability of the recent deployment [by the Soviets] of over 600 modern ICBMs of MX size or larger."

At the same time, the Commission suggested that several hundred MX missiles might eventually have to be deployed, along with other weapons, if the Soviets "refuse to engage in stabilizing arms control and engage instead in major new deployments."

As a third element of the ICBM modernization effort, the Commission recommends a program to demonstrate the feasibility and military value of superhardened shelters or silos that could serve as a springboard for eventually deploying MX in such silos and for housing small, single-warhead ICBMs in hardened silos or shelters. Further, "vigorous investigation should proceed on different types of land-based vehicles and launchers, including particularly hardened vehicles."

The Commission's conviction that "smaller is better" extends also to the ballistic missile launching submarine force, where it recommends that research "begin now on smaller . . . submarines, each carrying fewer missiles than the [Trident's twenty-four], as a potential follow-on to the Trident submarine force." Explaining that such a program would parallel its recommendation to deploy small, single-RV ICBMs to reduce the value of individual targets, the Commission states that the objective of such a development should be to design a submarine and associated missile system that would, "as much as possible," reduce the value of each platform and also present radically different problems to a Soviet attacker than does the Trident submarine force.

This work should proceed in such a way that a decision to construct and deploy such a submarine force could be implemented rapidly should Soviet progress in antisubmarine warfare so dictate. "A submarine force consisting solely of a relatively few large submarines at sea, each carrying on the order of 200 warheads, presents a small number of valuable targets to the Soviets," the Commission warns.

The Commission's primary concern in the area of ballistic missile defense hinges on the imperative of avoiding technological surprise by the Soviets. The ensuing requirement is vigorous research and development work on ABM technologies, in particular on ways to "sharpen the effectiveness of treaty-limited ABM systems with new types of nuclear . . . and nonnuclear systems."

IN FOCUS...

Seemingly at odds with the Administration's recent optimism concerning the feasibility of advanced ballistic missile defense, the Commission "believes that no ABM technologies appear to combine practicality, survivability, low cost, and technical effectiveness sufficiently to justify proceeding beyond the stage of technology development." Applications of current ABM technology, the Commission finds, "offer no real promise of being able to defend the United States against massive nuclear attack in this century."

In determining the ultimate purpose of this country's strategic nuclear forces, the Commission weighed the "threat of mass destruction" against the "threat of aggressive totalitarianism," pointing out that "the essential dual task of statecraft is, and must be, to avoid the first and contain the second." The Commission reasons cogently and eloquently that "our task as a nation cannot be understood from a position of moral neutrality toward the differences between liberty and totalitarianism" and adds that what should be feared most is that "confusion and internal divisions—sometimes the by-products of the vigorous play of free politics—will lead us to lose purpose, hope, and resolve."

From this premise the Commission moves to the importance of convincing the Soviet leaders with "calm persistence" that the West "has the military strength and political will to resist aggression; and that, if they ever choose to attack, they should have no doubt that we can and would respond until we have so damaged the power of the Soviet state that they will unmistakably be far worse off than if they had never begun."

Specifically, the Commission believes that the US "must be able to put at risk those types of Soviet targets—including hardened ones such as military command bunkers and facilities, missile silos, nuclear weapons and other storage, and the rest—which the Soviet leaders have given every indication by their actions that they value most, and which constitute their tools of control and power."

For the time being, the Commission states, ICBMs are generically the primary means for prompt and controllable retaliatory attack on hardened military targets in response to a Soviet first strike. This conclusion is linked to the fact that the "overall perception of strategic imbalance caused by the Soviet ability to destroy hardened land-based targets—with more than 600 newly deployed SS-18 and SS-19 ICBMs—while the US is clearly not able to do so with its existing ballistic missile force, has been reasonably regarded as destabilizing and a weakness in the overall fabric of deterrence."

Defense Secretary Caspar Weinberger, in testifying in support of the Commission's findings, elaborated on the fundamental importance of what he termed the Soviet monopoly of prompt, hard-target kill capability. It gives the Soviets a twofold advantage: "First, it enables the Soviets to launch a very high confidence first-strike attack on our land-based ICBMs, while expending only one-third of their ICBM force in the process. The large store of remaining ICBMs would then enable them to divert weapons to other essential targets in a first-strike attack and still maintain a large and effective reserve force to conduct follow-on attacks.

"Second, the fact that we lack a prompt retaliatory capability against very hard targets allows Soviet planners to consider the possibility that, for the crucial first few hours of a nuclear conflict, the bulk of their ICBM force and supporting command and control structure would remain largely immune to US retaliation. This would eliminate one of the major sources of uncertainty that is such an important element of deterrence—the unpredictable effects of US retaliation on Soviet war plans. Without this crucial uncertainty exerting an influence on Soviet war planners, their confidence in their ability to fight and win a nuclear war is reinforced."

The need to redress this imbalance is one of the main reasons for deploying MX as rapidly as possible, which the Commission finds is achieved best by putting the new missile into existing Minuteman silos. Other factors that make such a deployment mode compelling are that abandoning MX in search of a substitute would "jeopardize, not enhance" the prospects for equitable arms control and "undermine the incentives to the Soviets to change the nature of their

own ICBM force and thus the environment most conducive to the deployment of a small missile."

There is the related conclusion that canceling the MX, when it is ready for flight testing, "when over $5 billion [has] already been spent on it, and when its importance has been stressed by the last four Presidents, [will] not communicate to the Soviets that we have the will essential to effective deterrence. Quite the opposite."

The Commission cites the aging of the current ICBM force as another factor that mandates deployment of MX. Producing the 195,000-pound MX is crucial for two additional reasons, according to the Scowcroft report: "As Soviet ABM modernization and modern surface-to-air missile development and deployment proceed—even within the limitations of the ABM treaty—it is important to be able to match any possible Soviet breakout from that treaty with strategic forces that have the throw-weight to carry sufficient numbers of decoys and other penetration aids [to ensure penetration of] the Soviet defenses. . . . Having in production a missile that could . . . counter such a Soviet step should help deter them from taking it. Moreover, in view of our coming sole reliance on Space Shuttle Orbiters, it would be prudent to have in production a booster, such as MX, that is of sufficient size to place in orbit at least some of our most strategically important satellites."

All these objectives can be gained at reasonable cost—estimated at $16.6 billion in 1982 dollars—by deploying 100 MXs in Minuteman silos. The central judgment in this context is that the "vulnerability of such silos in the near term, viewed in isolation, is not a sufficiently dominant part of the overall problem of ICBM modernization to warrant other immediate steps being taken, such as closely spacing new silos or ABM defense of those silos. This is because of the mutual survivability shared by the ICBM force and the bomber force in view of the different types of attacks that would need to be launched at each.

"In any circumstances, other than that of a massive surprise attack on the US by the Soviet Union, Soviet planners would have to account for the possibility that MX missiles in Minuteman silos would be available for use, and thus they would help deter such attacks. To deter such surprise attacks, we can reasonably rely both on our other strategic forces and on the range of operational uncertainties that the Soviets would have to consider in planning such aggression—as long as we have under way a program for long-term ICBM survivability, such as that for the small, single-warhead ICBM to hedge against long-term vulnerability for the rest of our forces."

IN FOCUS...

The Commission's case for the small missile—with a throw-weight of about 1,000 pounds—compared to Minuteman III's 2,350 pounds and MX's 8,300 pounds—hinges on this consideration: "A single-warhead ICBM, suitably based, inherently denies an attacker the opportunity to destroy more than one warhead with one attacking warhead. The need to have basing flexibility, and particularly the need to keep open the option for different types of mobile basing, also suggests a missile of small size. If force survivability can be additionally increased by arms-control agreements which lead both sides toward more survivable modes of basing than is possible with large launchers and missiles, the increase in stability would be further enhanced."

The Commission contends that the design of such a missile hardened against nuclear effects can be achieved with current technology. "It should have sufficient accuracy and yield to put Soviet hardened military targets at risk," the report suggests. Congressional experts subsequently questioned whether such a small missile could accommodate both the weight of a sophisticated guidance system and a sufficiently large warhead over the required ranges to attain this type of lethality.

The Commission predicts wisely that its recommendations "probably will not satisfy" all of the contending groups and constituencies that have staked out specific approaches to strategic force modernization. Nevertheless, there is the admonition not to deal with these issues as "political partisans or as crusaders for one specific solution . . . but rather as citizens of a great nation with the humbling obligation . . . of preserving both peace and liberty for the world." This goal is obviously worthy of national consensus.

Washington Observations

★ Defense Secretary Caspar Weinberger recently informed Congress that the "Soviets have developed a refiring capability for some of their larger ICBMs, which could allow them to reload their delivery systems several times." Congressional sources told this writer that the Soviets have just demonstrated their ability to reload an SS-18 silo in about twenty-four hours. Such a "rapid reload" would seem to violate SALT II.

Sen. James A. McClure (R-Idaho) meanwhile accused the Soviet Union of violating arms-control agreements with the US in a number of ways. Included are that the Soviets are keeping an ICBM force numbering between 1,000 to 2,000 missiles in an illegal stockpile; that they have conducted fifteen nuclear weapons tests with yields in excess of the Threshold Test Ban Treaty's limit; that they have flight-tested two new ICBMs, even though SALT II permits only one new missile development; that the Soviets appear to be deploying long-range air-launched cruise missiles without counting the launching aircraft as required by SALT II; that the Soviets are producing Backfire bombers at a rate greater than permitted; and that the near-total encryption of recent ICBM, SLBM, and sea-launched cruise missile tests, along with massive camouflage, concealment, and deception programs, violates SALT II's prohibition against interference with the US national means of verification.

★ Presidential Science Advisor Dr. George Keyworth told an AFA meeting in Chicago, Ill., recently that this country needs better coordination of the "nearly half a billion dollars per year the US spends on a bunch of very diverse programs [in the directed-energy weapons field] that I think are clearly going nowhere." While the Soviet Union outspends this country in directed-energy weapons R&D "by a small amount," he suggested that the "Soviet Union poses no immediate threat to the US—I mean certainly not for the rest of this decade—because of laser or any other directed-energy technology program."

Dr. Keyworth, expressing his own view as a scientist and that of most scientists who have looked at MX basing "in detail," stressed that Closely Spaced Basing, or "Dense Pack," is "far and away the winner from among many runners because . . . it is the only system that offers us a reasonable degree of survivability." He said "superhardening," the make-or-break aspect of Dense Pack, represents a "very simple piece of technology." The schemes for overcoming Dense Pack with advanced systems "won't stand up to ninety seconds of intense scrutiny. I believe this system is a genuine step forward," the Presidential Science Advisor said. ■

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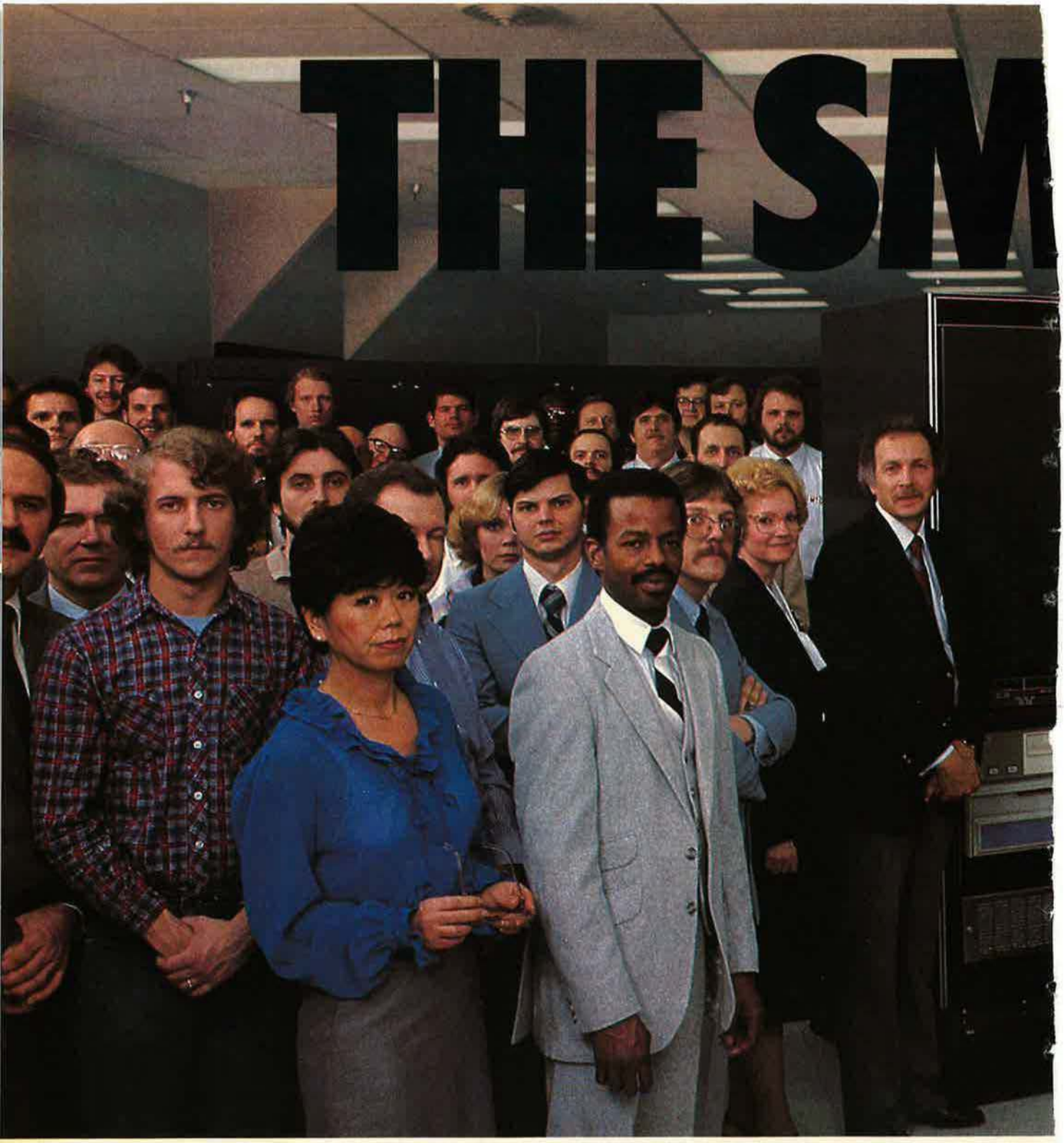

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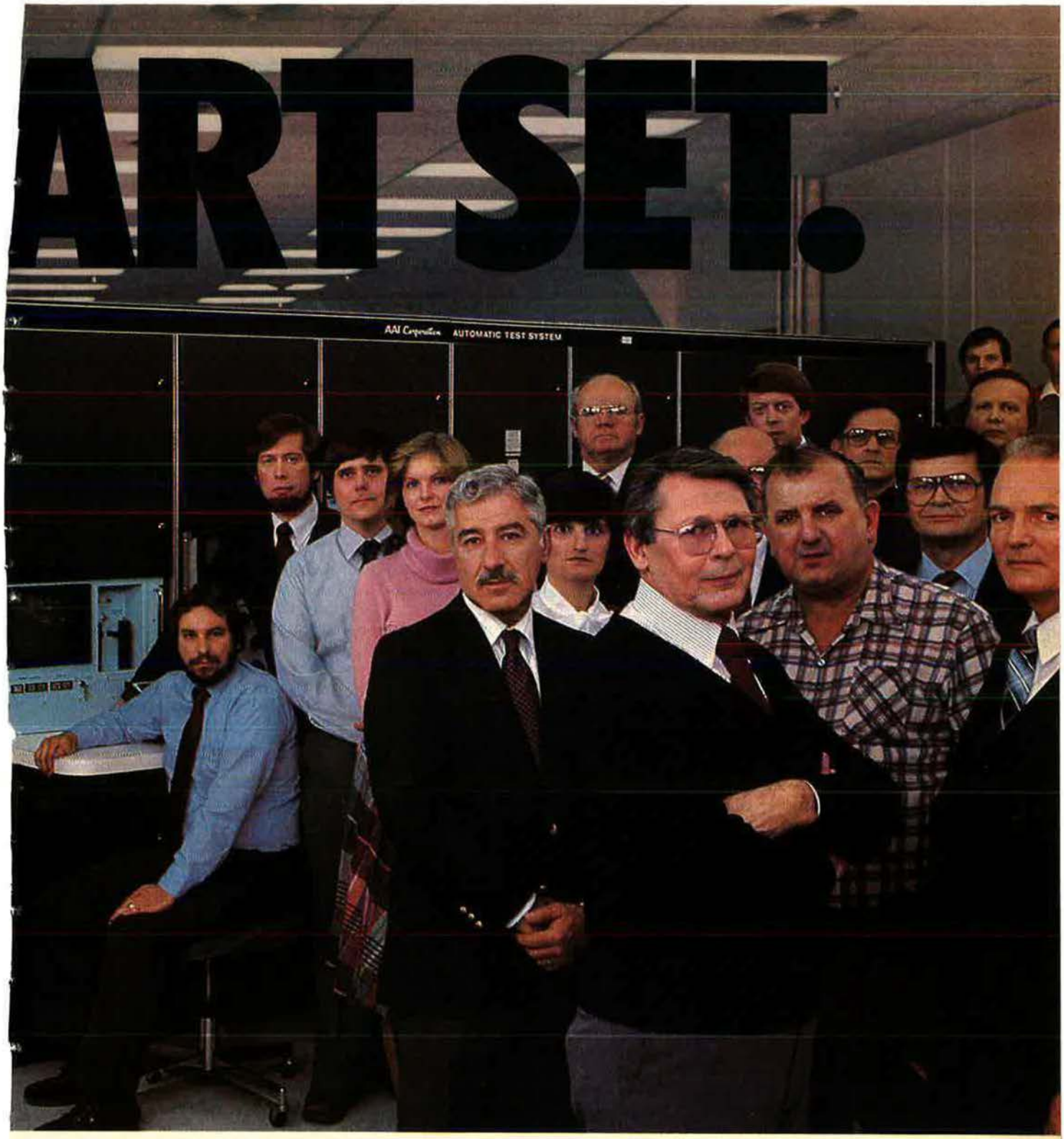

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CAPITOL HILL

By Kathleen G. McAuliffe, AFA DIRECTOR OF LEGISLATIVE RESEARCH

Washington, D. C., Apr. 22

MX Basing

A final solution on MX basing may be at hand. Bipartisan support is building in Congress with members of the House Democratic and Republican leadership, as well as key members of the Armed Services Committees, endorsing the President's recommendation that 100 MX missiles be put in existing Minuteman silos while R&D goes forward on a small, single-warhead, mobile ICBM. Even some Pentagon critics, like Rep. Les Aspin (D-Wis.), are pushing the MX proposal, which would amount to some $16.6 billion in total program costs.

The feeling seems to be that the land-based leg of the triad must be modernized and, while MX in existing holes will not be invulnerable, the synergistic effect of all US strategic systems makes MX in silos the "optimal solution." Sen. John Stennis (D-Miss.), a long-time member of the Armed Services Committee, may have summed up the majority feeling on MX by saying there is nothing practical left to do but accept the plan.

Sen. John Tower (R-Tex.), committee chairman, said that although many do not take comfort in the panel's MX recommendation when taken in isolation, under the circumstances—time, political, and environmental problems—it is the best possible decision. He acknowledged that it is nearly impossible to "separate completely the future of MX from its past" in response to testimony by Scowcroft panel members that political realities played a role in the recommendations. These same members readily admitted that absent such realities, MX in a multiple protective shelter (MPS) scheme with hardening would have been the most militarily effective basing system.

A united Joint Chiefs of Staff (JCS) earlier recommended to the President an ICBM basing decision almost identical to that of the President's panel, eliminating any possibility of Congress exploiting JCS division on the issue, as was the case with Closely Spaced Basing.

White House officials are encouraged by broadening support, and congressional adoption is predicted "even if by the narrowest of margins." Congress has until the beginning of June to pass resolutions approving the proposal. The Committees on Appropriations are charged with reporting such legislation, and both are less disposed to favor MX than are the Armed Services Committees. Last year, it was the House Appropriations subcommittee on defense that successfully led the fight to defeat the procurement funds for the missile.

Confidence-Building Measures

DoD sent Congress a four-part package of "confidence-building" initiatives to enhance joint US-USSR communications in response to a congressional directive last year. The proposals are designed to ensure that a nuclear war between the two superpowers never occurs as a result of accident or miscalculation, although Secretary of Defense Caspar Weinberger acknowledged that such a scenario is very remote.

The recommendations are being reviewed by Congress and Soviet leaders for bilateral approval; Secretary Weinberger believes such "simple things" will benefit everyone and, hence, should lead to speedy agreement. The four measures include enhancing the US-USSR "hot line" by addition of a high-speed facsimile transmission capability, a similar link between US and USSR military command centers, establishment of communications links between the US embassy in Moscow and the Soviet embassy in Washington, and establishment of a multinational agreement providing for consultations in the event of terrorist explosion of nuclear weapons or a terrorist group attempting to acquire nuclear weapons *(for more details, see p. 27).*

More ALCM-Bs Proposed

The Air Force has decided to request funding for up to 240 Air-Launched Cruise Missiles (ALCM-Bs) in FY '84. The decision to continue the production line is to ensure an orderly transition to the Advanced Cruise Missile (ACM), a program that, according to USAF, is progressing smoothly. While specifics on the schedule and quantity of the ACM are classified, the Air Force anticipates a total ALCM-B/ACM force of some 3,000 missiles. With a commitment to 1,499 ALCM-Bs through the current fiscal year and with 240 added in FY '84, the ACMs should number about 1,300.

ALCM-B procurement in FY '84 would ensure a smooth transition to the newer missile since the ALCM-B would continue actual delivery through FY '86, just when the ACM would begin coming off the line. The ACM makes use of significant advances in technology and will have better overall performance with improved range, accuracy, survivability, and reduced observables.

Minuteman III vs. MX

Some respected members of the Senate Armed Services Committee, including Sen. Sam Nunn (D-Ga.), suggested that upgrading the already deployed Minuteman III ICBMs with an improved ARIES guidance system and the Mk 12A warhead might yield a system with the same capability as the MX.

USAF Chief of Staff Gen. Charles Gabriel refuted the suggestion, saying such a program would not have an initial operational capability until two years after MX and a full operating capability date of 1991, and would add no warheads to the inventory. Former Defense Secretary Harold Brown agreed and claimed further that it would not be as accurate as the MX.

While the Minuteman III upgrade program would probably cost some $5 billion less than MX, it would have a lower throw-weight, a smaller footprint, and less range than the MX. The Minuteman III missiles deployed in Wyoming would be unable to reach many Soviet SS-18s. Also, the system's age and its limited numbers make it short-lived. General Gabriel told the Senate flatly that nothing would compare with the cost-effectiveness of fielding MX. ■

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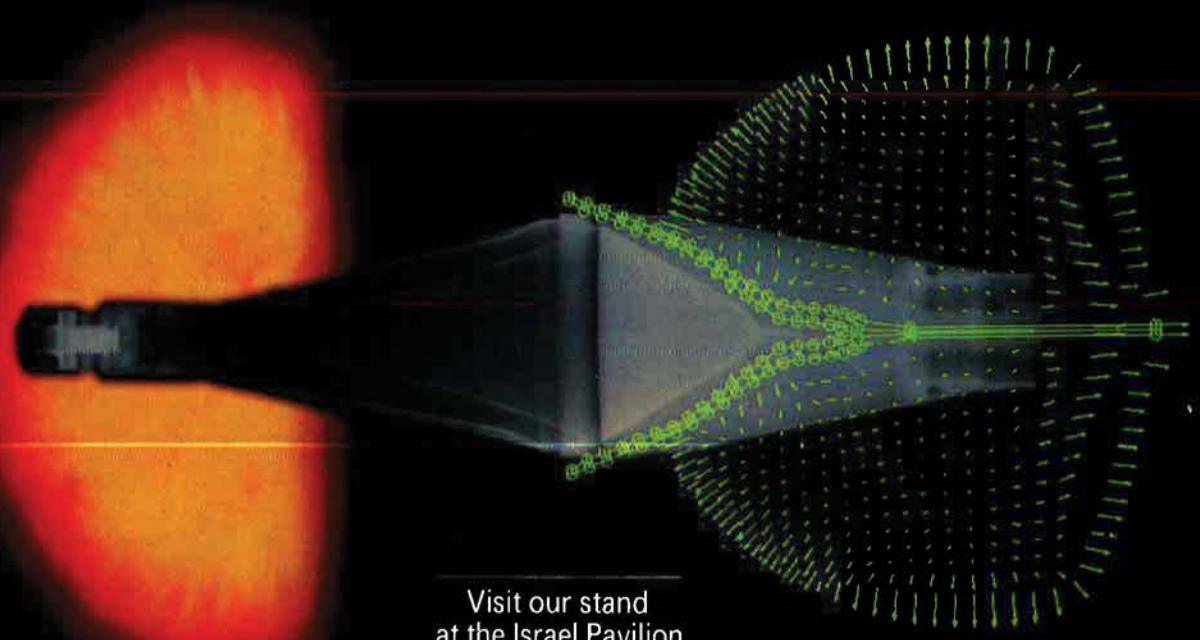

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GENERAL DYNAMICS

AEROSPACE WORLD
News, Views & Comments

By William P. Schlitz, SENIOR EDITOR

Washington, D. C., May 6

★ The Air Force has resumed flying one of the four original B-1 bomber prototypes in a reactivated flight-test and evaluation program designed to assess upgraded avionics and weapon-delivery systems.

The program being conducted at Edwards AFB, Calif., is aimed also at testing other B-1 modifications to be incorporated in the B-1B multirole bombers.

The initial B-1 flight-test program lasted nearly seven years and ended in April 1981 after accumulating nearly 2,000 hours of data. The B-1B program inherits this extensive reservoir of information and will add some 1,000 flight hours to be logged in the renewed program.

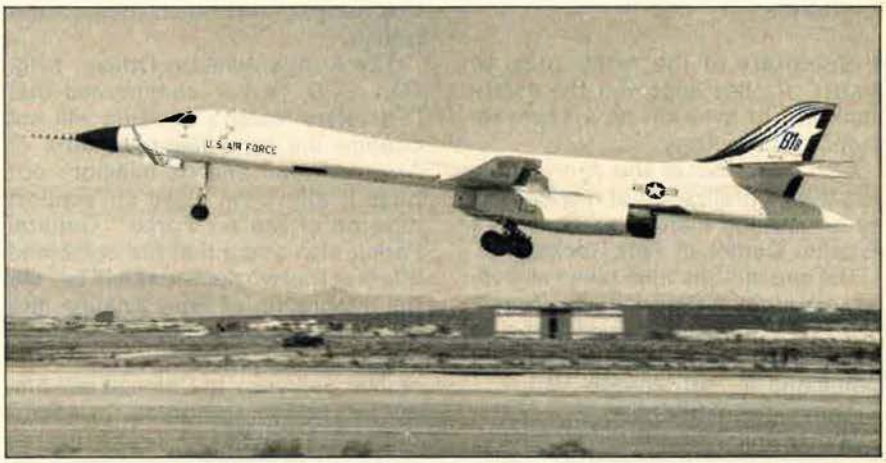
First flight of the B-1B is scheduled for early 1985. That aircraft will differ in outward appearance very little from the first four prototypes.

Structurally, the landing gear will be strengthened to handle increased gross takeoff weight—up from 395,000 pounds to 477,000 pounds. In addition, fixed inlets optimized for high subsonic, low-altitude flight will replace the variable-geometry inlets in the prototypes, and the radar cross section will be considerably reduced to make the B-1B even harder to detect.

The program leading to development of the B-1B is centered on three test aircraft—B-1 original prototypes Nos. 2 and 4, plus the first B-1B off the new Rockwell assembly line in Palmdale, Calif.

The No. 2 prototype will be used to test and evaluate weapons carriage and separation characteristics and confirm flight control system modifications and flying qualities. In the original B-1 test program, the No. 2 prototype was a structural loads test aircraft and logged more than 282 hours on sixty flights. It also achieved the top speed of the four prototypes—Mach 2.22 in October 1978.

Prototype No. 4, flown to the Farnborough Air Show in England last September, will test the B-1B's offensive and defensive avionics systems and verify them for operational use. Flight testing on No. 4 is expected to begin in mid-1984. In the original test program, No. 4 was evaluated as a "full capability" aircraft and recorded 378 hours in seventy flights to close out the program in April 1981.



Data acquired during the seven-year flight-test program of the original B-1 will be useful in upgrading the bomber to "B"-version standards. Further test flights are in progress at Edwards AFB, Calif. See item. (USAF photo by TSgt. Sam Hotton)

The production B-1B is scheduled to enter the reactivated test program in early 1985 and will be tested and evaluated as the "full-capability" B-1B prior to introduction of the bomber into SAC's inventory beginning in 1986.

The current test and development program will ensure a fully operational aircraft will be provided to SAC on the initial operational capability (IOC) date. However, follow-on testing and evaluation of the B-1B and related weapon systems are expected to continue until the late 1980s.

The B-1B is a multirole, four-engine bomber with intercontinental range and the capability of being refueled in the air.

Configured as a strategic penetrating bomber, the four-place aircraft will be able to carry a variety of conventional and nuclear bombs and missiles. It is expected to be able to serve in this role well into the 1990s.

The B-1B is powered by four General Electric F101-GE-102 turbofan engines rated in the 30,000-pound-thrust class.

A TOW antitank missile streaks from the launch tube of the Army's new M2/M3 Bradley Fighting Vehicle System during recent tests. The TOW weapon subsystem for the vehicles, which began entering the inventory in March, is in production at the Hughes Aircraft Co. facility in El Segundo, Calif. FMC Corp. builds the vehicle.

AEROSPACE WORLD

Boeing Co. is developing the B-1B's offensive avionics—state-of-the-art electronic systems that will give the aircraft extremely high-accuracy navigation and bombing capabilities.

The defensive avionics, developed by Eaton Corp.'s AIL Division, is an extremely sophisticated system that will protect the aircraft electronically.

Management for the B-1B program is provided by the Aeronautical Systems Division's B-1B System Program Office, directed by Maj. Gen. William E. Thurman.

★ Secretary of the Army John O. Marsh, Jr., has approved the establishment of aviation as a separate branch of the Army.

Also approved at top Army levels was the centralization of responsibility for aviation matters at the Army's Aviation Center at Fort Rucker, Ala.

The two actions were taken as a result of a study to determine the Army's aviation requirements undertaken by the Army's Training and Doctrine Command at Fort Monroe, Va.

Army Chief of Staff Gen. E. C. Meyer asserted that "voids in aviation training and training development, piecemeal development of aviation doctrine and force structure, and the education and training requirements generated by equipment advances" mandated single responsibility for aviation matters.

New battle doctrine for Army aviation has broadened its role as a combat maneuver element. That doctrinal development and personnel management considerations, according to General Meyer, made formation of a separate aviation branch necessary.

General Meyer has directed the Army Staff to give further study to the Training and Doctrine Command's Aviation Implementation Plan. That study will include personnel management, aviation training, aviation logistics, budget, and branch composition issues.

The Army's Aviation Officer, Brig. Gen. E. D. Parker, commented that "Secretary Marsh's decision will not change the fundamental nature of Army aviation and its mission; nor does it affect the close air support mission of the Air Force." General Parker also noted that the combined effect of the two decisions will be "the full integration of Army aviation into the combined arms team."

★ The Secretary of Defense has presented to the Congress, in accordance with Public Law 97-252, the Department of Defense "Report on Direct Communication Links and Other Measures to Enhance Stability."

Public Law 97-252, dated September 8, 1981, directed the Secretary of Defense to conduct a full and complete study and evaluation of possible initiatives for improving the containment and control of the use of nuclear weapons, particularly during crises.

The Secretary shares with the Congress the conviction that "we can and should improve existing mechanisms to control crises that might lead to the use of nuclear weapons. We must also make every effort to ensure against nuclear war ever occurring between the United States and the Soviet Union as a result of accident, miscalculation, or misinterpretation."

DoD has carefully assessed a broad range of possible new initiatives to further those goals. As a result of that evaluation, the Secretary has proposed to the President several important measures:

- The addition of a high-speed facsimile transmission capability to the Hotline.
- The creation of a Joint Military Communications Link between the US and the Soviet Union.
- The establishment by the US and Soviet governments of high-rate data links with their embassies in each other's capitals.
- Agreement among the world's nations to consult in the event of a nuclear incident involving a terrorist group.

Each of these measures would increase the ability to resolve crisis situations and to prevent the escalation of military incidents, DoD officials said. Taken together, they would mark significant progress toward eliminating the danger that accident or misinterpretation could lead to nuclear war.

The Defense Secretary has also proposed for further study several possible new technical and procedural measures that might enhance the US's ability to verify treaty compliance and thereby further the goal of effective, significant arms control. These measures will be further analyzed by the Administration in the context of the development of verification measures for specific arms-control treaties.

★ On-site testing has begun of a new air defense system for southern Germany.

The first of the system's four centralized command centers is expected to become operational this summer, with the entire system on line in 1984.

Called the German Air Defense Ground Environment (GEADGE), the new system is designed to provide faster and more accurate detection of intruders in West German airspace, resulting in quicker reaction by German and NATO defense forces.

Built by Hughes Aircraft Co., the system replaces a 412L air defense system installed in the early 1960s. The new system will integrate new and existing long-range surveillance radars into a single network. Data from a variety of radars can be correlated on display consoles to form a complete and accurate picture of airborne threats, officials said.

Northrop's Mach-2 class F-20 Tigershark fighter is scheduled to make its international flying debut at this year's Paris Air Show at Le Bourget Airport. One of the newest US-developed fighters, the sleek aircraft is shown here on takeoff decked out in its air show paint scheme.

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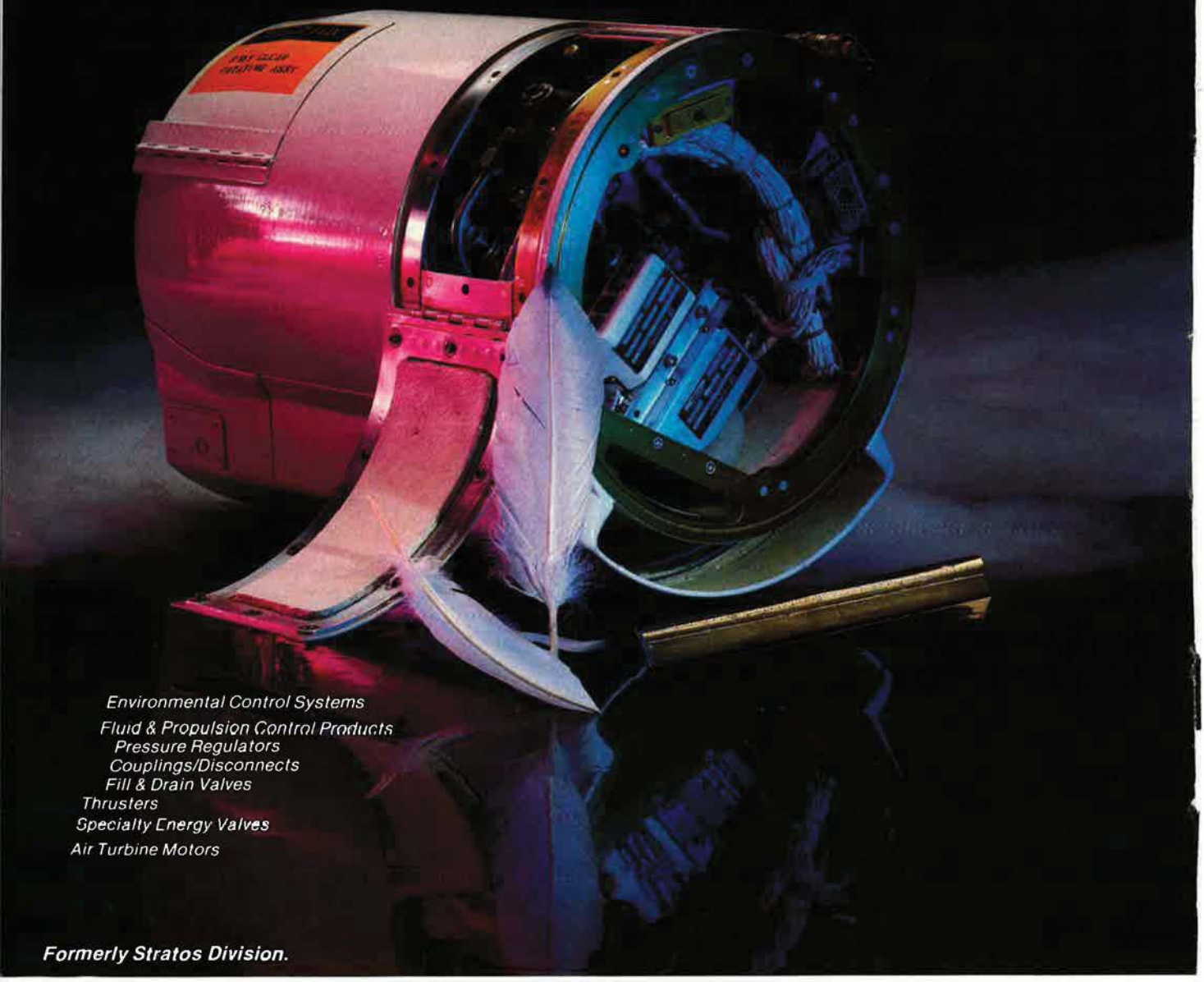

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The GEADGE system provides a reporting network for status of resources, including air bases, aircraft, missile batteries, and such other items as weather.

The southern part of West Germany was not included in the extensive NATO Air Defense Ground Environment (NADGE) system, built by Hughes in the late 1960s and stretching from Scandinavia to Turkey.

GEADGE will interface directly with NADGE, including sites in the northern portions of West Germany, Italy and France.

In addition to the four centralized command centers, GEADGE will include manned and unmanned fixed and transportable radar systems to ensure complete air surveillance.

AEROSPACE WORLD

Eventually GEADGE will receive radar information directly from the E-3A AWACS early warning aircraft patrolling Europe. *(For additional details of improvements to NATO's command control and communications capabilities, see p. 62 and p. 72.)*

★ The Air Force has agreed to a partnership with the other three services to develop an advanced vertical lift aircraft, the JVX.

USAF's JVX support program office is at Aeronautical Systems Division's Deputy for Airlift and Trainer Systems at Wright-Patterson AFB, Ohio.

The JVX request for proposals seeking preliminary designs was issued earlier this year, and full-scale development source selection is expected in mid-1985.

While development testing will be a joint service and contractor effort, officials said, each service is to conduct its own operational testing because of diversity in mission needs.

The Army is interested in a VTOL as an electronic warfare vehicle. USMC wants a medium amphibious transport and assault aircraft. The Navy seeks to eliminate a deficiency in combat search and rescue. And USAF needs the aircraft for long-range special operations and combat search and rescue.

The joint service requirement is for 1,086 aircraft with a total estimated procurement cost of $25 billion, with the plane operating in the 1990s and beyond.

The Army is to be responsible for thirty-four percent of development cost; Navy/USMC fifty percent; and USAF sixteen percent, with its 200 aircraft assigned to MAC.

★ Britain, France, and Germany recently agreed to the joint development of a new generation of antitank missiles.

The program definition phase under the agreement is to be initiated by Euromissile Dynamics Group, the prime contractor organization representing British Aerospace, Aéro-

World War II American Women POWs Attend Reunion

Washington, D. C., was the scene of an uncommon historical event in April with a three-day reunion of American women who were World War II prisoners of the Japanese. For some, it was their first reunion ever.

The women came to the nation's capital in conjunction with the VA-sponsored National POW/MIA Recognition Day ceremonies. The gathering was attended by members of veterans organizations, former POWs, and MIA families *(also see p. 138)*.

The thirty-one women, from all across the US and as far away as Australia, represented the eighty-one American military women interned after the fall of the Philippines. They spent the duration of the war at Santo Tomas and Los Banos prison camps. Miraculously, all eighty-one, mostly Army and Navy nurses, survived the ordeal, although several have died since.

Life was harsh in the camps, but "you didn't dare give up hope," said Mrs. Peggy Greenwalt Walcher of Menlo Park, Calif. The nurses did what they could for those suffering such illnesses as dysentery, jaundice, and dengue fever. They set up hospitals with makeshift equipment and administered what limited medicines were available.

"The people in the camps were always hungry," noted Mrs. Bertha D. Henderson of Sunnyvale, Calif., an Army Reserve nurse. The ration for each was one cup of rice per day, supplemented by what food could be grown or scrounged.

"Many of the older prisoners who just couldn't take it any longer died from disease and starvation" before liberation in 1945, said Mrs. Henderson.

With the return of peace, many of the women left the service to marry and raise families. Friends kept in touch through Christmas cards and occasional visits, but the Washington reunion was the first assembly as a group.

The women were showered with long-overdue and well-deserved recognition during visits to the Pentagon, Arlington National Cemetery, and the White House, where each met and was photographed with President Reagan. They were also feted at a series of luncheons, dinners, and receptions in their honor.

American women who were POWs during World War II are greeted by President Reagan during White House visit.

The idea for the reunion began with a conversation last year between Sam Moody of AFA's Orlando Chapter and Dorothy Starbuck, Chief Benefits Director of the VA. Another AFA member and former POW, Lt. Col. Eunice Florence Young, USAF (Ret.), supplied vital information on the whereabouts of other women. In all, sixty could be contacted.

While the Department of Defense expressed interest, funds to finance the women's visit to Washington were unavailable. With the help of Marjorie R. Quandt of VA's Department of Medical Surgery and other VA employees (including out-of-pocket contributors), Dorothy Starbuck set out to solicit reunion funding. A number of organizations—including AFA—and individuals responded generously.

The resulting media coverage during the reunion focused the nation's attention on a group of heroic women of whom all Americans can be proud.

—Corinna L. Petrella

spatiale, and Messerchmitt-Bölkow-Blohm.

The short- to medium-range successor to the Milan missile is visualized as a lightweight infantry weapon capable of penetrating the hardest armor and highly resistant to countermeasures. The consortium anticipates the lowest possible cost per unit by producing the weapon in very high numbers.

The Group's long-range missile is intended as both an air- and ground-launched fire-and-forget system that will allow a high rate of fire and evasive maneuvers by the launch vehicle. The weapon is to have all-weather capability and ease of adaptation to any carrier or helicopter, officials said.

★ Congratulations to the Army's Aviation Center at Fort Rucker, Ala., for a new flying safety record. Maj. Gen. Carl H. McNair, Jr., Commander of the Center, told AIR FORCE Magazine that April 14 was the 365th day of training without a Class A flying accident. The student and instructor aviators at Fort Rucker, in the year that ended April 14, flew more than 420,000 hours without a significant personal injury or damage to aircraft. Each day that passes sets a new record.

General McNair, while thankful for the accident-free record, noted the need for sustained attention and vigilance if it is to continue. He believes much of the credit for safer Army flying is due to the better-quality young men and women now flying, both as instructors and students; to realistic training that keeps everyone alert; to increased use of simulators that prepares aviators to cope better with emergencies; and, finally, to the grace of God.

Regarding simulators, General McNair said that the ten at the Aviation Center operate six days a week, twenty-two hours a day.

★ The Mexican Air Force (*Fuerza Aerea Mexicana*, or FAM) is successfully integrating its new Northrop F-5 aircraft into its operations. The aircraft, ten F-5E and two F-5F, were purchased under a $113 million foreign military sales agreement in 1980. They are based at Santa Lucia, about fifty kilometers north of Mexico City.

Two FAM instructor pilots received nearly a year's training at USAF bases before delivery of the aircraft. Fully qualified as instructor pilots, upon completion of the training they formed the nucleus of the FAM's F-5E/F operational pilot cadre. Six other pilots received shorter transition training in the States from other aircraft to the F-5 type. They continue

AEROSPACE WORLD

advanced training at Santa Lucia under guidance of the two instructor pilots, who also are transitioning other selected pilots into the type. More than thirty mechanics and other skilled support personnel received training in the specialties required for sustained operation of the F-5s.

Seven of the aircraft (five F-5E, two F-5F) were delivered in mid-1982 and were flown during the aerial display observing Mexican Independence Day on September 16. The other five F-5Es were delivered by the end of October 1982.

In other aircraft types, the FAM is now operating fifty-four Pilatus PC-7 turboprop trainer/strike aircraft. Among older types the PC-7s replace were the FAM's AT-6 Texans, all of which are now gone from its service. One of the AT-6s was donated by the FAM to USAF's San Antonio Air Logistics Center, where it was dedicated as a permanent display on April 18.

★ The Southeast Region Operations Control Center, the first of eight new air defense centers slated for CONUS, Canada, Alaska, and Hawaii, has gone into operation at Tyndall AFB, Fla.

Under the modernization program, three additional centers are scheduled to come on line in June and July. The centers will replace those in use since the 1950s. They're at North Bay in Ontario, Canada; McChord AFB, Wash.; and Elmendorf AFB, Alaska. Centers at Griffiss AFB, N. Y., and March AFB, Calif., are to be completed this fall. A center at Wheeler AFB, Hawaii, should be in operation by mid-1984.

The new control centers will detect and identify all aircraft approaching the US and Canada. The Southeast control center at Tyndall relies on radar input from sixteen sites along the Atlantic and Gulf coasts operated jointly by the military and FAA.

Reflected in the new systems is advanced technology, with modern computers the size of seven vending machines replacing obsolete vacuum-tube computers that required a half acre of floor space, officials said.

The new centers are expected to save $100 million annually and will require 5,000 fewer operators.

The Southeast center serves the 23d NORAD Region, which encompasses more than 3,000 miles of shoreline and nineteen states.

★ AFRES has activated its first military training unit—the 8050th Military Training Squadron—at Lackland AFB, Tex.

The new unit will be collocated with active-duty units at the Air Force Military Training Center at the base. If mo-

Falcon Foundation, Skelly Trust to Team Up

The Falcon Foundation and the Gertrude Skelly Trust are organizations that make possible a year in a tough preparatory school for deserving and motivated young people whose marks are not quite up to the Air Force Academy's demanding standards.

Ah, say the cynics, a thinly disguised scheme to improve the football team. The cynics are wrong, for even if these organizations wanted to concentrate on split ends and quarterbacks, the rules forbid that sort of thing.

Instead, they seek out those young people who give every indication of wanting an Air Force career and who are physically qualified for flying, but whose test scores need improving and who cannot afford a prep school. After a careful selection process, a group of young men and, now, women are given a year of academic polishing, after which they generally gain admittance to the Air Force Academy.

The results over the years have been gratifying to those who devote their time and money to the project. By and large, these onetime rejects not only do better than average academically, but, more importantly, they have a better-than-average record of staying the course.

The headquarters for the Falcon Foundation, in order to be near the Air Force Academy, recently moved from Los Angeles to Colorado Springs. With the move come high expectations of enlarging the Falcon Foundation program, as has been done by the similar and older Naval Academy Foundation.

Up until now, the Skelly Trust, while pursuing similar objectives, has operated separately. Recently, Harold Stuart, a former Air Force Under Secretary, and John Marsh—executors of the Skelly Trust—decided to form a partnership with the Falcon Foundation. Henceforth, the Falcon Foundation will perform administrative functions for both scholarship funds under the watchful eye of Lt. Gen. Benjamin Bellis, USAF (Ret.), Falcon Foundation President. —T. R. Milton

The evolution of an automatic test system...

the Bendix way.

It began with the recognition of the need for a practical, cost-effective method for testing printed circuit boards, taking that task away from large ATE. Bendix Test Systems Division engineers went to work on the problem, as an in-house R & D project.

The result was the Bendix 9070 module tester. It performs the functions of GO/NOGO screening and fault isolation every bit as well as any large ATE...at a fraction of the cost. And, it can be made to do more, with the addition of available plug-in assemblies. The 9070 was quickly recognized as the answer to a wide variety of commercial test requirements.

When the Air Force established requirements for a guided missile test system, we knew we had the answer in the 9070. We adapted it to perform the required testing and fault isolation for the target seeker systems.

The 9070 became the Multi-Purpose Test Set (MPTS) and does the job that previously had needed three separate test sets.

That's the Bendix way. Evolution, as contrasted to re-inventing the wheel. We created the 9070 as the solution to a specific problem and built in the capabilities for solving future problems. It could be the solution to yours. Other examples of the Bendix way are described in our brochure "Automatic Test Systems the Bendix way." Please ask for your copy.

Patent Number — 4,108,358

The Bendix Corporation
Test Systems Division
Attn: Marketing Department
Teterboro, New Jersey 07608
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Bendix

The power of ingenuity

SCIENCE/SCOPE

Vacuum-tube computers spanning half an acre of floor space will be replaced by modern computers the size of two vending machines when North America's new air defense system goes into operation late this year. Hughes Aircraft Company's Joint Surveillance System will replace aging SAGE (Semi-Automatic Ground Environment) and BUIC (Back-Up Interceptor Control) systems. It will link U.S. Air Force surveillance radars, civil air traffic control radars, and Canadian radars into a shared system. Seven regional control centers -- each equipped with the smaller computers -- will monitor skies 200 miles beyond North American borders. An eighth center will monitor skies surrounding Hawaii.

The U.S. Army will save over $200 million by using simulators to train troops to use and repair Firefinder weapon-locating radars. The Firefinder detects and tracks enemy artillery and mortar fire with a pencil-thin electronic beam. It instantly backplots their trajectories so counterfire can be directed with pinpoint accuracy. The Firefinder trainer simulates battlefield conditions so troops can learn to operate the radar without using live artillery fire and without taking a radar out of deployment for instruction. Also, where only one student could operate an actual radar, six students can train at once under the control of one instructor. Maintenance exercises train students in trouble-shooting, fault isolation, and replacement of components without risk of injury or damage to equipment. Hughes builds the Firefinder radars and trainers.

The sharp "eyes" of the F-15 Eagle make this air superiority fighter ideal for air defense missions. The aircraft's radar can spot high-flying or low-flying intruders from all altitudes and aspects. The pilot easily operates the radar, regardless of the electronic countermeasures environment or stresses caused by air combat. Hughes builds the AN/APG-63 radar under contract to McDonnell Douglas for the U.S. Air Force.

Most of the main battle tanks in the free world carry laser tank fire control systems developed by Hughes. The system determines the distance to a target based on the time it takes a laser burst to reach the target and reflect back. This information is fed into a computer with such data as crosswind and temperature so the gunner can be given precise ballistics for a first-round hit. Tanks equipped with laser systems include the M47, M48, M60A2, M60A3, Centurion, Chieftain, Leopard 1, Leopard 2, and M1. Hughes and its seven licensees in Europe have built thousands of laser tank fire control systems -- more than all other companies combined.

Sweden's new combat aircraft, the JAS-39, will use a new kind of head-up display (HUD) to enhance its multirole capabilities. The display utilizes diffraction optics made by using holographic techniques. Such data as airspeed, heading, and target information are superimposed on a laminated glass combiner mounted at the pilot's eye level, saving the pilot from looking down at his instruments. Compared with conventional displays that use mirrored glass, the Hughes HUD has a wider field of view, is more transparent, has more visible symbols, and reduces reflections from the sun.

bilized in a contingency or wartime, the 8050th would come under the operational control of Hq. ATC at Randolph AFB, Tex.

Peacetime management of the unit will be the responsibility of the Reserve's Tenth Air Force, headquartered at Bergstrom AFB, Tex.

The squadron is authorized ninety-three Reservists and will be operational in Fiscal Year 1984. The unit will also have a small number of Air Reserve Technicians, Reservists who also hold full-time positions as Civil Service employees to provide day-to-day continuity of operations.

Members of the 8050th will acquire instructor skills needed to train newly recruited enlisted people. They then will serve alongside their ATC counterparts in training active-duty, ANG, and AFRES enlistees.

During a national emergency, 8050th instructors would help train recruits in support of surge requirements, officials said.

People are needed to fill the unit's Reserve and full-time slots. The 8050th is also seeking prior-service members with military training experience or previously associated with ATC, preferably in training jobs.

AEROSPACE WORLD

John Bruce Dodds 1953–1983

John Bruce Dodds died of cancer in Vacaville, Calif., in April. He was twenty-nine. Mr. Dodds was a junior and a student leader at the Air Force Academy in 1974 when cancer was diagnosed in one of his legs and it was amputated at the thigh.

Because of his courageous persistence and the high regard in which he was held by his fellow cadets, regulations were waived and he was allowed to graduate with his class. The Class of 1975 presented him with a special plaque and sabre, and the Cadet Wing gave him a standing ovation.

Not only adjusting to his handicap, Mr. Dodds went on to become a skier and a licensed pilot who flew his own plane. He earned a law degree from Notre Dame in 1980 and was employed by the law firm of Fulbright and Jaworski in Houston, Tex., until this past spring.

He was buried at the Air Force Academy.

For details, contact the 433d Tactical Airlift Wing recruiting office, Kelly AFB, Tex., at (512) 925-7895 or AUTOVON 945-7895.

★ **NEWS NOTE**—The Boeing Management Association plans to establish a program for 1984, 1985, and 1986 to **commemorate the fiftieth anniversary of the B-17 Flying Fortress.** Many groups who flew in the aircraft would like to conduct reunions in the Seattle area. The Management Association is gearing up to support them with speakers, displays, tours, and the like. The contact is R. G. McLester, 5118 S. 164th, Seattle, Wash. 98188. Phone: (206) 243-3180.

Died: Maj. Gen. Richard H. Carmichael, USAF (Ret.), a decorated combat veteran of World War II and Korea whose final service before retirement in 1961 was as Commandant of the Air War College, of heart failure in Washington, D. C., in April. He was seventy.

Died: 2d Lt. Thomas C. Lennep, Jr., USAF, former Arnold Air Society National Commander and ex-officio member of AFA's Board of Directors, as copilot in the crash of a B-52 in Utah in April. The active AFA member was twenty-six.

Died: Col. Budd J. Peaslee, USAF (Ret.), whose service career spanned twenty-five years and who in 1943 helped lead the Eighth Air Force's October 14 "Black Thursday" attack on the ball-bearing works at Schweinfurt, at Fort Ord, Calif., in April. The long-time AFA member was eighty. ■

INDEX TO ADVERTISERS

The machine is the Air Force's new, supersonic, tactical jamming aircraft, the EF-111. And inside its lean frame is the ALQ-99E Jamming Subsystem, an electronic powerhouse that will help the EF-111 perform virtually any ECM mission.

The ALQ-99E—fully integrated into the EF-111 aircraft—uses key equipment from Raytheon. This includes one RF calibrator and multiple transmitters and exciters per aircraft. Within each exciter, interchangeable and programmed technique cards, in combination with software, enable the EF-111 to react to diverse and rapidly changing threat conditions. In addition, the equipment's frequency coverage, reliability, and effective use of available jamming power give the aircraft its ECM punch.

This all adds up to the kind of flexible capability the EF-111 needs to increase the effectiveness of any strike force—whether in its role as standoff jammer, in penetrating the world's densest electronic defenses, or in providing close air support. Small wonder that such versatility makes the EF-111 a critical element in the U.S. Tactical Air Forces.

And, taking advantage of advancing technology, Raytheon is working with the Air Force to develop components that will extend the life of

We put the electronic punch in the Air Force's supersoni

the EF-111 well into the 21st century.

Raytheon...helping the supersonic EW machine meet any threat—today and tomorrow.

For details on Raytheon's airborne ECM capabilities, write on your letterhead to Raytheon Company, Government Marketing, 141 Spring Street, Lexington, Massachusetts 02173.

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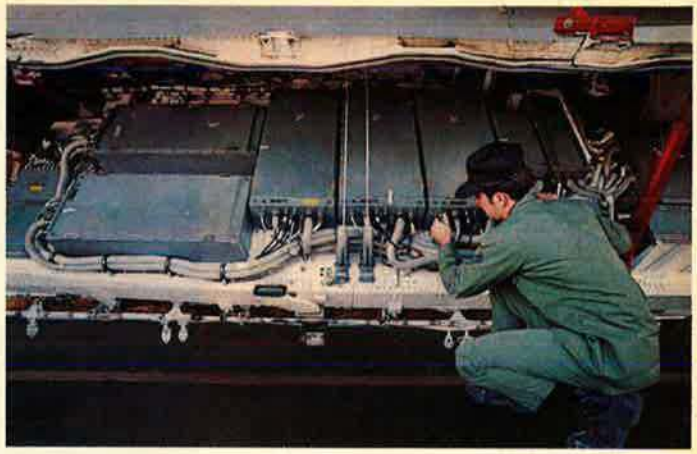
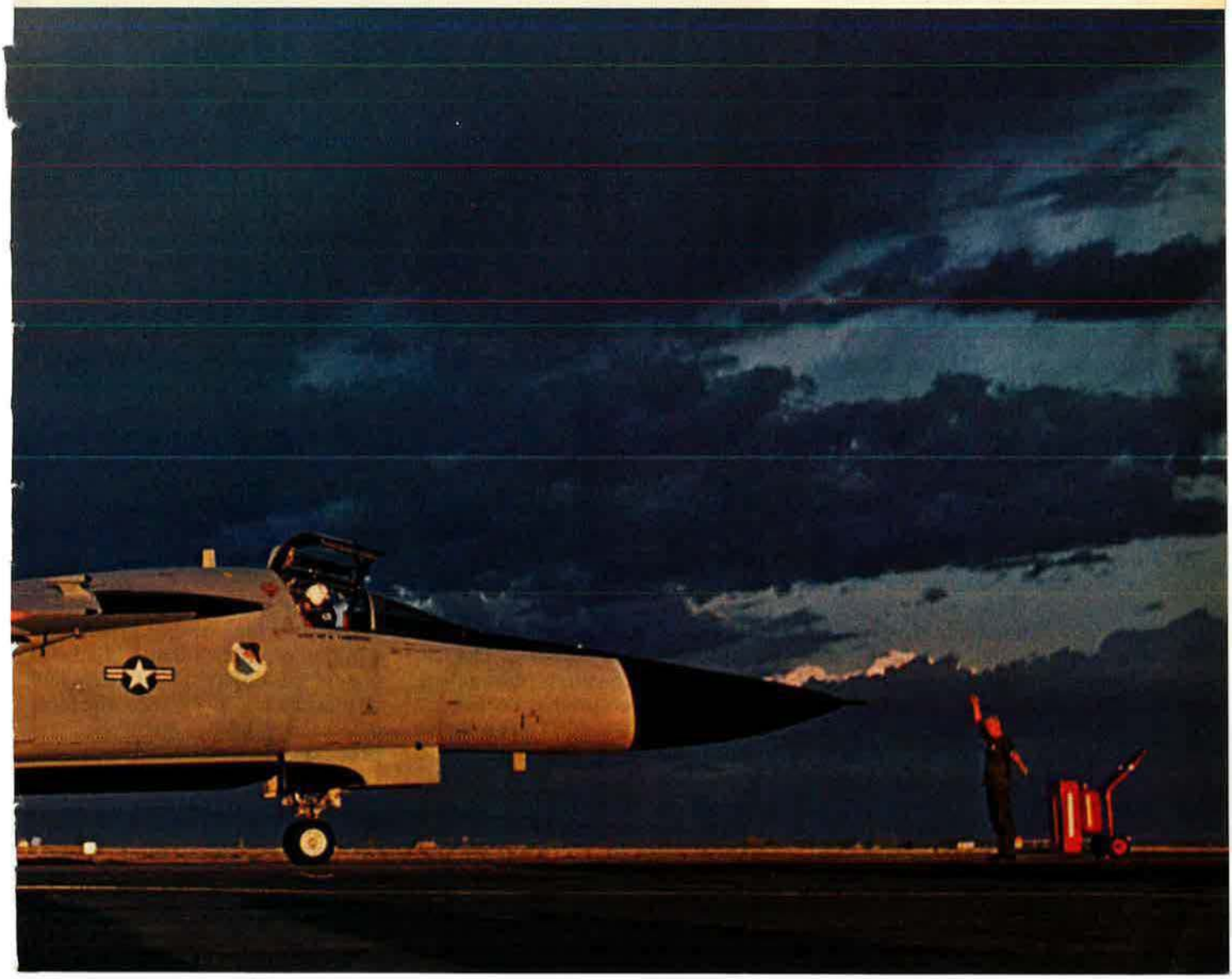
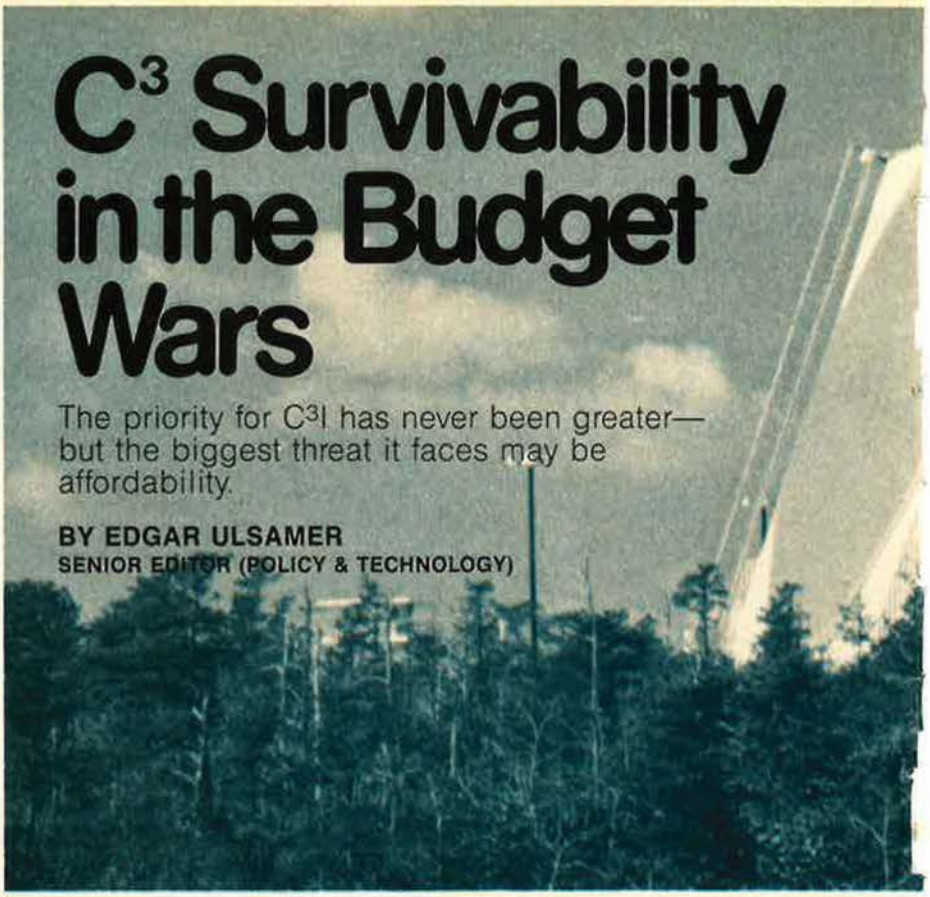


EW machine.



C^3 Survivability in the Budget Wars



The priority for C^3I has never been greater—but the biggest threat it faces may be affordability.

BY EDGAR ULSAMER
SENIOR EDITOR (POLICY & TECHNOLOGY)

THE FY '84 defense budget allocates $34.7 billion to the command control communications and intelligence (C^3I) function. This amount is about $8.5 billion greater than last year's request and reflects the growing importance of C^3I to modern warfare and deterrence of war. As Defense Secretary Caspar W. Weinberger told Congress in his latest annual report, C^3I has evolved into an integral part of this country's defense structure, with the effectiveness of its military forces "inextricably related to the quality of C^3I components and to the manner in which they are integrated with associated weapon systems and decision-makers."

It follows that these systems—that are so essential to implement strategy, control forces, and employ weapons—have become as important as combat forces and weapons themselves. Quite logically, the Defense Department and the Air Force are placing emphasis on improving the endurance of the C^3I systems that support the strategic nuclear, theater nuclear, and conventional forces. As the annual defense report puts it, "C^3I systems must not merely survive, but must remain capable of performing their basic functions in both lethal and electronic warfare environments. By the same token, C^3I systems should not degrade the survivability and endurance of associated forces and weapon systems."

Put into specific terms, the architects of modern command and control networks need to keep three criteria uppermost on their priority list. First, increased responsiveness, mobility, and sustainability of the US combat forces require more flexible, reliable, secure, and enduring C^3. Second, integration of the operations of various services and allies requires that these instruments of force management be capable of "interoperability and connectivity," meaning simply that they must be able to talk to each other easily and quickly. Third, C^3 systems can't remain "passive," but instead must be able to resist and counter existing and projected electronic combat capabilities of the other side.

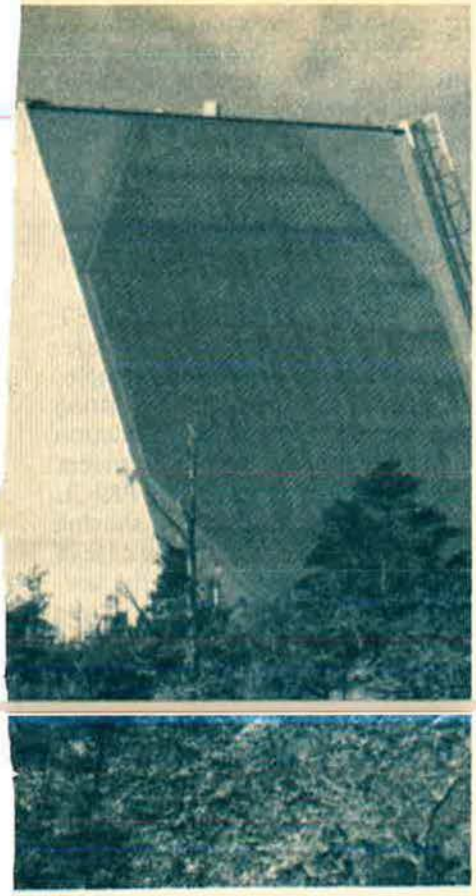
The Air Force architects of C^3 and electronic warfare (EW) systems also are keenly aware of two overarching traits of a make-or-break nature: affordability and cost control. Both clearly are uppermost concerns of the command charged with designing and acquiring most of the Air Force's electronic systems, AFSC's Electronic Systems Division at Hanscom AFB, Mass. As ESD Commander Lt. Gen. James W. Stansberry puts it, the "top-priority problem that we have—one that we haven't mastered completely but that we are trying mightily to solve—is controlling costs."

Finding the Golden Number

With an annual business volume well in excess of $3 billion that soon could reach the $5 billion mark, ESD has compelling reason to take innovative steps to control and lower costs through improved productivity and management. The Division is in the business of inventing and creating new products where, at the outset, "we don't even know what these things will look like." What the problem boils down to is that the developer must come up with a firm cost estimate while projects are still in a nascent state—even the associated requirements have not been pinned down fully—in order to be included in the long-term budget plans of the Air Force and the Defense Department.

The problem of estimating costs before the performance parameters and system engineering details are nailed down, of course, could be eased by plugging into the calculations ample reserves to cover uncertainties and imponderables. But, as General Stansberry is quick to point out, there are "institutional pressures" to make the estimate "affordable or else the program won't get off the ground." Also, it is the nature of military officers "to take on a task and do it" in an enthusiastic, mission-oriented way, which tends to lead to optimistic estimates.

As part of an AFSC-wide effort, ESD is working toward broad recognition of the fact that a "budgetary guess is different from a detailed cost estimate." In essence, the idea is to keep all parties involved in the process—from the Air Force and OSD to the Congress—from setting prematurely the "golden number" of a given program. Once a firm cost estimate is agreed to, the developer becomes its "steward" and if he



The PAVE PAWS phased-array radar system provides warning and attack characterization of SLBM launches against the US. (USAF photo by Eddie McCrossan)

can't keep his program at or below the "golden number," he has failed, with all that entails, General Stansberry suggests.

Affordability and the threat-driven requirements somehow must be brought into consonance through tradeoffs in order to find the "golden number." ESD is working these tradeoffs pragmatically and in a hard-nosed way, as three examples cited by General Stansberry demonstrate.

In the case of the Ballistic Missile Early Warning System (BMEWS) modernization program, ESD cut the coat to fit the cloth when cost estimates grew well beyond the available money. Congress allocated $60 million for the program, but the estimates had grown to $150 million. At that point, ESD took an unconventional approach.

Several qualified contractors were asked on a competitive basis to make assessments of what kind of a system they could build for $80 million by scaling back the original requirements. ESD then reviewed the contractors' proposals for trading off performance in order to stay within the prescribed funding level, accepting some but not all of the tradeoffs, and concluded that the trimmed-down system retained the basic performance features deemed essential by the Air Force. (If the contractors had failed to meet essential requirements, the Air Force would have informed Congress that no militarily useful system could be built for the allocated money and that specified additional funds were required.) A revised request for proposal reflecting these tradeoffs has just been issued by ESD.

Trimming and Backing Off

ESD took a slightly different approach in the case of the "Comfy Challenge" program structure. Involved is the development and acquisition of a mobile ground-based jammer that can be carried by C-130 aircraft. Its development is to cost no more than $20.8 million and its acquisition no more than $205.2 million. Original estimates were pegged at an R&D phase costing some $40 million based on the ability to jam simultaneously and automatically all the bandwidths a potential enemy might use.

But because of budget constraints, ESD and Electronic Security Command, the primary user, trimmed the requirements somewhat without compromising the system's essential features. These are the ability to jam and deceive hostile aircraft—over a range sufficient to prevent release of standoff weapons—in order to protect such high-value targets as airfields. Comfy Challenge is to be able to work in concert with such systems as the Army's Air Defense Electronic Warfare System and the Compass Call airborne C^{3}CM (command control and communications countermeasures) system.

A recently issued request for proposal (RFP) on Comfy Challenge contains the weighted performance requirements of the Air Force. By using an innovative design to budget approach, the contractor will build and test an engineering model and furnish the Air Force with proposal data for making a production decision. This the contractor can do with minimal government reports, reviews, and meetings. General Stansberry pointed out, however, that if industry can't do the job for the specified amount, the Air Force will have to obtain whatever additional funds are needed to develop a workable system or let the program die.

ESD took a markedly different approach in the case of the critically important groundwave emergency network (GWEN) program. GWEN's purpose is to link the National Command Authorities (NCA), NORAD, SAC, all strategic bomber and ICBM wings, and the PAVE PAWS SLBM surveillance radars for the purpose of warning

Thomas J. Murrin, left, President of Westinghouse's Advanced Technology Group, and ESD Commander Lt. Gen. James Stansberry watch a robot sign their names to the productivity improvement agreement GET PRICE.

and force execution under the Single Integrated Operational Plan (SIOP). GWEN is an adjunct of the minimum essential emergency communications network (MEECN) that assures reliable dissemination of war orders by tapping various frequency bands of the electromagnetic spectrum.

GWEN's primary and most urgent task is to maintain positive control over SAC's bomber fleet. In its first phase GWEN is to develop the means for coping with the disruptive effects of EMP, or electromagnetic pulse, generated by detonating Soviet warheads. The system negates EMP by using a very low frequency ground wave—in essence the ground portion of a normal sky wave—which is generically capable of resisting such disruptions of the ionosphere as EMP, communications blackout, and scintillation, as induced by nuclear weapons.

In its second phase, which as yet is in a planning stage, GWEN is to develop the redundancy of nodes needed to assure survivability against physical attack. This means providing a large number of paths, which would assure that the messages get through even if major portions of the grid are destroyed. This probably will entail about 300 GWEN relay sites rather than the forty or so nodes planned for the initial, or Thin-Line Communications Connectivity, phase of the program.

The only way for an aggressor to put the full-up GWEN out of commission is a dedicated, massive attack against its nodes. This probably would not make much sense militarily, as an attacker would use up a major share of his nuclear arsenal just to neutralize one US command and control network. Also, because of the size of such a raid against the entire GWEN grid, it would be doubtful that the aggressor could gain the very objective behind such an act, *i.e.*, catching the US strategic nuclear forces off guard in an "ungenerated" state.

In the first cut at establishing the "golden number" for the full-up GWEN grid, ESD encountered a perplexing situation: the cost estimates ranged from about $430 million to $2.8 billion. Because of this "mind-boggling" span, General Stansberry explains, a meeting of high-level representatives from various Air Force commands and government agencies, including the White House, was convened. The group decided to deal with the problem in stages. The consensus was that reliable cost estimates for the entire program could not be made at this time. There simply were too many unknowns. But without a price tag, GWEN simply would not make it into the POM, the program objective memorandum, that is the basis of the budgeting process. The same would have happened if ESD had "played it safe" and put a price tag of almost $3 billion on what is thought of as a relatively simple system.

The group decided, therefore, to back off and confine the initial program to areas that were understood sufficiently to support realistic cost estimates. This turned out to be the Thin-Line Communications Connectivity element of GWEN, which ESD could price out "with some precision, and this is the only number that we stand behind until we learn more," according to General Stansberry. The thin-line version of GWEN is slated for completion in 1985, while the full-up version of the system is expected to reach full operational capability in the late 1980s, according to the Defense Department.

GET PRICE: War on Rising Costs

GWEN, the BMEWS modernization, and Comfy Challenge attempt to answer the problem of estimating the costs of systems before the first piece of hardware has been built. ESD and, in a broader sense, AFSC and the Defense Department are concerned equally with what happens after a system goes on contract. In the case of ESD, cost growth after contract award is being held to an admirably low two percent, not counting adjustments for authorized changes to accommodate advancing technology or for other essential reasons. Still, there is considerable room for improvement, in the ESD Commander's view.

As part of AFSC's "war on cost" policy, ESD, in concert with Westinghouse Electric Corp., has come up with a formula that promises to revolutionize government/industry cooperation. Known as GET PRICE, for "Productivity Realized through Incentivizing Contractor Efficiency," this seminal program encourages defense industry to invest in modern cost-saving manufacturing technology and thereby slow the spiraling costs of military systems.

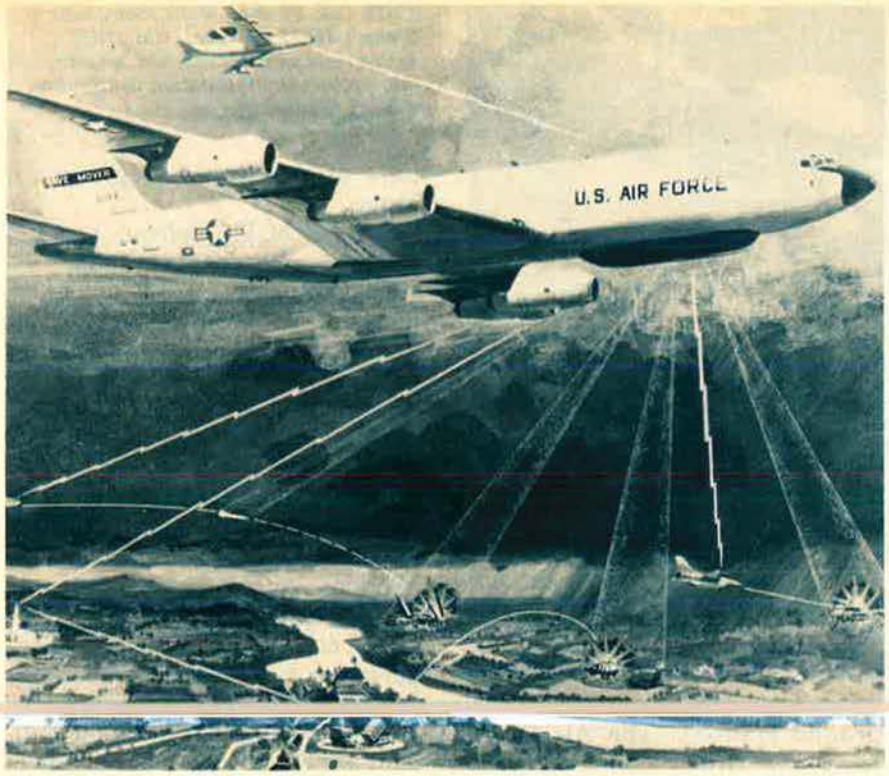
Although the details of GET PRICE are complex and legalistic, the underlying principle is simple. In place of the "penalty" for cutting the cost of systems in production that industry pays under the current way of doing business, GET PRICE creates a mechanism for sharing both profits and risks. In the case of most military systems that the government buys from industry, there is no marketplace to set prices through a competitive environment except for competition in the up-front, developmental phase and "leader/follower" acquisition arrangements that are only practical under rare, special circumstances. Production contracts are negotiated and industry profits are set on the basis of a complex system of weighted guidelines and cost estimates based on past experience.

The basic flaw of the process is that the total dollar value of individual contracts is used to establish profit, with the latter simply showing up as a straight percentage of the former. If the contractor lowers costs by whatever means in follow-on contracts—usually negotiated annually—the base on which his profit is calculated goes down, and so, of course, does his profit. Rather than having an incentive to invest in robotics, automated assemblies, or other labor- and cost-saving capital equipment, contractors, in fact, are encouraged not to lower prices and not to modernize their plants.

GET PRICE changes the picture completely. Initially, at least, it is tailored to contractors with a high and relatively stable level of defense business involving a range of products and contracts.

A Three-Step Process

The first step is an umbrella arrangement, called a "business deal," whereby the contractor presents a series of investment proposals that could enable him to do business for less.



Artist's concept of an aircraft employing the Joint STARS radar system. Joint STARS, an Air Force/Army effort, envisions use of an airborne radar that will detect, track, and direct real-time attacks against slow-moving and stationary ground targets. The system will be tied into the existing C³ network.

In the second step, the government reviews the merit of these productivity-enhancing, cost-cutting measures and the two sides negotiate a maximum incentive, a flat dollar amount, that the contractor becomes eligible to earn over a specified number of years. The incentive is not to exceed a fair commercial rate of return on investment.

In order to achieve this rate, the maximum incentive may be as high as half the savings that can be realized from the contractor's investment in automated equipment or other modernization. The government, needless to say, gets the remaining savings in the form of lower costs.

This agreement also allocates the total incentive amount to individual participating programs over a specific period, based on the volume of business the contractor is expected to conduct with the government. If the projected volume of business drops by more than ten percent of the projection, the government promises to make a "best effort" to ease the problem through extension of the period over which the incentive may be earned or substitution of participating programs, but it is not legally obligated to change the arrangements.

The third step is negotiation of individual production contracts by the participating program offices and sharing of fifty percent of negotiated savings with the contractor up to the point when the preagreed maximum dollar incentive is reached. The government, of course, gets the other half of the savings in the form of lower costs. Payment is made to the contractor in four installments. The first is paid after the contractor's new equipment goes on line and savings to a specific program have been negotiated. The remaining savings are paid over the life of the production run, with the last one due upon completion.

Advantages for Both Government and Industry

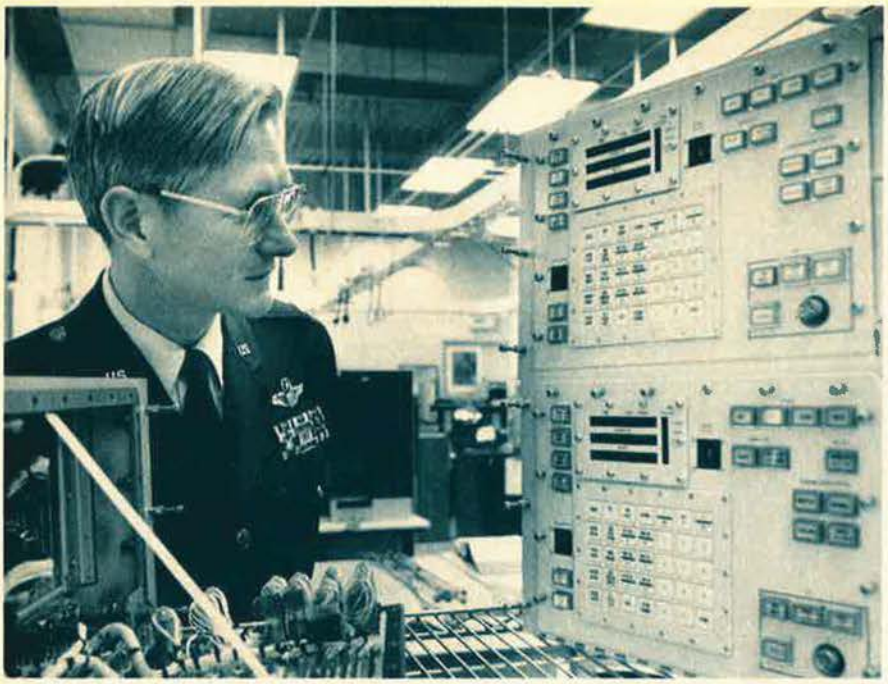
The government, General Stansberry points out, does not "pay one penny of up-front money for the capital investments" and is able to negotiate a lower price for what it buys from the outset. The worst thing that could happen to the government's interest is that the savings might turn out to be less than expected. Even in such a case, the government is protected because savings shared by the contractor under future production contract negotiations would reflect the lower realized savings. As a result, the contractor would risk not being able to earn, within the agreed-upon time period, the maximum dollar incentive that made the investment viable for the contractor.

The advantages accruing to the government go beyond the participating programs and the command that causes plant equipment upgrades by a defense contractor. The productivity enhancements benefit *any* product going through the modernized Westinghouse facility, because, as General Stansberry puts it, "the effects go [illegible] the form of lower production costs. Over the next decade the total savings from the GET PRICE automation effort at the Westinghouse facility could reach $1 billion for all the company's defense customers, he believes.

The Air Force is negotiating or discussing GET PRICE programs with a number of major defense contractors. Eventually, General Stansberry believes, the GET PRICE concept will spawn an overall policy change in how the Defense Department does business with its major contractors. The program's fundamental benefit seems clear: By encouraging defense contractors to invest in the means to perform their job better for less, the nation's overall defense posture is bound to gain.

Major Tactical C³ Programs

By merging a number of separate service programs aimed mainly at interdiction of the Warsaw Pact's second echelon by means of MTI (moving target indicator) and FTI (fixed target indicator) radars and standoff weapons, the Defense Department last year created two joint programs, the Joint Surveillance and Target Attack Radar System (Joint STARS) and the Joint Tactical Missile System (JTACMS). The latter is being developed by the US Army as DoD's executive agent, while the former was assigned to ESD.



ESD's Col. Norman Wells looks over a Class 1 JTIDS terminal. The JTIDS system will provide reliable, secure, jam-protected information distribution among tactical forces.

Secretary Weinberger told Congress that Joint STARS is to "provide the Army with a wide-area surveillance capability, and the Air Force with a full weapons guidance capability." By strengthening battle management and improving standoff interdiction capabilities, Joint STARS, he added, will contribute significantly to the battlefield interdiction capabilities of the Army and the Air Force. In concert, Joint STARS and JTACMS will make it possible to acquire moving and stationary targets deep beyond the forward line of troops (FLOT) in real time, and to destroy them reliably with standoff weapons.

Joint STARS's primary challenge—typical of joint service systems—is to reconcile and accommodate the disparate requirements of the two services. The Army, for instance, needs to look only about twenty to thirty kilometers beyond the FLOT, while the Air Force would like a radar range of 200 kilometers. The Army needs an operational capability sooner than the Air Force. The Air Force wants to be able to look through weather and to do so from higher altitudes than the Army. Obviously, the Air Force must be able to detect second-echelon armor, even when it is standing still, over a considerable distance using synthetic aperture radars. The Army is looking for moving targets and can get by with processing the target information in its nearby ground stations. The Air Force needs on-board data processing and airborne platforms that can work in league with forces that are rapidly deployable on a global scale.

Initially, the Defense Department envisioned Joint STARS as a common-core radar development, meaning that the two services would have been able to design systems with differing capabilities that shared major components. The latest Defense Department directive is to develop only one system. Also, the system is to be usable by and first deployed on the Army's OV-1 Mohawk aircraft.

As General Stansberry points out, a joint program entails tradeoffs by all participants. There has been a convergence of Army and Air Force requirements over the past few months, according to the ESD Commander, with the result that a request for proposal on this $2 billion program is about to be released to industry.

The Air Force might use two types of aircraft as platforms for its Joint STARS radar, the U-2-derived TR-1 and a modified Boeing 707 jetliner bearing the military designation C-18. There is concern over the fact that the TR-1 has neither the range nor the ability of operating independently of ground stations. These shortcomings reduce the effectiveness of the TR-1 as a Joint STARS platform that must be able to deploy quickly and function as a part of the Rapid Deployment Force.

Until JTACMS delivers standoff weapons with adequate range, the Air Force plans to use Joint STARS in connection with fighter aircraft that penetrate hostile airspace low and fast and, with the system acting as their eyes and ears, "pop up" over the target for rapid weapons release. The feasibility of such an approach was demonstrated by the Air Force last fall during tests at the White Sands Missile Range in New Mexico.

An airborne Pave Mover radar—the precursor of Joint STARS—guided an F-4E from a standoff distance of seventy-five miles to a dummy weapons drop that theoretically wiped out a moving column of tanks the pilot could not see. The F-4E was flying at a speed of 500 miles an hour at an altitude of 450 feet. The tanks were moving at a speed of eleven miles per hour in a widely spaced column. By feeding the Pave Mover data to the F-4E's computer, the aircraft was able to stay below the "enemy's" radar coverage. Other Pave Mover tests demonstrated the ability to guide missiles carrying submunitions to kill large numbers of tanks.

Notwithstanding the constraints on tailoring Joint STARS to USAF's specific mission requirements, there is considerable enthusiasm for this program. "Even though it probably won't do everything the Air Force wants, if this is what it takes to get started, let's go ahead and see what can be done," General Stansberry avers. Although the Joint STARS systems of the Army and the Air Force will be constructed from identical elements, the Air Force system will use a larger number of modules in key parts of the radar to meet multimode requirements. The Air Force system could be expanded and improved to meet growing mission requirements in the future, according to the ESD Commander.

Antijam Systems

The cardinal deficiency of the Air Force's tactical C^3 systems is their

vulnerability to enemy jamming. Jammed communications mean that combat performance will be seriously degraded, causing losses of men and aircraft. Work on jam-resistant air-to-air and air-to-ground UHF (ultrahigh frequency) and VHF (very high frequency) communications is under way at ESD.

The first system to tackle the anti-jam (AJ) challenge is HAVE QUICK. It provides ECCM (electronic counter-countermeasures) protection for USAF's primary UHF C^3, in the main ARC-164 radios used for air-to-air and air-to-ground operations. HAVE QUICK-modified radios are also being tested aboard Navy ships and aircraft for eventual deployment. The Army, too, is acquiring HAVE QUICK radios and some European NATO members are expected to follow suit.

HAVE QUICK originally was seen merely as a quick fix measure, to be supplanted by a more sophisticated system. This is no longer the Air Force perception. Because of congressional opposition to the Air Force's initially proposed follow-on system, called SEEK TALK, ESD is working on evolutionary enhancements of HAVE QUICK.

After Congress pulled the plug on SEEK TALK last year—in the main because of the contention that it was too costly and duplicated another program—ESD, in concert with the user commands, formulated a new approach designated HAVE CLEAR. This high AJ voice system combines some of the SEEK TALK approaches with technologies that became available more recently. Termed an extremely cost-effective concept by General Stansberry, HAVE CLEAR uses computer-driven "frequency hopping" to eliminate the need for such costlier solutions as SEEK TALK's adaptive antenna array techniques to "null" enemy jammers. In March, the Defense Systems Acquisition Review Council (DSARC) approved the HAVE CLEAR program but as yet has not authorized go-ahead.

Meanwhile, there are indications that some of the same congressional elements that opposed SEEK TALK are now campaigning against HAVE CLEAR. At the root of the problem is a philosophical schism between the Air Force and the Navy over how to fight tactical air battles. The Navy basically fights such engagements on the strength of data from various sensors and, as its track record shows—the latest involving the downing of two Libyan jets by two F-14s in the Gulf of Sidra in August 1981—does it well.

The Air Force, operating under different tactical conditions, relies on voice as well as data to exchange rapidly such information as SAM or MiG sightings. As TAC puts it, "While data is important, we don't want to have to send a telegram to a squadron member to tell him that he has got a MiG on his tail. We want to tell him." In technical terms, this ability to talk is called an AJ conferencing capability.

As a result, there is entrenched among influential congressional staff experts the notion that the Joint Tactical Information Distribution System (JTIDS), with an expanded voice capability, eliminates the need for HAVE CLEAR. JTIDS provides jam-resistant, secure communications between force elements using a high-volume, high-speed digital data link. Operated by tactical air, land, and naval forces, this highly survivable system provides not only limited tactical data and limited voice communications, but also furnishes relative navigation and limited cooperative identification information to individual terminals within the JTIDS net.

The system uses a technique called time division multiple access (TDMA)—or, in the case of the Navy, DTDMA, for distribution time division multiple access—to create jam-resistant networks that can handle vast amounts of digital data. JTIDS "frequency hops" across a wide spectrum and transmits encoded pulses of digital data with the result that it is jam-resistant and secure.

Two classes of terminals are being developed under the program. Class 1 is for such large aircraft as AWACS and for facilities that link JTIDS ground-based networks. The Class 2 terminal, a smaller design intended for installation in mobile tactical platforms, is now in full-scale development, with initial deliveries planned for later this year. Joint Air Force and Army testing is to be conducted in about two years, leading to an FY '86 production decision. The system is currently planned for installation in F-15 aircraft. The Army will also use Class 2 terminals in vans in support of its Position Location Reporting System and HAWK batteries. The USAF/US Army and UK version of JTIDS will be interoperable with that of the Navy. The United Kingdom is also acquiring full-scale development Class 2 terminals for testing later on in the air defense variant of the Tornado.

The Air Force, General Stansberry points out, has concluded that JTIDS cannot also accomplish the AJ voice requirement because the frequency spectrum allocated to JTIDS does not provide sufficient AJ processing gain at the information rates that would be required of a combined data and voice terminal. It is more prudent to install a HAVE CLEAR capability in aircraft like the F-16 and A-10 that have an urgent voice requirement but no need for the high-capacity data transfer capability that JTIDS provides. The capability to handle data could be added later, if that becomes necessary.

Production decisions on USAF and Navy versions of the Class 2 terminal are expected in the mid-1980s, with deployment occurring in the late 1980s and early 1990s. The fate and schedule of HAVE CLEAR, of course, depend on the Defense Department and Congress.

C^3CM Programs

The part of electronic warfare that figuratively uses electronic systems both as a shield and a sword is called C^3CM, for command control and communications countermeasures. Its broad purpose is offensive action against the electronic portion of the enemy's combat forces and systems by exploiting, jamming, deceiving, or destroying them.

Secretary Weinberger told Congress that the Pentagon is placing "considerable emphasis on maintaining a technological advantage in this area of rapidly evolving competition," including a fifteen percent boost in current funding levels over last year's. The Air Force, he testified, developed "an Electronic Combat Action Plan to support a

balanced acquisition program for both destructive and disruptive assets." Similarly, USAF, the Army, and Readiness Command formulated a joint operational concept for command control and communications countermeasures that coordinates individual responsibilities, targeting procedures, and execution doctrine, he said. All Air Force C³CM programs are handled by ESD through a special deputate that was set up more than a year ago. Its function is to coordinate a number of open and highly classified C³CM programs in progress at ESD and elsewhere.

Among the key open programs are Comfy Challenge (referred to earlier) and the EC-130H Compass Call jamming system that AFLC built and delivered in a record two years from initial contract award. Modifications of Compass Call are being managed by AFSC's Aeronautical Systems Division. Another record-shattering performance involved the "PAVE TIGER" program that went from initial requirement status to concept definition in sixty days. A lethal defense suppression minidrone, PAVE TIGER will be used by the Air Force against important ground targets. The program is managed by the Aeronautical Systems Division. It was conceived last year in response to classified requirements in the C³CM area by a "tiger team" led by ESD's deputy for C³CM and composed of representatives from Armament Division, ASD, TAC, and ESC. These defense suppression minidrones are to be produced over the next few years. The same drone may be used for another C³CM program, known as PAVE CRICKET.

Drones are obviously ideal platforms for C³CM systems, especially if such low-observable technologies as Styrofoam construction materials are incorporated. Similar advantages accrue to other expendable C³CM devices, such as the Army's C³CM projectile and handheld jammer.

A series of programs initiated because of Electronic Security Command requirements—some open and others classified—is another key element of the Air Force's C³CM effort. Included are "Comfy Kid," whose mission is classified; "Comfy Shire," which in essence is a data base covering what should, and should not, be jammed in a combat environment; and "Comfy Fox," a signal security system that warns users not to use signals that, in a given circumstance, the enemy might be able to pick up.

ESD's task of developing the Air Force's C³CM architecture includes a program originated by the Defense Advanced Research Projects Agency (DARPA) called the Critical Nodes Targeting Project. As its name denotes, the objective here is to go after the opponent's electronic combat capabilities at a level and in a manner that assures maximal damage. The first requirement is to come up with passive detection systems that can categorize nodes of this type and locate them within a general area. After that it probably will become necessary to use such active means as a radar spot beam to get additional characteristics before a determination can be made of whether and how the node is to be dealt with, using such methods as jamming or physical attack.

A somewhat different project centers on "false signature generation"—a form of electronic ventriloquism to hide, make invisible, or provide decoys for USAF's own critical nodes in combat. A key concern here is the protection of USAF and NATO aircraft by means of electronic masking and deception.

Strategic C³ Systems

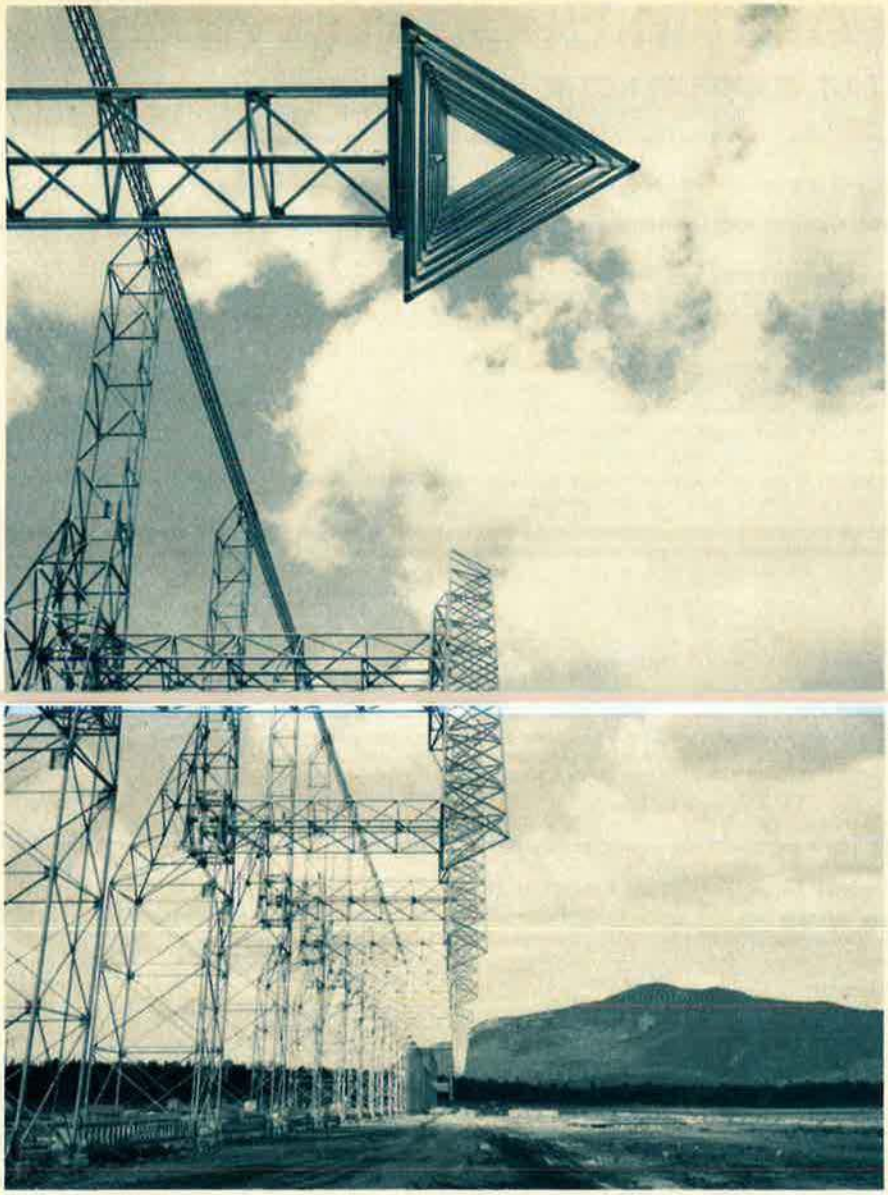
The MILSTAR EHF (extremely high frequency) satellite communications system—designed to provide survivable and enduring command control and communications for SIOP execution and other purposes—is a joint service program whose principal users will be the nuclear forces, the Navy, and tactical elements of the Army, Navy, and Air Force. ESD's program responsibility centers on the development and acquisition of all airborne and certain specialized ground terminals and their integration with other SIOP systems. MILSTAR, when operational, will back up, augment, and possibly replace the Navy's fleet satellite communications system (FLTSATCOM), the Satellite Data System (SDS), and AFSATCOM, the Air Force's relatively "soft" satellite communications system.

AFSATCOM terminal deployment will be completed by the end of this year. Involved is installation of these terminals on strategic bombers, reconnaissance and surveillance aircraft, ground and airborne command centers, and missile launch facilities. Also, an AFSATCOM communications package is being installed on certain host satellites to ensure continuity of communications in critical geographic areas.

Two related programs, the SAC Digital Network (SACDIN) and the Aircraft Alerting Communications EMP hardening effort (AACE) are tied to AFSATCOM and MILSTAR. SACDIN is expected to go into production next year. This network modernizes the aging and capacity-limited hard-copy C³ system by providing rapid, two-way, secure command and control information between Hq. SAC and such subordinate SIOP elements as SAC missile and bomber/tanker command posts. In addition to greater survivability and capacity, the system also will provide increased flexibility and growth capability. The system is about to complete full-scale engineering development.

AACE was born of the recognition that a C³ chain is no stronger than its weakest link. This upgrade program takes a "brute force" approach, using such devices as steel enclosures and electronic filters to provide EMP protection for SAC's ground-based emergency action equipment that now lacks intrinsic hardening. Rather than redesign the equipment, the upgrade effort involves no advanced technology and relies on shielding of the equipment and sealing it by plugging potential EMP penetration paths with filters. While considerable progress is being made in hardening electronic components at the lowest end of the scale against EMP, vulnerabilities persist at the chassis level. ESD, therefore, decided against attempts to harden the equipment itself and confined the program to encapsulation.

One of the five key elements of the Administration's strategic force modernization package announced in 1981 is upgraded strategic air defense of the United States. Several ESD programs support this requirement. Soviet development of the



Transmit antennas of the OTH-B radar system developed by ESD. The OTH-B system uses backscatter of radar signals from the ionosphere for long-range detection of aircraft.

B-1-like Blackjack bomber and air-launched cruise missiles underscore the urgency of such measures. Two of the primary efforts with near- to long-term payoff are OTH-B, the over-the-horizon backscatter radar system, and upgrading of the Distant Early Warning (DEW) Line, also called the North Warning System.

OTH-B uses the over-the-horizon backscatter radar technique for aircraft detection and tracking. The radar signals are transmitted around the earth's curvature by refraction and reflection of the signal off the ionosphere. Target refraction and reflection of the signal (backscatter) are returned to the receiver by the same processes. The propagation path permits detection of targets well beyond the horizon and, therefore, beyond the detection capabilities of ground-based, line-of-sight radars. Its reach is up to 1,800 miles. OTH-B is handicapped in looking north, however, because of the potential interference by the so-called Northern Lights.

OTH-B covers the coastal approaches from east and west, but can't do so reliably in a northern direction. The only north-looking system—the DEW Line that runs across Alaska, northern Canada, and Greenland—dates back to the 1950s, is costly to operate, and has several gaps in coverage. RFPs for an upgraded DEW Line are to be issued in the near future. The improved system will consist of new, short-range, unattended radars and upgraded, long-range, minimally attended radars that together will provide all-altitude coverage of the northern bomber and cruise missile approaches to North America.

Over the long term, possibly by the mid-1990s, constellations of radar satellites could be placed in orbit to detect and track low-flying aircraft and cruise missiles as they approach North America. The Rome Air Development Center, an affiliated element of ESD, is pursuing research and development of such systems. Funded mainly by DARPA, this system involves space-based radars with apertures of up to seventy meters.

Two basic approaches are under consideration. Both would be confined, at least initially, to coverage of the North American continent. One version would consist of at least six satellites deployed at an altitude of between 5,000 miles and 6,000 miles. Its cost would be around $5 billion. The other version, considerably more expensive, would consist of at least fourteen satellites deployed at an altitude of about 1,000 miles. The high-altitude system would probably lack the ability to detect "stealthy" aircraft and cruise missiles. The lower altitude proliferated radars, on the other hand, appear capable of doing so.

Either system would employ an on-board single data processor to eliminate the requirement to "downlink" raw sensor data. RADC is investigating three key elements of a space-based radar system. This involves work on extremely lightweight antenna designs, transfer/receive module designs, and on-board single processor research.

Clearly, systems of this type are a long way in the future and weighty questions about vulnerability to preemptive attack and various tradeoff considerations will have to be answered before the Air Force would commit to their deployment. For the time being, therefore, ESD will concentrate on what General Stansberry identifies as its top priority problem: designing and building military electronic systems—that the country needs and can afford—better and for the lowest price possible. ■

What's Happening in Electronics at ESD

A CHECKLIST OF MAJOR ELECTRONICS PROJECTS

(As of May 1, 1983)

NAME AND MISSION	STATUS	CONTRACTOR
Deputy for Command Control and Communications Countermeasures (EC)		
C^3 Countermeasures Joint Test and Evaluation A series of field tests to assess friendly C^3CM capabilities and to determine the impact of C^3CM on enemy operations. Additional evaluations will include traceability of C^3 effects, measures of effectiveness, and specific performance of selected weapon systems.	Development	None
C^3 Countermeasures Planning Includes planning and coordination activities for technology advances and systems development in support of an overall Air Force C^3CM capability. Key activities include development of a Command Control and Communications Countermeasures Architecture supported by mission analyses and assessments of existing and planned AFSC C^3CM programs, and the development of a C^3CM Investment Strategy Plan.	Continuing	None
C^3 Countermeasures Systems Development Acquisition of ground-based systems that provide a capability to conduct C^3 countermeasures activities in training, contingency, and wartime, and to provide systems to monitor friendly operations security.	Concept Definition	None
COMFY CHALLENGE A ground-based jamming and deception system that will be used to disrupt hostile communications and non-communications signals during wartime. During peacetime it will be used for training our own operators.	Starting Design Competition Prior to Full-Scale Engineering Development	None
COMFY FOX A mobile, self-contained signal security assessment capability system that will collect and analyze friendly signals, determine vulnerability, and report the results for correction.	Drafting Performance Specification	None
COMFY SHIRE This is a C^3CM Support Data Base now under construction, initially to support Compass Call. The data base will also be used for studies and simulation. Later it will be made generally available to DoD users involved with electronic combat. COMFY SHIRE will serve as a production and configuration management focal point for derivative data bases located elsewhere.	Full-Scale Engineering Development	None
Critical Node Targeting Development of a system to locate and identify C^3 nodes for targeting and destruction in a timely manner.	Concept Definition	None
Deputy for International Programs (FA)		
Japan Base Air Defense Ground Environment System Systems engineering and program management assistance to the Japan Air Self-Defense Force in upgrading the current BADGE (Base Air Defense Ground Environment) Systems.	Ongoing Engineering Assistance	None
Royal Saudi Air Force Alternate Command Operations Center (ACOC) Acquisition of a Royal Saudi Air Force Alternate Command Operations Center. The Center will use commercially available equipment and software.	Proposal Review and Contractor Negotiation	None
Royal Saudi Air Force C^3 System Acquisition of a ground command control and communications system for the Royal Saudi Air Force. The system will provide for the interface of existing tactical radars, the Saudi E-3A AWACS, and elements of other Saudi military organizations.	Planning	None
Spanish Systems Assistance to Spanish Air Force for maintenance and operation of Spain's air defense system. Provides modifications and improvements to the network including weapon and command and control improvements, increased radar coverage, and augmentation and upgrade of communication links.	Acquisition	Hughes Aircraft Co.; General Dynamics; Rockwell/Collins
Deputy for Mission Support Systems (OC)		
Air Force SAFE Program Procurement and deployment of DoD BISS program-developed and commercially available physical security equipment to approximately seventy USAF bases and 210 sites worldwide. These systems will protect such mission-critical/high-value resources as stored weapons, strategic/tactical alert aircraft, open and closed sheltered alert aircraft, special mission aircraft located on parking areas, specified command posts, and other specifically identified strategic resources.	Procurement/Deployment	ASEC, Sandia; Melpar; General Dynamics; EG&G
Air Staff Information Management Systems State-of-the-art technology will be used to increase the efficiency of handling management information. It will increase the productivity and efficiency of the USAF Air Staff with the latest automation systems, techniques, and networking.	Prototype	MITRE Corp.
COBRA JUDY COBRA JUDY is a USAF shipborne phased-array radar system to collect data on foreign strategic ballistic missile tests. Air Force and Air Force contractor personnel will manage, operate, and maintain the technical systems on board the ship. The Navy's Military Sealift Command will own and operate the ship.	Operational	Raytheon Co.
COBRA JUDY X-Band A modification to extend the capabilities of the basic COBRA JUDY system to allow it to gather and provide data vital to the development of other systems.	Procurement	Raytheon Co.
DoD Base and Installation Security Systems (BISS) An evolutionary RDT&E program to provide a DoD standard electronic exterior physical security system for protecting DoD resources worldwide. This system's components include sensor, imaging, entry control, and command and control equipments. The system concept emphasizes maximum commonality of major items and a variety of supporting subsystems. It offers a flexible choice of equipment (USAF developed/commercially available) that must be tailored to the unique physical characteristics of the location and to the threat.	Advanced Development/Engineering Development	Canadian Commercial Corp.; ASEC

NAME AND MISSION	STATUS	CONTRACTOR
Information Resources Management (IRM) Program This program will employ state-of-the-art technology to automate management information handling and to increase the productivity and efficiency of professionals through automation, and to minimize overhead development costs through use of off-the-shelf equipment. The IRM program is a development effort to implement within AFSC the Paperwork Reduction Act of 1980.	Development	Booz-Allen & Hamilton; Bedford Research Associates; Computer Engineering Associates; Input-Output Computer Services
Logistics Management System Will employ the latest technology to increase the efficiency and productivity of worldwide wholesale logistics agencies that provide supplies and support to Air Force units. Mission effectiveness will be enhanced because of the increased efficiency of logistic support efforts by AFLC and all logistics agencies.	Development	None
Operations System Network (OPSNET) OPSNET is a proposed multilevel secure information management system for Hq. USAF DCS/Plans and Operations. It will consist of a network of automated systems and equipment that will link the entire DCS together and provide for easier information flow and access. The purpose of the system will be to increase the productivity of, and reduce the workload on, action officers.	Development	None
SEEK SCORE To develop and produce a radar bomb scoring system for SAC for training and evaluation of aircrews in a realistic operational environment.	Development	Sierra Research Corp.
Tactical LORAN Digital Avionics Systems Development and acquisition of the AN/ARN-101(V) Navigation, Weapons Delivery and Reconnaissance Systems for RF-4C and F-4E aircraft. This digital modular avionics system combines LORAN/inertial information and integrates radar, optical, infrared, and laser sensors to satisfy requirements for precision delivery during the 1980s.	Installation, Operations	Sperry; Lear Siegler; JAYCOR
Automated Weather Distribution System (AWDS) AWDS will enhance Air Weather Service's meteorological support for the Army and the Air Force. The system will reduce labor-intensive tasks using advanced computer technology, color graphic displays, and sophisticated meteorological and graphic presentation software. A total of 163 automated Base Weather Stations worldwide and twenty tactical versions will interface with two communication networks for distribution of global alphanumeric and graphic meteorological data.	Development	None
Traffic Control and Landing System (TRACALS) TRACALS encompasses fixed and mobile ground facilities, with associated avionics, to support the USAF Air Traffic Control function. Major systems being acquired include navigation aids, radar approach control equipment, landing systems, and simulators.	Continuing Development and Acquisition	Many
Weapons Storage and Security System (WS^3) (Weapons Storage Vault) RDT&E and production planning to provide dispersed, unattended, tactical nuclear weapons storage. Weapons will be collocated with tactical aircraft in hardened vaults beneath the floors of closed aircraft shelters. The vaults will be controlled and secured by an integrated C^3 system that will include security sensors internal and external to the vault, TV monitoring, hardened communications, and central annunciation of alarms.	Advanced Development/Engineering Development	Sandia
Deputy for Strategic Systems (SC)		
Air Force Satellite Communications Systems Phase I, a UHF SATCOM system, is in the field serving the SIOP forces. Phase II, an enhancement of the UHF and SHF airborne/ground terminal to provide more reliable, jam-resistant, survivable satellite communications to the strategic forces, is being developed. Now in planning is Phase III, a new communications system operating at UHF and EHF with a common transmission format for maximum interoperability among all services.	Deployment, Development, Conceptual	Rockwell International; Linkabit Corp.; Tracor Corp.
Air Force Support to MEECN Upgrades the Air Force and Army Survivable Low Communications Systems (SLCS) as part of the Minimum Essential Emergency Communications Network (MEECN). Major developments include airborne LF/VLF transmitters, new receive antennas for transverse electric mode reception, incorporation of the Navy MEECN Message Processing Mode (MMPM), and mini-LF/VLF receive terminals for bomber aircraft. This program is designed to meet the requirements of the Joint Chiefs of Staff, CINCSAC, and Theater CINCs.	Definition, Development, Production/Deployment	Westinghouse; ASEC; Spears
Air Force World-Wide Military Command and Control System (AFWWMCCS) Involves systems planning and engineering for Air Force elements of the World-Wide Military Command and Control System. Activities will focus on intersystem engineering of selected AFWWMCCS existing and planned assets.	Conceptual/Validation/Development	None
Berlin Radar System This program will modernize the Berlin Air Route Traffic Control System by consolidating Air Traffic Control Operations at Tempelhof Central Airport, replacing the current long-range radar system with a modern 3-D AN/FPS-117 radar, and automating the associated operations center.	Acquisition	General Electric Co.
BMEWS Modernization Program Upgrade of the three operational sites (Greenland, Alaska, England) operated by SAC and the Royal Air Force. The Missile Impact Predictor is being upgraded by replacing the aging computers now in use with off-the-shelf computers and by translating software assembly language into a higher-order language. Radar improvements (Greenland, England) are planned that will meet the 1980s threat and give the system an attack assessment capability to meet the need of the National Command Authorities.	Acquisition	ITT, Federal Electric Corp.
Communications System Segment Replacement Improvement of the reliability, capacity, maintainability, and flexibility of the NORAD Cheyenne Mountain Complex communications processing function by replacement of the Communications System Segment (CSS) acquired through Program 427M. The CSS handles message processing, formatting, technical control, line code conversion, and routing of internal and external messages.	Definition Phase	None
CONUS Over-the-Horizon Backscatter Radar Provide an Over-the-Horizon Backscatter Radar System for long-range tactical early warning and surveillance of aircraft approaching North America.	Full-Scale Engineering Development/Production	General Electric Co.
E-4 Airborne Command Post Provides the National Command Authorities and the Commander in Chief of Strategic Air Command with a survivable airborne command and control system that will operate during the pre-, trans-, and postattack phases of a nuclear war. As a survivable emergency extension of NMCS and SAC ground command and control centers, the E-4 Airborne Command Post provides high confidence in US ability to execute and control SIOP forces in a nuclear environment.	Development, Production/Deployment	Boeing (prime); E-Systems

NAME AND MISSION	STATUS	CONTRACTOR
Ground-Based Electro-Optical Deep Space Surveillance System (GEODSS) The GEODSS system will extend Strategic Air Command's and North American Aerospace Defense Command's spacetrack capabilities for detecting and cataloging space objects out to the 3,000–20,000-nautical-mile range. This will be a global network of five sites to detect optically, track, and identify satellites in earth orbit.	Acquisition	TRW Inc.
Ground Wave Emergency Network (GWEN) GWEN will provide US strategic forces with the ability to maintain critical CONUS long-range command and control communications connectivity, despite atmospheric disturbances present in both the trans- and postattack phases. Survivability for this system is provided primarily by proliferated relay nodes, using unmanned, groundwave radio equipment collocated where possible with existing commercial/government broadcast towers. Strategic forces units, equipped with compatible radio equipment, will interface with nearby nodes for participation in the overall network.	Conceptual/Development	RCA; Rockwell; R&D Associates
Joint Surveillance System (JSS) The JSS program was established to acquire and deploy a peacetime air surveillance and control system to replace the Semi-Automatic Ground Environment (SAGE) and Back-Up Interceptor Control (BUIC) systems for the CONUS and Canada, and the manual ground environment systems in Alaska and Hawaii. The primary mission of JSS is peacetime air sovereignty and airspace surveillance, with limited air defense functions. For Canada, the mission includes support of wartime air defense functions; in Alaska, the mission includes performance of tactical air control. Eight Region Operations Control Centers (ROCCs) are approved.	Production/Implementation	Hughes Aircraft Co.
MILSTAR A multiservice satellite communication program for worldwide communications in a severe jamming environment. It will have secure voice and data capability for strategic and tactical/mobile users. ESD is responsible for developing airborne terminals.	Planning Phase	None
North Warning A line of Main Stations (MSs), Minimally Attended Radar Stations (MARSs), and Unattended Radar Stations (UARSs) from northwest Alaska across northern Canada to eastern Baffin Island and then southeastward to Newfoundland. Each MS and MARS site will be equipped with a minimally attended long-range radar. These sites will be positioned for mid- to high-altitude coverage. Each UARS will be equipped with a short-range radar as a gapfiller for continuous low- to mid-altitude coverage.	Planning Phase	None
PAVE PAWS Primary mission of PAVE PAWS is credible warning and attack characterization of sea-launched ballistic missiles penetrating the PAVE PAWS coverage. The warning and attack characterization data include an estimation of launch and impact points and times. Radars are operational at Otis AFB, Mass., and Beale AFB, Calif. Others are planned for the southeast and southwest United States.	Operational/Full-Scale Engineering Development	Raytheon Co.
SEEK IGLOO Replacement of equipment at all thirteen Air Force long-range radar sites in Alaska with solid-state, highly reliable radars that provide range, azimuth, height, and beacon data on all detected targets. Implements a Minimally Attended Radar concept: maintenance by not more than three medium-skill radar technicians and no on-site operators. A major objective is a large-scale reduction in the life-cycle cost of Alaskan radar surveillance systems.	Development	General Electric Co.
Space Defense Operations Center (SPADOC) SPADOC, to be located in the NORAD Cheyenne Mountain Complex, is the central Command Control Communications and Intelligence element of the Space Defense Command and Control System. It will consist of new ADPE, displays, interface equipment, and communications upgrades. It will act as the focal point for higher-echelon command and control and disseminate space-related information to other US commands. SPADOC will collect and disseminate real-time information on space status, warning, and operations direction.	Development	Ford Aerospace
Strategic Air Command Digital Network (SACDIN) A program to modernize Strategic Air Command's Control and Communications Systems from both the operational and maintenance standpoints. SACDIN will provide two-way, direct, secure data communications with enhanced survivability from the National Command Authorities to the nuclear strike forces through the Commander in Chief, SAC. It will replace parts of the SAC Automated Command and Control System.	Development	ITT, Defense Communications Div.
WWMCCS Information System (WIS) This total information system planned for the post-1985 time frame will replace, modernize, and enhance the current WWMCCS Automatic Data Processing. WIS encompasses the information collection, processing, and display system that includes WWMCCS ADP and related software systems, procedures, and supporting telecommunications. The modernization focus is on the backbone of standard WWMCCS ADP that supports command and control functions on Honeywell H6000-based systems.	Acquisition/Development	None
Deputy for Tactical Systems (TC)		
AF Joint Interoperability of Tactical Command and Control Systems (JINTACCS) JINTACCS is a JCS-directed joint program to improve the operational effectiveness of the services' tactical C^2 systems used in support of joint tactical operations through the 1980s. JINTACCS will develop and test an interoperable system architecture and standardize message structure, message language, and operating procedures. The intent of the Air Force program is to support the joint program and to ensure that USAF requirements are reflected in the developed and tested standards.	Development	None
Combat Identification System—Indirect Subsystem A triservice program to develop and deploy a worldwide, NATO-compatible system to provide accurate and timely target identification information to battle commanders and weapons controllers. The system concept includes the development of automated multisource correlation and fusion of information from multiple sources, and the development of electronic support measures (ESM) as an additional source of aircraft identification information. A demonstration of the system concept is planned for CONUS and Europe. Following prototype demonstration, the plan is to develop the Indirect Subsystem related hardware and software for the deployable Tactical Air Control System.	Concept/Development	Watkins-Johnson Co.; Calspan Corp.
Combat Theater Communications Acquisition of tactical digital communications equipment for the multiservice area under the auspices of the DoD Joint Tactical Communications (TRI-TAC) Program. This includes all trunking, access, and switching equipment for mobile and transportable tactical multichannel systems, associated systems control and technical control facilities, local distribution equipment, and voice, record, data, and ancillary terminal and COMSEC devices.	Definition, Acquisition, and Production	Martin Marietta Aerospace; Raytheon Co.; Systems and Applied Sciences; ASEC; RCA

NAME AND MISSION	STATUS	CONTRACTOR
Digital European Backbone Incremental upgrade of portions of the European Defense Communications System (DCS) from a frequency division multiplex (FDM) analog system to a time division multiplex (TDM) digital system with higher reliability components. This will provide a modern wideband, digital, bulk-encrypted capability between Defense Satellite Communications System earth terminals and major commands.	Acquisition and Deployment	TRW Inc.
EIFEL (Follow-on) This new EIFEL effort is a bilateral US-German program that will provide functional commonality for the planning, tasking, and status reporting in support of offensive tactical air operations in the NATO Central Region. ESD will develop automated assists for the wings and squadrons through the use of a development test-bed at Spangdahlem AB, Germany. The local workstations will be interconnected through a local area network. The Germans will develop a set of Host Standard Software that will perform common system functions at the force-management and unit levels.	Definition	None
HAVE CLEAR Develop/acquire for the tactical air forces a high antijam radio system that will meet the voice communications needs in the jamming environments of the mid-1980s and beyond.	Development	Hazeltine Corp.
HAVE QUICK Provides an improved near-term air-air and air-ground-air jam-resistant UHF voice communications capability that will allow TAF mission accomplishment against current and future threats.	Development	Magnavox Government Industrial Electronics Co.
Intelligence Analysis Center (IAC) The IAC will provide automated assistance to the Marine Air/Ground Task Force intelligence organizations to store data, correlate information with a master file, perform analyses on collected information, and prepare and disseminate intelligence reports to appropriate organizations. The IAC segment is to be contained in standard 8' × 8' × 20' mobile shelters capable of worldwide deployment.	Production	ADCOR
Intra-Theater Imagery Transmission System The Intra-Theater Imagery Transmission System will be an interim dissemination system utilizing the Tactical Facsimile equipment being developed under the TRI-TAC Tactical Digital Facsimile Program. This program will give the tactical air forces an interim capability to transmit photographs and other intelligence information rapidly to high-priority users via electronic means.	Development, Production	Litton Industries
Joint Surveillance Target Attack Radar System (Joint STARS) Joint STARS is an Air Force/Army program to develop a common radar that will satisfy the services' needs for a Fixed Target Indicator, Moving Target Indicator, and Synthetic Aperture Radar to detect, track, and direct weapons against stationary and slow-moving ground targets. The system will consist of this radar integrated aboard TR-1, Army OV-1, and Boeing 707 (C-18) aircraft; ground stations; weapon guidance units; and sufficient aircraft to support the RDJTF mission all tied together by a common data link with interfaces into the existing C^3 network.	Development	Hughes Aircraft Co.; Grumman Aerospace; UTC; Norden Systems
Joint Tactical Information Distribution System (JTIDS) A program to develop a high-capacity, reliable, jam-protected, secure, digital information distribution system that will provide a high degree of interoperability among data collection elements and command and control centers within a military theater of operations.	Engineering Development/Production	Hughes Aircraft Co.; Singer/Kearfott; IBM, Federal Systems Div.
Manual Radar Reconnaissance Exploitation System (MARRES) This program is the exploitation element of the AN/UPD-8 Side-Looking Airborne Radar System. The AN/UPD-8 ground system consists of several elements with split management responsibility: antenna control, data link, and correlator/processor (ASD); exploitation equipment and communications (ESD). MARRES uses equipment similar to the Imagery Interpretation System to provide the radar imagery interpreter automated aids in performing target identification and location.	Production	Texas Instruments
Operational Application of Special Intelligence Systems (OASIS) Improvement of tactical command control and communications capabilities through the application and interfacing of appropriate surveillance and special intelligence systems. Emphasis is aimed at improvements to the USAFE Tactical Fusion Center (TFC) in its role in support of Allied Air Forces Central Europe.	Development and Acquisition	Martin Marietta Aerospace
Sentinel Bright Design, develop, and acquire training systems to cover the full range of cryptologic specialties. Included will be a generic Voice Processing Training System and its specific follow-on, and an ELINT Training System, a Maintenance Training Module, a Collection and Processing Training Module, an Analysis and Reporting Training Module, and an Interdisciplinary Training Module. Simulation and computer-aided instruction will be emphasized.	Development and Acquisition	Logicon Inc.
SINCGARS Develop and acquire SINCGARS systems to provide jam-resistant secure voice VHF/FM communications that will interoperate with the US Army-developed equipment.	Development	ITT, Aerospace Optical Div.; Cincinnati Electronics; Rockwell/Collins
Speakeasy Secure Voice Terminal Secure voice terminals for triservice use over normal AUTOVON. These terminals are characterized by good voice quality and can be used in the normal office environment. The terminals will be delivered to AFCC for deployment. The terminals will expand the number of users having access to the existing defense automatic secure voice system and will provide secure voice to selected C^2 and other high-priority triservice agencies.	Production	Harris Corp.
Tactical Air Control System Improvements This program will increase Tactical Air Control System capabilities for combat command and control of tactical aerospace operations. Improvements consist of mobile communications and electronic systems capable of nuclear worldwide deployment that are interoperable with Army, Navy, and Marine Corps tactical data systems. Project includes MCE, ULSA, STEM, CAFMS, Arm Alarm, and Arm Decoy.	Definition, Development, Production	GTE Sylvania; Westinghouse Electronics; Litton Industries
TEREC Remote Terminal (TRT) The TRT provides near-real-time ground processing for timely reporting of radar emitter threats transmitted from RF-4C aircraft equipped with Tactical Electronic Reconnaissance sensors. The TRT will be comprised of off-the-shelf communications and automatic data-processing equipment installed in shipping containers designed for ready transition to system operations.	Production	Texas Instruments
Deputy for Acquisition Logistics and Technical Operations (AL)		
Computer Resource Management Technology Development and application of automated tools and techniques to improve the acquisition of computer resources used in defense systems. Thrust areas include: computer security, automated requirements analysis tools, computer-based training, high-order language support (JOVIAL J-73 and Ada), and software acquisition guidebooks.	Engineering Development	Many

NAME AND MISSION	STATUS	CONTRACTOR
GET PRICE A program to reduce the production cost of Air Force electronic command control and communications systems by encouraging contractor capital investment in modern technology. Increased productivity and improved product quality are key objectives. Contractor direct and indirect manufacturing areas are analyzed; specific, required manufacturing technologies are demonstrated; and capital investment incentives for new technology acquisition are negotiated.	Continuing	Westinghouse
Deputy for Airborne Warning and Control Systems (YW)		
E-3 Airborne Warning and Control System (AWACS) Provides survivable airborne air surveillance capability and command control and communication functions. Its distinguishing technical feature is the capability to detect and track aircraft operating at high and low altitudes over both land and water. Used by Tactical Air Command, with Tinker AFB, Okla., as the main operating base; aircraft may deploy throughout the United States and overseas to provide surveillance, warning, and control in a variety of peacetime and wartime situations.	Acquisition and Operational	Boeing (prime); Westinghouse (radar)
NATO E-3A Acquisition of E-3A Sentry aircraft for the North Atlantic Treaty Organization (NATO) with special modifications to meet NATO requirements.	Acquisition and Operational	Boeing (prime); Westinghouse (radar)
Saudi Arabia E-3A/Tanker Development and acquisition of five modified E-3As and six derivative tankers to fulfill United States government commitment to the Saudi Arabian government.	Development and Acquisition	Boeing (prime); Westinghouse (radar)
Deputy for Development Plans (XR)		
AFCC Base Support Communications Planning Development of a comprehensive support communications plan that describes a broad concept of architecture for base communications through 1990. This plan will address full integration and interoperability of support communications between essential elements. This plan will form the basis for Hq. AFCC decisions to upgrade base communications significantly.	Development	MITRE Corp.
Airborne Communications Restoral Relay (ACRR) The objective of this planning activity is to provide both the strategic and tactical communities a method of restoring satellite communications resulting from direct physical attack, nuclear effects, jamming, or internal failure. The system will also provide the capability to relay UHF and VHF line of sight (LOS) communications in a theater conflict. In this planning activity, suitable airborne platforms and communications packages will be identified and detailed cost estimates will be proposed.	Planning	MITRE Corp.
Air Defense Planning Within the framework of the North American Air Defense Master Plan (ADMP), this effort provides technical support for identifying, analyzing, and recommending cost-effective options for continued development of future air defense systems and subsystems. This includes a current study to define and evaluate alternative approaches for surveillance and communications and command and control capability in the Aleutian Islands, as well as continued support for the Hq. AFSC Atmospheric Defense Vanguard Plan.	Planning	MITRE Corp.
Air Weather Service 2000 A joint ESD/AWS architectural study to define a fifteen-year roadmap for evolution of the Air Weather Service. Air Force weather requirements will be gathered and balanced against current capabilities. New systems/technology/operations concepts will be defined to satisfy any deficiencies.	Planning	MITRE Corp.
Command and Control Concept Evaluation Capability (C^2 CONCAP) C^2 CONCAP is a development planner's tool to assist in structuring viable Air Force C^2 concepts and acquisition strategies. Projected military scenarios, e.g., EOB, friendly force status, threats, can be simulated to define promising C^2 concepts. Critical parts of C^2 systems (functions, information flow, structure, man/machine interface) can be modeled to evaluate sensitivities to such characteristics as target types, weapons, and geography. As specific user-oriented simulation tools are developed, the basic capability expands for future applications. The object is to provide the capability to the development planning community and to assist in defining viable concepts and investment strategies.	Ongoing/Planning	MITRE Corp.
European Theater Air Command and Control Study (ETACCS) ETACCS has three objectives: (1) to analyze NATO proposals for improving the Allied Command Europe ACCS, identify issues raised by these proposals, and aid in establishing a coordinated US position with respect to these proposals; (2) to identify US plans and programs that may affect European theater air command and control capabilities and evaluate these in relation to the Air Defense Planning Group (ADPG) proposals; and (3) to develop US long-range goals, objectives and plans, and plans for improvement in air command and control in the European theater, which will serve as an overall guide for actions to be taken by the US in this area.	Ongoing	MITRE Corp.
Ground Attack Control Center (GACC) Provide an improved Air Force capability to manage near-real-time sensor and attack assets for attacking time-sensitive ground targets. Program will be strongly user-oriented because new operational concepts will drive technical requirements. TAC and TAFIG are actively involved. Program direction expected in FY '83 and funding starting in FY '84. Will be tied to the Modular Control Element (MCE) Program for host hardware.	Ongoing	MITRE Corp.
MAC C^2 Upgrade A comprehensive architecture to enhance the MAC Command and Control System has been developed, including the implementation for the selected upgrade. Perform preacquisition planning for the Information Processing, Improved Data Set, and UHF SATCOM terminal capabilities for MAC C^2. Recommend approaches for implementation, including development and procurement strategy. Demonstrate technical concepts for the development of these systems.	Conceptual/Development	BETAC; MITRE Corp.
Military Satellite Communications (MILSATCOM) Architecture A broad systems-level evaluation of all MILSATCOM systems, including such constellations as MILSTAR, FLTSAT, SCS, and DSCS, emphasizing the terminal segment and associated user requirements compilation and analysis. This in-depth examination analyzes MILSATCOM deficiencies and offers recommendations to assist Air Force managers with both near-term and far-term MILSATCOM decisions. Results of this architectural effort are documented in a MILSATCOM architecture document addressing current, planned, and proposed MILSATCOM system developments.	Ongoing	MITRE Corp.
Multimission UHF SATCOM Terminal (MUST) Concept definition and preacquisition planning for a relatively low-cost UHF satellite communications (SATCOM) terminal to fit the needs of users whose mission does not require more capable and expensive SATCOM service, such as SHF or EHF systems. The principal potential user is Military Airlift Command (MAC). A modular design will permit MAC or other users to select certain optional features based on specific needs.	Development	MITRE Corp.; ASEC

NAME AND MISSION	STATUS	CONTRACTOR
Operational Intelligence Systems Concepts Planning (OPS/INTEL) OPS/INTEL plans for and evaluates concepts of intelligence systems for Air Force mission requirements. Systematically analyzes, assesses, and integrates the roles and requirements of intelligence systems that support military forces' command and control. Analyzes current capabilities and deficiencies, projects requirements and enemy threats, e.g., for tactical theaters—USAFE and PACAF, and RDJTF. Development planning and acquisition activities now being structured include the intelligence portion of the Air Force Recce/Intel Mission Area Analysis, Common Digital Exploitation System (CODES), and the Imagery Architecture Plan (IAP). As appropriate, limited demonstrations are planned and conducted to evaluate or prove concepts. Effort includes architecture analyses, mission area analyses, concept development, and concept exploration with emphasis on an investment strategy for correlation/fusion systems to support force commanders.	Planning	MITRE Corp.
PACAF Command and Control Architecture Development of an architecture for tactical command and control in the Pacific theater. The architecture will include a description of the current concept of operations, existing C^2 systems, and current and programmed capabilities. Capabilities will be assessed and solutions will be proposed to correct deficiencies.	Planning	MITRE Corp.
Space C^3 Intersystem Planning This project investigates C^3 requirements for present and future Air Force missions in space. The primary objective is to ensure a cohesive system for operating in and from space to support the Air Force's expanding roles.	Planning	MITRE Corp.; Aerodyne Research
TRACALS Improvement Program Definition of concepts to support a survivable Traffic Control Landing System for the pre-, trans- and postattack periods. Specifically, mission requirements and related peacetime/wartime threats for theater-deployed TRACALS systems will be established with AFCC; current and planned TRACALS programs deficiencies will be identified. Concepts for a new survivable ATC system, including proposed technical alternatives and long lead time development, will be recommended.	Development	MITRE Corp.
Strategic C^3 Planning This project provides intersystems engineering and analysis support for SAC, MAC, and ADCOM strategic C^3 improvements efforts. Emphasis is to be directed toward timely preattack alerting functions and survivable C^3 capabilities for force recovery and management in trans- and postattack nuclear environments. Relationships and interdependencies between surviving strategic force C^3 capabilities and other civilian/military reconstituted communications will be defined and exploited for mutual advantage. Specific programs under this project are: Survivable Strategic Force Management, Strategic C^3 Planning (Vanguard), SAC Command Post Upgrade, ADCOM RAPIER Interoperability Planning, HERT Interoperability Planning, REPAIRNET Concept Development, and Peacekeeper Sensor Interfaces.	Planning	MITRE Corp.; HTI
Future Tactical Air Control System (TACS) Support of Hq. AFSC in the conceptual design of a distributed, deployable Tactical Air Control System. The objective is to ensure that the future TACS (1990 and beyond) will be successful and survivable. Effort provides for timely and efficient program implementation of advanced C^2 systems called for by Vanguard and the TAFIIS Master Plan. This includes development of system design concepts to counter future threats and to satisfy stated needs. Emphasis on detailed system solutions will ensure identification of critical needs and provide focus and guidance for technology and acquisition projects. After consideration of new designs and evaluation of alternative approaches, it will provide for integration of existing and planned technology into TAF C^2.	Planning	MITRE Corp.
Tactical C^3I Interoperability This effort involves a process that emphasizes user/developer interaction in defining interoperability requirements for systems being developed by ESD. Includes a study of tradeoffs between technical, operational, and procedural requirements and options so that tactical C^3I systems will operate together where required.	Ongoing	MITRE Corp.; Logicon
Tactical Communications Architecture Development of the communications portion of a tactical air forces C^3I architecture. The objectives are to provide a framework for development of tactical C^3I systems and an interoperability baseline to be used in acquisition planning. This process involves documenting requirements, capabilities, and needs, identifying shortfalls, and proposing programs to eliminate those shortfalls.	Planning	MITRE Corp.
Tactical Warning and Attack Assessment Vanguard Analysis This includes the Atmospheric Surveillance and Warning and Ballistic Missile/Surveillance and Warning Vanguard Plans. Analysis will include current capabilities assessments, identifying deficiencies, developing and evaluating a baseline plan, and prioritizing development goals in accordance with current Air Force direction on plan content and format.	Planning	MITRE Corp.
Technology Guidance Planning (Tech Plans) Tech Plans efforts are designed to develop technology investment strategy guidance for Air Force and DoD laboratories, research centers, and contractors who support ESD C^3I systems acquisition. Primary objective is to translate ESD planning activities (Vanguard, Architectures, Mission Area Analyses, SONs, Concepts) into Technology Planning Guidance for the C^3I technology base community. Assists in formulating technology base investment strategy by identifying technology areas that could yield high payoff in the orderly development of future capabilities. In one of these areas, AFSC has been designated the lead Air Force organization in fiber optics development, a technology opportunity. ESD's main task is to generate a fiber optics development investment strategy based on: requirements analysis, technology assessment, deficiency documentation, identification of impacts on current/planned systems, and recommended technology and equipment developments. The ESD/Development Plans Tech Plans role also includes periodic canvassing of ESD mission deputies to generate comprehensive statements of technology need (TN), evaluation of TNs generated, and development of broadbased guidance for the technology base community. Results are published in the annual ESD Technology Planning Guide (TPG).	Planning	MITRE Corp.
USAFE C^3I Planning Support A joint ESD/USAFE initiative to identify and recommend improvements to USAFE command and control systems. The results are documented in Interoperability Requirements Documents (IRDs), which analyze and determine needs, investigate alternatives, and recommend solutions to the functional and system interfaces of facilities/systems with other USAFE and NATO C^2 systems.	Planning	MITRE Corp.
USAFE Command and Control Architecture This project enables the Air Force to design future C^2 systems to support European tactical air operations within a comprehensive framework. Current and planned C^2 systems and capabilities will be examined and analyzed against needs. A set of alternatives will be proposed to correct near-, mid-, and long-term deficiencies.	Planning	MITRE Corp.
USREDCOM Command Center Upgrade Produce a Technical Analysis and Cost Estimate (TA/CE) that analyzes the operational requirements, equipment, facilities, information, and data flows. Provide recommendations and alternative designs with associated costs for USREDCOM/JDA Command Center Upgrade.	Planning	MITRE Corp.

Electronic Combat In Operation

Once the domain of spooks, electronic combat now pervades all aspects of warfare. Tactical Air Command is taking steps to ensure that it also pervades all aspects of training of the tactical air forces.

BY F. CLIFTON BERRY, JR., EDITOR IN CHIEF

For a long time, people in the Air Force gave more lip service than real attention to electronic combat. In effect, that meant that USAF could well have been bested in the first stages of the next conflict because of its inability to fight and win in the electronic arena.

That neglect is a thing of the past, and preparing for electronic combat is now a top priority. This is especially true of the tactical air forces (TAF), where past neglect of the realities of electronic combat has been replaced by full and unrelenting attention to all of its dimensions.

In past issues, AIR FORCE Magazine has covered elements of USAF where significant progress in electronic combat is under way. Electronic Security Command is bringing its special skills and equipment into the worldwide day-to-day operations, training, and planning of the tactical air forces. The Tactical Fighter Weapons Center blends electronic combat into its Red Flag exercises, and, with the Tactical Air Warfare Center, writes considerations of electronic combat into the textbooks of the fighter force.

Now it is time to examine the Tactical Air Warfare Center (TAWC) and its crucial role in making the tactical air forces ready to fight and win in electronic combat.

Electronic Combat

The term "electronic combat" can be thought of as a stool with three legs. The "legs" are electronic warfare (EW), command control and communications countermeasures (C^3CM), and suppression of enemy air defense (SEAD). The intelligence support from all sources, giving information and analysis on threat characteristics, can be seen as the rungs that connect the legs.

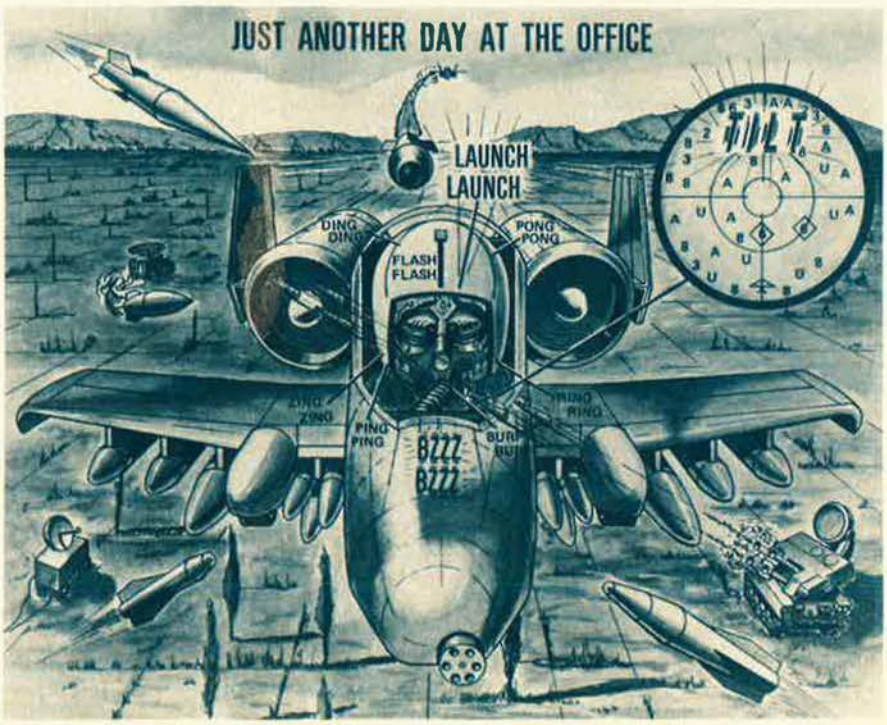
According to Maj. Gen. Thomas S. Swalm, Commander of the Tactical Air Warfare Center, in electronic combat the Air Force's goal is to gain control of the electromagnetic spectrum through effective use of EW, C^3CM, and SEAD disruptive and destructive operations. The C^3CM strategy is to counter the enemy's C^3 and protect our own by operational security, deception, jamming, and destruction across the spectrum of activities.

In SEAD, the strategy is to disrupt or destroy the enemy's ground and air defense capabilities. Tactical Air Command and the Army's Training and Doctrine Command and its Forces Command have now agreed on doctrine and procedures as expressed in the joint manual J-SEAD, completed in 1982. Ideally, General Swalm says, TAWC prefers to develop disruptive and destructive equipment and tactics that will suppress enemy air defenses without always having to engage them directly with fighter-type aircraft.

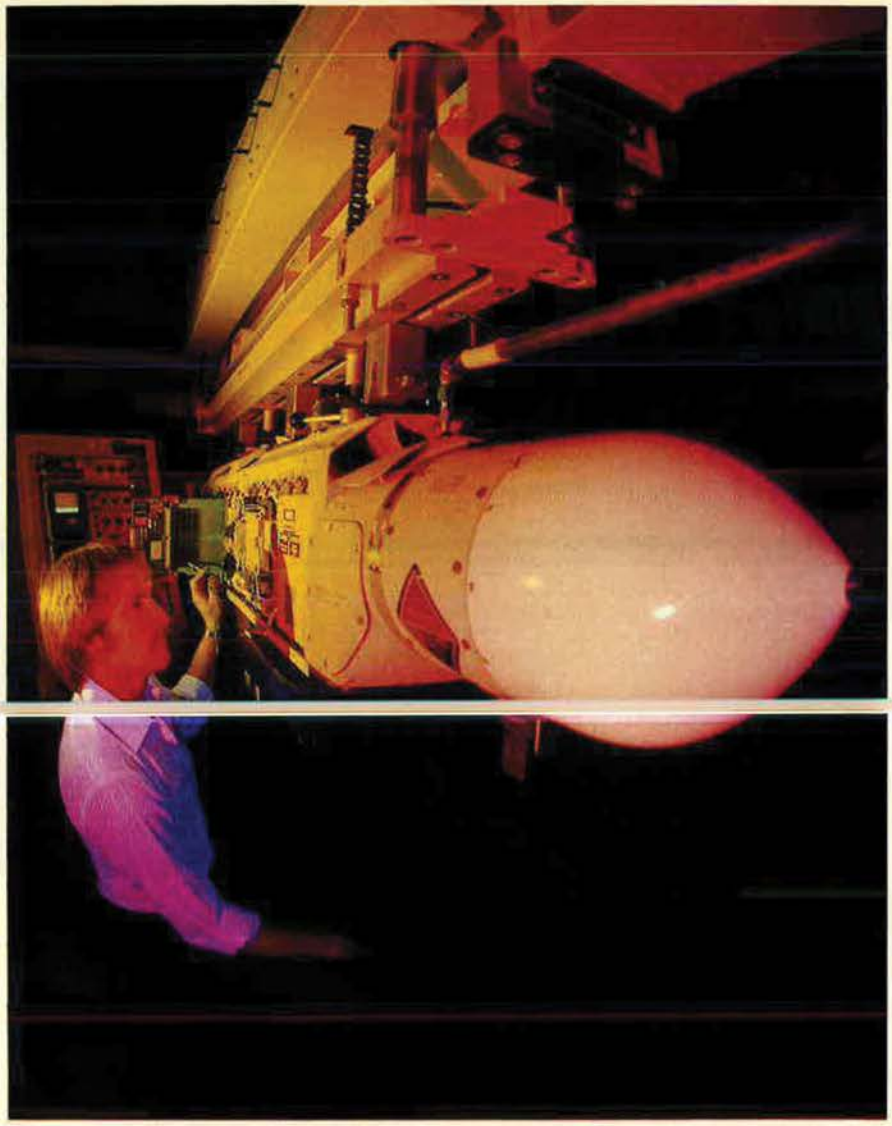
General Swalm says that TAWC, with headquarters at Eglin AFB, Fla., is responsible for "defining and implementing the 'blueprint' for all electronic combat operations, with special emphasis given to effective integrated tactical air employment. From a management framework, the program to accomplish this tasking is called Green Flag."

(Note: Tactical Air Forces refers to the Tactical Air Command, United States Air Forces in Europe, Pacific Air Forces, and Alaskan Air Command. General Swalm notes: "We lead the tactical air forces in focusing on military electronic combat operations worldwide.")

Through its activities, TAWC enhances the combat capabilities of USAF operational wings, including



"Just another day" in electronic combat for this A-10 pilot, beset by missile and gun fire as well as air-to-air missiles and jamming in his headset. With proper equipment, tactics, and training, he'll press through safely.



Special filtered lighting highlights this Westinghouse AN/ALQ-131 electronic countermeasures pod undergoing test. The modular -131 is reprogrammable on the flight line. It's used in F-16 and F-4 fighters.

those of the Air Force Reserve and the Air National Guard. Its involvement extends from the very beginning of the acquisition process from concept through development, test, and evaluation, into production and operation. General Swalm sees TAWC's role as the vital one of ensuring that user requirements are met in the acquisition process.

When the process evolves into production, TAWC ensures then that training, tactics, maintenance, and equipment instructions are up to the standards needed to fight and win the electronic combat battle.

TAWC Activities

TAWC's functions can be grouped into an almost infinite number of combinations. However, the major headings of testing, training, tactics, and evaluation cover the field very well. That word "evaluation" keeps cropping up when one considers TAWC and the more than 200 projects under way at any time. Evaluation is a constant thread woven through all activities, but whatever the scope of evaluation, it is done with the ultimate user in mind. To that end, all of TAWC's project people are experienced practitioners of tactical air warfare in all its dimensions.

Examples of current and continuing TAWC projects that keep the force ready to engage in electronic combat are shown in the gallery of projects in the following pages.

For example, in the continuous Electronic Warfare Evaluation Program (EWEP), the center engages in evaluation of such passive systems as radar warning receivers and such active systems as electronic countermeasures jammers in aircraft of the tactical air forces. Under EWEP, aircraft from operational squadrons, designated by tail number, are flown to Eglin AFB by their own crews. There, TAWC experts from the Deputy Chief of Staff/ Electronic Warfare (Green Flag) evaluate the aircraft electronic systems in flight operations over enemy air defense simulators to ensure that they are up to the standards needed to fight and survive. This continuous process of self-protection systems evaluation provides invaluable experience to crews from the tactical air forces. It also provides a large enough sample of capabilities and limitations to create a high level of assurance that shortcomings are identified early enough to correct them throughout the tactical air forces in time.

Another example of TAWC activities is updating all the radar warning receivers in TAF aircraft. They are the primary electronic combat self-protection equipment in the aircraft. These updates are required because the enemy threat keeps evolving. Intelligence data on the threat provide the technical information needed for each update. TAWC also evaluates the update to determine whether changes in operational tactics or maintenance procedures are required. TAWC is actively involved in monitoring development of self-protection equipment like the new USAF radar warning receiver, the ALR-74.

In jamming systems—that is, those that actively interfere with enemy electronic emissions—TAWC's involvement is across the board. It must continue updating old external pods, such as the ALQ-101 and ALQ-119. The -101 is old, but still around; the -119 is used on most tactical aircraft. The newest operational electronic countermeasures pod is the ALQ-131. Among its advantages over the earlier systems is its ability to be reprogrammed rapidly on the flight line. In addition, it is more reliable and maintainable than its predecessors. (Westinghouse Electric Corp.'s Defense and Electronic Systems Center is producing eleven ALQ-131s per month.)

TAWC also works all of the tacti-

cal internal jamming. These include the ALQ-135 in the F-15 and the ALQ-137 in the F-111F aircraft. Ahead is the more advanced airborne self-protection jammer (ASPJ). Its initial operations, test, and evaluations are expected to begin in late 1984.

USAF's primary tactical jamming aircraft are the EF-111A (radar jammer) and the EC-130H Compass Call system (communications jammer). Their functions are to identify and disrupt enemy systems. The EF-111 carries out its functions in three different ways: from a standoff position, where it functions from a distance; in a close-in jamming position, when the threat allows; and by penetration escort, wherein the EF-111s escort strike aircraft to designated targets while jamming enemy radars along the route. The Compass Call system functions from a standoff jamming orbit only.

TAWC is actively involved with the EC-130H Compass Call aircraft. It was a quick development project for Tactical Air Command to answer the immediate requirement for an effective communications jamming system. In General Swalm's words, Compass Call is a "force subtractor. It subtracts capabilities from the enemy's forces." TAWC continues to realign tactics and procedures for the most effective use of Compass Call.

The experts of TAWC's F-4G Wild Weasel detachment at George AFB, Calif., working with the 37th TFW (equipped with F-4Gs) and the 35th TFW (F-4E), also based at George AFB, are running tests that blend different mixtures of F-4G and F-4E aircraft in electronic combat. This includes development of tactics as well as evaluation of existing hardware, all aimed at winning the electronic battle. Also, TAWC's aircraft and aircrews at the detachment are being used to test the AGM-122 Sidearm missile, a radar-seeking AIM-9 Sidewinder for use as a self-protection, point-and-shoot weapon.

4485th Test Squadron

Much of the flying for operational and tactics test and evaluation is done by TAWC's 4485th Test Squadron, which flies A-10, F-4, RF-4, F-15, and F-16 aircraft. Each fighter aircrew member of the squadron averages 2,000 flying hours of experience.

Among recent tests, the 4485th participated in Trial Mace. Involving nine NATO countries, the test evaluated the usefulness of chaff as a counter to enemy radar. After tests flown in twenty-four different aircraft types, they concluded that chaff is still useful and effective. A follow-on test is evaluating the use of high-intensity flares against infrared-guided surface-to-air missiles.

At the 4485th, Capt. Jake Thorn has spearheaded the use of a small computer for electronic combat training as well as for relieving aircrew members of routine tasks. Using the minicomputer, he and his associates developed software for flight planning, weapons loading, and penetration planning against local threats for fighter and attack aircraft. TAWC also developed a program for the computer to be used as a trainer for radar warning receivers in any unit.

The result is a training device that shows aircrew members the types of indications they get on a radar warning receiver (RWR) in a hostile environment. This is done in the squadron without having to fly the aircraft or turn on emitters. It heightens the awareness of the aircrew on RWR indications and makes them sharper performers when they go into the air for actual missions. As a result of Captain Thorn's efforts, Gen. W. L. Creech, TAC Commander, directed a competition for selection of a small desktop computer for tactical air force units. That was won by the Cromemco Co. Captain Thorn will be ramrodding the system's implementation within TAC.

Training

The largest electronic combat exercise conducted by the tactical air forces is held on the electronic combat ranges of the Tactical Fighter Weapons Center, Nellis AFB, Nev. Called Green Flag, the third annual exercise was completed in mid-April. The first Green Flag in 1981 showed the tactical air forces just how far they had to go in developing realistic electronic combat capabilities.

Particularly revealing was the high percentage of sorties (approaching seventy percent) that had serious and adverse impacts on mis-

The EC-130H Compass Call aircraft is the heavyweight of the tactical jamming arena. Developed as a quick reaction project, it is constantly being improved, both in hardware and tactics.

sion effectiveness as a result of enemy jamming of aircrew voice communications. As a corollary, battle commanders found that aircrews equipped with the Have Quick secure voice system were able to press on and complete their missions. The next Green Flag in 1982 reinforced the need for a secure voice system.

Have Quick is a modification that introduces a frequency-hopping characteristic into today's UHF radios. Initially, the Air Force planned to buy 300 of them. That expanded rapidly to 600, then 900. The buy is now at 2,431, and expanding to 5,600 for USAF alone.

While introducing Have Quick as rapidly as possible, the tactical air forces continue to work on accomplishing war missions without it. That includes such passive measures as operational security, use of op codes, and preplanned frequency changes during a mission.

Green Flag exercises to date have heightened electronic combat awareness and proficiency of about 3,600 aircrews and 9,000 maintenance personnel in electronic combat. Some of the objectives in the 1983 Green Flag were validating the adverse impacts of communications jamming (determined in previous Green Flag exercises), reprogramming of electronic countermeasures and radar warning receivers against new threats, and assessing the effects of the EC-130H Compass Call aircraft on the enemy's air defense command and control system. A parenthetical note here: The exercise at Nellis AFB is the largest manifestation of TAC's Green Flag program. Green Flag continues throughout the year, pervading all aspects of TAWC's work with the tactical air forces' electronic combat assets.

Blue Flag is a major realistic exercise conducted four times annually by TAWC's 4441st Tactical Training Group. In Blue Flag, the 4441st develops and conducts training for tactical combat and support force battle managers using present-day realistic situations. As such, it provides a useful training situation and vehicle for operational tests and demonstrations of concepts, procedures, and equipment.

For example, Blue Flag 83-2, held at the end of March, focused on a NATO situation. The scenario zoomed in on AFNORTH, with emphasis on simulated combat operations in the Air Baltic Approaches (AIRBALTAP). It brought together actual incumbents of top command and staff posts in AIRBALTAP, who observed the actions of players duplicating their jobs as they functioned in real-world situations using current orders of battle and staff procedures.

Other Blue Flag exercises concentrate on similar "real world" scenarios worldwide. For instance, Blue Flag 83-3 late this month will follow a scenario involving the 2d Allied Tactical Air Force and the Northern Army Group (2ATAF/NORTHAG). The players will come from TAC's Twelfth Air Force and the Army's Forces Command, with observers on hand from 2ATAF and NORTHAG. In late September, Blue Flag 83-4 will work a Rapid Deployment Force scenario. Its players will be drawn from Ninth Air Force and the Army's Training and Doctrine Command.

The Air Ground Operations School is USAF-chartered, with a USAF colonel as commandant, and USAF and US Army deputy commandants. Its curriculum includes courses conducted by a joint faculty, with instructors from the Air Force, Army, and Navy. The curriculum is reviewed annually, and the review includes joint service coordination to reflect the constantly changing needs of the services. All of the AGOS courses, which graduate more than 1,800 students annually, now pay keen attention to electronic combat. The Senior Tactical Battle Managers course, whose students are general and flag officers or senior colonels/Navy captains, concentrates entirely on readying them for directing the electronic war in the real world.

With only 1,300 assigned members, the TAWC is having a global impact in preparing the Air Force for electronic combat warfighting. Its influence is felt across the board in every tactical air role and with every tactical warfighting system. Its day-to-day actions ensure that USAF will win the tactical electronic war. ■

What's Happening in Electronic Combat at TAWC

The EF-111A is one of USAF's primary tactical jamming aircraft. Forty-two are being produced by Grumman Aerospace.

Evaluation

Electronic Warfare Evaluation Program (EWEP). The EWEP evaluates operational radar warning receiver (RWR) and electronic countermeasures (ECM) systems and Mode 4 identification, friend or foe (IFF) systems, and determines mission capabilities of these systems in a simulated combat environment. It has been going on since 1975.

Computer Modeling Programs. Green Flag is developing sophisticated computer models of a potential electronic combat (EC) battlefield. Also being developed are in-depth models of our tactical aircraft and their EC capabilities. These models together will provide valuable information to the OT&E and TD&E planner as he identifies critical areas for in-flight evaluation. The models will eventually give the tactical planner a medium in which to maximize battle management and employment of EC systems in composite force employment operations.

ALQ-119A (Seek Ice). Seek Ice is a major modification to the ALQ-119 jamming pod. In light of the new surface-to-air and airborne threats that the Soviets have developed and will be able to develop, the Raytheon Co. was given a contract to replace the majority of the ALQ-119's internal circuitry and incorporate current Rotman lens array technology. The pod modification will provide improved programmability, reliability, and maintainability. The contract was let by Warner Robins Air Logistics Center, and TAWC monitors the program to ensure that the TAF get a usable end product. TAWC works closely with Raytheon, Warner Robins ALC, and Hq. TAC.

ALQ-119 jamming pod is being modified to meet changing threats.

AGM-45A Shrike is launched from F-4G Wild Weasels against enemy radars.

Trial Mace. Trial Mace is a multinational NATO evaluation completed in 1982 in Europe. Its purpose was to optimize chaff effectiveness and tactics against air defense radars.

Trial Embow. Trial Embow is a multinational NATO evaluation being conducted in Europe in 1983. Its purpose is to optimize flare capability and tactics against infrared-guided air defense systems.

F-4G Test Integration Plan (TIP). Integrates all F-4G/APR-38 test programs requiring the use of USAF TAWC Detachment 5 test-configured F-4G aircraft. The TIP forecasts test and evaluation requirements, integrates test schedules, and defines command responsibilities for the performance of F-4G testing. Future tests include the FOT&E of AGM-88 HARM, DT&E/IOT&E of the APR-38 performance update program, and Q/QOT&E of annual OFP updates.

AGM-45 Shrike Gravity Bias Modification. This program will result in improved capabilities of the Shrike antiradiation missile in a low-altitude environment. Test firings of modified missiles on USAF TAWC F-4G aircraft verified computer simulations, which led to the decision to modify missiles and the APR-38/Shrike interface.

F-15 Tactical Electronic Warfare System (TEWS). This test includes updates to the TEWS in all of its system components. The most recent flight test (IOT&E) was an update to the ALR-56A and was a major improvement to the F-15 radar warning receiver. The ALQ-135 is the F-15's self-protection jammer, and it also will be modified to cope with the evolving threat. IOT&E flight testing is also ongoing on the F-15's ALE-45 chaff/flare system.

ALE-40 Dual Chaff Cartridge. The new dual chaff (RR-180) cartridge and dual chaff sequencer switch will enable TAF aircrews to double the chaff load carried in their ALE-40 expendables countermeasures dispensers.

AGM-65D IR Maverick IOT&E. The infrared (IR) Maverick was developed to provide a twenty-four-hour, low-light-level/adverse weather precision ground attack capability for application in the close-air-support and defense-suppression roles. The purpose of this IOT&E is to provide an estimate of the operational suitability and effectiveness of the AGM-65D prior to the first major production decision.

F-15 TEWS Intermediate Test Equipment (TITE). This test is on the TEWS Intermediate Test Equipment (TITE). The TITE is undergoing major improvements for maintenance support of the F-15 TEWS. The test is an FOT&E ongoing at TAWC and involves improvements to computer-controlled automatic test used at the intermediate level for alignment, test, and fault isolation of LRUs associated with the F-15 TEWS. This TITE is a critical piece of support equipment. It allows the intermediate-level blue-suit maintenance technician to perform actions necessary to return an LRU to operational status. It provides for comprehensive automatic test of LRUs that do not pass flight-line self-test or that have critical failures.

EF-111A Employment Development. The successful completion of the Phase I and II FOT&E has provided Tactical Air Command (TAC) with a data base for follow-on tactics development and evaluation (TD&E) radar-jamming projects. Review of previous and ongoing test results have enabled identification of areas that require additional testing and tactical assessment of aircraft capabilities for operational application and system enhancements.

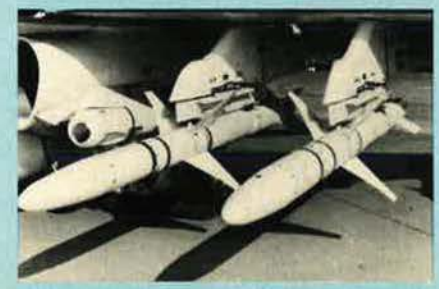
AN/ALR-69 Radar Warning Receiver (RWR). The ALR-69 RWR, installed on A-10, F-16, AC-130, and HH-53 aircraft, identifies enemy air defense radars and provides audio and visual cues to the aircrew. USAF TAWC is ensuring that the software in the system reflects the latest threat data by modifying the decision logic as new intelligence is received. Before the new software is fielded, USAF TAWC conducts operational flight tests to evaluate the new operational performance.

AN/ALQ-131 Advanced Tactical Electronic Countermeasures Pod. The ALQ-131 ECM pod is a self-protection jammer that can be carried on all tactical fighter aircraft. As a computer-controlled reprogrammable system, it can be reprogrammed rapidly to respond to mission requirements caused by threat changes. Currently the system is undergoing technique development, refinement, and follow-on testing to augment and enhance its jamming capabilities.

A-10 Electronic Warfare Suite. The A-10 EW Suite (ALR-69, ALE-40, ALQ-119, and ALQ-131) is being flown by the TAWC on combat profiles with combat loads to determine the combined effectiveness of each self-protection system to warn aircrews collectively of threat presence and to defeat an array of ground-based air defense radar-controlled systems during A-10 missions.

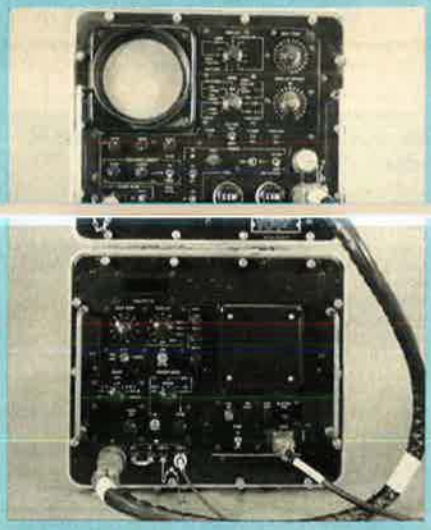
ALE-38 Evaluation. The ALE-38 bulk chaff dispenser was flown in Green Flag 83 to determine utility against modern land-based air defense environments.

AGM-65D IR Maverick extends ground-attack capabilities into low light and adverse weather.



AGM-88 High-Speed Anti-Radiation Missile will enhance "Wild Weasel" lethality.

The AN/APM-427 Improved Radar Simulator can be used on the flight line.



Follow-on test and evaluation of AN/USM-430 will result in improvements to the fielded system.

AGM-88 High-Speed Anti-Radiation Missile (HARM). A joint Navy/Air Force program to develop a defense-suppression weapon. Employment is planned for Air Force F-4G Wild Weasels and Navy A-7, A-6, and F/A-18 aircraft. System has completed IOT&E, with FOT&E planned for FY '84.

AN/USM-430 Electronics Test Set Follow-on Operational Test and Evaluation (FOT&E). The AN/USM-430, currently in the Air Force inventory, is for use at the organizational and intermediate maintenance levels to determine voltage standing wave ratio and insertion loss in both waveguide and coaxial transmission line components as installed in prime Air Force weapon systems. USAF TAWC will perform an FOT&E to evaluate the system's operational effectiveness/suitability. The results of this test will be used to recommend improvements to the AN/USM-430.

AN/APM-427 Improved Radar Simulator (IRS). The program will provide the Air Force with an improved portable system to perform testing and dynamic simulation of various aircraft electronic warfare receiver systems. USAF TAWC will evaluate the system's operational effectiveness/suitability through follow-on operational test and evaluation. The results of this evaluation will be used to recommend corrections to production AN/APM-427 systems.

AN/USM-464 Countermeasures Test Set. This test set is designed to provide flight-line capabilities for testing EW equipment. It provides the capability to test EW jammers, receivers, and power-managed systems. RF and digital stimuli are generated by the USM-464, and the responses of the system under test are processed, measured, and analyzed to determine if they meet operational performance requirements. USAF TAWC will perform a test of the first "production phase" unit this summer.

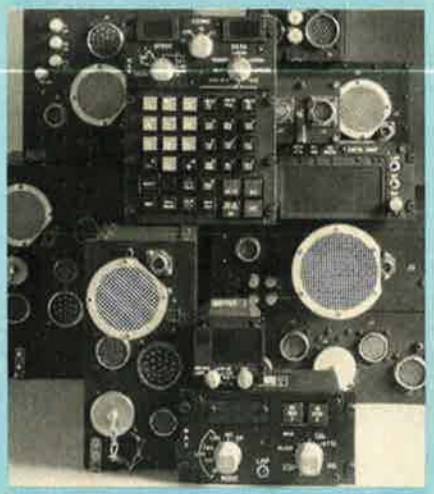
AN/ALQ-131 Receiver/Processor (R/P) ECM Pod. The R/P is an update to the basic AN/ALQ-131 ECM pod. The R/P adds a power-managed capability that increases jamming effectiveness and reduces crew workload. It is rapidly approaching the initial operational testing and evaluation (IOT&E) phase.

APR-38 Performance Update Program (PUP). The PUP modification is updating the APR-38 Radar Attack and Warning System to meet future operational [illegible] engineering development. USAF TAWC is supporting the development and conduct of the combined (ASD/AFTEC) DT&E/IOT&E testing of PUP hardware and software.

AGM-122 Sidearm. Sidearm is a joint Navy/Air Force program to develop a short-range antiradiation missile variant of a modified AIM-9 seeker mated to an AIM-9L Sidewinder missile body. Employment is planned for Marine AH-1 helicopters and for USAF F-4G Wild Weasels.

APR-38 Operational Flight Program (OFP) Update Program. The APR-38 OFP is the computer software contained within the Homing and Warning Computer (HAWC), which controls the operation of the APR-38 system. The OFP is updated on an annual or emergency basis to respond to new operational requirements and threat changes. USAF TAWC QOT&E testing of each OFP is accomplished to ensure that operational requirements are satisfied prior to releasing the OFP to the user.

ARN-101 QT&E/QOT&E. A Class IV modification is being implemented to replace the current LN-12 inertial navigation system (INS) with the ARN-101 in the F-4G Wild Weasel. The purpose of this combined test (conducted by Ogden ALC and USAF TAWC) is to identify and evaluate any adverse impacts on operational effectiveness that may result from the installation of the ARN-101 in the F-4G.



Together, the components of the ARN-101 add new "brains" to tactical aircraft.

Training

Tactical Fighter Electronic Combat Instructor Course (TFECIC). TFECIC trains highly qualified pilots, electronic warfare officers (EWO), and weapon systems officers (WSO) to instruct at the tactical fighter squadron level on principles and equipment of electronic combat (EC). The TFECIC prepares the student to act as the focal point on all EC-related subjects and to instruct unit aircrews in the employment of EC systems. This course is directed primarily at the single-seat pilot as the TAF draw down its dual-seat fighter and personnel resources. Formal courses are scheduled in March, May, August, and October.

Wing Electronic Combat Managers Course (WECMC). WECMC trains wing electronic combat officers (ECO)/electronic combat pilots (ECP) to manage a wing's EC program. Prepares a student to act as the wing focal point for EC-related subjects and to provide guidance to all operations and maintenance levels of EC activities. First class is scheduled for September 1983.

Electronic Combat Training Seminar (ECTS). The ECTS is a five-day course held semiannually to provide electronic combat officers (ECO), electronic combat pilots (ECP), weapons and tactics officers, and intelligence personnel with updated information they can use in unit EC programs. Specific areas covered include the changing threat environment, tactics, EC training, optimum employment of unit EC equipment, and new EC assets and their employment.

Electronic Combat Maintenance Training (ECMT) Seminar. The ECMT Seminar is a five-day briefing and seminar held annually to provide mid-level maintenance technicians with information they can use in their daily work, pass on to fellow maintenance technicians, and use in OJT programs for recent technical school graduates. Specific areas covered include the current threat, other Air Force agencies' interaction with wing maintenance, specialized EC equipment, and peculiar problems/cures. It provides a forum for cross-talk between the operational units' EC equipment technicians and USAF TAWC technicians/engineers.

Electronic Combat Training Exercises. Under a dual management concept, USAF TAWC (Green Flag) and USAF TFWC (Red Flag) team up to co-manage large-scale, electronic combat training exercises on the Nellis AFB, Nev., electronic combat ranges. These six-week-long exercises provide TAF aircrews the means to increase awareness and proficiency in integrated application of all types of EC assets. The three Green Flag exercises have provided invaluable tactical training to more than 3,600 aircrews and 9,000 maintenance personnel. Approximately 3,500 sorties are flown during Green Flag exercises in realistic threat and radio electronic combat threat environments.

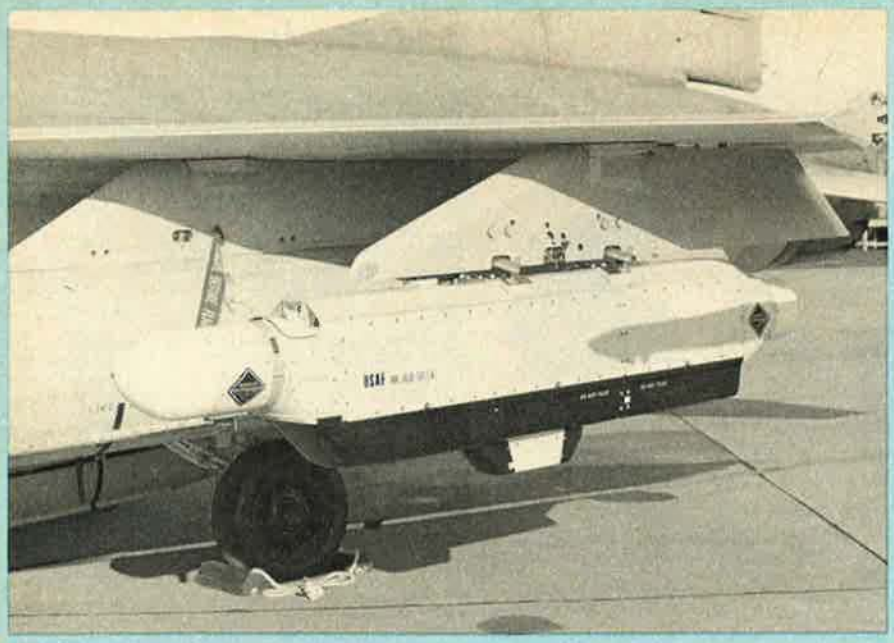
Tactics Development and Evaluation

EF-111 Tactics Development and Evaluation (TD&E). This TD&E investigates pertinent employment concepts of the EF-111A Tactical Jamming System (TJS). The project is organized to develop and evaluate the employment tactics in the EF-111's three employment roles: (1) standoff jamming (SOJ); (2) close-in jamming (CIJ); and (3) penetration/escort. Five areas are being evaluated: mission planning, mission geometry, self-protection, jamming strategy, and command control and communications (C^3). Results will be used to determine optimum employment tactics.

F-4G/F-4E Mixed Force TD&E. The objective of this TD&E is to determine best use of the F-4G Wild Weasel aircraft when teaming it with F-4Es. F-4Es are the weapons deliverers for targets found by the more specialized F-4G threat-location systems.

Special

AN/APR-38 Radar Attack and Warning System (RAWS). The RAWS handbook is designed to provide basic information to aircrews and staff officers on the APR-38 RAWS and its capabilities and limitations. The handbook is under revision to provide descriptive information on the latest operational flight program.



The reprogrammable AN/ALQ-131 jamming pod can be carried on all tactical aircraft.

Memory Loader/Verifier is described below.

ALQ-119-15-17 Electronic Countermeasures System. The ALQ-119-15-17 is an operational tactical electronic countermeasures system deployed worldwide. The ALQ-119 is employed by F-4, A-7, A-10, F-111, and F-16 tactical aircraft. Supported by the ALM-126C Semiautomatic Support Equipment (SASE), the ALQ-119 system is the mainstay of the tactical air forces' electronic countermeasures system. TAWC is responsible for the preparation, maintenance, and distribution of mission data and operator handbooks. TAWC supports visits to user units to identify and correct deficiencies in the ALQ-119 system. In support of the ALQ-119 system, TAWC works closely with Warner Robins ALC and Hq. TAC.

ALQ-131 Electronic Countermeasures System. The ALQ-131 is an operational tactical electronic countermeasures system employed by TAC and USAFE. The ALQ-131 represents a significant technological advancement that incorporates modular instructions and onboard computer control of self-test and systems operations. Advanced concepts in automated support equipment have been implemented that provide for conversational computer-aided maintenance and programming. In addition, by use of a portable memory loader/verifier (MLV), the ALQ-131 is flight-line programmable. USAF TAWC is responsible for mission data and handbook preparation, maintenance, and dissemination.

Electronic Counter-Countermeasures (ECCM) Program. The ECCM program develops methods, tactics, and procedures to allow the sustained use of the electromagnetic spectrum despite the enemy's use of electronic warfare. USAF TAWC is the TAF manager for ECCM and is responsible for identifying required equipment modifications and training programs for aircrews. F-15, F-16, AIM-7F/M, AMRAAM, Cara, and GBU-15 are but a few of the systems being reviewed for ECCM capabilities in formal TD&Es; exercises such as Green Flag and Seabat provide real-time ECCM training during inflight activities. An annual "State of ECCM Health" will be published to summarize the current capabilities and deficiencies of tactical air force systems.

Radar Warning Receiver Software Updates. The Tactical Air Warfare Center is the focal point for reprogramming tactical radar warning receivers for the tactical air forces, Military Airlift Command, Alaskan Air Command, Air Force Reserve, and the National Guard Bureau. The Center continually monitors operational and intelligence inputs and determines if EW RWR deficiencies exist or if enhancements are warranted.

Area Reprogramming Capabilities System. The TAWC provides technical monitoring and assistance to the development agencies to ensure that ARC meets TAF requirements. The ARC will provide a capability for the user commands in the CONUS and in worldwide theaters to respond rapidly to changes in their EW threats through mission data changes in field reprogrammable EW system software.

RWR and EW System Developments. The TAWC monitors and provides technical assistance to development agencies involved in the acquisition of future tactical warning systems. Following system development, TAWC ensures that systems like the ALR-74 and Integrated New Electronic Warfare System meet future tactical aircraft requirements.

EF-111A Upgrade Capabilities. Developmental studies are under way at the request of AFSC to evaluate the upgrade capabilities for the EF-111A to counter the 1990s' threat. These improvements include, but are not limited to, increased ERP, state-of-the-art hardware, and improved power management.

AN/ALQ-94/137 Upgrade. This is a Quick Reaction Capability (QRC) program that will upgrade electronic warfare self-protection system capabilities for the F-111 and FB-111 aircraft against the newer radar threats.

F-4G Ground Playback Station (GPS). The GPS was designed to provide reconstruction of the F-4G mission, battle-damage assessment, and aircrew training. The system uses APR-38 components and interfaces with the CONRAC aircraft mission recorder. Delivery to operational units is scheduled through FY '83.

Electronic Warfare Portable Automatic Test Equipment Calibrator (EW PATEC). A portable system containing calibration standards that will be used to verify the calibration of EW Automatic Test Equipment. The concept is to have one configuration of EW PATEC to be used on as many EW Automatic Test Equipment systems as possible to avoid future proliferation of PATEC standards. USAF TAWC is monitoring the development and providing inputs to Hq. TAC to support management decisions.

AF Common/Standard Memory Loader/Verifier (MLV). The MLV is a portable, self-contained computer system that will provide the capability to load and verify the core memory of embedded avionics digital computers on the flight line or in the shop environment. USAF TAWC has been asked to monitor the program and provide Hq. TAC with status/progress information to support management decisions.

AN/ALQ-165 Airborne Self-Protection Jammer (ASPJ). The ASPJ is scheduled to be the new self-protection jamming system for the F-16 tactical fighter starting in FY '85. It is an internal system that will provide optimum electronic countermeasures (ECM) techniques against threat air defense radars. USAF TAWC is currently providing engineering and flight-test expertise to the development test and evaluation community to ensure the ASPJ meets the requirements of the tactical air forces.

EC-130 Compass Call. Compass Call is the nickname for a modified C-130H aircraft with special electronic countermeasure systems that intercept and jam enemy command control and communications (C^3) elements. The combat mission is to reduce an enemy's capability to wage air warfare by confusing its defenses and disrupting its C^3. TAWC is responsible for developing concepts and strategies that concentrate Compass Call's communications jamming capabilities against the enemy's most critical and vulnerable C^3 links. The strategies include the total integration of all tactical air force electronic combat capabilities. In addition, the center is responsible for conducting numerous operational tests and evaluations of both the aircraft systems as well as such ground support systems as the mission simulator/trainer and the mission-planning facility. ■

EC-130H Compass Call aircraft confuses and disrupts enemy communications.

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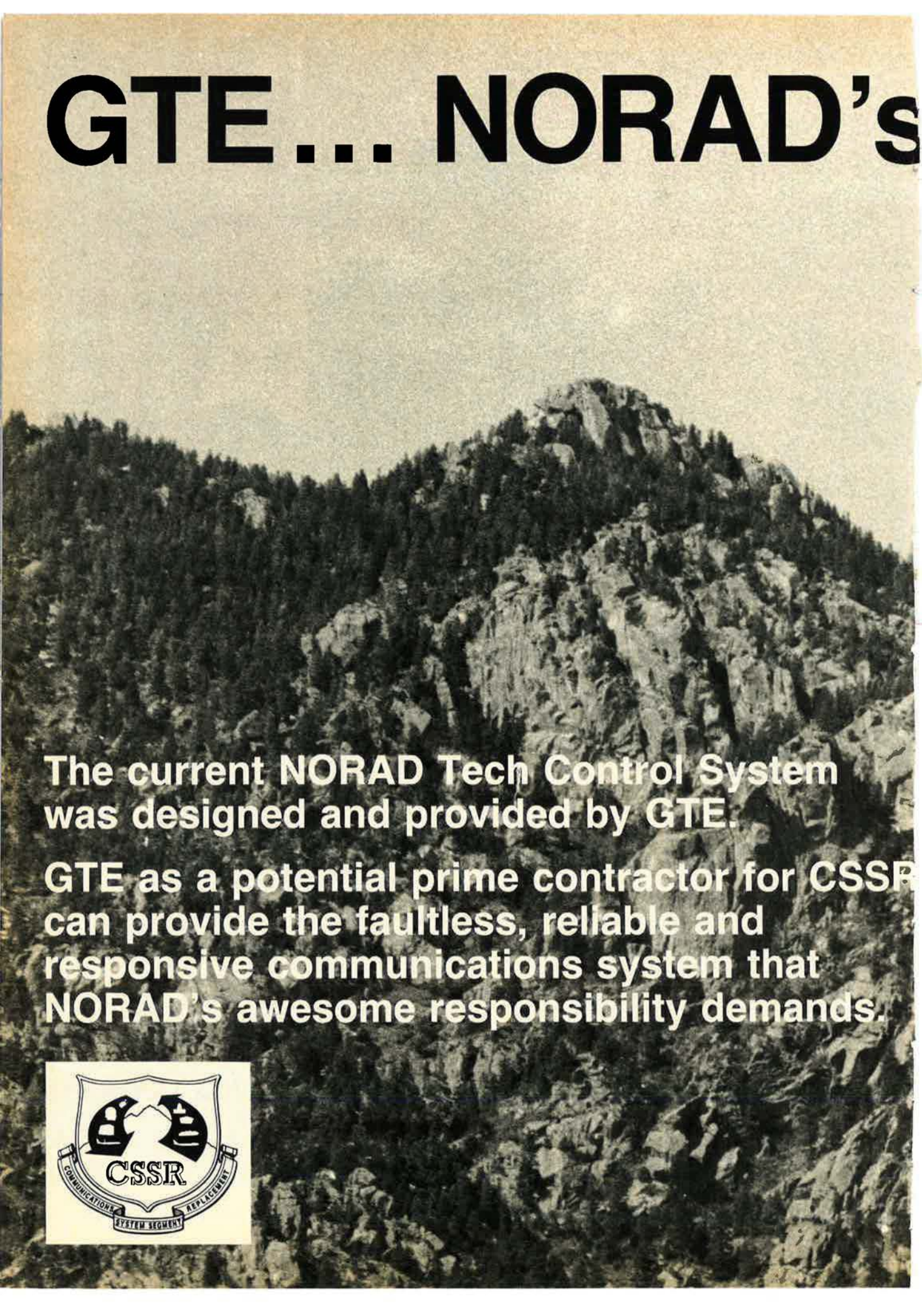

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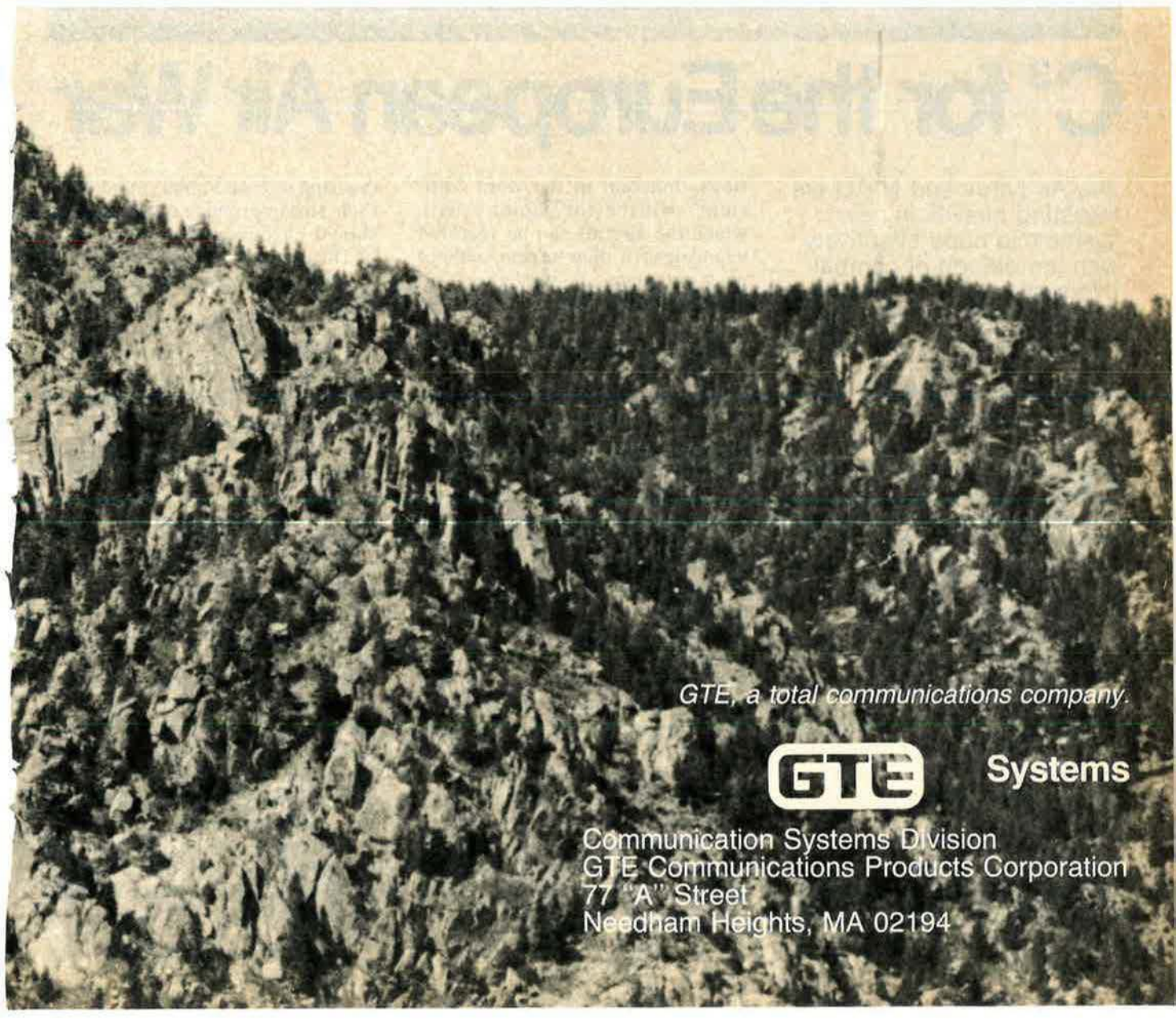

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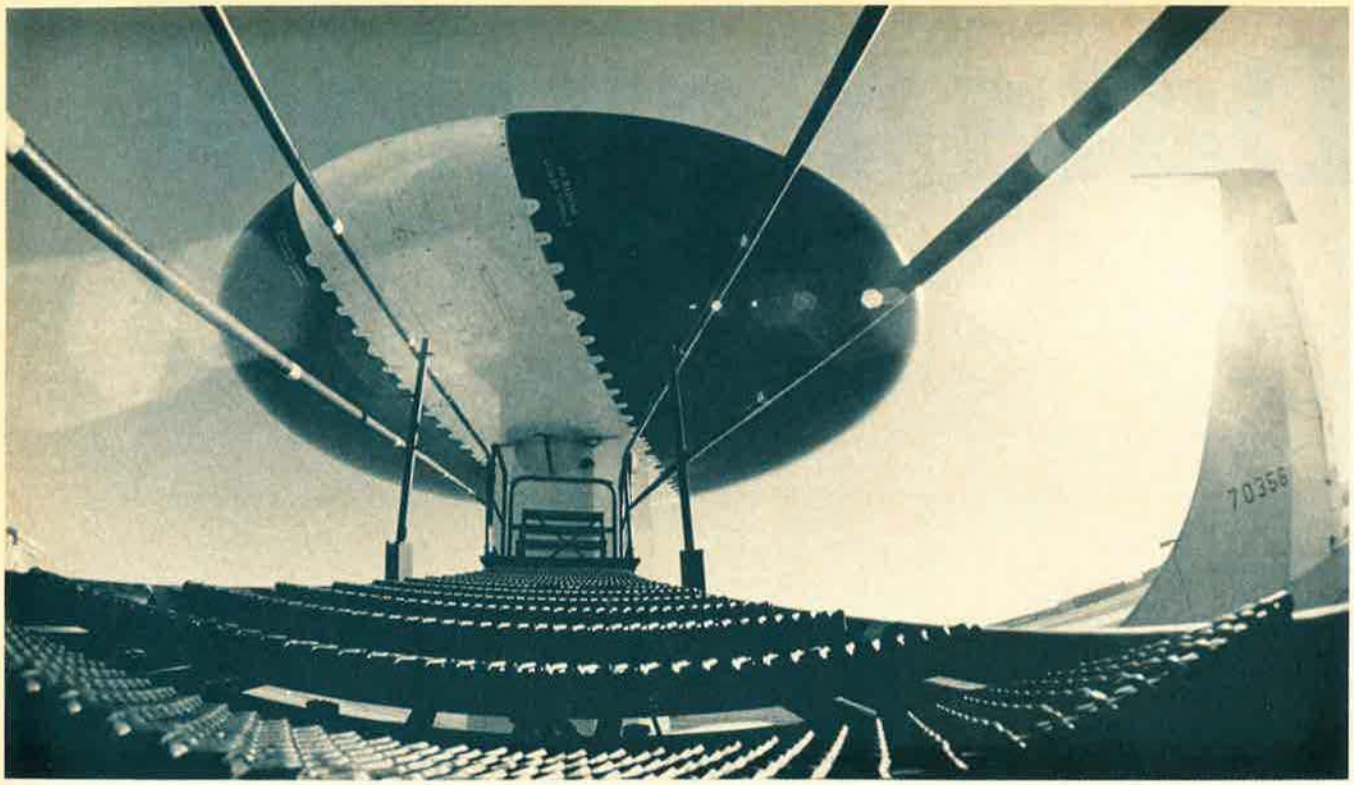

C³ for the European Air War

The Air Force and NATO are investing heavily in new systems to cope effectively with the deluge of combat information expected during a conflict with the Warsaw Pact.

BY WILLIAM P. SCHLITZ
SENIOR EDITOR

ONE of the most perplexing problems sure to confront USAFE and its NATO allies on a tactical battlefield in Europe would be the assimilation and use of vast amounts of information that a modern war would generate.

Sensors—airborne, ground-based, and orbital—are capable of collecting a mind-boggling volume of enemy threat and target data in real time. But the ability to process, organize, interpret, and exploit this data has not kept pace. Under current conditions, much of it would remain unutilized.

In terms of NATO airpower, the best line will be the efficient use of a considerable number of tactical aircraft tailored to a variety of missions. Inherent in the word "efficient" will be the rapidity with which the aircraft can be vectored to and destroy their targets, without mass confusion and warfighting capability deteriorating into a series of uncontrolled skirmishes.

In this regard, the speed with which combat information can be processed and used will be of the essence. Information derived on Europe's tactical battlefields is certain to be highly perishable. Given, for example, the finite number of air-superiority sorties possible, the ideal objective would be to vector friendly fighters directly to bogies rather than to have them expend valuable time in combat air patrols searching for the enemy.

While not solving the battle data problem by a long shot, several new systems currently coming to the fore in Europe point to real progress.

These systems share a number of common aspects besides their obvious enhancement of the vital area of command control and communications. For example, all are force multipliers; all are in some sense multinational; all are aimed at increasing interoperability; and, with their strong promise of success, all should encourage the undertaking of future NATO jointly funded, managed, and even manned programs.

The new systems include:

- The NATO Airborne Early Warning and Control program.
- The Joint Tactical Information Distribution System (JTIDS).
- The EIFEL automated tactical command control and information system.

NATO E-3A AWACS

At least a dozen languages are spoken at the NATO air base at Geilenkirchen in northern Germany adjacent to the Dutch and Belgian borders.

But the base is no Tower of Babel where a confusion of tongues is leading to cross-purposes. On the contrary, the various nationalities have been assembled at Geilenkirchen to speak in one voice in pursuit of a common mission.

That mission is the operation and support of the E-3A Component of the NATO Airborne Early Warning Force (NAEWF).

LEFT: Symbolic of NATO and USAFE's efforts to revolutionize C³ is the huge rotodome aboard the E-3A early warning aircraft.

"The E-3A Component is the largest single, commonly funded effort ever undertaken by the Alliance and is a landmark of international cooperation in the shared planning, acquisition, ownership, and operation of a major weapon system," commented USAF Maj. Gen. Leighton R. Palmerton, NAEWF Commander, to AIR FORCE Magazine.

General Palmerton is stationed in Mons, Belgium, at Supreme Headquarters Allied Powers Europe. There, he and his staff act as liaison with NAEWF's top three "customers": Supreme Allied Commander Europe, executive agent for the NAEWF program; Supreme Allied Commander Atlantic (SACLANT); and Allied Commander in Chief Channel (CINCCHAN).

Geilenkirchen has been selected as the Main Operating Base of the E-3A Component, and six of the aircraft—all delivered ahead of or on schedule—are already operating from there. By 1985, NATO hopes to have eighteen E-3As in Europe, with twelve at Geilenkirchen and the remainder deployed to Forward Operating Bases at Preveza, Greece; Trapani, Italy; Konya, Turkey; and a Forward Operating Location at Oerland, Norway.

The other NAEWF Component is to consist of eleven Nimrod AEW Mk 3 aircraft financed, built, and flown by the UK. *(For more on Nimrod, see story beginning on p. 72.)*

According to officials, the maritime and aerial surveillance capabilities of the Nimrod's new radar will make it compatible with the E-3A Component aircraft. This would also be true of any E-3 Sentry aircraft deployed to Europe from CONUS to supplement the NATO NAEWF in time of crisis.

USAFE and NATO have a lot of chips riding on the E-3A AWACS program. While only in an embryonic stage, the potential is enormous.

Consider the early warning role. Three E-3As flying overlapping orbits in Central Europe can provide high- and low-altitude surveillance from the Mediterranean to the North Sea. Operating normally at an altitude of about 30,000 feet and remaining 100 nm within NATO borders, the aircraft can provide coverage of all low-level attack corridors.

But as great as this capability for early warning may be, it is but a basic element in the E-3A's potential bag of tricks. In fact, it might be just a slight exaggeration to suggest that NATO's use of the E-3A force might be limited only by the imagination.

To borrow a thought from another era: If you're not part of the solution, you're part of the problem. However, it's not as easy as that. The paradox is this: while NATO AWACS will certainly add to the C³ complexity by generating targeting and other data, NATO AWACS in its ultimate configuration should be a major factor in providing tactical commanders unprecedented battle management capability.

For its part, the airborne early warning concept has already been proven in combat. During the air war above Lebanon, the E-2C Hawkeye tipped the scale in favor of the Israeli Air Force. Its airborne radar was used to vector F-15s and Kfirs against Syrian MiGs.

While other mission potentialities await a proving-out process, NATO planners currently emphasize the AWACS defensive role. But AWACS has potential for much more than providing warning time of impending attack. AWACS could be an excellent means for command control of air defense, with target data being passed in real time to fire units. With increased battle management, better exploitation of available firepower should follow.

Versatile Mission Profile

The key to the early warning role of NATO AWACS is that they have the drop on low-flying intruders that ground-based radars can't see. From well within NATO territory, they can immediately detect and track bandits taking off from Warsaw Pact airfields. The E-3As have the ability to vector ground-hugging friendlies up against high-flying bogies.

NATO and Standardization

Reflecting concern at the highest levels—and as required by law—Secretary of Defense Caspar W. Weinberger recently submitted this year's report to Congress on the extensive effort under way to standardize equipment within NATO.

The move toward standardization—"or at least interoperability"—within the Alliance has taken on critical importance within the last decade as Soviet and Warsaw Pact forces have continued to increase ominously in both size and quality far beyond the requirement for an adequate defense.

Another key factor accelerating NATO efforts to standardize has been the economic realities facing the Alliance: inflation, energy shortages, and the staggering costs of developing and deploying modern weapon systems.

In his report, Secretary Weinberger underscored a number of broad policy initiatives NATO has embraced to step up standardization: near- and long-term defense and armaments planning, data exchange agreements, mutual use of emerging technologies, multinational programs like the F-16, and cooperative and joint military training.

The Secretary stressed, however, that serious deficiencies still remain. "We must improve NATO's efforts to allocate development of related weapon types to specific allies under the family of weapons concept," he urged. "Artificial barriers to trade in defense equipment must be removed under the reciprocal memoranda of understanding that we must have with our allies. Coproduction may be selectively employed to provide industrial participation to allies. . . . Finally, the 'two-way street/armaments cooperation' must be made a reality through increased trade in defense equipment in both directions across the Atlantic resulting in benefits to NATO as a whole," Secretary Weinberger noted.

"In particular, I see a major leadership role for industry in this process and will be working to reduce obstacles to direct industry-to-industry agreements," he added. His report noted that the real burden of achieving weapons standardization has shifted to the civil authorities and institutions within NATO and is fundamentally a political and economic rather than a military problem.

Serious shortfalls were underlined in a number of other areas within NATO. Specifically, for air defense, there is a lack of standardization in aircraft navigation systems, identification (IFF) equipment and procedures, air-to-air munitions, and air defense ground environment radar systems.

Finally, the Weinberger report singled out command control and communications as a problem area that needed to be addressed urgently. However, in its summary of NATO standardization programs, the report noted several that promise concrete progress in shoring up the C³ gap. These are discussed in adjacent pages.

The following examples suggest the potential range of missions.

Also in a defensive role, the AWACS should be able to transmit tracking data to surface-to-air missile sites.

At the same time, the E-3As should be able to steer allied close-support and interdiction-bound aircraft clear of hostile fighters, and, following air engagements, inform friendly offensive air forces where surviving Pact aircraft are landing.

NATO AWACS can also be seen providing vital information to air rescue, reconnaissance, medical airevac, and airlift forces.

Receiving data from transponder-equipped vehicles, the E-3A could contribute to the land battle by delineating for ground commanders force boundaries and status.

Because of their mobility, the NATO AWACS are also less vulnerable than ground-based radar and have an additional ace in the hole by being able to vector protective fighters against intruders coming their way.

Such inherent electronic counter-countermeasure features as low antenna sidelobes and chaff rejection circuitry allow the E-3A to operate more successfully than other generations of AEW aircraft against airborne and ground jamming. The E-3A radar also has the ability to determine the relative bearing of an enemy jammer with its radar in either an active or a passive—nontransmitting or "listening"—mode. The aircraft's mobility enables it to apply jammer avoidance tactics when necessary.

In the maritime surveillance role, NATO AWACS can detect and track not only enemy shipping but, for example, can also warn carrier task forces of aerial—or surface—danger headed toward them. Concerning seaborne matters, it should be pointed out that two of the three major "customers" of the NATO Airborne Early Warning Force Command are the Supreme Allied Commander Atlantic and Allied Commander in Chief Channel.

Joint Operational Force

This abbreviated report on the NATO AWACS wouldn't be complete without a capsule discussion of the events taking place at Geilenkirchen AB. There, the first wing-size multinational flying unit is forming up. Currently at about 1,900 people, this force is expected to expand to some 2,242 with the advent of the full complement of eighteen E-3As organized into three squadrons by 1985.

The air forces of eleven nations are represented, generally in proportion to their financial investment in the program: Belgium, Canada, Denmark, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Turkey, and the US. An interesting sidelight is that while contributing no personnel, Luxembourg has a financial stake in the program and because of international legal complexities the aircraft are registered in that tiny nation.

Allied Teamwork

"'The nations' [as the allied members are referred to] have contributed people of very high caliber," commented General Palmerton, NAEWF Commander. "English is the international language of aviation," he noted, "and is also the common tongue spoken at Geilenkirchen. While most of those assigned by the nations to the base are fluent in English, others receive remedial training to bring them up to proficiency."

While few problems have arisen because of deficiencies in formal English, most misunderstandings occur through the use of idioms.

"For example," pointed out German Brig. Gen. Klaus W. Rimmek, "how do you expect someone otherwise fluent in English to respond when asked, say, by an American associate, 'Do you read me?'" General Rimmek is the E-3A Component Commander at Geilenkirchen.

While the US has contributed the largest financial investment in the NATO AWACS program, Germany has provided the largest contingent—military and civilian employees—at Geilenkirchen. Reflecting these major investments, at some point in the future the NAEWF Commander will be a German and the Component Commander an American.

"In forming this international force, precedents are being set every day," commented Lt. Col. James Marshall, Deputy Commander in charge of the E-3A Training Center. "Right from the start, multinational crews manned the aircraft both in the 'front end' [cockpit] and 'back end' [where the system's electronic equipment and staff are located].

"To a significant degree, historic national differences have been overcome in flying and staff positions, much like any NATO international military headquarters," Colonel Marshall noted.

At Geilenkirchen, officers, enlisted people, and civilian employees alike eat at the central mess hall, where special menus are tailored to ethnic differences. In disciplinary matters, however, each national group is responsible for its own personnel.

Simulator a Key Feature

Responsible to the Training Center and one of the key features at Geilenkirchen is the Simulator Operations Branch. It is equipped with a Canadian-built "front-end" simulator for flight-crew training and a "back-end" simulator for AWACS mission instruction.

Flight crews and AWACS mission specialists alike are thoroughly trained during a full spectrum of simulator familiarization before they ever set foot in the aircraft for operations.

As befitting the European environment, the simulator training stresses operations in bad weather.

"Simulator scenarios include visual scenes depicting operations at the FOBs so that deploying aircrews will be familiar before ever flying there," noted simulator instructor Capt. Ken Ellis. "While the individuals may vary, the ultimate objective is to put entire crews through entire missions in the simulator."

While initially E-3A personnel were trained Stateside to create a cadre, the mixed force at Geilenkirchen is geared to train all its own people across the board, and has developed courses to do so.

This has been a Herculean task considering that on the flying side alone there are twelve separate courses (for the four cockpit and thirteen AWACS mission slots). At Geilenkirchen are also trained the personnel assigned by the nations to staff the Forward Operating Bases.

On the maintenance side, students spend mornings in the classroom and afternoons in the shops.

Extending to mixed crews aboard the AWACS Component aircraft flying from Geilenkirchen AB in Germany is the multinational aspect of the NATO force assembled there. The E-3A program is the largest single, commonly funded effort in Alliance history.

"Language differences might pose a problem here except that mechanically inclined people of whatever nationality tend to speak an international language, which has as its basic credo 'Let's fix it,'" noted Lt. Col. Jay Price, Commander of Squadron I (also known as "The University of Squadron I").

To educate the NATO alert apparatus on the potential capabilities of AWACS, people from the regional and sector operating centers and fighter pilots from NATO squadrons visit Geilenkirchen for short familiarization courses.

NATO C³ Upgrade

The Joint Tactical Information Distribution System (JTIDS) is a highly jam-resistant, secure information distribution system that provides digital and voice transmissions for use in a tactical combat environment. JTIDS has been adopted as the basis for ECM-resistant communications throughout NATO.

Further, in December 1978 JTIDS was selected for the NATO Airborne Early Warning and Control Program. The equipment is being built under a multinational agreement in both Europe and the US.

But that's not all. NATO's string of radar air defense sites, NADGE (for NATO Air Defense Ground Environment), is currently being overhauled to become JTIDS-capable. In this program—the Air Defense Ground Environment Integration Segment (AEGIS)—some forty-one NADGE sites are to be JTIDS-operational by 1985. Ultimately, NATO JTIDS is to be extended to tactical surface vessels and aircraft. (In the US, the F-15 has been earmarked as the first fighter to receive JTIDS equipment.)

The implications of these improvements may well prove critical. Essentially, JTIDS will provide for the controlled exchange of air surveillance data between NATO AWACS and the NADGE system, eventually including the Nimrod Component. In terms of air defense, ground controllers will be able, among other things, to watch targets detected and tracked by AEW radars.

Germany is coproducing JTIDS terminals for installation at NADGE sites and has participated alone or in league with the UK in equipment compatibility tests to help achieve frequency clearances for JTIDS.

The development of JTIDS is a significant breakthrough in solving communications jamming and radio saturation problems. JTIDS will allow an entire battle force on a communications network. And this while broadcasting vital information to everyone on the net in near real time.

JTIDS uses time division multiple access technology, which means splitting each second of time into small fractions. Each communicator on the net pulses his message into the system as a data burst when his fraction of time rolls around. JTIDS has been described as a huge party line, but "subscribers" (terminals) on the line can't jam it up with chatter since they talk to each other electronically in their assigned transmission time slot.

For either transmission or reception, a JTIDS system has 98,304 individual time slots, or 128 time slots per second, with a primary line-of-site range of more than 300 nm.

The E-3A AWACS Component is but one segment of a broad NATO approach to solving the problem of C³ in today's technological environment.

A Two-Sided Coin

The JTIDS program is a coin with two sides—one involving the US military and the other NATO. A major segment of the first concerns equipping USAF E-3 AWACS Sentry aircraft with Class 1 terminals. "In-line" production aircraft destined for TAC's 552d Airborne Warning and Control Wing at Tinker AFB, Okla., are to get them. The previously delivered "core" aircraft there will be retrofitted so that eventually all thirty-four (USAF is hoping for an additional twelve) aircraft in the E-3 fleet will be JTIDS-capable.

In a related effort, under a joint Army/Air Force program, IBM Corp. has developed the Adaptable Surface Interface Terminal (ASIT) to provide interface between AWACS/USAF's Tactical Air Control System and the Army's Air Defense System.

"This will permit ground 'subscribers' to receive via JTIDS-equipped E-3s track data on their scopes," noted Lt. Col. Dan Busse, JTIDS Deputy Program Director with AFSC's Electronic Systems Division, Hanscom AFB, Mass.

The Class 1 equipment was tested at Eglin AFB, Fla., in 1981–82, has entered production, and will be fielded in a year, Colonel Busse said.

Working with TAC, ESD is also developing a Class 2 terminal to equip a broader set of tactical forces, such as fighter aircraft. To this end, the Class 2 terminal is currently in full-scale development and is slated to begin a flight-test program aboard an F-15 in October of next year.

Once operational, said Donald C. Latham, DoD Deputy Under Secretary for C³I, "not only will AWACS and F-15s be able to communicate vocally and digitally, but two AWACS, or two F-15s for that matter, finding themselves in a heavy jam environment can switch to encryptically secure JTIDS voice to talk to each other free of enemy interference."

According to Mr. Latham, "The E-3 will also be capable of an IFF [identification friend or foe] function. For example, F-15s in the JTIDS net will appear as 'blue tracks' on the E-3's scope."

Also in any future fighter equipped with JTIDS, a pilot should be able to dispense with maps and other hand-carried details of missions in favor of a prerecorded cassette that plugs into his JTIDS console. This would provide the whereabouts of threats and other pertinent data on his scope. Information on the cassette could be updated automatically as required from a ground station. Fighter aircraft have never had such a capability, Mr. Latham stressed.

As visualized for fighter aircraft, display ranges could be selected to allow pilots access to data sent by other JTIDS-equipped aircraft and C² centers (AWACS or ground) that may be outside his own radar range or visual sight.

A pilot could also display his route, waypoints, targets, air bases, recovery bases, and friendly, hostile, or unknown aircraft, as well as friendly or hostile ground elements and location of the forward edge of the battle area (FEBA).

Further, a pilot could ascertain a friendly aircraft's fuel and weapon reserves, speed, and track to determine if it could support him on a mission. He could also be advised of an enemy aircraft's altitude, speed, and track. The pilot could assign himself a target aircraft with notification being fed into the net so that a target/threat coordinator can be established, thus avoiding having two or more friendly aircraft attacking the same target.

The US Army also is buying Class 2 terminals to equip units down to at least the division and brigade level. They'll be used in the short-range air defense role, and in

conjunction with the Army's Position Location and Reporting System, will make possible reports on the whereabouts of vehicles and even people. This type of equipment will be the size of pocket tape recorders.

The Army visualizes a host of benefits. To suggest just two: The timely availability of target data from numerous sources for the rapid direction of artillery fire, and notifying short-range air defense of the vector of friendly aircraft returning from the FEBA to assure the planes against accidental opposition.

Eventually, according to Mr. Latham, it also will be possible to pass E-3-acquired data at least down to the battalion level using JTIDS. "In a reverse benefit," noted Mr. Latham, "data from ground forces can be passed up to AWACS. As we learn more about the E-3's capabilities, we see it evolving into a true command and control aircraft rather than simply a flying radar. As such, and with the Army sending up data on the FEBA, it should be possible for AWACS to work not only air-to-air but part of the air-to-ground battle as well," he added.

Regarding the US Navy, under study are options to provide interoperability with the other services via JTIDS-equipped surface combatants and aircraft of all types, Mr. Latham noted.

On the European side of the coin, the JTIDS program is being shepherded by the NATO Airborne Early Warning Program Management Agency (NAPMA) headquartered at Brunssum in the Netherlands. NAPMA's JTIDS program is of a much broader scope, to include equipping NADGE ground sites with terminals. Regarding NATO E-3As, the ninth "in-line" aircraft scheduled to be delivered to Geilenkirchen next December probably will be the first with production JTIDS. The previous aircraft will be retrofitted. The first four aircraft have been flying an air-ground interoperability test program begun in 1982. The E-3As can communicate via their conventional radios or the preproduction Class 1 terminals with two operational test ground stations located in Germany and Denmark.

Development of the next-generation Class 2 terminal is the foundation of a NATO standardization agreement with the ultimate objective of linking JTIDS capability with the Alliance-wide Multifunction Information Distribution System (MIDS). By the same token, the UK is formulating a plan to equip its Tornado fighters with Class 2 terminals to link them with Nimrod aircraft and the ground-based UKADGE system. This should also assure efficient interoperability between Nimrod and E-3As.

EIFEL and the ATOCs

Finally, there is another major program to upgrade NATO's handle on C^3.

With the full implementation of highly sophisticated and automated tactical command control and information systems in the NATO Central Region, the Alliance will have taken a giant step forward in its ability to process data quickly in conducting offensive air operations.

The EIFEL system (the German acronym stands for Electronic Information Command System for the Luftwaffe) was developed by the German Air Force and first went into operation at GAF's Allied Tactical Operations Centers (ATOCs) at Kalkar and Messtetten.

Last year, EIFEL went into use at USAFE's ATOC at Sembach AB in Germany. And with the system's introduction at the British, Dutch, and Belgian site at Maastricht in the Netherlands, there will be complete standardization of the NATO ATOCs throughout the Central Region. Eventually, all ATOCs will have computer-to-computer interfaces through EIFEL systems.

In effect, EIFEL has taken most of the slow and manual procedures—such as lengthy teletype transmissions—out of offensive air mission planning and tasking.

An ATOC is responsible for both immediate and preplanned offensive air support tasking. EIFEL has been designed as a key element in

American Blue-suiters at Geilenkirchen

Currently, some 350 USAF people are assigned to the NATO E-3A Component at Geilenkirchen AB in Germany. That figure is expected to increase to 448 by 1985.

The American experience at the base began in 1980 when blue-suiters assigned there grew to a force of seven. With the NATO AWACS program in an embryonic stage at that point, these and allied counterparts had to pretty much scrounge for what they needed until logistics support was properly organized.

Even now, other than several enlisted dormitories, there is no housing available on the base. So single blue-suiters and families alike must live "on the economy"—off base and within the outlying German communities. This has resulted in an interesting assimilation of certain aspects of each other's culture.

For example, American newcomers are warned never to imbibe and then drive. The German police are empowered to see forcibly to the administration of blood alcohol tests of suspect drivers.

For administrative purposes, all blue-suiters at Geilenkirchen come under the jurisdiction of Detachment 7 of the 1141st Special Activities Squadron. Detachment 7 is commanded by Maj. Scott Brown, who with wife Capt. Jo Brown is one of eight blue-suit joint-spouse couples assigned to Geilenkirchen. An adjunct to Capt. Jo Brown's military duties is her role as Schools Officer for American dependents.

"What started as a few leased classrooms in a nearby former monastery and eighty-nine students has evolved into the use of five good-sized buildings and almost 400 students," she noted. Although mostly Americans, several other nationalities also attend.

Captain Brown is responsible for logistics support for the school through conventional DoD funding for dependents. This is no mean feat. "I manage an annual budget of $700,000 that includes monies for some day-to-day operations as well as bus and custodial contracting," she noted.

To ensure compliance with the bus contract, Captain Brown checks the service herself. "This has meant many early-morning and afternoon trips. Needless to say, I have become intimately familiar with the backroads to the more than fifty towns to which school bus service is provided," Captain Brown declared with a grin.

Out-of-the-ordinary duties seem to be the norm for Americans at precedent-pioneering Geilenkirchen. MSgt. Clayton Shelley, for example, is helping to establish an international military police force on base, the first such unit in history. Making this formidable task interesting is the maze of authorities, jurisdictions, and other legalities that must be navigated in creating such a force. Complicating Sergeant Shelley's efforts is that regulations and manuals for governing and training must be written from scratch.

the conduct of both. "For example, any of the air bases in an ATOC EIFEL net can punch into the system the status of its runways, aircraft, and crews," noted Lt. Col. Samuel B. Thompson, USAFE EIFEL program manager. "Thus, the ATOCs know what sources are available for immediate commitment."

EIFEL drastically "decreases the length of the preplanning cycle from the time general guidance is received from—in the case of Sembach—the 4th Allied Tactical Air Force until the tasking order is transmitted to the designated wing," Colonel Thompson noted.

The key is the host computer at the ATOC that stores and processes information. This is linked to higher headquarters and subordinated units alike by dedicated, secure, and redundant land lines. For example, Sembach ATOC is linked not only to its main operating bases in Germany but to bases in the UK as well. To demonstrate the extent of the coverage, it might be useful to list those with terminals plugged into Sembach ATOC EIFEL:

MOBs, Deployment Bases, Air Support Operations Centers, Control and Reporting Posts, Operations Support Center at Ramstein AB, Combat Operations Intelligence Center, Tactical Fusion Center, Sector Operations Center-3, 4ATAF Static War Headquarters, and NATO Operations Support Cell.

At such mobile sites as the ASOCs and CRPs, the EIFEL equipment has been ruggedized.

For the twenty-four-hour preplanned mission cycle, target and resources assignments are transmitted to the Sembach ATOC from Allied Air Forces Central Europe via 4ATAF. In the form of a daily operations order, these instructions are the basis for the ATOC to initiate its daily cycle on the use of attack resources in its area.

"After a review of the availability and readiness of these resources," commented Colonel Thompson, "missions are identified and appropriate wings assigned specifically to them. The ATOC picks the weapon systems, determines the number of sorties, time over target and ordnance, and arranges for tactical control."

This is where EIFEL is especially useful, noted Colonel Thompson. "There is sort of a building-block approach here, with all this essential data appearing on the console of, say, the particular wing to be tasked. Thus, the wing receives preliminary notice of the elements of the final Air Task Order (ATO) and can start to get its ducks in a row."

While the ATO, or "frag," is still produced manually, it is greatly speeded up by console displays and printouts from the EIFEL data bank.

Meanwhile, an Air Support Operations Center may key in a request for an immediate mission. Surveying existing resources, the ATOC may accept or refuse. If the mission is turned down, the requesting agency is automatically notified and given a reason for the refusal. If the mission is accepted, the ASOC will complete the planning and task the appropriate unit.

Whether a mission is immediate or preplanned, the ATOC will monitor, coordinate, and evaluate it. Data about critical factors—*i.e.*, losses and results—can be entered into the EIFEL computer either at a remote site or at the ATOC. These are automatically available to all concerned, with mission data displayed, analyzed, or modified at any time.

The optimum objective is to have all four EIFEL systems interfacing so that higher-level NATO command centers can exchange data and eventually provide cross-tasking.

In October 1982, the US Department of Defense and the German Ministry of Defense agreed to an EIFEL follow-on program, with the other interested NATO Central Region countries formally informed of the action that November. Currently, US funding for EIFEL R&D is about $3.5 million in each of the next five years.

Other C³ "Thresholds"

Finally, the Air Force and NATO have what may be termed in the "threshold" phase other systems to upgrade C³ capabilities.

OASIS (for Operational Applications of Special Intelligence Systems) was initiated in 1978 to develop the capability to receive, correlate, and disseminate warning and force assessment (dynamic order of battle) intelligence rapidly to AFCENT/AAFCE and US/NATO in a form usable by decision-makers.

"To this end, an OASIS 'assessment center' is in operation at the NATO command and control facility at Boerfink near Ramstein AB," noted Mr. Latham. "In the large and modern bunker at Boerfink are OASIS displays and computer capability into which is channeled over a secure voice and intercom system information from a wide variety of sources, including extremely high-level intelligence."

According to Mr. Latham, "OASIS has successfully automated the basic tasks of intelligence analysts and significantly improved the ability to receive, process, and disseminate large volumes of near-real-time air situation intelligence critical to NATO."

While very promising for the future, OASIS has received a development setback due to budgetary restraints. No FY '84 Air Force funds have been allocated for the program.

On a smaller scale than OASIS but with the same objective of improved C³ is the LOCE testbed system located in the Combat Operations Information Center at Ramstein AB. LOCE (for Limited Operational Capability for Europe) is an offshoot of the joint Army/Air Force program toward "information fusion" to help field commanders make use of target data by assessing the input of a multiple set of terminals leading from US Army, Air Force, and NATO sources.

The objective is decision-making in terms of allocating and directing forces in a rapidly moving, constantly changing battlefield situation. (This capability would go beyond that of NATO AWACS, Mr. Latham points out, although AWACS data would be fed into LOCE.)

The first of a kind of this type of assessment, a more capable follow-on system under a joint Army/Air Force agreement is expected to be deployed in the next three or four years, Mr. Latham added.

One feature of the new system might be LOCE assessment centers located for survivability in remoted vans linking the sensors and command centers via the ATOCs. ■

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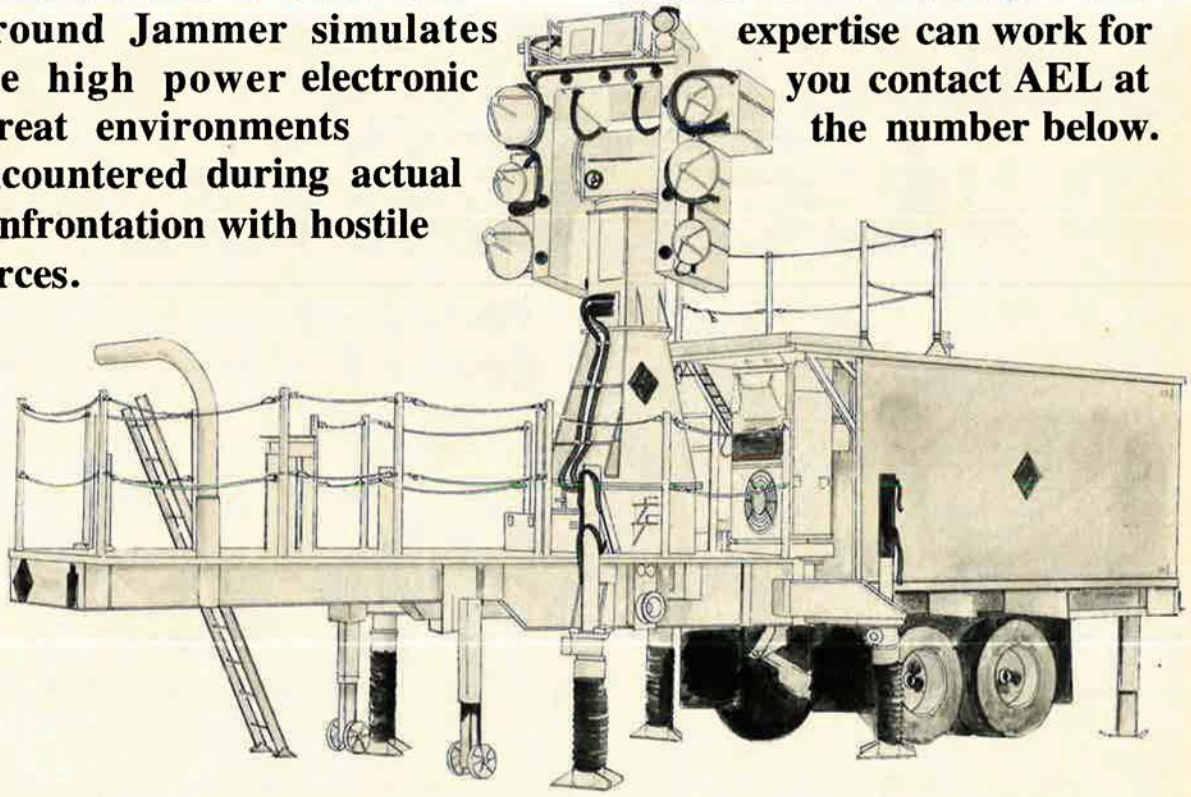

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A Continental Outlook On Airborne Early Warning

Western Europe moves toward meeting its needs for long-look radar and improved C^3 centers.

BY MARK BERENT

THE NATO Airborne Early Warning (NAEW) program is coming along better than expected in many areas, slower than desired in others. Equipment is arriving, the multinational command and operational structure is in place, and training has begun. All this since 1980. At Geilenkirchen AB, Germany, air and ground crews from eleven NATO countries (Belgium, Canada, Denmark, Germany, Greece, Holland, Italy, Norway, Portugal, Turkey, and the US) are flying and maintaining six NATO E-3A Airborne Early Warning (AEW) aircraft. Eventually, thirty multinational aircrews will be assigned to operate the eighteen E-3As that will be in place by 1985.

This E-3A component force is the first NATO flying unit. Since NATO is not a national entity, the E-3As are registered in Luxembourg. The front-end crews say the airplane (a modified Boeing 707-320) is a delight to fly; the back-end crews (mission specialists at nine consoles) say the Westinghouse APY-2 land-and-sea surveillance radar is exceeding specifications. English as the common language works just fine. Multinational maintenance works. Even the food is great. From the operating standpoint, everybody is happy.

The Force

And at SHAPE Headquarters in Belgium, where the Force Allocation Group (The Force, as they call themselves) is located, the bosses and planners are happy with how well NAEW is integrating into the NATO air defense system without any desk-pounding political problems.

The Force has operational control over the E-3A Component (as it will with the eleven British Nimrod Mk 3 AEW aircraft when they begin to come on line later this year). The Force responds to the requirements of the three major NATO commands: SACEUR, SACLANT, and CINCHAN (Supreme Allied Command Europe, Atlantic, and Commander in Chief Channel). The Force receives the NATO command requests, looks at E-3A availability, establishes priority, then allocates aircraft where and when they are needed by the commanders in the NATO Air Defense Ground Environment (NADGE) system. NADGE uses the E-3As to augment its forty-plus ground stations. Since radar beams go out in a line of sight, the pulses cannot see around mountains or beyond the curvature of the earth. The E-3A solves this by taking the radar higher. From several miles up, it can see farther, and its look-down features enable it to sort out low-flying aircraft from the ground clutter in radar returns.

Thanks to the E-3A's on-board computer, the days of weapons controllers using grease pencils and "handy dandies" (a plastic ruler-like device used to plot radar return tracks on the scope) are long gone. Communication with the fighter force, however, is still by UHF radio channels in clear voice.

That makes some people nervous. It means that all fighter directions and target information, as spoken by the weapons controller, are neither secure nor jam-proof. Furthermore, a clever Warsaw Pact signal intelligence operator can tape the controller's voice and quickly play back selected commands to the fighter pilot in an attempt to spoof him off target.

JTIDS a Solution?

There is much talk about JTIDS, the Joint Tactical Information Distribution System, as a solution. By using time division multiple access, everyone's computer "talks" to everyone else's. That is to say, all target and threat information and all friendly force positions are continuously available in a computerized format to everybody on the network. Each can receive or input data according to his particular need and situation. The receiver's terminal displays selected sips from the fire hydrant volume of available information. And JTIDS is nodeless: it doesn't require any central processing station. JTIDS can be used for ships, airborne or ground-based C^3 stations, fighters, or strike aircraft.

All well and good. But JTIDS is not yet on-line. NATO E-3As have it, but so far only two ground stations are JTIDS-capable. No fighter or strike aircraft have it.

"To have it" means one must have the terminal that can pick up, decode, and display incoming information as well as input, code, and transmit outgoing information. The biggest JTIDS terminal is called the Class 1. It is used on the E-3As and in the ground stations, and it probably will be installed on larger naval vessels. A smaller terminal, the Class 2, is suitable for fighters and strike aircraft. If developed, a man-portable terminal will be the Class 3.

The first fighter JTIDS equipment, the Class 2 terminal, will be installed in three USAF F-15s by 1984 to test the system. Meanwhile, and much sooner, ground stations are being JTIDS-equipped with the Class 1 terminal, but even that requires an enhancement called the NATO Airborne Early Warning/Ground Integration Segment (NAEGIS). NAEGIS hooks the E-3A real-time radar information into NADGE console displays. Hughes Aircraft is the contractor for this $400 million program.

The six E-3As at Geilenkirchen are in a training-only status at present and will remain so until 1985. They train as high-altitude radar

In the 1970s, NATO was slow in making its AEW decision, so the British pressed ahead with the bulb-nosed Nimrod.

surveillance platforms and control some airborne intercepts (called "hacks" by the weapons controllers). They do not provide close air support, or control any air assets except the fighters allocated to them in their mission-tasking message. As the training continues, however, and as ground commanders learn better usage of the E-3A, a two-way flow of tactics development will probably result. The point here is that NAEW has yet to be used to the maximum since nobody yet really knows all the ways it can be used. Among other things, it will probably evolve into an alternate command and control center.

The E-3A in its NAEW role is forcing standardization, at least so far as terminology and tactics are concerned, from Allied Forces Northern Europe in Norway to Allied Forces Southern Europe in Italy and all the ATAFs and NADGE centers in between. As the E-3A flies into *any* region, a local controller is at a console to help nudge and smooth standardization, and that's a plus.

A minus, at least for now, is that the current training syllabus for the E-3A component at Geilenkirchen has no provisions to practice aerial refueling, although the E-3A is perfectly capable.

And there is another minus. It involves airlift support for deployment. The E-3A component has three forward operating bases (FOBs): Preveza, Greece; Trapani, Italy; Konya, Turkey; and a forward operating location (FOL) at Oerland, Norway. So far there is no airlift dedicated to FOB and FOL deployment. The Force, as it is now with no special priority, will just have to stand in line with everybody else to present its movement request.

One suspects that dedicated tanker and airlift support will be forthcoming.

Nimrod Coming On Board

As mentioned, NAEW also includes the eleven British Aerospace Mk 3 Nimrods with their Marconi-Elliott land-and-sea surveillance radar. Unlike the E-3A with its revolving thirty-foot radome atop the fuselage, Nimrod has large nose and tail radar scanners to provide 360-degree surveillance. Just as the E-3A airframe is a modified transport, so the Nimrod is a variant of the de Havilland Comet 4C transport.

In the late 1960s, as aircraft penetrator tactics evolved into high-speed, low-altitude dashes to avoid ground-based radar, the British began looking at adaptation of the early Mk 1 Nimrod maritime surveillance aircraft for overland coverage. Simultaneously, NATO planners realized the same deficiency

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Mark Berent is a retired USAF fighter pilot who logged one year at a Montana radar site and four years in Southeast Asia. His most recent articles appeared in this magazine in the February '83 issue. Under the pen name of Berent Sandberg, he co-authors novels about a retired USAF fighter pilot. The third, Chinese Spur, *is in bookstores now. It is about current POWs/MIAs in SEA. A fourth novel is in progress.*

and stated they would seek out an airborne radar platform. The British joined that effort and more or less put Nimrod Mk 3 on the back burner.

By March 1977, however, NATO still hadn't defined what it wanted to buy. The British decided to press ahead with the Mk 3 as their share of NAEW. Eleven Nimrods are scheduled to supplement the eighteen E-3As. Like the NATO-owned E-3As, the British-owned Nimrods will be under operational control of the Force.

At the moment, Nimrod front-end crews are performing flight acceptance checks while back-end crews are getting checked out on the ground with the Marconi radar. It has been said E-3A overland surveillance is better than Nimrod's, so Nimrod will probably patrol NATO's northern flank, which includes the Baltic and North Sea regions.

The British are also looking into just what communication method they should use. If NADGE uses JTIDS, so must Nimrod. The RAF also has to decide whether to use JTIDS. If USAF does, the RAF probably will.

When Nimrod is operational it will fly out of RAF Waddington, northeast of London in Lincolnshire on the North Sea coast. Forward operating locations will be Kinloss in Northern Scotland and St. Mawgan on the southwest tip of the UK.

AEW Low French Priority

Since the early 1970s, the French also have been looking into AEW. Currently they use Atlantic and Neptune aircraft for sea surveillance, but have no overland capability in the air or on the drawing board. Current ground-based radar sites use a ground observer corps to detect and identify low-flying aircraft.

Realizing that an AEW capability was needed, the French looked at Grumman's E-2C Hawkeye and Boeing's E-3A Sentry a few years back. First it was rumored they would tip toward the E-2C, then toward the E-3A. The E-2C seemed less expensive and better suited for naval use. E-3A proponents pointed out that the French Air Force already has Boeing experience with their KC-135Fs and that, furthermore, the E-3A is compatible with the NATO buy.

Also considered by the French is their Transall C.160, a twin-turboprop transport slightly larger than a C-130. Transall use would require purchase or fabrication of back-end radar and computer systems, probably from the Nimrod system. All in all, any domestic option would be a costly enterprise.

But so would E-2C or E-3A purchases. Since the Mitterrand government came to power in 1981, the franc has been devalued three times, unemployment is at a post-war high, inflation is at twelve percent, and the foreign deficit is more than $1 billion.

On top of all that, AEW is not a very high priority in French defense planning. The French are going heavily into nuclear deterrence. In fact, nearly twenty-five percent of the defense budget goes to nuclear forces. French military aircraft buys dropped about fifty percent this year. So it really looks as if France isn't going to buy or fabricate any sort of AEW.

Weaving the Net

All of these options are being discussed by NATO planners as they try to weave together an air-to-air, air-to-ground, and ground-to-ground net that is secure, jam-proof, and fast.

Apparently, there was no E-3A surveillance in the area when an Mi-2 Hoplite helicopter flown by two defectors crossed the Baltic from Poland to Sweden in February. As to why some part of the system did not detect the helicopter, an experienced USAF major says: "We aren't defending against just one. NAEW detects unusual movement and activity long before a strike can be mounted. Then, if an air battle results, we'll get that one or any others that come across."

And that in itself can serve as a deterrent, as shown by six deployments of USAF E-3As since 1979 from Saudi Arabia to Korea to Egypt and a few places in between.

Call it Radome Diplomacy if you like. It works. ■

The French looked at the E-2C Hawkeye as a low-cost solution to their AEW requirement. The E-3A and the Transall C.160 were considered, too. While the capability is needed, the French economy is in trouble and France may not buy or fabricate any sort of AEW.

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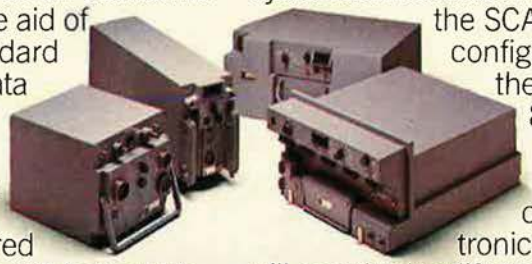

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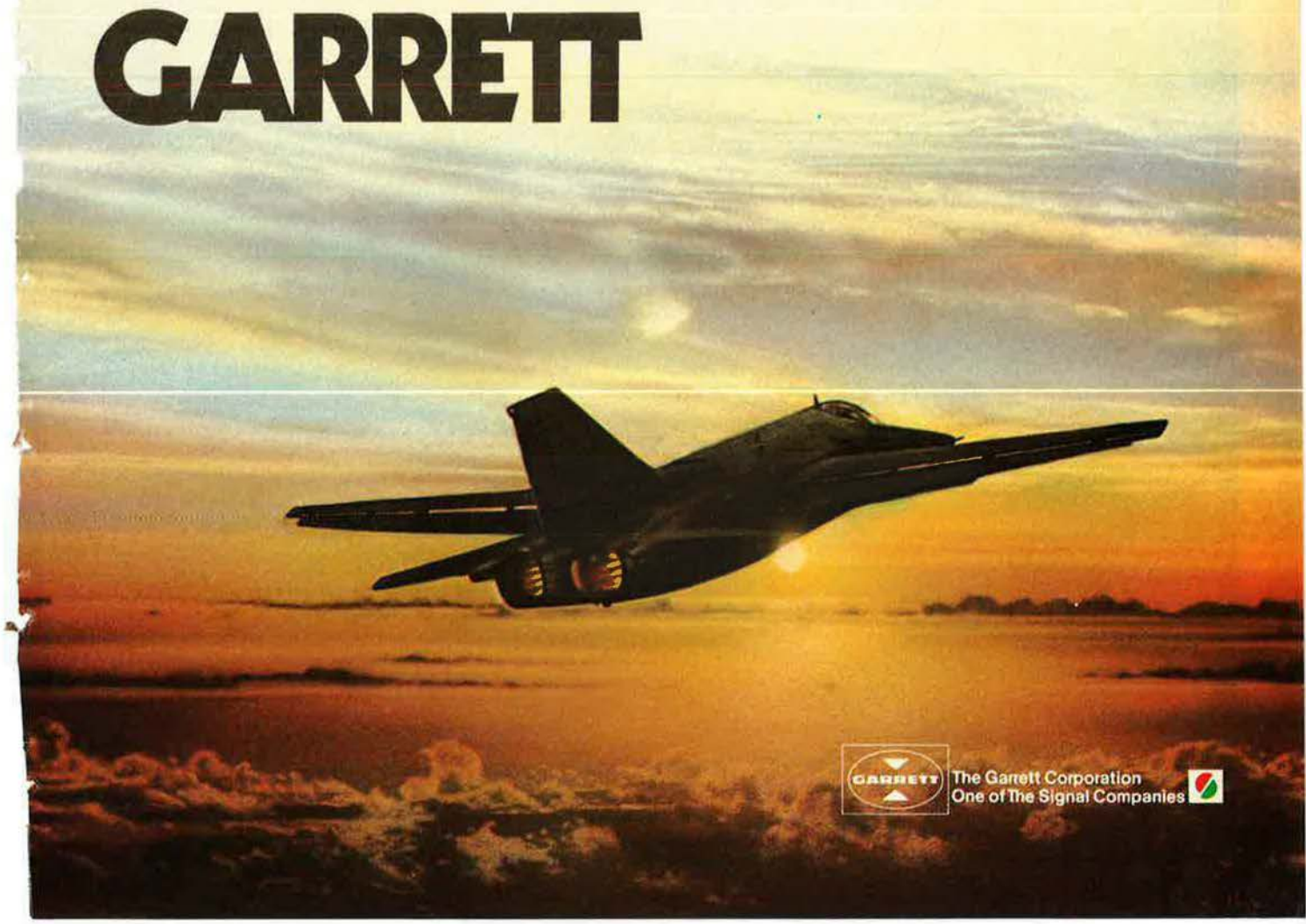

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Managing Change In Telecommunications

From telephones to satellite terminals, USAF's communications needs are evolving and its appetite for information services is growing.

BY CAPT. MICHAEL B. PERINI, USAF, CONTRIBUTING EDITOR

FROM an aircraft crew chief to a missile silo launch control officer, the Air Force relies on communications people and equipment to convey information from one person or place to another.

What is being done to ensure that essential communication services like telephone, message, or data processing will be provided during war? This article looks at some of today's problems, existing communications systems, and breakthroughs in technology, and reports on the primary command responsible for engineering, installing, maintaining, and operating much of the equipment now in use or soon to be in the inventory.

The Problems Ahead

Soviet military forces are expected to try to destroy communications facilities, or at least to hamper their use by electronic jamming.

The Air Force is working to lessen the communications degradation that would occur during a conflict.

"The first problem we must solve is readiness," says Maj. Gen. Robert F. McCarthy, Commander of Air Force Communications Command (AFCC). "The users need more reliable, durable equipment that is jam-resistant and secure."

Many of the communication facilities managed by AFCC—control towers, radar approach control units, and landing aids—are located near runways, a prime military target. "We expect collateral damage and must ensure that our communi-

Tropospheric antennas at Sahin Tepesi, Turkey. When greater distances are required, communications signals are transmitted by tropospheric scatter receivers sixty-five to 400 miles apart.

cations are survivable and redundant," says General McCarthy. Facilities are now being hardened to minimize wartime damage. In addition, air traffic controllers are being equipped with new protective masks that will permit them to communicate better with pilots in a chemical warfare environment.

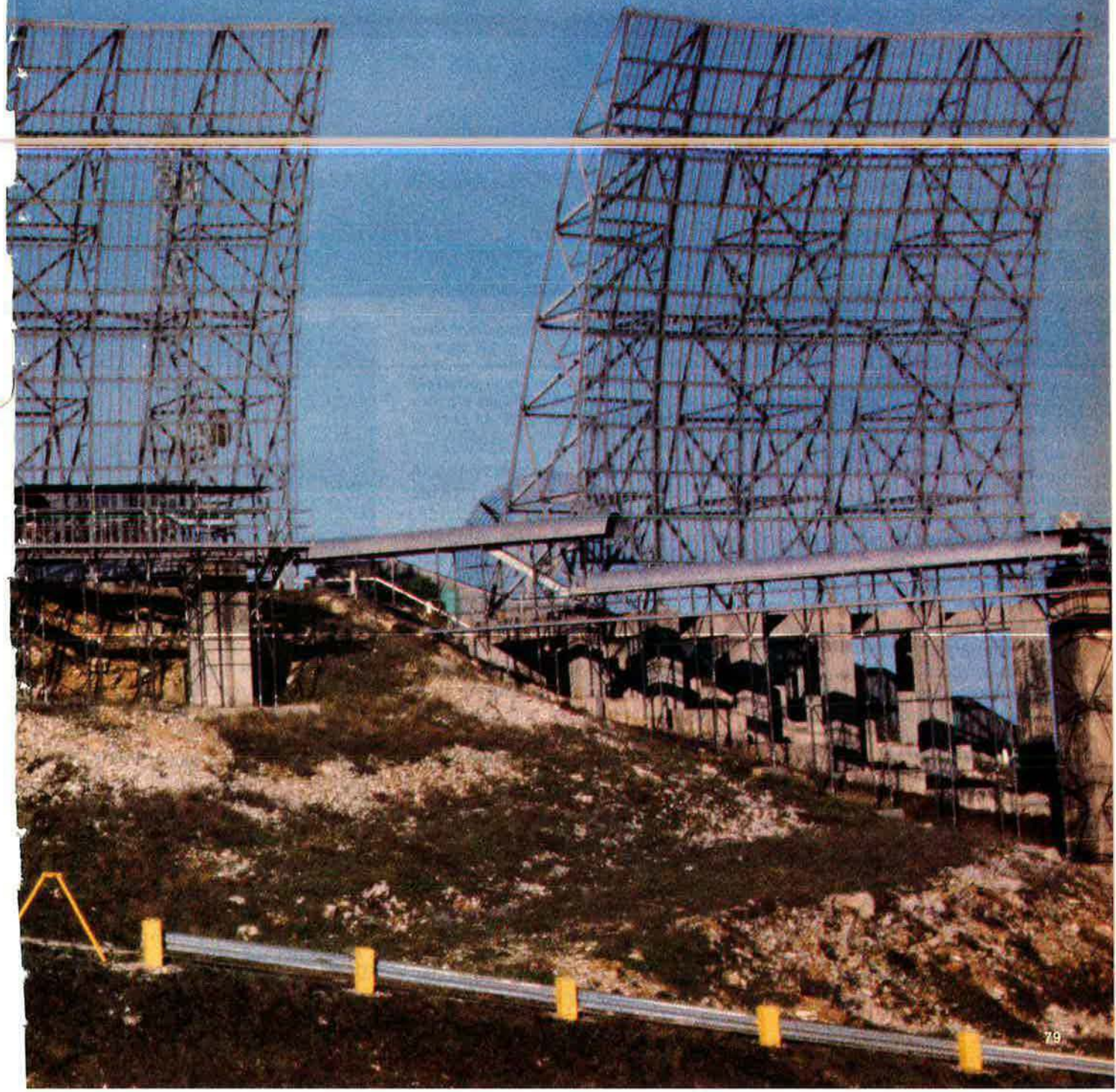
Making a simple phone call, he says, will be more difficult during war. "We must be sure that the pathway to keep vital information flowing during all stages of conflict remains open," he adds.

The Digital European Backbone program, which replaces and improves the main microwave communications system in Europe, will increase reliability and capability. At the same time, transmitted data is encrypted so that if the transmission is intercepted, the information remains protected. To help eliminate possible sniper and terrorist attacks, General McCarthy says facilities in Europe are being "toned down"—camouflaged. In addition, physical security is being increased by concrete revetments and electronic instrusion devices.

Providing a logistics tail to support communications requirements, which to an overseas area could mean competition for airlift, is another problem that is being worked. "Several years ago, for example, we brought back a lot of the combat communications gear from overseas. We are now reversing this trend," General McCarthy says.

The first phase of prepositioning $1.3 million worth of minor but essential hardware items, such as antennas, reels of cable, and cable-splicing kits in Europe and the Pacific, has been completed.

AFCC maintains 300 different



types of equipment. For about 200 of these, there are only twenty or fewer units in the field. While replacing much of the old equipment with new hardware and keeping supply lines open (the command manages an inventory of more than $40 million in electronic spare parts), General McCarthy says he is also restructuring career fields. "We are overspecialized today," General McCarthy acknowledges.

A test program is in progress with Air Training Command to train technicians to work on a family of related equipment rather than on one-of-a-kind hardware. The first class of forty-six out of 150 technicians was expected to graduate in May.

Even so, other people issues remain. Three-fourths of the command's 50,000 people work in high-technology career fields that are easily transferable to the civilian sector. Engineer retention, however, remains high; civilian engineer jobs are ninety-seven percent filled and military electrical engineer requirements are eighty-five percent filled. But airman reenlistment rates are below the Air Force average. Thirty-one percent of the Air Force's total isolated tour slots are in AFCC. In addition, the command has 2,400 assignments to locations where there are no family facilities.

Initiatives to improve retention rates include job enrichment programs, facility improvement plans, and, as mentioned previously, skill restructuring.

The command is supplemented by 187 reserve forces units with more than 15,000 people who contribute more than 79,000 days annually. "Without these responsive and committed people, no amount of modernizing, automating, or equipment procurement will add to readiness," General McCarthy emphasizes.

The Air Force still has problems of communications interoperability with other services and allies. "It is absolutely necessary that our systems interoperate with each of our services and our allies, particularly in the NATO environment, so we can avoid mismatches in equipment and procedures," General McCarthy says.

New acquisition and cooperative programs will help relieve these problems. The Joint Tactical Communications Program (TRI-TAC) will provide improved secure digital communications for US and allied tactical forces. TRI-TAC equipment ranges from telephones to radios to complete communication systems. AFCC receives the first message switches this summer.

The Navstar Global Positioning System (GPS) is a space-based radio positioning/navigation system of eighteen satellites that will provide extremely accurate, worldwide, three-dimensional positioning and velocity information coordinated with Universal Time. The US is developing GPS with the participation of nine other NATO nations. The system is expected to reduce proliferation of navigation aids. AFCC is tasked with maintaining much of the communication and automated data-processing equipment and ground antennas and station monitor sites.

ABOVE: Giant billboard-shaped antennas are the telltale mark of tropospheric scatter communications sites. RIGHT: Transportable strategic tactical satellite terminals are also entering the inventory. (USAF photos)

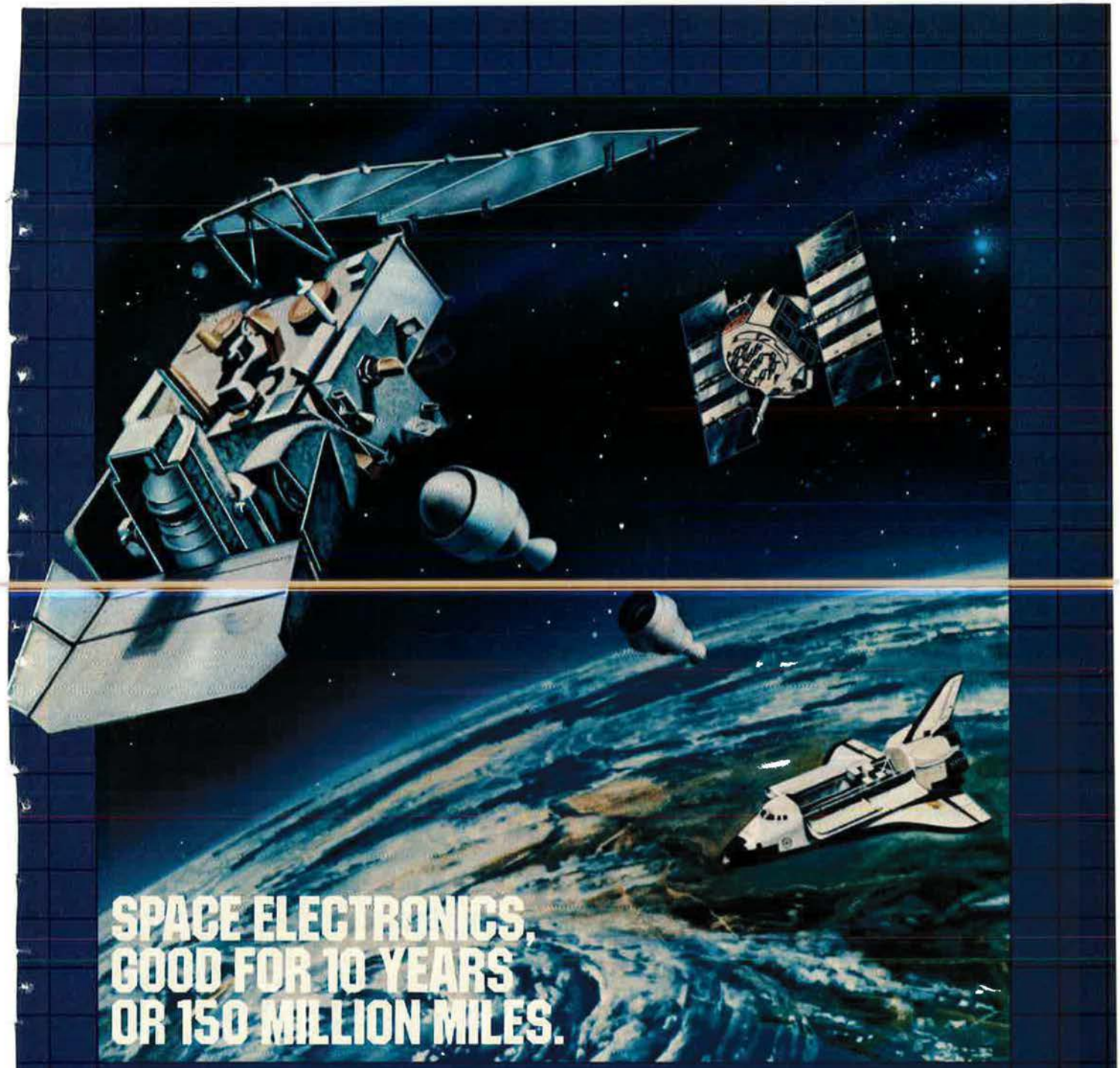
Building a Military Communications System

Effective command and control, or C^2, requires more than the ability to transmit an order to "launch." Backing up such capabilities is a communication system that is vital in ordering replacement parts, coordinating personnel movements, and arranging by phone and message all the details that will make a military force responsive.

In order to allow the National Command Authorities (NCA) to exercise centralized control of the nation's military forces, what is known today as the World-Wide Military Command and Control System (WWMCCS) was created. It is the backbone of our present national-level C^2 structure. WWMCCS is not a single new system built from the ground up. Rather, it is primarily the integration of several existing systems and a few new subsystems.

Lessons learned from the Israeli attack on the USS *Liberty* in 1967, the capture of the USS *Pueblo* in 1968, and the shooting down of a US EC-121 by North Korea in April 1969 showed that the mission-oriented components were inadequately linked and not subordinated to the central command system. Today, the Chairman of the Joint Chiefs of Staff is responsible for management of WWMCCS.

Support of the NCA is the WWMCCS's main mission. It is the means of receiving information for



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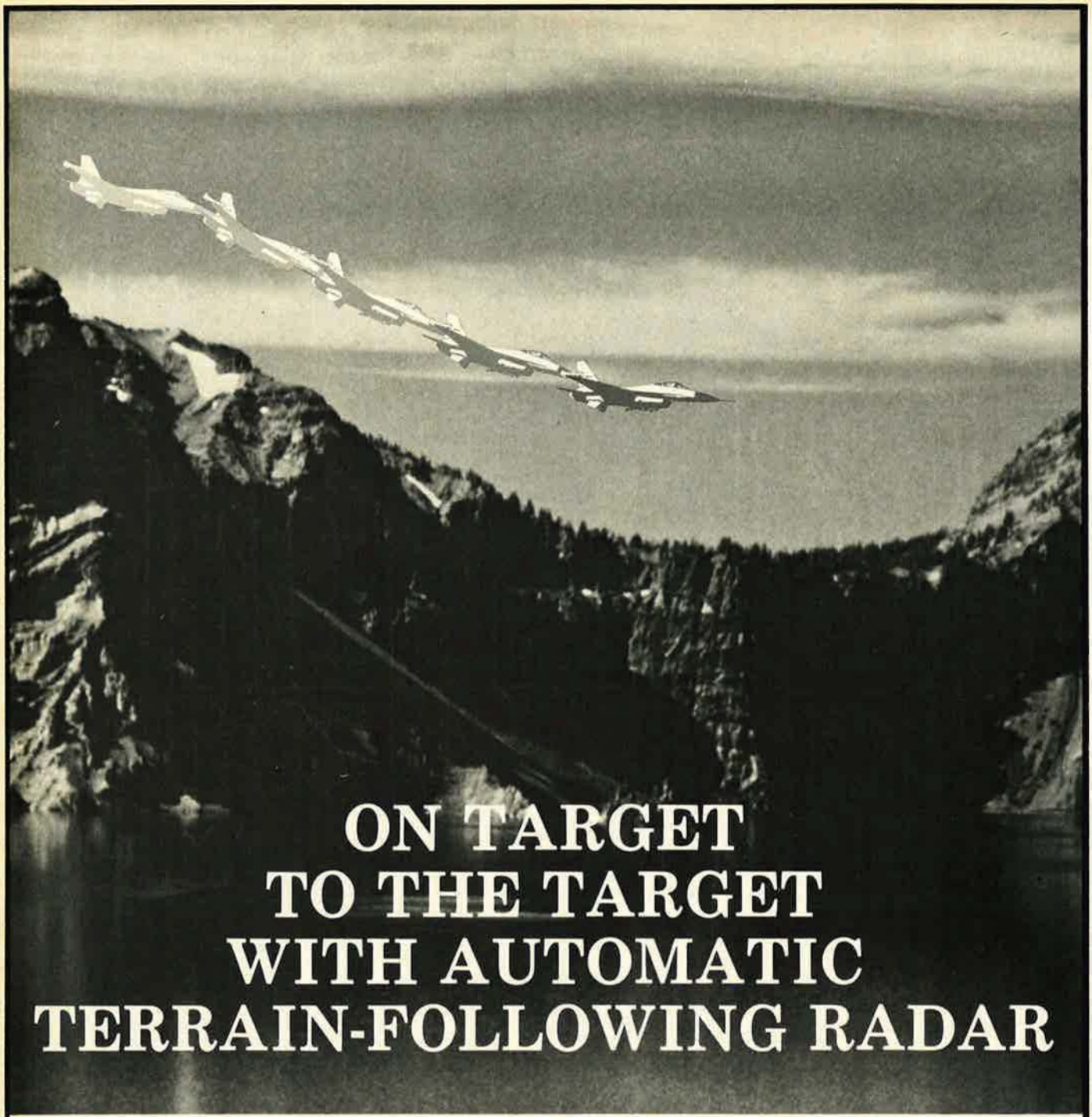

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decision-making and providing direction to the unified and specified commands. WWMCCS also supports the JCS and the C^2 systems of the subordinate commands.

The Air Force's role in WWMCCS is broad—acquiring and operating more than seventy percent of the system. AFCC has recently been involved in upgrading the WWMCCS Intercomputer Network (WIN) by reorienting circuits to even out traffic flow to improve survivability. The command is also installing the C-30 Interface Message Processor, a minicomputer that acts as a routing switch.

Communications that support WWMCCS are provided through the Defense Communications System (DCS), managed by the Defense Communications Agency (DCA). The DCS is a composite of DoD-owned and -leased telecommunications subsystems and networks under DCA management control and operational direction. DCA provides long-haul, point-to-point, and switched network telecommunications needed to satisfy requirements of DoD and certain other government agencies.

More than 3,000 DCS sites are located in seventy-five countries and islands; almost 2,000 of these sites are overseas. Thus, the DCS provides the means to connect command posts, weather networks, intelligence networks, dispersed tactical units, headquarters supply agencies, large automated data-processing centers, facsimile machines, and people—all by electronic communications.

The DCS does not include mobile/transportable communications facilities organic to the military services like ship/shore/ship, air/air, and other tactical telecommunications. Nor does it include base user/subscriber facilities and the on-site telecommunications facilities associated with or integral to weapon systems and to missile launch complexes.

"We act as the Air Force's operational and maintenance command for DCS/Air Force interrelated systems," General McCarthy says.

Thus, AFCC provides a single Air Force point of operational contact for the DCA. In addition, the command operates and maintains forty-seven percent of the DCS. The Air Force FY '84 budget request includes $401 million for support of DCS.

AFCC's Role in Combat Communications

"The communications services we provide today will essentially remain unchanged during war," General McCarthy says.

The command provides ground and space communications to the Air Force and other federal agencies—everything from operating and maintaining base telephone systems to managing the largest air traffic control system in the free world to providing long-haul communications support.

The command is the most widely dispersed unit in the Air Force. Unlike other commands, AFCC does not own any bases. Rather, it operates as a tenant at more than 430 locations in every state except Vermont, and in twenty-one foreign countries and island possessions.

AFCC possesses operational control and maintenance control of most communications responsibilities in the Air Force. Its technicians do not, however, repair on-board aircraft communications systems. Furthermore, they do not operate or maintain such Tactical Air Force (TAF) on-site communications facilities as the Tactical Air Control Center, Control and Reporting Centers, and Forward Air Control Posts.

They do today, and would during war, provide a voice and data link from the TAF headquarters to the Joint Task Force headquarters, to bare-base locations, to the Airlift Control Center, and to home stations.

The command also provides tactical satellite communications to all DoD and Air Force users as requested.

"The President, OSD, and JCS may require AFCC services during a crisis," says General McCarthy. The Aeronautical Radio System, a general-purpose ground-to-air communications link at sixteen locations worldwide, allows contact with aircraft anywhere. Special dedicated circuits on the system, operated through the Master Network Control Center by the 2045th Communications Group at Andrews AFB, Md., allow constant contact between aircraft carrying the President, Cabinet members, and senior government officials and the White House Situation Room.

At the Pentagon, the 2044th Communications Group provided communications during 1982 to the Secretary of Defense during his trips to Europe, the Middle East, and the Far East. The 2044th also maintains eighty percent of the critically essential C^3 system in the National Military Command Center.

The sensors that warn of attacking ballistic missiles and enemy aircraft rely on communications and maintenance provided by AFCC. The command also operates and maintains ground stations in fifty-six locations linking major command and control networks, including the National Emergency Airborne Command Post ground entry points, SAC's Giant Talk facilities, NORAD's Combat Operations Center located in Cheyenne Mountain, and Hq. USCENTCOM at MacDill AFB, Fla.

In the air operations area, AFCC technicians maintain the NOTAM system that gives military aviators real-time information on airfields and weather conditions at distant bases. Digital weather computer switches, centrally located in the Pacific area, Europe, and the US, are used to distribute weather and NOTAMs to Army, Navy, and Air Force locations. Graphic products from Air Force Global Weather Central at Offutt AFB, Neb., are transmitted over AFCC facsimile circuits. "These circuits are critical to flying safety and data in planning and executing military operations," General McCarthy says.

Deployable Communications Support

"We must be able to move rapidly to any spot on the globe and support customer communications and air traffic service needs," General McCarthy says.

Combat communicators have more than 126 different pieces of equipment to operate, including power generators, field telephone sets, tropospheric scatter systems, and tactical satellite communications equipment. "Equipment must be mobile, durable, secure, and easy to operate," he adds.

Last year, the Quick Reaction

Package (QRP), a stepvan with both voice and record communications capability, was introduced to provide minimum essential communications for command and control within minutes of rolling out of a cargo aircraft. Designed and fabricated by AFCC personnel, forty-eight of the vans have been ordered by the Air Force to provide reliable communications in support of bare bases, reconstitution, humanitarian relief, and other worldwide contingencies. The first twelve vans will be based in the US and Europe, to be used by all major commands as needed.

To become more responsive to the needs of the operational community, AFCC is realigning its combat communication forces. "We are going from a posture of principal support for tactical air bases to a more flexible structure that permits tailoring packages of people and equipment to meet a specific requirement," General McCarthy says.

At the same time, Air National Guard combat communications units are being realigned to provide more effective support. Seventy percent of the combat communications support for exercises is provided by 7,500 members of ANG units. In wartime they would reinforce the 3,000 active-duty combat communicators.

Wartime air traffic control operations will require deployable equipment and flexible procedures as well. Mobile equipment in the inventory includes such items as portable control towers, radar approach control vans, navigation and landing aids, and wind-measuring equipment.

A recently completed two-year test program in the US and overseas demonstrated the capability to more than double aircraft launch and recovery rates. "The amount of space between aircraft on the ground and in the air has been reduced, standard approach speeds set, and talk between pilot and controller shortened," says General McCarthy.

Basically, the new procedures, now being implemented in USAFE, PACAF, and TAC, call for self-navigation of aircraft to predetermined points. Pilots then configure their aircraft in terms of speed and altitude in accordance with new guidelines so as to accommodate a flow that will allow aircraft space as close as a mile and a half on final approach.

To repair damaged communications facilities, AFCC has formed some 650 active-duty and reserve force "E&I Ready Teams." The 3,500 members of these teams represent thirteen different E&I disciplines. More than $4.3 million worth of support equipment for these teams is expected to be prepositioned in Europe and the Pacific by FY '86.

"There will be less communications during a conflict," General McCarthy acknowledges. "Therefore, communications discipline will be necessary, requiring people to learn 'work-around procedures' and thus making more effective use of the communication channels available."

Exercising with degraded communications is now being written into deployment exercise plans and practiced in Brave Shield, Solid Shield, Blue Flag, and Global Shield. "Exercises allow alternate routing and reconstitution procedures to be practiced. Battle managers also learn to function in a degraded communications environment," General McCarthy says.

Breakthroughs and Trends

Microchip technology and digital electronics are revolutionizing the equipment and the means Air Force people will use to conduct their work in the future.

"The ever-present challenge of modernizing communications systems to keep pace with our customers' rising needs and expertise continues to face us," says General McCarthy.

In the past, base communications has evoked little interest in the research and development community because it has not been considered C^2. "Just recently, it was recognized that more command and control information passes through the base network than was previously thought, and this local network is probably one of the weakest links in the transfer of information from user to user," General McCarthy says.

The Air Force FY '84 budget request includes $258 million for improvements in base/support communications. The funding will be used to replace or modernize base telephone systems that, at some locations—for example, Scott AFB, Ill.—date all the way back to 1938. New computer-controlled digital switching systems will save manpower through increased equipment reliability and automated maintenance diagnostics. To the customer it will mean a greater number of available lines, and, in some cases, such features as call forwarding, call transfer, and three-way calling without operator assistance.

Many Air Force Telecommunications Centers (TCC) are still in the "manual" mode. Messages at many bases must be typed by the originator and then delivered to the TCC. The message is checked, routed, retyped into a punch-type format, double-checked for accuracy, and then transmitted. Several programs are being implemented to reduce manpower in TCCs. The first, now nearing completion, is the consolidation of TCC operations at bases that previously had separate on-base centers dedicated to individual users.

Another program provides equipment that reads message forms, routes messages, and either produces a paper or magnetic tape or transmits them via AUTODIN directly, thus eliminating the retyping of messages.

Furthermore, third-generation computer equipment that reads messages automatically and routes and transmits them is being installed at bases with large message volume. Remote computer terminals are located in the offices of customers for direct input into the automated system. Now operational at three bases, the upgrades are proposed for Ramstein AB, Germany; Offutt AFB, Neb.; Randolph AFB, Tex.; and Clark AB in the Republic of the Philippines.

Intrabase radio (IBR) systems are depending more and more on smaller handheld transceivers. AFCC manages more than 30,000 radios. Centralized base radio paging systems that interface directly with the telephone system are being introduced to allow individuals to be contacted from any base telephone. Two-way radios are being modified for privacy and security.

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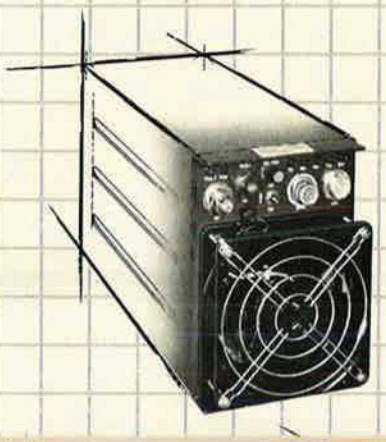

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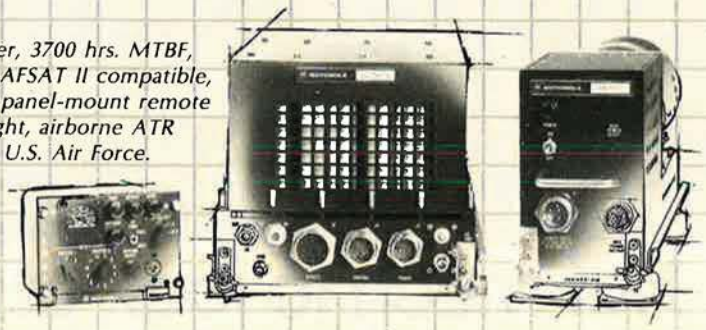

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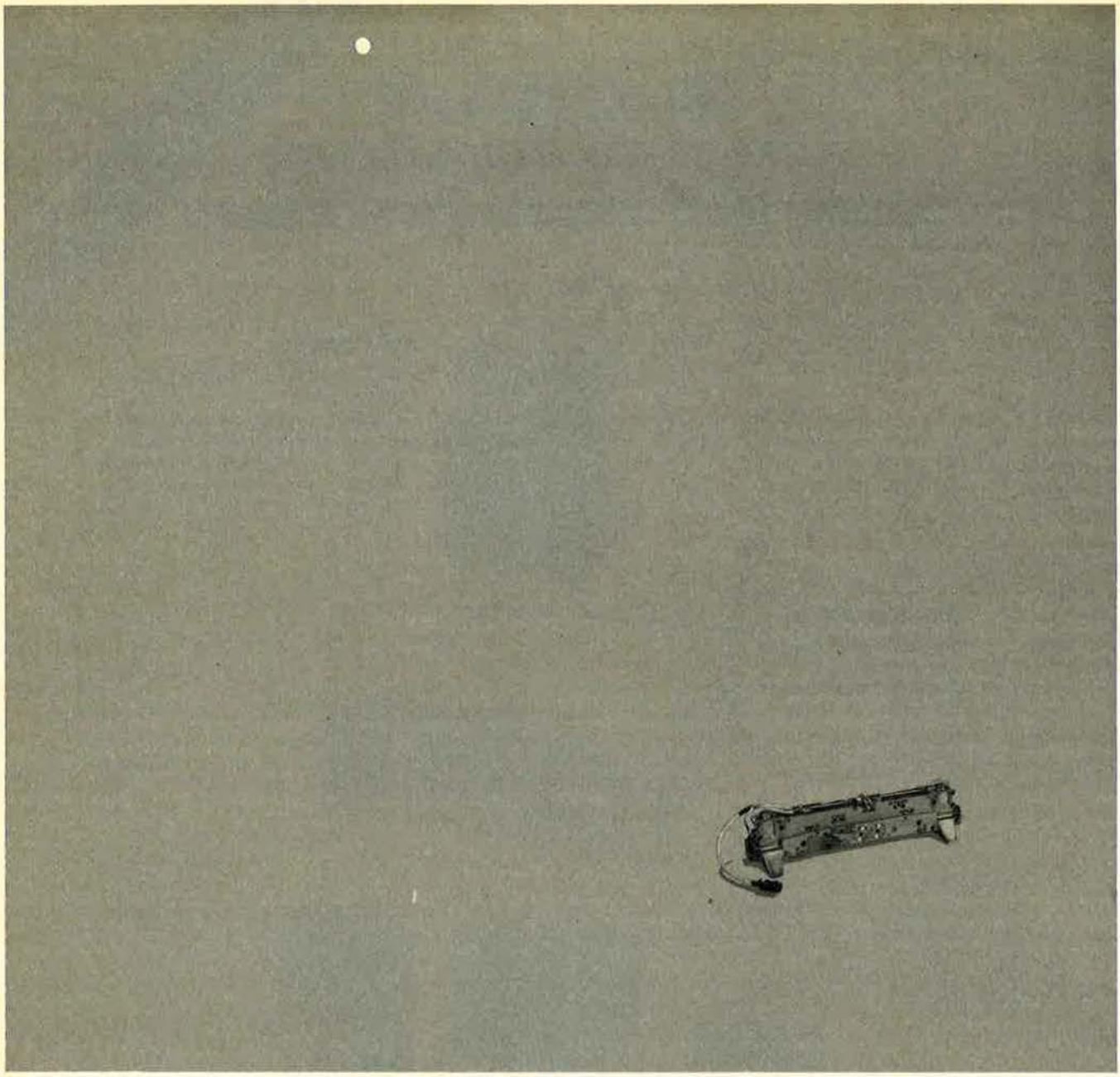

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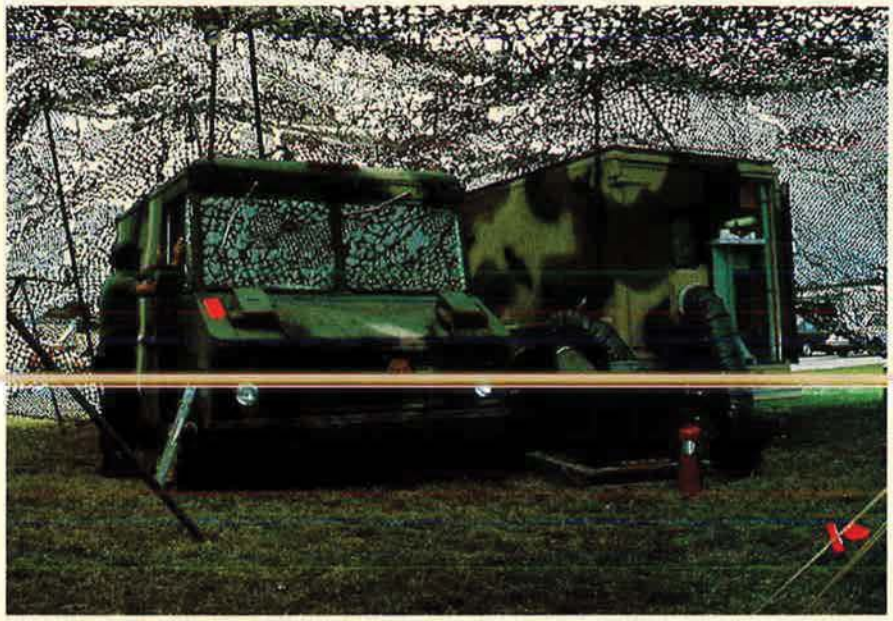
A lesson learned with the explosion of a Titan II missile at Damascus, Ark., in September 1980 was that there is a need to provide secure communications at the scene of such incidents. A special purpose mobile communications unit, dubbed HAMMER ACE, was established by AFCC.

HAMMER ACE consists of rapid deployment teams of engineers and technicians equipped with the latest communications gear. "These teams can support disaster response forces—contingencies that require limited, but highly flexible, secure communications," General McCarthy says.

The transmissions are relayed through a base station set up at the disaster site to Scott AFB, Ill., via satellite, then through service and military or commercial telephone. During late 1982, a C-141 crashed in a remote area near the Tennessee-North Carolina border. Within four hours, the HAMMER ACE team had established secure telephone communications lines.

Weather-observing equipment maintained by AFCC at 225 locations is being automated. For example, most of the present equipment is based on vacuum-tube technology and has remained virtually unchanged for the past fifteen years. When complete, the new hardware will reduce maintenance time and provide a more automated observing system that will decrease human involvement in gathering weather data.



ABOVE: Within minutes of rolling out of an aircraft, the Quick Reaction Package can provide voice and record communications. LEFT: Deployable satellite terminals provide tactical communications links. (USAF photos)

Many of the communication breakthroughs are a direct result of increased computer use. "Many earlier generation computers owned by the Air Force are, however, inadequate for today's needs, or are difficult to support," General McCarthy says.

To exploit this rapidly advancing technology, AFCC provides centralized management of nine data-processing organizations. Activities range from evaluation of existing Air Force computers to procuring new ones.

The Air Force will replace 277 supply and base-level computers with 153 new ones by the mid-'80s. AFCC will manage the $476.2 million acquisition from Sperry, the largest computer buy in Air Force history.

Space—The New Arena

The command's role in space will continue to grow.

It is now the principal Air Force contact for commercial and military satellite communications capability requirements to support military operations, including tactical operations.

"We maintain close coordination with other Air Force and DoD organizations to ensure the integration of satellite communications into Air Force C^3 objectives," General McCarthy says.

The command now operates and maintains thirty multipurpose satellite communications ground terminals that include nearly one-half of the DSCS's ground terminals, two of the systems operations centers, and all of the Air Force Satellite Communications Systems ground terminals.

Work is progressing on the Jam-Resistant Secure Communications program (JRSC) that calls for installation and operation of twenty satellite terminals at Air Force locations over a four-year period. AFCC's role is to plan, program, fund, install, test, and eventually operate the terminals.

"We wrote the Air Force operational concept as well as the joint operational concept for MILSTAR," says General McCarthy. MILSTAR is scheduled to be deployed in the late 1980s as the next-generation Military Satellite Communications (MILSATCOM) program. The system is designed to serve both the nation's strategic and tactical forces by providing a worldwide, highly jam-resistant, survivable, and enduring MILSATCOM capability. The Air Force has been designated the executive agent.

Finally, looking ahead—the fields of digital and microchip technology seem to be boundless.

"The user's appetite for information services will also grow," General McCarthy says.

As a result, for the foreseeable future Air Force telecommunications will be in a state of transition for the planners, managers, and users. The principal challenge for AFCC's communicators will be one of managing change. ■

The Costly Alternative To Controlling Cost

Unless cost growth can be eliminated altogether, a shortfall in weapons procurement is likely—even if the Air Force gets every budget dollar it has asked for.

BY JOHN T. CORRELL
SENIOR EDITOR

THE original plan was to build the F-15 fighter at a rate of 144 aircraft a year, but it didn't work out that way. Instead, procurement of the initial inventory was stretched out from six years to nine, which added $2 billion—the price of an additional wing of F-15s—to the program cost.

This is not an isolated example. According to a study by Air Force Systems Command, this sort of thing happened all too often during the past decade. It now takes longer and costs more to build a weapon system than it used to.

Real cost growth—the increase beyond that caused by inflation—averaged more than five percent a year on major Air Force systems in the 1970s. And systems are getting more expensive in other ways, too. In constant dollars, the price tag on an F-15 is about fourteen times the cost of an F-100 in the Truman era. Most of the difference is because the F-15 has advanced capabilities that could only be dreamed of when the F-100 was built. It has, however, become progressively more expensive to add increments of capability to weapon systems.

Development time for current systems is typically 11.5 years, almost double the time for systems in the 1950s and 1960s.

The Systems Command study finds that, over time, the leading reasons for cost and schedule growth have changed. Before 1970, technical problems were the most frequent cause of programs getting into trouble. That changed in the 1970s, though, when program instability became the biggest reason why procurements went astray.

Several factors contributed to the acquisition turbulence. Air Force funding expectations were too optimistic. In fact, procurement budgets actually declined in constant dollars below the levels of the 1950s and 1960s. This, along with unanticipated double-digit inflation, created a funding gap. The response frequently decided upon was to cut back on quantities and stretch out programs over more time. That wrecked the budget as well as the schedule, since delays, additional overhead, and inefficient production rates drove up costs.

There were other destabilizing influences. Frequent requirements changes were made to systems already in advanced stages of development. Increasingly active participation in program management by the Pentagon and Congress had an impact, too.

The A³ Study

The AFSC analysis, called the Affordable Acquisition Approach (A^3), is the best of several recent studies on the ravaging effects of cost growth on system acquisition. These studies have aroused the attention of Congress and have inspired commentary, much of it irresponsible, in the public media.

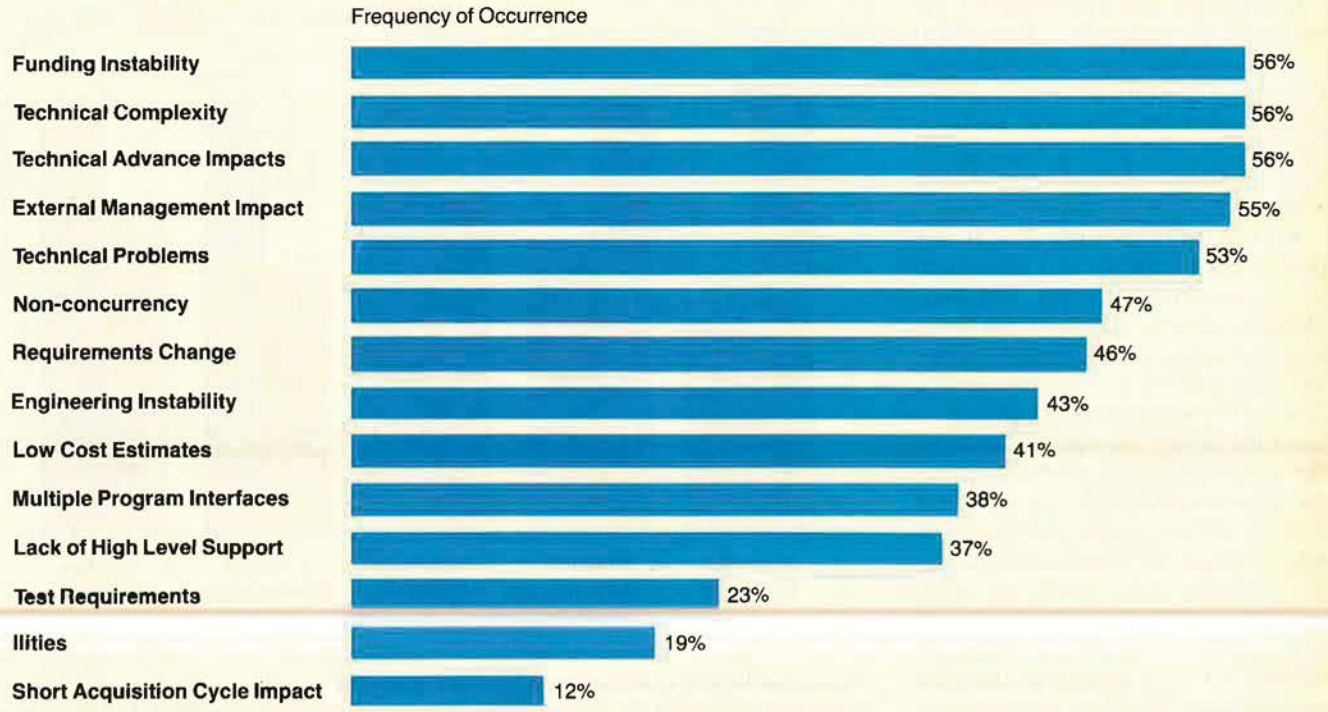
The real question is whether the historical cost growth pattern can be broken. Top-level Air Force and Defense Department officials say it can be. They cite new acquisition initiatives, such as multiyear procurement, as reasons why history need not repeat itself.

The Air Force, for example, claims savings of nearly a quarter billion dollars so far on multiyear procurement of the F-16 fighter. The F-16 was one of the first programs approved for the multiyear ap-

Shortfall Scenarios

The potential shortfall in the weapons buy is a function of real cost growth and procurement authority. If cost growth continues at the historical five percent rate and procurement authority (in 1982 dollars) averages $19.2 billion—the full amount called for in the FY '83–88 projection—the resulting shortfall will be twenty-three percent. If, however, funding is held to the FY '82 level of $10 billion, the shortfall will be sixty percent.

Troublemakers, Big and Small



The A³ study looked at fourteen factors contributing to cost and schedule growth and ranked them by frequency of occurrence over a thirty-year period. Examined in more recent focus, some factors have assumed greater significance while others declined in importance.

proach, which eliminates the stops and starts and inefficient production rates that are common in year-by-year contracting.

The A³ conclusions are similar to those reached in previous reviews of the acquisition process, but this study is different for several reasons. The most important is that it is based on empirical data from analyzing 109 past system acquisitions. A more dramatic reason, though, is that it projects hypothetical but specific consequences that might occur if history *did* repeat itself.

Even if the procurement budget sails untouched through Congress, the Air Force will experience a shortfall in its weapons buy unless it either kills some programs or has succeeded in totally wiping out cost growth.

Should cost growth continue at the 1970s' annual rate of five percent for the next five years, the buying power of the Air Force budget could be cut by up to twenty-three percent. And that assumes the Air Force gets every penny for procurement called for in the President's program and the Five-Year Defense Plan. This is by no means certain.

The FY '84 Program Objective Memorandum (POM) forecasts an average annual AFSC procurement authority between now and FY '88 of $19.2 billion, or about 2.4 times the average of the past six years. The increase is to fund continued modernization of the strategic and tactical forces.

The chart on the facing page shows the impact of various cost growth and funding level combinations. The worst case hypothesized in the A³ study is that the procurement budget is held at the FY '82 level over the entire period, and that cost growth climbs to seven percent a year. The sixty-three percent shortfall resulting from this combination means that the Air Force could carry out only thirty-seven percent of its planned acquisitions.

The Problem Factors

The A³ team analyzed three decades' worth of system procurements and came up with a list of fourteen factors that seemed to contribute to program cost and schedule growth. The chart above shows the frequency with which each factor occurred over the thirty-year period. Some factors have since declined in importance, and others have become more significant. For example, funding instability—found in fifty-six percent of all the programs examined—occurred forty-eight percent of the time in the years before 1970, but sixty-four percent of the time since then.

The study notes that the factors are interdependent. "For example," it says, "technical problems may require additional time and money to solve. This may cause funding problems and lead to a requirements change if it is perceived that correcting the technical problem is too costly. At the same time, the presence of technical problems and cost growth may weaken the support that the program has within the Air Force, the DoD, or the Congress, resulting in a program with funding problems, requirements changes, and external management involvement."

Inflation is a perpetual problem. It is bad enough by itself, but it feeds on cost growth like a loan shark's interest rates. Selected Acquisition Reports (SARs) on major Air Force R&D programs showed that infla-

tion caused by real cost growth added up to nearly twice as much as the amount of the original overruns.

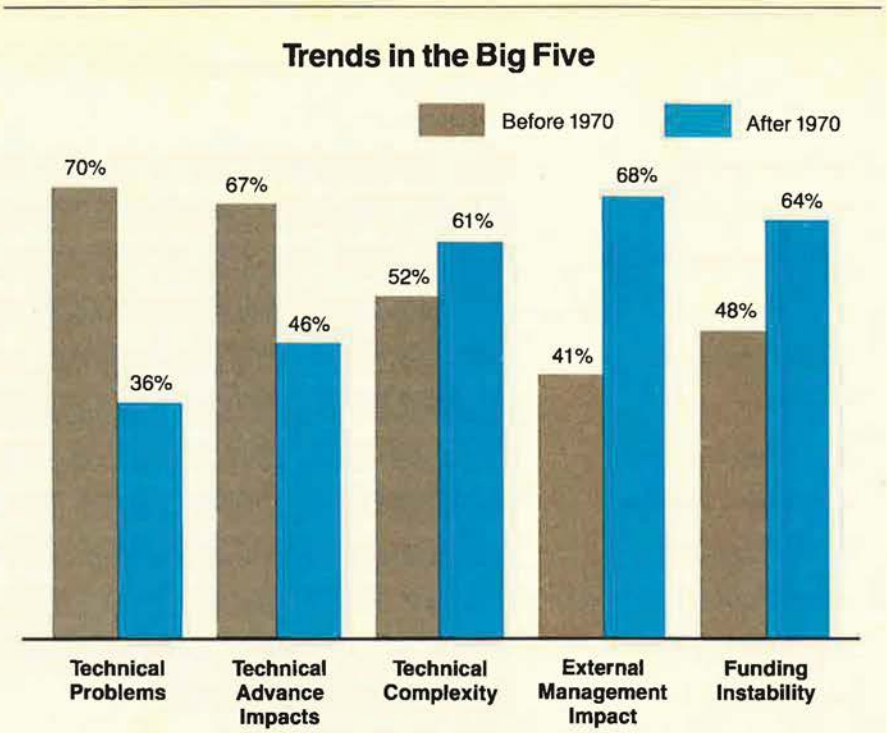
One of the ways A³ studied the data was to group the intertwined factors into four clusters—technical factors, risk management factors, government management factors, and funding instability factors—to look at their relative importance over time.

• **Technical Factors.** Far fewer programs encountered technical problems in recent years, and trouble arose less frequently from going into full-scale development before the bugs had been worked out of a system. Engineering instability—meaning design changes initiated by the program office or the contractor—declined sharply as a source of trouble. (Requirements changes, which originate somewhere above the program office level, are quite another matter, about which more will be said.) Technical complexity, defined for A³ purposes as the existence of large numbers of interfaces, subsystems, and components, rose in importance. Overall, technical factors caused less cost and schedule growth in the 1970s than they once did.

• **Risk Management Factors.** In the early 1970s, the Pentagon adopted a conservative "fly-before-buy" acquisition philosophy. There was less reliance on concurrency, in which a production decision is made before development is completed. Systems can be fielded quickly with concurrency, but glitches are more likely, too. The reduced range of Minuteman I is an example of concurrency leading to less capability than was desired. The A³ findings for the risk management cluster came as no surprise. Problems arising from concurrency and shortened acquisition cycles are less frequent. Test requirements have increased. Program managers have to spend more time on the "ilities"—the reliability, supportability, and design-to-cost work generated by a cautious acquisition philosophy—but these are comparatively minor factors in the overall cost and schedule problem.

• **Government Management Factors.** More and more, program directors have had the Air Staff, the Defense Department, and Congress looking over their shoulders. The number of programs experiencing such "external management impact" has grown from less than half prior to 1970 to more than two-thirds in recent times. Changes to system requirements generated somewhere above the program manager's head occur somewhat more often than they once did. Emphasis on joint service developments has given the program office more interfaces to worry about. Half of the 1970s programs—compared with a fourth in the 1950s and 1960s—ran into cost or schedule growth as a result of weak high-level support. Overall, government management factors figure increasingly in program troubles.

• **Funding Instability Factors.** Fully two-thirds of the acquisition programs in the 1970s suffered from seesaw funding or other budget decisions at the Air Staff, Defense Department, or congressional levels. The damage was offset to a degree because *Air Force cost estimators during this period were more accurate than their predecessors had been.* The number of programs in which cost estimates based on initial program definition turned out to be low declined from forty-eight percent to thirty-six percent. "This is not to say that over one-third of the programs with cost-estimating problems is a suitable situation, but only to point out that the number of programs with such problems have decreased," the A³ study comments.



These five factors contributed to cost and schedule growth in more than half of the programs studied by A³. Their relative importance, however, declined. Technology became less of a problem while external management impact and funding instability grew more troublesome.

The chart above shows the five factors most often affecting cost and schedule growth. Technical problems have declined in importance. So have technical advance impacts—an awkward term that means going into full-scale development with immature technology. Technical complexity is slightly up as a driver of cost and schedule growth. The big surges since the days when systems cost less and were fielded sooner have come in external management impact and in funding instability.

What Can Be Done?

The Air Force's acquisition woes are not worse than those of the other services, but, thanks to the A³ study, they are better documented and analyzed. Unfortunately, the study has been seized upon by some as evidence that the Air Force needs a tighter collar and a shorter chain

in fiscal matters. A more reasonable conclusion is that the Air Force has responsibly faced up to its procurement problems. A³ confirms that recent Air Force and Defense Department efforts on cost and schedule growth are pointed in the right direction, and it provides a basis for further efforts. AFSC has combined all of its cost-control actions into a major push called "Project Cost."

The Air Force had a lot of help getting into its present predicament, and will need a lot of help getting out of it. Some of the bigger variables in cost and schedule growth depend on action above the Systems Command level. But smaller factors—as well as factors that have declined in relative importance—still cause trouble. Thus, the A³ study calls for both a top-down and a bottom-up attack on cost.

Key elements in that attack are already in progress. Multiyear procurements, which the Air Force had been advocating for years, were part of the Acquisition Improvement package that Deputy Defense Secretary Frank C. Carlucci introduced in 1981. As noted earlier, multiyear contracting can smooth out instability and lead to efficient production rates if the technique is used properly.

Another Carlucci initiative was Preplanned Program Improvement (P³I), which provides for upgrade modifications to systems after they are deployed. It decreases the temptation to design high-risk features into a developing system, since those features can be added later after the technology matures. It may even cut down on the number of requirements changes inserted into ongoing programs for whatever reason. According to one Pentagon analyst, there were more than 500 design changes to the F-15 in its second year of *production*. (Systems Command sources say, however, that such a figure would have to count extremely minor items.)

To protect programs further from unnecessary change, AFSC is putting tighter control on "baselines," which define a system in terms of cost, performance, support, and schedule. Requests for baseline changes are screened more carefully nowadays. Earlier this year, Systems Command began requiring new program directors to sign "contracts" committing themselves to the baselines of their programs within forty-five days of taking charge. Future baselines will reflect firm agreement among AFSC, the Air Staff, operating commands, and supporting commands.

Baselines can still be changed for legitimate reasons, such as reassessment of the evolving threat over the long period a system is in development. Advocates of a change, however, will have to demonstrate the absolute necessity of their proposal, and must show that disruption to the program will be minimal. In addition, a baseline change proposal must now come in with a "zero cost alternative," meaning at least one idea of how to do it without any more money.

In support of realistic budgeting, the Air Force and the Defense De-

partment are making greater use of independent cost estimates. The independent estimate is compared with the one the program manager turns in, and the higher of the two becomes the budget figure unless there is a strong rationale for doing otherwise.

The Air Force is also dusting off the "Should Cost" technique, which sends teams to contractor plants in search of wasteful practices that make production of a system cost more than it ought to. Teams are empowered to look into everything from wage settlements to the amount of scrap material thrown away.

A^3 proposes that full-scale development be viewed as a commitment and that production be a "tough gate" in the system acquisition process. Early development is relatively cheap, accounting for only three percent of the life-cycle cost of a typical system. Full-scale development adds another twelve percent. The big expenses begin with production. Since nearly all programs that reach full-scale development go on to production, the Air Force must be sure—very sure—of programs it allows to proceed into full-scale development, the study says. Beyond that point, however, commitment must be unswerving. "Once in production at an economical rate, stay there," the study advises. "It's cheaper than stretching out a program."

The study says further that a strong Planning, Programming, and Budgeting System (PPBS) effort will be needed. It does not describe the difficulties in achieving that.

In theory, the Defense Department's PPBS is supposed to match up military requirements with the resources to procure them. In practice, PPBS limped along badly all through the 1970s, and the defense acquisition process grew apart from it. Repairing PPBS was one of the Carlucci initiatives.

But even if the fiscal machinery in the Pentagon has been fixed, that may not be enough. As a recent study by the American Enterprise Institute points out, Pentagon budgets are not arrived at in reality by establishing military requirements and then funding to the level indicated. Budgets are sized in terms of percentage increases or decreases from previous budgets.

During hearings on FY '84 funding, Defense Secretary Caspar Weinberger asked repeatedly that Congress think in terms of requirements instead of budget percentages. On the Hill and in the media, a tendency persists to contrast proposed increases in the defense budget with cuts elsewhere in federal spending—the so-called "fairness" issue. Argument continues about whether the proper increase for defense would be ten percent, five percent, or some other figure.

Should the Air Force somehow succeed in its seemingly impossible task of reaching zero cost growth, the weapons buy in the outyears could still fall short as a result of budget cuts.

No matter how difficult a target zero cost growth is, the A^3 data should supply plenty of motivation for the Air Force to go after it with a vengeance.

Consequences of Failure

The fate of future procurement budgets lies with Congress and the President, and to lesser extent with the priority that the Defense Department puts on systems procurement vs. other needs. The Air Force will have its hands full with the cost growth part of the problem.

Instances of zero cost growth are rare. The Air Force brought it off in acquisition of the Cobra Judy missile-tracking radar, but that was a one-of-a-kind system that basically took mature Cobra Dane technology and put it aboard a ship. The original C-141 buy came in on cost, too.

There is evidence, however, that recent initiatives are having a positive effect. Both the B-1B and F-16 programs are tracking very near their baselines.

The consequences of failure to achieve zero cost growth, combined with lower-than-projected budgets, are illustrated by two examples in the A^3 study.

The situation hypothesized is that the Air Force has succeeded in holding real cost growth to two percent a year, and that procurement budgets average $15 billion a year—midway between the current budget and the planned level.

As the chart on p. 88 shows, this would mean a thirty percent drop in buying power.

To illustrate the depth of such a cut, the first A^3 example lops a sample thirty percent out of the Air Force procurement budget from the FY '84 POM. The following programs are lost: WASP, MRASM, Infrared Maverick, Navstar, the derivative fighter, HARM, GLCM, LANTIRN, the F-16 buy, and part of the F-15 buy.

This is not to say that the Air Force would react to a budget cut of that size by cutting these specific programs, but rather to show how much a reduction of such scope would hurt. Other cutback options would be similarly painful.

In the second example, the drop in purchasing power is the same, but this time the response is to stretch out programs and slow production rates. Doing this would increase costs by somewhere between $6 billion and $14 billion. Should the higher figure turn out to be correct, the penalty would be equivalent to the cost of more than 400 F-15s, or more than fifty B-1Bs, or about eighty C-5Bs.

No matter how difficult a target zero cost growth is, the A^3 data should supply plenty of motivation for the Air Force to go after it with a vengeance.

When programs get into trouble or if funding expectations are not met, the intelligent decision will be a hard one. It means canceling weak programs rather than weakening healthy programs by stretching them out and perpetuating the old cycle of cost escalation. ■

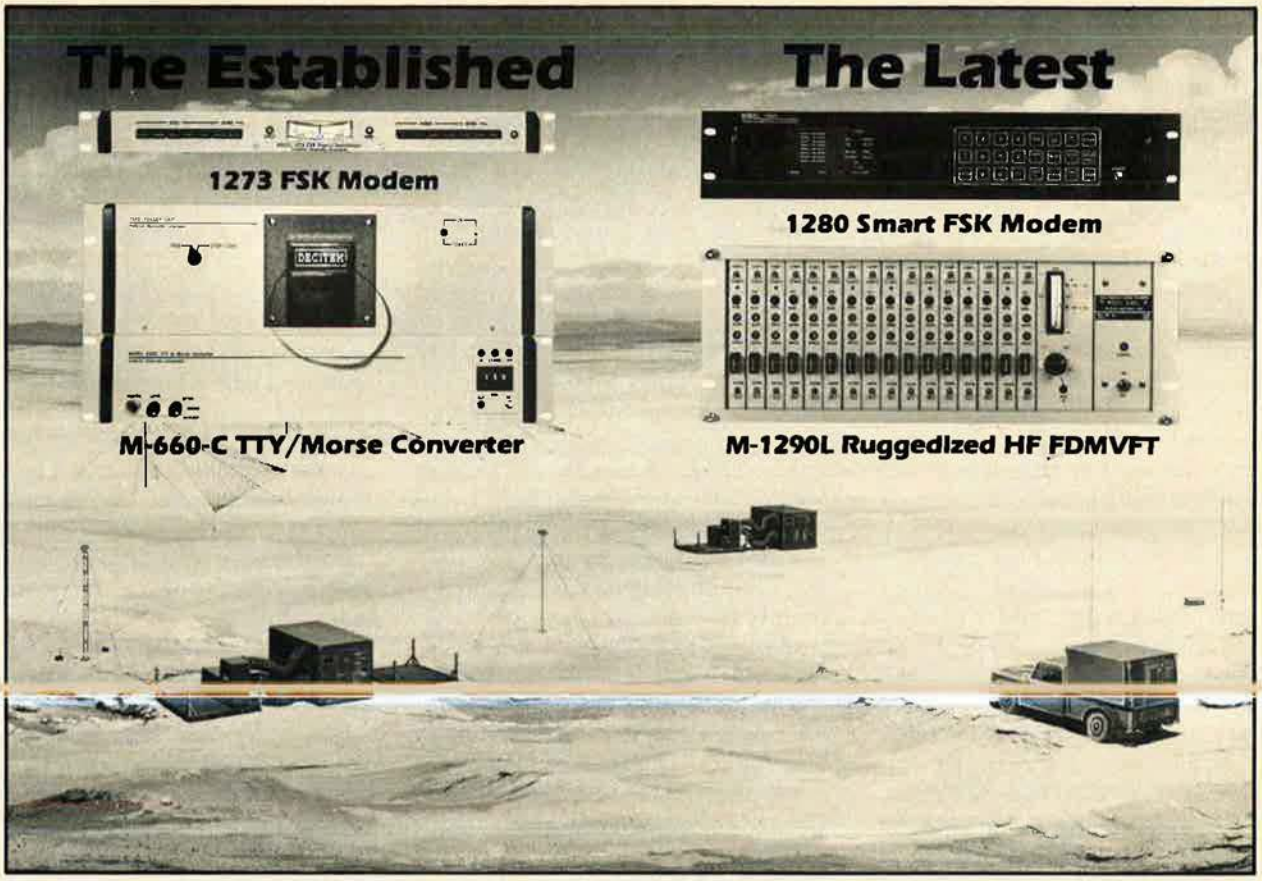


Photo of Deployed AN/TSC-60 System courtesy of Rockwell International.

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Questions At the Paris Air Show

Public eyes are watching the skies as aircraft cavort daily above Le Bourget Airport. But the real business is done on the ground, near the spot where Charles Lindbergh landed on May 21, 1927.

BY F. CLIFTON BERRY, JR.
EDITOR IN CHIEF

A RECORD number of exhibitors is scheduled to show their wares and compete for business during the thirty-fifth Paris Air Show *(35e Salon International de l'Aéronautique et de l'Espace)*. More than 910 exhibitors representing thirty countries will be on the show grounds at Le Bourget Airport, a few miles north of Paris. Aircraft in the show, both flying and on static display, number 185.

The show, sponsored by the group of French air and space industries (GIFAS), runs from May 26 through June 5. The show is organized and conducted by Director General Henry Lafont and his staff. Official opening ceremonies are on Friday, May 27, presided over by President of France Francois Mitterrand, President of GIFAS Jacques Mitterrand, and Commissioner General of the show Serge Dassault.

Although the aircraft performing in the daily flying display from 10:00 a.m. to 6:00 p.m. are the most visible elements of the Paris Air Show, the real business is conducted on the ground. It takes place at exhibitors' stands, or at their business and entertainment chalets along the show line, or back in town at meetings and meals.

US Companies Missing

Several major US aerospace companies decided not to exhibit or to have chalets at this year's show. Among them are McDonnell Douglas, Lockheed, General Dynamics, and Vought, companies who have previously made a major presence at the show. Pratt & Whitney Aircraft, the engine manufacturer, will not be there, although its parent, United Technologies, will be. Even though those companies and smaller ones are not exhibiting, a few top officials from each will be in Paris during the air show, observing and conducting business. Boeing will be present, but will not display its 757 and 767 transports as it did at the Farnborough Air Show last September.

The absence of the US majors opened up exhibit and chalet space for others, who came forth in record numbers. Strong pushes for new aerospace business will be made by the air and space industries of Argentina, Brazil, Greece, Israel, Japan, the Netherlands, and West Germany, among others. The eastern bloc of countries seeking business and showing their wares include the USSR, Czechoslovakia, Hungary, Poland, and Romania.

Some Questions

Companies and nations will be at Paris to get information as well as business. Several topics are currently of major interest worldwide, as well as of specific value to certain companies and countries.

Consider the case of development of an advanced fighter aircraft. An important question is whether the European countries' economic and political situations will tolerate the costs of developing an advanced fighter. A British Aerospace Corp. example, the Agile Combat Aircraft, was unveiled at Farnborough last September. The hope was that it would be built by a consortium of British, German, and Italian companies, following the example of the Tornado. Other questions are whether the German and Italian governments are willing to participate, and to what extent they will provide financial support for the development. Then, what are the limits of support from the Thatcher government, and how much of its own capital can British Aerospace afford to put into ACA to keep the project alive while awaiting political decisions?

Similar questions face the French ACX (for Advanced Combat Experimental) aircraft, being developed by Avions Marcel Dassault-Breguet. The French Minister of Defense recently gave government approval for the project. Besides the basic financial questions, there is the issue of whether Germany or the UK are willing to become partners in the ACX development program.

The ACA and ACX cases give rise to larger questions on international projects. Will European countries continue to have their own indigenous aerospace development capa-

bilities, either singly or collectively? Or will they more often be forced by fiscal realities into cooperative ventures with the US, Japan, or Third World countries who are fast developing first-rate capabilities?

Surely Europe is still a prime market for US aerospace and high technology companies. But if the Europeans need collaborative projects to survive, what terms will they seek from US counterparts? Or, if US companies or the Reagan Administration do not agree to European cooperative needs, will large chunks of the European market be lost by default?

In two immediate cases, the Europeans are incensed over restrictive actions by the US Congress. They apply to specialty metals—shutting out European suppliers—and to the ejection seat in the McDonnell Douglas/British Aerospace Hawk trainer aircraft for the US Navy. In the latter case, the House required that an American ejection seat be competed against the existing British Martin-Baker seat in the Hawk. Show attendees will be watching for efforts by companies and governments to convince US legislators attending the show of the need for repealing the strictures.

Financing Shifts

In both the military and commercial fields, what financing trends will be most apparent at Paris? Coproduction or coassembly projects have been around for years, and constitute indirect forms of financing. Other methods now coming into vogue include customers paying for purchases in commodities instead of currency (Peru bartered fish meal to the USSR for helicopters, for instance); the seller assisting buyer in marketing his products worldwide (Northrop with Swiss industries to clinch an F-5E sale); or the seller providing offset markets within his own company or country for the buyer. The new US Export Trading Company Act facilitates that plan, whereby a focal point within a supplier corporation brings customer companies' products to the attention of other corporate divisions or other potential US customers. Both General Electric Trading Co. and Sears World Trading Co. are recent examples.

This show is considered by many observers to be the "make-or-break" outing for Northrop's F-20 Tigershark fighter. They will be watching for indications either that actual orders are imminent, or that such expected potential customers as Jordan or the United Arab Emirates have dropped the fighter from consideration.

A hot topic, and one in which questions abound, is technology transfer. The Reagan Administration has taken strong measures to restrict this damaging flow of information. Other countries may protest, but at the same time will be trying to safeguard their own technological advantages. For some US companies, the most recent concern will have been exhibit data deleted by the Department of Defense, or exhibits that have been delayed or scrapped because of tightened DoD review.

Looking at military aircraft, people will be asking how far the multirole movement has gone and where it might be heading. European and Third World countries are arming their trainers as a matter of course, so that more often they are trainer/attack instead of pure trainers. They seem to be thinking of more roles per airframe, while recognizing the penalties imposed on each role. There has been novelty thinking in this field, such as putting guns and missiles aboard 747s, and mounting air-to-air missiles on Nimrod patrol aircraft. What other multirole schemes will be proposed at Paris? A philosophical question: Between wars, do we think multirole to save money, but wish for more effective specialized equipment when the shooting starts?

These questions are just a sample of those to be asked by the 80,000-plus trade visitors who descend on Paris and Le Bourget. The main question is whether they get valid answers. That will not be answered until well after the gates have closed on June 5. ■

FAR LEFT: A Mil Mi-17 in Aeroflot markings on static display at the 1981 Paris Air Show, where it was first displayed in public. The helicopter, like all the Soviet aircraft at Paris, was billed as "civilian." Pre-show speculation in 1983 was that the Soviets would unveil their C-5A lookalike at this year's event. LEFT: Crowds of trade visitors leaving the US Pavilion at Le Bourget mingle with the public on one of the open days at the 1981 show. More than 80,000 trade visitors attended that year, and nearly 40,000 of them went through the exhibits at the US Pavilion.

The Stout and the Strident On The Mediterranean Rim

Russians get a warm welcome in Athens, but not this correspondent, who is denied entry by Greece.

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

"GET Away to Greece," say the travel posters. In my case, it was just get away. It seems someone in Andreas Papandreou's government—I don't flatter myself that it was Papandreou himself—came across an article I had written in AIR FORCE Magazine some years ago. A capsule description of Mr. Papandreou in that piece, while by no means scurrilous, was sufficiently *lèse majesté* to cause the Greek government to put out the no-welcome mat. I was torn between feelings of rejection and elation at this unexpected notoriety.

The same week of my non-visit saw the arrival in Athens of the Soviet Prime Minister, Nikolai A. Tikhonov, a man who emerged from obscurity for the celebratory occasion of warming up Greek-Soviet relations. According to press accounts, Mr. Tikhonov was greeted by Mr. Papandreou, along with kisses from Melina Mercouri, Minister of Culture and onetime star of *Never on Sunday,* and a cheering crowd of Greek Communists bearing placards hailing Comrade Tikhonov as the Prime Minister of Peace.

Meanwhile, over on the military side of the airport, another crowd was picketing the gate of the US air base. These are not the best of times for the Greek-American relationship nor, for that matter, Greece's role in NATO.

The current trouble began with the Turkish invasion of Cyprus in 1974 and Greece's withdrawal in protest from NATO's integrated military structure. What is generally forgotten is that the Turkish invasion was in response to an attempted Greek coup in Cyprus, aimed at making Cyprus part of Greece. Brigadier Ioannidis, the shadowy chief of intelligence in the Papadopoulos regime and last chief of the junta, was behind the botched coup attempt. The success of Turkey's Cyprus invasion, itself no candidate for inclusion in any book on great campaigns, showed up the sad state of Greek military preparedness. As a consequence, the junta fell, thus paving the way for the eventual return of the left-leaning Andreas Papandreou, former US citizen, who seems to have developed a severe anti-American bias since his days at Berkeley.

The Cypriot Thorn

Anyway, Cyprus started the most recent trouble, although the United States was innocent of any role in that affair. In fact, American diplomacy has managed the evenhanded feat of alienating both Greece and Turkey for many years: Greece, because the United States failed to come to the rescue in 1974, and Turkey, because of a scolding letter from President Johnson in 1964 over another crisis in Cyprus and the arms embargo later enacted by Congress during the late 1970s.

Cyprus may have set off the current problems with Greece, but there are other matters that are now making the situation worse. There is the military aid program, always a sensitive issue between Greece, Turkey, and their common benefactor, the United States. This year President Reagan infuriated the Papandreou government by proposing an increase in Turkish military aid from $402 million to $755 million, while keeping aid to Greece at the previous level of $280 million. From the Greek point of view, this altering of the ratio in military aid is a US attempt at intimidation.

Another problem affecting not only Greek-American relations or Greek-Turkish relations, but the whole outlook for Greece in NATO, is that of Aegean airspace. Briefly, Greece had undisputed responsibility for the Aegean FIR (Flight Identification Region) before the Cyprus affair. Until then, Greece participated in the NATO integrated military structure and thus, at least some of the time, in the 6th Allied Tactical Air Force headquartered at Izmir. With a USAF lieutenant general in command of 6ATAF, disputes involving Aegean airspace were resolved by this impartial NATO command. Turkey was thus quiescent, if not exactly happy, over Greek responsibility for the FIR.

Then, when Greece stormed out of the NATO military structure, all bets were off. A Turkish lieutenant general now commands 6ATAF; he has a USAF deputy and no Greek officers on his staff. Turkey has said it will never agree to the pre-1974 airspace boundaries, and Greece will never give up air defense responsibility for the hundreds of Greek islands in the Aegean. Moreover, Greece apparently wants to extend its ICAC responsibilities into a matter of national law, with the consequent right to veto entry into the Aegean. Compared to this problem, King Solomon's determination of the true mother was kindergarten stuff.

The Greek position on the Aegean also causes the Sixth Fleet some concern, for the US Navy has always refused to recognize any nation's authority over carrier operations in international waters. In the Navy's view, that takes in the entire Aegean except for those bits six miles around the islands. Greece is letting carrier operations go unchallenged so long as they are under national control. When the Sixth Fleet chops to NATO for an exercise, there are occasional Greek intercepts.

Where Greece is headed is anyone's guess. Mr. Papandreou has lowered his pitch since taking office, a not uncommon occurrence when people assume responsibilities, but the immediate future of

Greece in NATO would appear to be a troublesome one. Papandreou, who is his own Defense Minister, took the unprecedented action of vetoing the communiqué at the December 1982 ministerial meeting.

US Bases In Greece

As for the United States bases in Greece, their long-term future remains doubtful if we are to believe Mr. Papandreou's published declamations. The ongoing base agreement discussions have run into periodic snags, presumably because the price and conditions for lease renewal are a little hard to swallow. In the end, however, the bases will probably survive, although with some new restrictions—a logical prediction because it is in the interest of both Greece and the United States, to say nothing of NATO, that the US continue to use the four installations. Logic, on the other hand, does not always appear to be the guiding factor in this volatile Greek government's decisions.

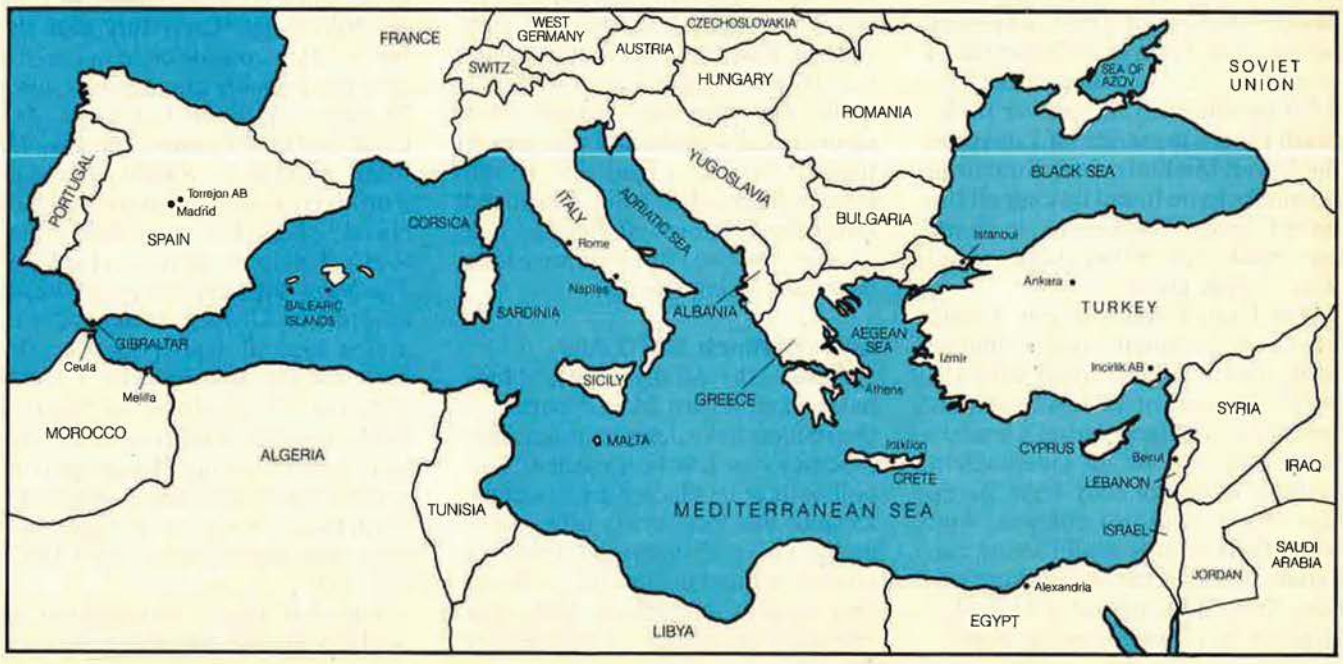
In the long run, most informed people think Greece will come back into the Alliance on a less grudging basis. There will still be problems with Turkey, as there have been for much of the past sixty years—or four hundred years if we count the Ottoman Empire—but its security is best served in NATO. Cast adrift as a neutral, Greece could be fair game for the same sort of bloody Communist uprising it endured after World War II. Mr. Papandreou is seemingly not worried about any recurrence of that episode for he has welcomed back to Greece some 20,000 Communists who fled into Bulgaria and other safe havens when the civil war ended in 1947. What the professional, and traditionally conservative, Greek officer corps thinks of this gesture is something only they know.

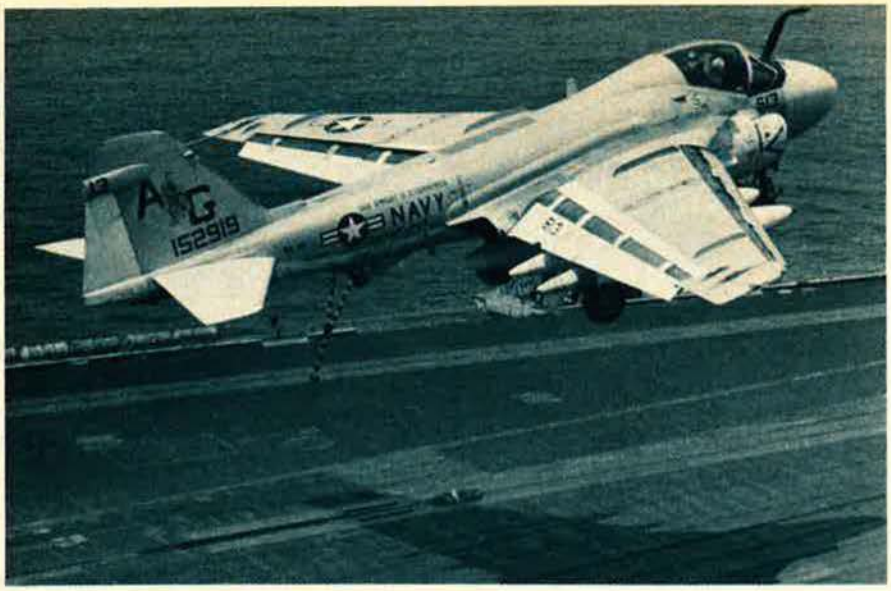
Touchdown of a Greek Air Force F-4E Phantom.

Libya and Lebanon: Double Trouble

Elsewhere in the Mediterranean, the problems seem to multiply. While Comrade Tikhonov was reveling in his brief moment in the sun, the Sixth Fleet, supported by four AWACS airplanes, which cruised over from Tinker AFB, Okla., established a watch on Col. Muammar Qaddafi. He was making ominous moves along the Libyan border with Sudan, an ally of our new friend, Egypt. Evidently, the message came through, for nothing happened, but it was another reminder of the apparent inevitability of trouble with Libya sooner or later.

Qaddafi's stockpile of weapons exceeds any conceivable need for self-defense against his neighbors, as well as exceeding the capability of the Libyans themselves to employ this arsenal. Perhaps the USSR just took advantage of an ingenuous Bedouin with money to burn, but that is not a likely explanation for the Libyan arms buildup. It is not a simple matter to turn camel drivers into pilots and technicians, so it is fair to assume all that weaponry envisages some outside help. The So-





While carrier aircraft of the US Navy's Sixth Fleet continue to project the image of America as the predominant NATO seapower in the Mediterranean, Soviet naval strength is on the upsurge in the area.

viets, not incidentally, have recently signed a friendship treaty with Libya.

When the Sixth Fleet, really the carrier *Nimitz* and its supporting convoy, took up station off Libya's coast, it had to leave its usual position these days off the coast of Lebanon. The situation there has all the ingredients for long-term turmoil. Certainly, Lebanon will not be put back together in its former idyllic state if, in fact, it can ever be put back together at all. Syria, after the plastering it took from the Israelis in the first days of the Lebanon invasion, has been quietly reequipped by the USSR. The Soviets have evidently increased their advisory presence in Syria as well and taken over the direct manning of the two SA-5 missile sites. In answer to the Sixth Fleet's presence off Lebanon, the Soviet Mediterranean Squadron is usually to be found lurking off the tip of Cyprus. The Soviets, in short, have made it plain they stand behind their Syrian client.

The United States' client, Israel, has not given much public evidence lately that it is concerned with US public opinion or policy. It strains credulity to believe Israel's leaders think they can set an independent course, although they have given that impression in Lebanon. And while there is little doubt Israel can handle Syria or any other Arab nation, there is the matter of US aid—largesse is a more precise word—without which Israel cannot survive. Beyond that, there is always the danger of direct Soviet involvement in an Israeli-Arab conflict, especially if the US tie is loosened.

Egypt, while determinedly nonaligned, can be counted a US friend. It is also moving back toward the Arab world, following the post-Camp David estrangement. The reequipping of the Egyptian Air Force with F-16s, along with Mirage 2000s, Mirage Vs, and Alpha Jets, proceeds on schedule. Thirty-five F-4Es, pried out of the USAF's hide to seal the Camp David agreement, will now presumably be sold to Turkey. US-Egyptian relations have vastly improved since the 1973 Yom Kippur War, but it would be a mistake to take Egypt for granted. It is a nation with immense problems as a geometrically exploding population tries to fit into a land that is still mostly desert. And while Egypt and Israel have sworn off fighting one another, the two countries are a long way from being friends.

Italy: Staunch NATO Ally

Across the Med in Italy, things have taken a turn for the better as the Italians have demonstrated a democracy can function more or less oblivious of its elected government. Despite electoral crisis after crisis and a noisy Communist Party in control of most major cities—Rome and Naples included—Italy has managed to subdue its murderous Red Brigade, meanwhile remaining a staunch NATO ally. And while the Benelux countries have dithered over the stationing of cruise missiles, Italy has never wavered in its decision to accept them.

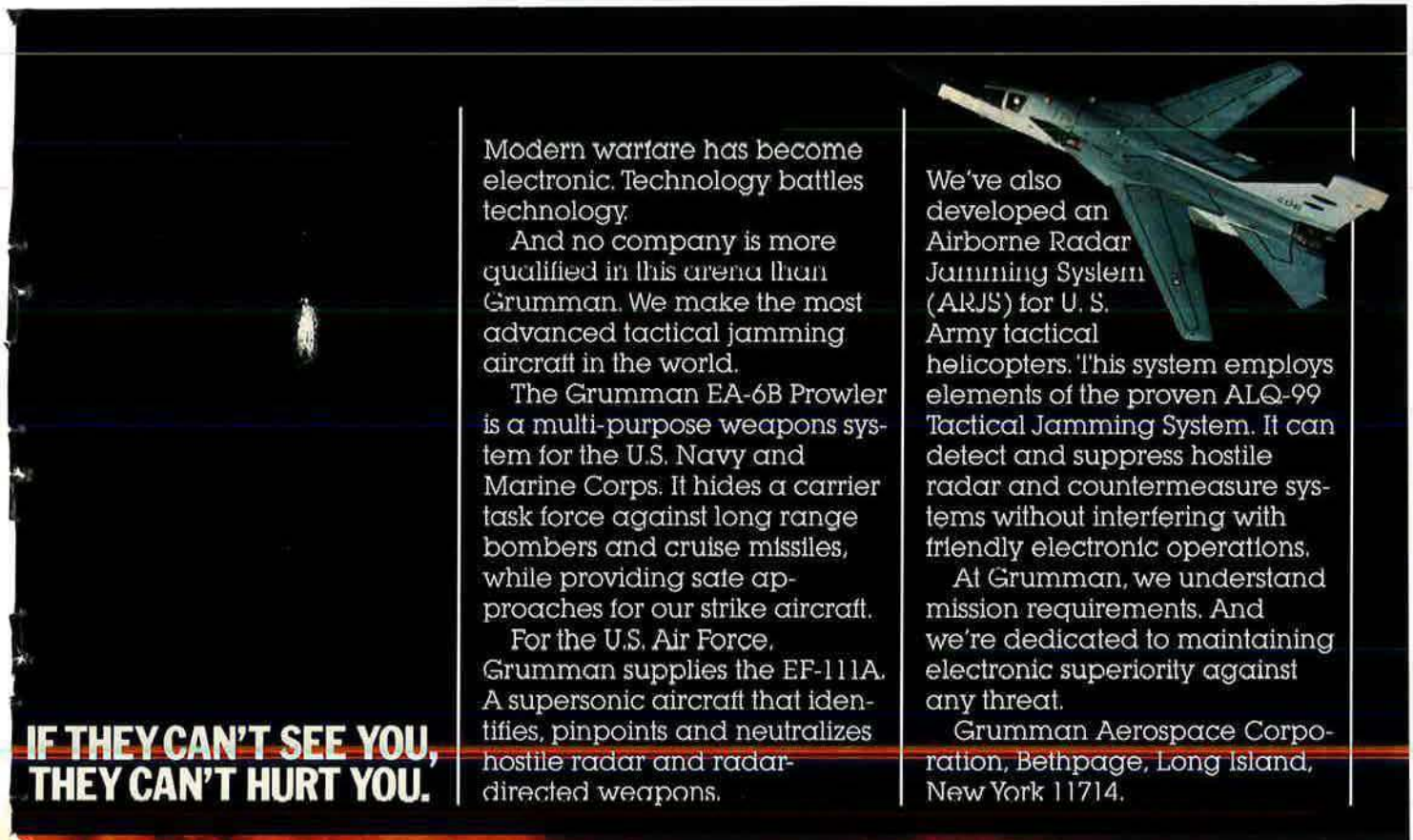
The fact that Italy has survived the ineptitude of its politicians, indeed, almost forgotten they exist, is a tribute to the career government officials, civilian and military, who have carried on in their country's best interests.

It is a great thing for NATO that Italy has been a stable and effective ally, given the *à la carte* membership of France on one side and the uncertain behavior of Greece on the other.

Notwithstanding, then, its Communist mayor, its notorious criminal syndicate, the Camorra, and a reputation for lawlessness, Naples is the headquarters for NATO's Southern Command. CINCSOUTH has invariably been a US Navy admiral, in deference to the Mediterranean naval predominance of the Sixth Fleet. There was a time back in the sixties when the Med was an American lake, the *Mare Nostrum* of Mussolini's empty boast. What with an increasing Soviet naval presence, including attack submarines, and a rising threat from land-based air, the Sixth Fleet is no longer quite so dominant, but it is still an impressive and what is perhaps more important, a visible symbol of US power.

CINCSOUTH is an American admiral who, until recently, had only his NATO hat. Early this year the Navy, after considerable agonizing over the possible implications, gave to Adm. William J. Crowe, Jr., CINCSOUTH (relieved in May by Adm. William N. Small), the additional title of Commander, US Naval Forces, Europe, a title hitherto attached to an admiral in London. The Navy will keep its elegant headquarters on Grosvenor Square with a vice admiral deputy there as the man on the scene, and CINCSOUTH will continue in Naples, but he now has at least nominal control of forces. This change puts at rest the traditional reluctance of the Sixth Fleet Commander to acknowledge the preeminence of CINCSOUTH.

The Air Force component of NATO's Southern Command is Air



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South, commanded, as always, by a USAF lieutenant general. Some years ago the US Air Force, in a move to give the Commander, Air South, more NATO clout, assigned him the additional responsibility of Commander, Sixteenth Air Force, which is headquartered at Torrejon, Spain, a move that left the Vice Commander, Sixteenth Air Force, as the day-to-day commander in Spain. It was not a happy arrangement and was abandoned last year in favor of making the Commander, Air South, a Deputy Commander, US Air Force, Europe, for the southern region. The present commander, Lt. Gen. Earl Brown, is an experienced tactical air officer. His main concern is, of course, the Aegean airspace problem, and while there are still Greek officers on the staff of Air South, in apparent harmony with Turks, that is about as far as the harmony goes.

There is some consideration being given to the establishment of a 7ATAF in Greece to match the one in Turkey. A new headquarters will not solve the problem, but it might contribute to better communication across the Aegean.

At any rate, the Air South people are working hard to preserve some kind of air coordination in the eastern Med. The one big thing in their favor is the essential objectivity of NATO military people, as opposed to politicians, when faced with a situation dangerous to allied security. Andreas Papandreou may be Defense Minister as well as Prime Minister, and he has moved his own men into the top posts, but Greece's military is still made up of officers and senior noncoms who believe in NATO and western solidarity unless there have been some remarkable changes of heart.

France and Spain: Half In, Half Out

Another Mediterranean nation and part-time NATO ally, France, continues on its own ambiguous way. The cooperation between the French and United States Navies in the Mediterranean is excellent, as it is, for that matter, in the Persian Gulf. But France remains aloof from the NATO military organization, and there seems no chance it will ever return, short of, perhaps, an unlikely offer to make a Frenchman, with greatly enhanced authority, the Supreme Allied Commander.

Dug-in Italian troops supported by a helicopter during an Allied Forces Southern Europe exercise. Despite a series of domestic crises, Italy remains a firm member of NATO.

Just now, France has too many internal problems to worry very much about its NATO relationship. The Mitterrand economic program is signaling difficult times for France's armed forces, especially the French Army.

Another distraction, and one that may be the source of bitter divisiveness before it is over, is the forthcoming trial of Klaus Barbie, the "Butcher of Lyons." The conservative French press reflects a sentiment that Barbie was brought back simply to take French minds off their current troubles. The conservative press also charges the left with attempting to take full credit for the resistance in World War II. The left-wing papers, meanwhile, are hinting at great disclosures of French collaboration during that war. The Barbie trial promises to be

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Gen. T. R. Milton's by-line is one familiar to AIR FORCE *Magazine readers through his regular "Viewpoint" column and his trenchant feature articles. His forty-year military career included combat service with Eighth Air Force in World War II, participation in the Berlin Airlift, command of Thirteenth Air Force, service as Air Force Inspector General and as USAF Comptroller, and duty as the US Representative to the NATO Military Committee. He retired from active duty in 1974. This article is a result of General Milton's recent trip to the Mediterranean. A companion article, "Turkey: NATO's Southeastern Keystone," appeared in the May '83 issue.*

a disagreeable experience not only for Barbie but for the country as a whole.

Whatever goes on in France will have little effect on neighboring Spain. The Spanish have their own preoccupations. While France enters into these peripherally—the French are obstructing Spain's European Community membership, and they have not done much in the past to control Basque terrorist movements back and forth between France and Spain—Spain's thoughts at the moment are centered on NATO membership. All the way in, or out?

When the Socialist Felipe Gonzalez was elected Prime Minister, he put a freeze on Spanish NATO participation, promising to settle the issue by referendum in May 1983. Now, it appears, there will be no referendum, a hopeful sign the issue is becoming moot.

Actually, the knowledgeable people in Brussels have assumed from the outset that Spain would finally come into full membership, but it is always dangerous to take anything for granted, especially in view of Gonzalez's electioneering stand. Referendums are sensitive to the way the questions are asked and are, in any case, precarious things to predict, so the cancellation of the referendum has to be good news for NATO.

It is hard to make any real judgment on Spanish military attitudes toward Alliance membership. The Army, conservative, with some senior officers still on active duty who look back fondly to the Franco days, tends to focus more on the enemy within than on the faraway Warsaw Pact. Among younger Army officers there is apparently some enthusiasm for the NATO role, but it is not universal.

The Navy and Air Force, particularly the Navy, see advantages and opportunities in NATO membership. There is the Mediterranean, where Spain has a long coast, and offshore are the Balearic Islands; both of these facts suggest an important NATO maritime role for Spain.

Then there is Gibraltar, viewed by Spaniards as a continuing affront to Spanish nationalism. Since it seems obvious Britain will not relinquish Gibraltar in the near future and is prepared to defend it if necessary, a first step toward easing the situation might be to establish a NATO naval headquarters on the Rock. If Spain were in NATO, perhaps a Spanish admiral could head the NATO command. The British, in fact, have suggested this might be an agreeable solution so long, of course, as the Spanish admiral had a Royal Navy chief of staff and the question of British sovereignty did not arise.

Spain has holdings in the Atlantic, the Canary Islands, which fall within NATO territorial boundaries and will require some new NATO military authority, presumably Spain. Then there are the advantages both the Spanish Navy and Air Force would gain by training with other NATO nations. It is not so easy to work up a case, or a mission, for the Spanish Army in NATO, but doubtless one will be found, always keeping in mind the Army's commitment to internal security.

If Spain Enters NATO

When Spanish doubts are finally resolved, hopefully in favor of full membership, an interesting question may arise about the status of USAF's 405th Fighter Wing at Torrejon, presently converting from F-4Ds to F-16s. The 405th at this time has no NATO mission in Spain, but simply stages out of Torrejon to Incirlik, Turkey, where it assumes a NATO task under COMAIRSOUTH in Naples. With the prospect of Spanish participation in the NATO military structure, there are some new possibilities.

The Spanish Air Force has decided on the F-18A as a new-generation fighter, whether because the terms were better than those offered for the F-16A or because they think the F-18A a better airplane. In any case, NATO's air forces will have a formidable complement of new-generation fighters based in Spain, if all goes well with Spain's membership. The question is how best to use this NATO fighter force of USAF F-16s and Spanish F-4s and F-18s.

Spain, for all its recent conversion to democracy, has retained a considerable share of its traditional xenophobic tendencies. The Spanish do not want foreigners on their soil except on Spanish terms, and they reject any notion of having Spanish forces within Spanish borders commanded by anyone but a Spaniard. Hence, any arrangements for NATO command of Spanish forces will presumably have to take this into account.

There is, moreover, the fact of Spanish territory both in the Med, the Atlantic, and on the coast of North Africa. So far as the Med is concerned, maybe Air South will be an acceptable attachment for the Spanish Air Force if there is a Spanish NATO commander in Spain. What, then, about the 405th? With the 405th now in F-16s, a good case can be made for creating a new mission for that wing, one of air superiority in the central and western Med in conjunction with the Spanish Air Force.

That, however, is just speculation. What is not speculation is the problem the Spanish North African coastal enclaves of Ceuta and Melilla may cause the Alliance.

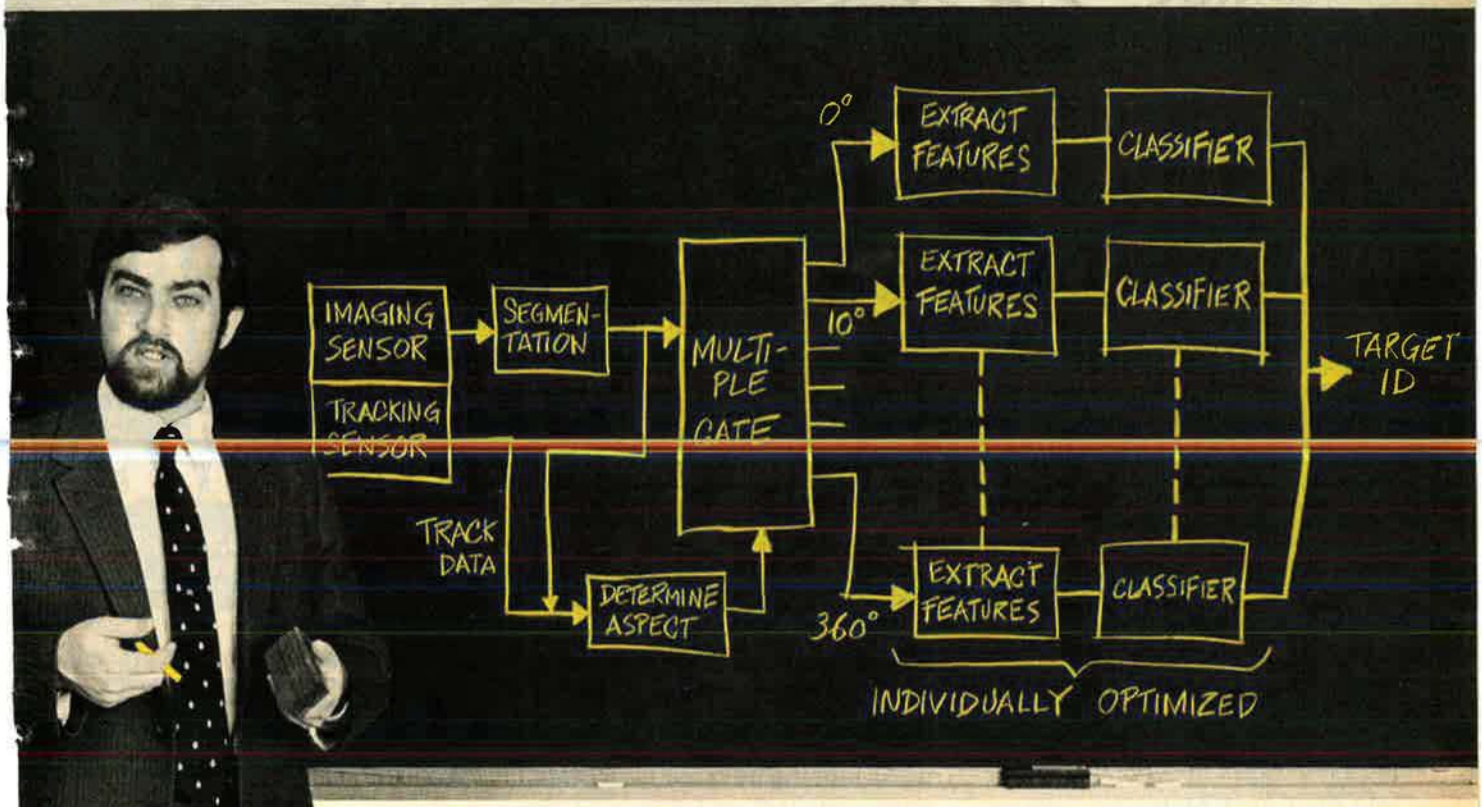
NATO has turned a blind eye over the years to the existence of North Africa, sort of a latter-day Flat Earth theory in which the Mediterranean conveniently disappears over a precipice. And so, when the Sixth Fleet takes an interest in Libya, for instance, or pays a visit to Alexandria, it does so on its own under the aegis of CINCUSNAVEUR, not CINCSOUTH, even if they are the very same admiral.

This wondrous strategic concept has been made easier to swallow by the fact that there has not been, up until the present, any territory along the North African coast that belonged to a NATO nation. The Portuguese colonies of Mozambique and Angola, now long gone, were south of the Tropic of Cancer, NATO's official boundary, and thus did not count. But Ceuta and Melilla are Spanish territory, are north of the Tropic of Cancer, and what is more, if not exactly threatened, at least are being eyed by Morocco.

All of this promises some interesting times for the staffs at SHAPE and NATO headquarters in Brussels. Whatever the bureaucratic difficulties Spain's entry may cause, it will be the best thing that has happened to the Alliance in a very long time, if, that is, Spain elects to come in as a full member. No one in NATO has any great enthusiasm for another member on the French model. ■

Image technology on the move.

Al Gorin on automatic target recognition systems.



"America's defense requires breakthroughs in automated target recognition systems that operate reliably in real- or near real-time and are able to adapt to changing tactical situations," says Dr. Al Gorin, Principal Scientist at Lockheed Electronics.

"These systems will combine processing that is both non-cooperative (such as imaging or ESM sensors) and cooperative (such as interrogation protocols). They also will involve networks of multiple sensors at disparate locations and will require distributed processing.

"They must be self-evaluating systems, deciding automatically on sensor dwell time on target, additional sensor allocation, and increased processing time necessary for highly accurate identification.

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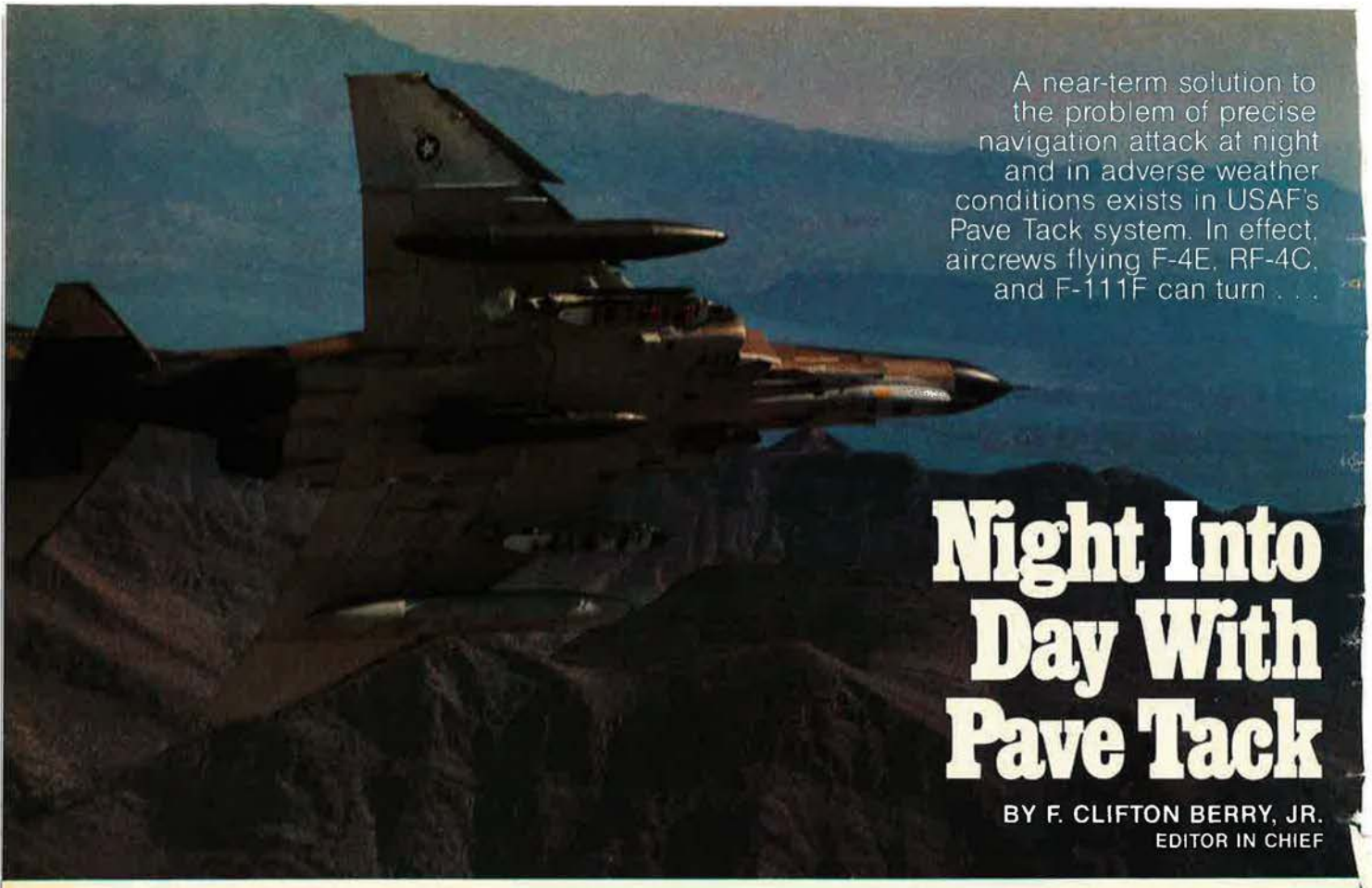


A near-term solution to the problem of precise navigation attack at night and in adverse weather conditions exists in USAF's Pave Tack system. In effect, aircrews flying F-4E, RF-4C, and F-111F can turn . . .

Night Into Day With Pave Tack

BY F. CLIFTON BERRY, JR.
EDITOR IN CHIEF

FOR navigation and attack at night and in adverse weather, the US Air Force is behind the times. Gen. W. L. Creech, Commander of USAF's Tactical Air Command, told AIR FORCE Magazine: "We are still at about the same place as the Army Air Forces were at the time of the Battle of the Bulge in December 1944, and that means our capability is near zero."

To redress the shortcomings over the long term, USAF is developing a system called LANTIRN, which will be fitted on the A-10, F-16, and derivative fighters. (LANTIRN stands for Low-Altitude Navigation and Targeting IR for Night system.)

For the short term, three of the tactical air forces' front-line aircraft types are being equipped with the Pave Tack system. With the installation of Pave Tack on the F-4E, RF-4C, and F-111F, the forces have an around-the-clock/adverse weather system for navigation and weapon delivery. Pave Tack's full name is AN/AVQ-26 Electro-Optical Target Designator system. It is a pod installation that fits externally on the belly centerline of the F-4E and RF-4C, and within the weapons bay of the F-111F. Ford Aerospace & Communications Corp. developed and is producing the system.

The Pave Tack system incorporates USAF's common modular forward-looking infrared laser transmitter/receiver and precision stabilized optical sight in a turret. The system is linked with the aircraft subsystems and cockpit controls through a computer mounted in the pod. The turret has a high slew rate, so it can function well at high speeds and low altitudes. The computer integrates the navigation, target acquisition, and fire-control functions of the aircraft.

Pave Tack extends the capabilities of the F-4E, RF-4C, and F-111F into night and reduced visibility conditions. It is an effective interim step toward the true in-weather system the tactical air forces need badly. Until that great day arrives, Pave Tack will be counted on for effective attacks in adverse conditions, whether in close support of friendly troops or in interdiction missions behind the enemy's front echelons.

The Pave Tack system is in production. Much of the test and evaluation of the system was performed by two of Tactical Air Command's units: the Tactical Air Warfare Center at Eglin AFB, Fla., and the Tactical Fighter Weapons Center at Nellis AFB, Nev. Both continue to follow Pave Tack in use for TAC, developing tactics and techniques to get the most from the system.

Maj. Bob French rolls his F-4E over the Nellis range area, showing the Pave Tack pod on the aircraft centerline. Relative size of Pave Tack pod can be compared with fuel pods. (AIR FORCE Magazine photo)

I got to fly a Pave Tack mission in an F-4E at the Tactical Fighter Weapons Center, and saw first-hand three of its features that please aircrews: the super-sharp imagery available in the cockpit, the ease of operation both for navigation and attack, and the accuracy of weapons delivery.

At the 422d T&E Squadron

Lt. Col. Dave Jenny is commander of the 422d Test & Evaluation Squadron, which performed much of the initial and follow-on operational test and evaluation of the Pave Tack system. He discussed the system's characteristics and the squadron's activities with it, and then introduced the officers with whom I'd

fly. Capt. Tom Henricks would lead the mission, and I'd be in the back seat of his aircraft. He is a 1974 graduate of the Air Force Academy, with more than 1,500 flying hours in fighters, most of them in the F-4. (He is now in the test pilot course at USAF's Flight Test Center, Edwards AFB, Calif.) The second aircraft in our flight would be flown by Maj. Bob French, with Capt. Larry "Scoop" Cooper as his Weapon Systems Officer.

The flight plan called for a formation takeoff from Nellis, then on to the Elgin South Military Operations Area of the Nellis complex. That part of the flight would be for orientation and also for system checks of the aircraft. We'd approach the Moapa power plant to demonstrate and check out the infrared capabilities of the system and to give me practice with the Pave Tack controls. Then we'd fly over to Nellis's Range 63 to attack ground targets with BDU-33 practice bombs.

Tom Henricks planned four different attacks: first, a ten-degree diving pass, then a toss delivery with laser designation, followed by a low-altitude approach masked by the terrain and a pop-up, then a formation attack in which we'd laser-designate the target for Bob and Scoop's aircraft and our own. The aircraft videotape recorders would provide a record for immediate recall and evaluation during debriefing.

The simulated enemy situation for our mission was briefed by Captain Cooper. Enemy weapons in the target area included ZSU-23-4 anti-aircraft guns at an airfield held by enemy forces. Our mission was to destroy the guns without affecting the runways or nearby civilian dwellings. The situation brief noted the presence of SA-7 surface-to-air missiles in the area. The mission required accuracy of navigation and weapons delivery, as well as ability to use terrain in the area to mask our approach and exit.

After the normal briefings on emergency procedures and fitting personal equipment, we were ready to go.

Preflight Activity

Captains Henricks and Cooper had entered the data on weapons characteristics, navigation information, and other material into the aircraft's computers and control systems ahead of time. They noted that one of the 422d T&E Squadron's projects is testing a Data Transfer Module made by LSI—a cassette that is the interface between the squadron's computer and the computer in the aircraft's ARN-101 bombing system. Well before a mission, they can enter all the required data onto the cassette via the squadron's own computer. At the aircraft and ready to go, they plug in the cassette. It dumps the information into the ARN-101 system in a couple of seconds, and they are ready to go. This saves time, of course; it also avoids inserting errors into the system.

During the walkaround, Tom Henricks showed the Pave Tack pod and explained its characteristics. Our aircraft, tail number 720140, had a gross weight of 53,400 pounds for this mission. Of that, nearly 1,300 pounds was the Pave Tack pod and its attaching hardware. Hung on the centerline of the big F-4E, the pod did not look its size: 163 inches long and twenty inches in diameter. The turret at the aft end of the pod, containing FLIR, laser transmitter and receiver, and stabilized sight would be stowed en route to the target, then deployed when we were ready. Tom noted that the 422d TES had had very few maintenance problems with the preproduction pods. Through contacts with operational squadrons, they had found that the production pods were even more trouble-free.

Cockpit orientation took more than an hour. Tom wanted to be sure that I knew the location of every switch and control, and understood how the several navigation, target acquisition, and weapons delivery systems were integrated.

The Flight

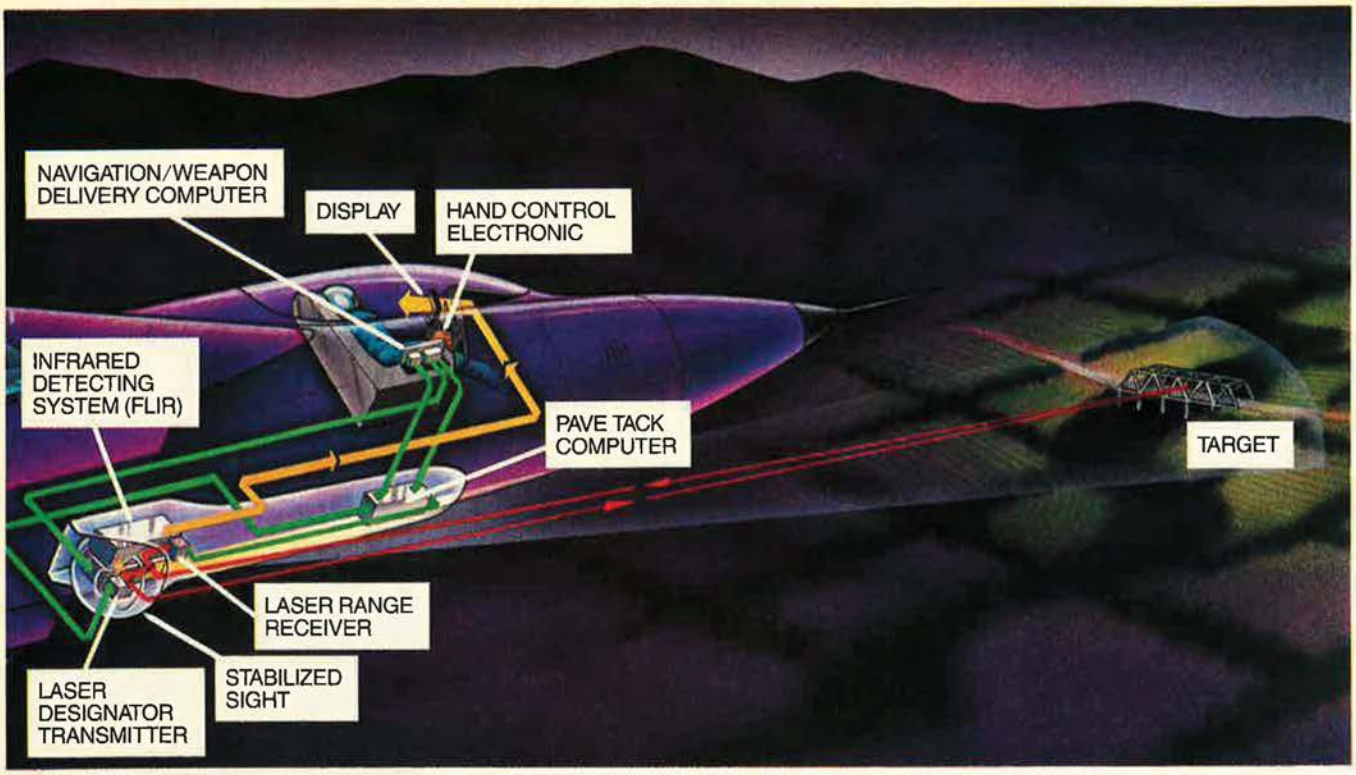
Engine start and taxi were normal, as were the final checks by the armament and aircraft specialists in the arming area short of the takeoff runway. Formation takeoff roll began with a nod of Tom's head. The two J79 engines in afterburner accelerated the aircraft rapidly through eighty knots. Tom applied back pressure at 100 knots; the nose came up smoothly and the aircraft lifted off at 180 knots.

Capt. Tom Henricks (right), after completing preflight walkaround inspection, checks arrangements in the rear cockpit. (Air Force Magazine photo)

Bob French kept close station through gear and flaps up and as we climbed at 3,000 feet per minute on headings toward the range area. He eased out to the right for a route formation. As we flew out of 12,000 feet for the assigned 16,000, he moved back in for the systems check, first on our aircraft, then on his. (Note: in the dialogue that follows, "H" is Captain Henricks, "F" is Major French, and "AFM" is Air Force Magazine.)

* * *

H: Reach up front of you and turn on the radar warning receiver. That's the POWER button.
AFM: OK, POWER.
H: Looks good. It'll take a second to warm up and then we'll see his lock on us.
AFM: I've got him at five o'clock on the radar warning receiver.
H: That's correct; that indicates he's locked on behind. Someone else is locked on in front of us.
AFM: That alpha or triangle?
H: That's right.



Pave Tack operational block diagram (courtesy Ford Aerospace).

The indications on the radar warning receiver are clear, and easily direct one's attention (or countermeasures) in the right direction.

Our systems check over, Bob French pulled ahead so that Tom Henricks could perform the same for him. That permitted practice with the radar, acquiring the other aircraft, and also linking the TISEO system with it. TISEO stands for Target Identification System, Electro-Optical. Mounted near the root of the F-4E's left wing, it provides clear television imagery for the aircrew. They have a choice of wide or narrow field of view, and can zoom in for a closeup of the selected target. This permits visual identification at long range.

Systems checks complete and in the range complex, our flight was cleared to descend for the navigation practice. The ARN-101 system ("Arnie" to the 422d aircrews) provided steering cues to the selected waypoints entered into its memory. Tom Henricks took the lead for this sequence.

H: One has the lead. OK, we'll go up to the north turn point that Arnie's steering us to, and see if it autosequences.

AFM: OK.

H: I'll get into the next valley and drop down a little bit lower.

AFM: Target's fourteen miles away?

H: That's correct. Now we're going to a tactical ingress airspeed, about 480 knots for a low-level.

AFM: I see airspeed coming up.

H: Today it looks like about 450 knots calibrated is 480 knots true airspeed. We're turning up the valley now, going toward the turn point of Elgin.

AFM: Nine miles. And we're going up through the valley. Heading is 025. Six miles from the point. Still 450 knots, 0.73 Mach, indicated.

H: Now we're cresting the ridge, and the point should appear on our nose in about two miles.

AFM: Mile and a half; one mile . . .

H: OK, the town is right on our nose. I'll roll over on the right wing so you can look straight down on it. If you'll look at the steering, it just swung to the next point.

And Arnie autosequenced, showing the way to the next turn point en route to the Moapa power plant. We flew through the next valley, then prepared to pick up the power plant on the infrared receiver.

H: I'm going to give you steering to the Moapa power plant so we can practice the Pave Tack training. You can see it's ahead twenty-three miles at 180. Now, reach over with your left hand in front of your left knee and get the ARN AIM switch—it's in SLAVE now—and bring it back to the ARN AIM position.

AFM: Coming back to ARN AIM.

H: Now you can go ahead and select POD while you're on that panel.

AFM: OK, POD—and there's a picture on the scope.

H: That's right; it's all ready to go. Now reach down and select IP INSERT by your left elbow—just depress the IP INSERT button.

AFM: IP INSERT . . . got it.

H: Now the pod is looking over toward that Moapa power plant off the left wing.

AFM: I'll be darned! There it is.

H: Now use the hand control. Select the top button. Depress that, and there's the chimney in the background.

AFM: I have it, near the base of the scope.

H: Now go full action and release, and take track with the thumb tracker, and there you go.

AFM: Now I've—whoops—OK, there it is. *[Reticle is kept on the target by thumb tracker trim movements on the integrated hand control on the ledge at the WSO's right hand.]*

H: Now I'm going to roll into it. It'll hit a gimbal limit and go into MPT, which is Memory Point Track.

AFM: There, I've lost it.

H: That's right; it hit the gimbal limit and prevents you from moving it. But as we move on, it'll still be looking at that power plant. Now I'll bring it around to the nose. In other words, the pod is stabilized on that point. As I roll out, we should be looking at it. There it is.

AFM: There it is. *[The preset point in memory returned to the screen.]* And now I'll move the cursor up the chimneys.

H: That's a pretty good picture. You can hit the middle button and it'll go times two magnification.

AFM: Wow . . . I keep losing . . . gotta track better.

H: Yeah, there you go now. We're still ten miles from it now.

AFM: I'll get the base of the chimney.

H: That's good. As we get closer, we should be able to see if there's any smoke coming out of those chimneys. It'll show up as a hot source.

AFM: It looks like the one to the right of the high one is black and has smoke, doesn't it?

H: That's right.

H: That's good; you can see the smoke coming out of the top now. I'll turn right to keep us in our area. You just continue to track the target.

AFM: OK.

At twenty-three miles, the picture clearly showed the plant's buildings and chimneys. The chimney in use appeared darker than the cold ones, and its smoke created a sharp artificial image on the screen.

We then headed for Range 63, steering according to Arnie's directions. Tom flew a low-level approach, checked in with range control, then performed the first attack, a dive toss without dropping a bomb. Purpose was to practice tracking the target with the laser. (Note: our radio call sign was Pinto 41. In what follows, "Ground" is "G.")

G: Pinto 41, this is Range 63. The range is cold, you're cleared on.

H: Pinto 41. And request laser hot.

G: Pinto 41, you're cleared laser hot.

H: Pinto 41. OK, you can reach down by your right knee and turn the laser to ON.

AFM: I'm pulling it up and all the way forward, and the light says LASER ON.

H: OK. We're ready to go. As you look at your scope now, I'm going to select DIVE TOSS. Your display says VIS now, so it's looking where my pipper is looking.

AFM: OK, that's the ridge line.

H: That's right. The targets are over at the right, two o'clock now.

AFM: OK.

AFM: Looks like two billboards out there—the white . . .

H: That's right; our circle is right beside the right-hand billboard, it's the dark area . . .

AFM: OK, I have it visually now. Looks like something darker in the center.

H: That's all chewed up because of the bomb impacts.

H: Pinto 41 is in dry to 63 for dive toss.

G: Cleared dry, 41.

H: I'm going to roll in and just put the pipper on the target . . .

H: . . . and when you see it, just go full action release.

AFM: OK, I have it.

H: Now take track with the thumb tracker.

AFM: I've got it.

H: You can punch in the top button and it'll go narrow.

AFM: OK.

H: Let's go ahead and fire the laser.

AFM: OK, the pickle button. *[Red button at left edge of stick top.]*

H: Now you're firing the laser, and to drop a bomb we'd be pickling now *[middle C tone in background]*. And it would come off here shortly *[tone continues, then stops]*. That's where it would come off. Now continue to track all the way through this.

AFM: I'm tracking. The ground is really chewed up there.

H: Yeah.

AFM: Now we're rolling over.

H: I'll get a little altitude . . . and our bomb will hit . . . just about . . . now. OK, I'll shut the laser off and we'll recover back to altitude.

Thanks to the practice at the power plant, tracking the target on the range seemed fairly easy. The trick was to disregard the aircraft maneuvers, and to concentrate on keeping the reticle on the target center.

ABOVE: Air Force Systems Command F-4E with Pave Tack pod on centerline. The TISEO (Target Identification System, Electro-Optical) "eye" can be seen on the left wing's leading edge (yellow circle). LEFT: Closeup of Pave Tack pod on F-4E in flight. (Air Force Magazine photo)

Maj. Bob French followed through, and the flight got ready for the next pass. This time, a live dive toss.

H: OK, I'm going to arm the system, and we'll drop a practice bomb on this one.

AFM: OK.

H: Forty-one is base. And we'll do the exact same thing, except this time a bomb will come off. And we'll hope to see it in the field of view.

F: Two base.

AFM: I have the target visually.

H: OK.

AFM: And we're rolling in.

H: Forty-one is in hot.

G: Cleared hot, one.

H: The pod is looking behind us. Go ahead and go RESET on the TIC panel on your left. OK, it's coming up now, we're good now.

AFM: OK.

H: Now picking up our dive; and you can go full action release and begin tracking . . .

F: Two is in.

H: And fire the laser . . .

G: Cleared hot, two.

H: Super! Now we'll just wait until we're in range.

AFM: I'm keeping it on it. *[Middle C tone begins. Tone stops.]*

H: OK, tracking now . . . bombs away.

AFM: Keep tracking.

H: And another ten seconds of fall on the bomb. . . . There's bomb impact. Shut the laser off, and we'll look back and see where the bomb hit. OK, you can see the bomb hit a little long on that one. We'll press on in the next one and try to make it more accurate.

The image in the screen remained steady and sharp throughout the pass; bomb strike and bomb-damage assessment could be done by the WSO while the pilot flew evasive maneuvers out of the area.

Next maneuver was a pop-up delivery. Tom Henricks approached the target behind the terrain.

H: We'll get down and do a pop-up type delivery on this one, simulating that we're avoiding the defenses.

AFM: We're coming along the ridge line, going down the valley.

H: That's right . . . *[seconds pass.]* One is base . . . this time we want a little more airspeed than the last one, so we're down here accelerating to about 520 knots, which will give us enough to come over the top on the pop-up.

AFM: OK.

H: One's up. *[Grunts as G-forces hit.]*

G: Clear, one.

H: When you see it in the field of view, go full action release, track it, fire the laser . . .

AFM: OK, I'm tracking.

H: OK.

AFM: Fired the laser.

H: Continue to track it. Good. Starting our delivery. *[Middle C tone again. Tone stops, bombs away.]* I'm off the target, continue to track.

AFM: OK.

H: And there's bomb impact, and I'll shut the laser off.

Maj. Bob French flew the same attack. Both our bombs fell a bit short, so Captain Henricks inserted minor corrections into the ARN-101 to compensate. Then Bob French joined up in a line abreast formation for the attack. This time, the two aircraft would fly different approach maneuvers to confound the defenses, but our laser designator would illuminate the target for both drops.

AFM: We're sneaking down the valley at 460 knots.

H: That gives us sbout 500 knots true, which is what we want. We're still out of line of sight from the target.

AFM: Yeah; we're about 100 feet AGL *[Above Ground Level]*.

H: OK, as we start our turn, he'll follow us through it, setting himself up on the inside *[grunts]*. Here he comes.

AFM: Yep.

H: And here we are line abreast at seven miles, ready for enemy action.

AFM: He's doing a turn out, as briefed.

H: Pods up.

F: Two.

G: Pinto 41 flight cleared hot.

H: Pinto 41. OK, sweeping in. When it's in the field of view just take track and fire the laser.

AFM: It is.

H: There it is.

H: Laser on. OK, fire the laser!

H: That worked out just right. We'll wait till we're in range. *[Tone sounds.]*

AFM: Still tracking.

H: Starting our delivery. Continue to track *[tone stops]*. Bombs away!

F: Roger.

H: OK, we'll be right back. Go ahead, just the thumb tracker again. Fire away again.

AFM: OK. *[Continuing to keep the reticle on the center of the target, designating it for Major French's drop.]*

H: Good.

F: Two *[he has dropped]*.

H: And there's his bomb impact, right in the field of view.

AFM: That's great.

H: Now we egress at high speed away from the target at low altitude.

* * *

These were dumb practice bombs whose impact on the target was well within the lethal radius of real iron bombs. If we had been dropping laser-guided weapons (and if I had kept the reticle precisely on the target), the impact error would have been within only a few feet. The 422d's aircrews consistently drop laser-guided weapons within a seven-foot CEP.

Cleared off the range, we flew back to Nellis. En route, additional practice with the system showed how easy it was to go from radar to TISEO to infrared imagery on the screen. At about twenty-five miles out, we activated the pod and commanded IP INSERT. It immediately slewed to the Nellis ramp, and the parking place we had left an hour earlier was centered precisely under the reticle.

Back on the ground, the debriefing covered all phases of the mission. We had videotape immediately, and could play it concurrently with the comments by aircrew members and Capt. Mitch Stucker, the operations analyst for Pave Tack. He and Captains Henricks and Cooper and Maj. Bob French verified my impressions: control operations are easily mastered, and accuracy improves sharply with each mission flown. That is being borne out in the operational squadrons using the Pave Tack system.

At this writing, Pave Tack is operational with the following USAF units: 48th TFW (F-111F) at RAF Lakenheath, UK; the F-4E-equipped 4th TFW, Seymour Johnson AFB, N. C., and 3d TFW, Clark AB, Philippines; and with the RF-4C-equipped 67th TRW, Bergstrom AFB, Tex., 313th Air Division, Kadena AB, Okinawa, Japan, and 10th TRW, RAF Alconbury, UK. ■

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CHANGING THE COURSE OF MANAGEMENT

THE CONTROLLERS COME HOME

"My lifeblood," an FAA facility chief calls the military people on duty at the nation's airports since the strike of August 1981.

BY CAPT. MICHAEL B. PERINI, USAF
CONTRIBUTING EDITOR

BY THE end of June, the last group of military air traffic controllers will be on their way back from civilian airports to their home stations.

Since August 1981, when government controllers began a strike in a dispute over pay and working conditions, more than 900 Air Force, Army, Navy, and Marine Corps controllers have been providing air traffic control service along with nonstriking FAA personnel.

According to one Federal Aviation Administration facility chief, "They have been my lifeblood."

The FAA's original withdrawal plan called for DoD involvement to end in September 1982. Last spring, however, the FAA asked for an extension until June 30, 1983. In response, the Air Force kept 130 controllers deployed past their original return dates. As of March there were still fifty-two Air Force controllers at twenty locations. The Army had ten, and the Navy and Marine Corps had four at seven locations.

Had it not been for FAA contingency plans, the strike of more than 12,000 controllers could have seriously crippled the nation's vital air transport network. These plans called for flow control procedures, reduced capacity (cutbacks in number of daily flights), and use of FAA supervisory personnel and military controllers.

The first controllers began arriving at the nation's largest airports within hours of the walkout, in accordance with a DoD and Department of Transportation agreement reached earlier in the year. They immediately began studying civilian control procedures, and quite a few began to work shifts in less than a week.

The temporary reassignment of military controllers to civilian airports had only a minimal effect on military flight operations. Even so, at the peak of its commitment, the Air Force had as many as twenty-seven facilities at or near minimum manning standards.

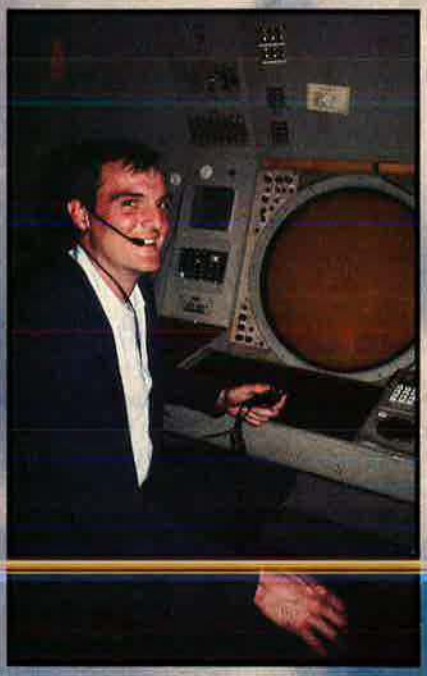
"Initially, a lot of people gave up

professional military education training and leave to ensure that the quality of service was protected for the users so that they could sustain flying operations back home," says Col. Derrel L. Dempsey, Deputy Chief of Staff for Air Traffic Services, Hq. Air Force Communications Command.

The Air Force alone deployed as many as 608 controllers, with a maximum of 486 at one time. They came from seventy-nine locations to augment FAA control tower and radar approach control facilities in sixty-five metropolitan areas. A few deployed controllers returned home in a matter of days. Most, however, were faced with an unusually long TDY of more than a year.

FAA officials feel confident that they can now handle the traffic with the remaining staff and newly hired and trained personnel.

"As of March, the air traffic control system was handling slightly more than ninety percent of pre-strike traffic levels and returned to 100 percent by April," says the FAA.



This is an improvement on the timetable announced by the FAA shortly after the strike. As a result, the FAA says it plans to lift remaining air traffic control restrictions for both airlines and general aviation in most parts of the country by the fall.

Did They Perform?

FAA officials were anxious about whether the deployed military controllers could learn new procedures, different equipment, and, ultimate-

LEFT: SSgt. Dan Garin on the job at Washington National Airport. BELOW: A commercial 727 takes off from National. Air traffic at US airports is returning to prestrike levels. (Photo by William A. Ford, Art Director)

ly, perform in high-traffic density locations like Chicago's O'Hare International Airport where, during peak periods, an aircraft takes off or lands every twenty-three seconds. At Washington National, an airport that has the reputation as a "controllers' nightmare," controllers must move more airplanes—an average of 1,200 aircraft operations in a day—in a smaller amount of airspace than at any other civilian airport in the US.

"The FAA did not know what kind of people they were going to get," Colonel Dempsey says. "They were quite surprised that we sent them good-quality controllers, only skilled people to work for them."

National Airport lost sixty-five of seventy-five controllers to the walkout. The ten nonstriking controllers were joined by twenty-four supervisors and sixteen Air Force and fourteen Army controllers.

"The military controllers moved swiftly, learned the things we asked quickly, and, more recently, have been training my new civilians," says Harry T. Hubbard, Chief of Washington National Tower and Approach Control.

The deployed Air Force people had radar experience so he put them to work in the radar room. The Army controllers had a tower background so he assigned them to the tower. "They all did a superb job," Hubbard says.

"The situation at Washington National was typical of the attitude and ability demonstrated by military controllers throughout the emergency," says the FAA.

The reaction from deployed controllers is one of satisfaction. "We proved we could do the job," says SSgt. Dan J. Garin, age thirty, deployed at Washington National from McGuire AFB, N. J.

"They still call us rookies, every now and then, but in a friendly way," says SrA. Rob C. Baechtel, age twenty-one, also deployed at Washington National from Dover AFB, Del.

"We showed the nation that we can do a wartime mission, which is to deploy for any contingency, operate in an unfamiliar environment, perform air traffic control, and do it on very short notice," says Colonel Dempsey.

Many of the returning controllers are finding equipment upgrade programs in progress at their bases, which will make air traffic control facilities more modern and like those managed by the FAA. Some 100 facilities will receive new, improved equipment under a $17 million program to improve radio and telephone service between control towers and radar facilities.

In addition, surveillance radars that provide computerized aircraft identification are being installed, as is a new GPN-22 Precision Approach Control Radar. The new radar is capable of handling multiple aircraft on final and literally "sees through heavy rain." Also being installed is the GPN-T4, a radar simulator used for training that can generate up to forty simulated targets at a time. All of these initiatives were programmed for installation prior to the strike.

The Retention Question

When the walkout began, Air Force manning figures showed that 1,081 controllers were eligible for separation between August 1981 and August 1982.

AFCC estimated that ninety percent of those eligible would leave the service. "We in fact retained seventy percent," says Gen. Robert F. McCarthy, Commander of AFCC.

He explains the reasons for the substantial increase in retention. "The Air Force acted very aggressively at the outset of the walkout to maximize reenlistment bonuses. Also, the 1981 pay raise helped, and so did the quality-of-life programs we initiated to take care of our deployed people."

The programs included a sponsor program at home bases to assist families of deployed controllers, visits to deployed controllers by AFCC staff members, a "time-off" policy giving controllers seven days off to return home to attend to professional and personal needs, granting waivers to carry up to ninety days of leave into FY '84, giving the option to accept PCS moves to deployed locations, and protection from receiving an assignment for twelve months after returning to home stations.

"Overall, the reenlistment rates now, and four months after the strike began, were as high as the prestrike rate," General McCarthy says.

Furthermore, the experience level per controller prior to the strike, which was about seven years, increased during the strike to about seven and one-half years of experience per controller.

Four of sixteen controllers who went to Washington National left the service. "Some of the young airmen who had not really experienced the true way of life within the Air Force did leave us," General McCarthy notes.

One who left the service in May was a four-year airman who was hired by the FAA as a controller. "I wanted to stay in the D. C. area. I like the amount of air traffic here. It's more of a challenge than elsewhere. I'm single. If I had a family, it might be different," he says. "A career change isn't really hard for me now," he adds.

Sergeant Garin is one deployed controller who decided to stay in the Air Force. He is a ten-year veteran, married, and the father of two children. "I reenlisted before I came down. I enjoy the military way of life and don't have any regrets about staying in." Since August 4, 1981, he has been living in a FAA-leased hotel room while his family remained at McGuire AFB, N. J.

The Rewards

For those controllers returning to their bases, the Air Force will benefit greatly. "The Air Force is going to get back some good controllers," Sergeant Garin says.

"My skill level has come up a lot. Working different types of aircraft at different speeds in such a high-density environment has been an excellent learning experience," he says.

Furthermore, the strike may improve military and FAA relations by eliminating any doubt that military controllers can do the job. "I would be quite pleased to take them into any combat situation," Mr. Hubbard says. "I know they are capable of providing the best air traffic service anywhere."

For their service to the nation during the crisis, the deployed controllers will receive the Air Force Humanitarian Service Medal, Air Force officials say. ■

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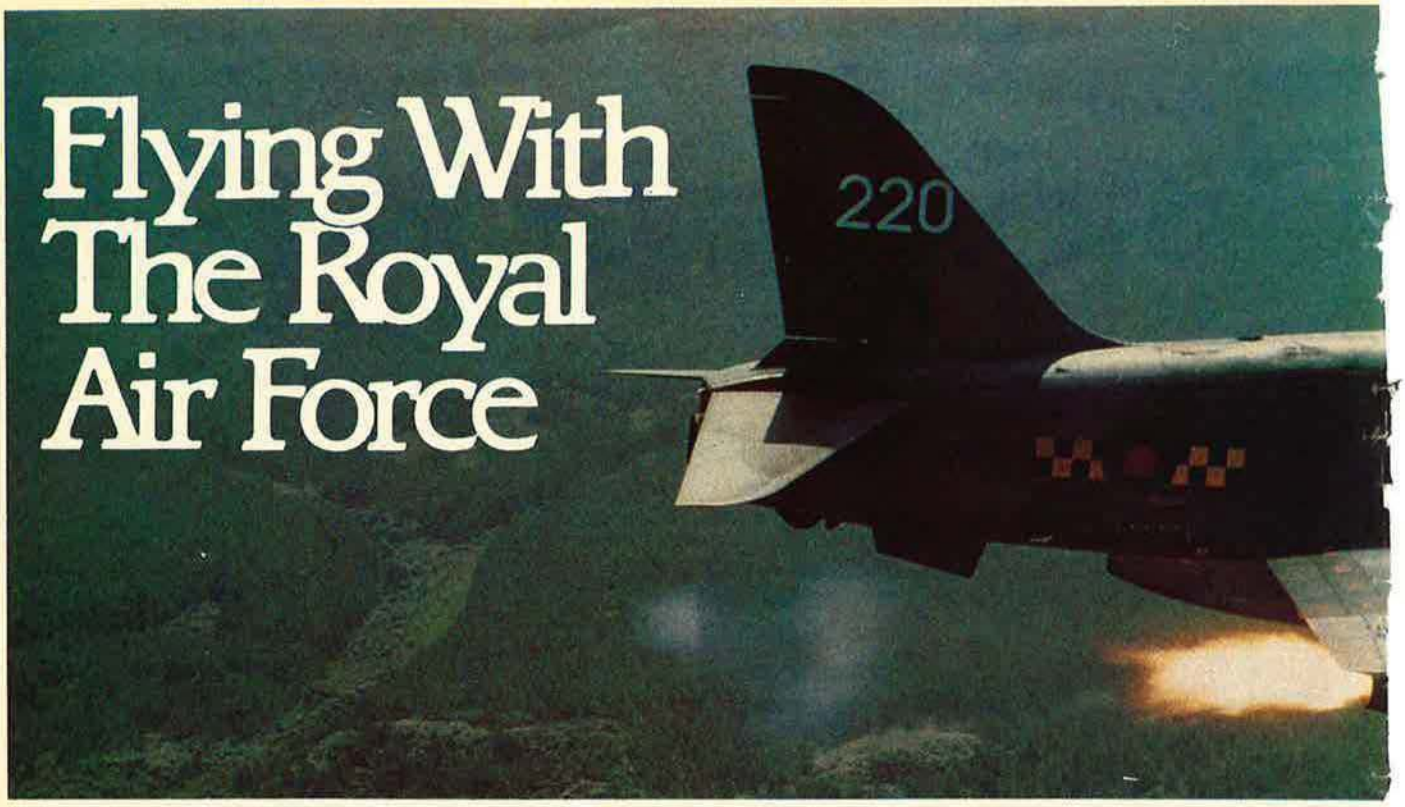


Aircrew exchanges between allied air forces build long-term bonds of fraternity as well as understanding of the others' equipment and procedures. A USAF officer on exchange duty with the RAF tells of the satisfactions he found in transitioning from USAF to RAF aircraft.

BY CAPT. DARREL R. GREER, USAF

WHAT fantastic luck! In the spring of 1981 I was notified of my assignment to the USAF Foreign Exchange Program. I was going to fly the brand-new Tornado ground-attack fighter with the Royal Air Force. It was a dream come true!

At the time of my assignment notification, I was an F-111 Instructor Weapon Systems Officer for USAF's Fighter Weapons School at Nellis AFB, Nev. The job was extremely enjoyable, and it seemed highly unlikely that I'd get two good deals in a row. But fortune smiled, and amazingly enough I was in the exchange program.

The exchange program has been around for years and operates on a one-for-one reciprocal exchange basis with participating services of various foreign governments. The idea is to integrate exchange officers into the host service operations to the maximum extent possible for the mutual benefit of both services.

Exchange officers serve in a wide variety of positions, ranging from Computer System Staff Officers to line pilots and navigators. I was selected to be in the initial instructor cadre of the Tornado Weapons Conversion Unit at RAF Honington in Suffolk, England. Eventually, once fully qualified, I would be instructing pilots and navigators converting to the Tornado weapon system. It was that "fully qualified" part that got my attention. My sponsor wrote a very nice congratulatory letter and proceeded to explain that my first thirteen months would be as a student in various RAF training programs.

Thirteen months? A student? How boring! Well, I won't bore you with the list of courses, but there was one that sounded particularly interesting. It was Tactical Weapons Unit (TWU) training in the Hawk aircraft at RAF Chivenor. Though I'd signed on to fly the Tornado, I knew that flying the Hawk would be fun, and looked at the opportunity as a bonus.

The Hawk is a two-seat, multipurpose, single-engine jet aircraft designed as an advanced jet trainer for undergraduate pilot training and for basic weapons training. For its weapons training role, the Hawk can be equipped with a 30-mm gun pod, air-to-air missiles, and a variety of live and practice air-to-surface ordnance. It's a relatively small aircraft, weighing in at only 10,000 pounds (with internal fuel and no weapons) and capable of maneuvering at eight Gs and sustaining six Gs in a level turn with normal fuel and weapon loads. Advanced flight controls make the Hawk representative of most modern fighter-type aircraft to which student aviators will eventually transition.

That's the Hawk in a nutshell, but there's a lot more to the TWU than the Hawk. In fact, the TWU program far exceeded my expectations and proved to be the most unique and impressive aviation training program I've ever seen or heard of. Because the TWU is so unusual, I want to share the essence of the program with you.

The RAF Tactical Weapons Unit

First, what is the TWU?

The TWU is an essential part of RAF tactical aviator development. Though it's only one step in a long training process, it is a very impor-

tant step. Using the Hawk multipurpose aircraft, the TWU introduces young aviators to weapons and tactics used throughout the RAF's fighter community. Two RAF bases are devoted to TWU training: RAF Chivenor and RAF Brawdy.

The original concept provided this introductory weapons and tactics training only for recent graduates of pilot training. Since its beginning, TWU training has seen several iterations. Now, with the main course still devoted to new pilots, the program has been expanded to provide fast jet fighter orientation for recent graduates of navigator training. Additionally, rated exchange officers, rated staff officers returning to fighter cockpits, and aviators transitioning to fighters from multiengine aircraft all receive this valuable training.

For the tactically oriented, a rough parallel may be drawn with Tactical Air Command's fighter lead-in training (LIT) program. However, in the TWU, all first-tour pilots receive the same amount and type of training, whereas USAF's LIT program is varied to provide more specialized training. This specialization reflects the requirements of the aircraft type to which the LIT student will transition. For example, in the LIT program a student destined for the F-15 will receive more air-to-air combat training than a student destined for the A-10. The A-10 student will receive more air-to-ground tactics training than his F-15 peer. Consequently, a TWU student receives considerably more sorties during this critical development stage than his LIT counterpart. For most cases, this equates to almost double the sorties per student.

Because the TWU revolves primarily around the first-tour pilot and navigator, I'll concentrate on their program. However, before continuing with TWU training, it's necessary at this point to overview how RAF pilots and navs are trained prior to the TWU.

The Pilot

After learning the basics of flying in a propeller aircraft, pilot candidates transition to the Jet Provost (equivalent to the T-37) and learn to fly a jet aircraft. They fly high and as low as 250 feet above the ground. Skills are assessed and each candidate's flying record is carefully reviewed before he is sent to fast jet training in the Hawk. Keen airmanship, situational awareness, and flying skills are considered essentials for the fighter force, and are a prerequisite for fast jet training.

Hawk XX 220 in marking of RAF's No. 63 Squadron fires 2.75-inch rockets during a training flight on the Pembrey Range. Hawks also carry a 30-mm Aden gun on the centerline. (Photo by Philip Birtles)

If selected for fast jet training, the candidate goes to RAF Valley to begin advanced jet training in the Hawk. Here, as he learns his new aircraft, he builds on his previous instrument and formation training. Tactical concepts and formations are also introduced at RAF Valley.

Very demanding low-level flying at 420 knots and 500 feet above the ground is a solo requirement for each pilot candidate. If an instructor pilot is in the back seat, the student is cleared to fly at 250 feet.

The low-level emphasis in flying training is markedly different in the RAF when compared to USAF. In USAF, undergraduate pilot training includes only two low-level sorties in the T-37. These are limited to 3,000 feet above the ground. USAF T-38 low-level training is limited to 1,000 feet and only three sorties. The RAF believes the demands of low-level training down to 250 feet will improve all the essential skills required by fast jet aviators.

Assuming the RAF pilot candidate has shown the "right stuff" at RAF Valley, he wins his wings and is then posted to RAF Chivenor or

RAF Brawdy to complete the TWU course before receiving his final aircraft assignment.

The Navigator

As in USAF nav training, the RAF nav student must learn the basics of navigation. This takes several months and a wide variety of sorties. Eventually the RAF student finds himself in the low-level phase of his training. Here again is the major point of divergence for USAF and RAF nav training. The Dominie basic navigation trainer is used to introduce students to radar and visual low-level flying down to 500 feet above the ground at 210 knots. The Dominie is a small twin-engine aircraft (similar to the T-39) and can accommodate only two students per sortie in this phase.

When the student nav completes the Dominie low-level phase, he then goes to the Jet Provost squadron to refine his map reading, crew coordination, and airmanship skills. He also learns the rudimentary elements of formation flying and basic flying maneuvers. During this phase, he must navigate visually at 250 feet while flying at 300 knots. If he proves his fast jet nav potential, he's screened for more low-level training in the Dominie and Jet Provost.

Advance training in the Jet Provost is very demanding for a nav student. Not only must he navigate accurately by dead reckoning (navigation by time, distance, heading, and airspeed), but he must also plan and execute attacks against simulated targets in the low-flying area. He does this at 250 feet, using a map, stopwatch, compass, and airspeed indicator as his only aids.

Low-level demands placed on USAF student navs are very light when compared to RAF training. A USAF student nav is given several T-45 simulator rides for low-level radar navigation training, one T-43 orientation flight at 2,000 feet above the ground, and several T-37 flights at a minimum en route altitude (MEA) based on 1,000 feet above the highest obstacle along the route of flight. I can assure you there is a tremendous difference between 1,000-foot MEA flying and 250-foot low-level flying. Navigation is considerably more difficult, and the stress level is increased multifold.

ABOVE: A Royal Air Force Tornado shows load-carrying capability. RIGHT: Jet Provosts are still in use for RAF training, for both undergraduate pilots and navigators.

When RAF student navs receive their wings, they also receive their assignments. If assigned to one of the RAF fighters or tactical bombers, the new "fightergator" must complete a few weeks at one of the TWUs to build his confidence and experience.

The Program

At the TWU, these fledgling fighter pilots and "fightergators" are exposed to tactical thinking in depth before becoming part of the "real air force." The course is not academically oriented, but is flying intensive. My impression is that the ultimate goal is to make flying second nature—just like riding a bicycle.

As previously mentioned, the main course is designed around the student pilot. It takes approximately four months to complete and involves about sixty sorties actually flown by the student pilot. Currently, there is no formal syllabus for a nav student, but he's expected to fly a minimum of twenty-five hours (about twenty-five sorties). Nav students always fly with an instructor pilot and, preferably, fly a few different sorties in each phase.

TAC's LIT program for navs is similarly conducted. Personally, I think it's a great idea. No such program existed when I left nav training. Virtually overnight I went from a 180-knot T-29 to a 480-knot-plus F-111. Most flying in the Hawk (or T-38) is done at speeds of 420 knots or greater; operating at such speeds is typical of most line fighters. Several phases are used to enhance further essential skills and to build confidence. Starting with a brief three-sortie familiarization phase to acquaint the student with TWU operations, these phases follow a building-block approach. Subsequent phases include formation, low-level navigation, weapons, air combat maneuvering, and simulated attack profiles. I was very impressed with the amount and type of training these aviators receive at such an early stage in their careers.

Five sorties make up the formation phase. From takeoff to landing, tactical formations are emphasized heavily on each mission. First, stu-

dents receive training at medium level, then progressively lower to 500 feet above the ground. These tactical formations are essentially the same as those used throughout the RAF fighter force. Both pilots and navs learn formation terminology, geometry, and maneuver. They will continue to build on formation skills in other phases. Eventually, in the low-level phase, the student pilot will participate in tactical formations with up to four aircraft, and he must be able to maneuver safely and efficiently as an integral part of the formation.

The low-level navigation phase expands on the low-level work to which the student was exposed previously. It starts with the student pilot flying a low-level route at 420 knots without the immediate aid of an instructor. Alone in his Hawk, the student's flight progress is monitored by an instructor pilot in a chase aircraft, usually with a nav student in the instructor's back seat. This initial sortie is flown at 500 feet, and if student performance is safe and effective, his next sortie is flown on a different route at 250 feet. Though early sorties in this phase are essentially flown single ship, later sorties are flown with four aircraft in tactical formation as low as 250 feet.

In the weapons phase, students are introduced to basic weaponry concepts; the optical weapon aiming sight (gunsight), an essential tool of all fighter aircraft, is given particular emphasis. A student learns to interpret and analyze the information available in the gunsight. He must use the sight information when attempting to track a maneuvering aircraft or bombing a ground target. A small aiming reference "dot" known as a pipper must be on the target at the right range, speed, and aircraft attitude when weapons are fired if the weapons are to be effective. This is a difficult task, even for highly experienced fighter pilots.

As the weapons phase continues, the TWU student uses what he's learned about the sight to strafe and bomb ground targets at a local weapons range. He also fires live rounds from the 30-mm gun pod at air-towed targets. In addition, he's exposed to weapons effectiveness concepts for different types of ordnance, to such planning factors as bomb spacing, and to practice weapons range patterns and procedures. His ability to position the pipper correctly is evaluated by his range scores and by reviewing the gunsight camera film, an extremely useful aid.

Because the Hawk has a gunsight in the back seat as well as the front, nav students reap great benefits from this phase. They learn to appreciate the difficulties of flying the aircraft while attempting to position the pipper properly for bomb release or gun firing. This is probably the only time in his career that a nav student will actually be able to see classroom instruction on the gunsight transformed into meaningful application. Undoubtedly, this experience with the gunsight will make him a better, more able partner in all phases of weapon delivery when he gets to his final assignment.

No Easy Task

Next is the air combat maneuvering phase. To be effective in the air-to-air arena, a fighter pilot must know the basics of fighting alone vs. another aircraft (1 v 1) or fighting with a wingman vs. another aircraft (2 v 1). In teaching these basics, the TWU excels. Each student is well briefed on the specific mission objectives of each sortie and how the objectives will be achieved. The student pilot flies each sortie twice, first with an instructor pilot, then solo. Thus, the learning points for each objective are reinforced.

Even though today's air-to-air missiles are so effective, as proven by British forces in the Falklands war and by the Israelis in Lebanon, it is still essential that a fighter pilot understand how to maneuver his aircraft for an air-to-air gun kill against an enemy fighter should the situation dictate. To do this successfully, a fighter pilot must be able to judge overtake, analyze his three-dimensional situation relative to the enemy, and then perform the right maneuver at the right time. Any fighter pilot, assuming he's honest, will tell you *this ain't no easy task!*

Consequently, initial sorties in the TWU's air combat phase are "canned" 1 v 1 setups to ensure that the student has an opportunity to see the advantages and disadvantages of each basic fighter maneuver needed in the air-to-air combat arena. As the phase progresses, he's introduced to 2 v 1 tactics and learns the radio discipline necessary to coordinate his efforts with those of his wingman. This progression culminates in air combat sorties that are not canned: The student must fight from a position of no advantage. Emphasis in this phase is on maneuvering the aircraft to a valid gun-firing position against an "enemy" aircraft, since this is the most difficult task of air combat.

Eight sorties constitute the final phase—the simulated attack profile or SAP phase. Now the student must put it all together. Drawing on experience gained in previous phases, he plans low-level attacks against different targets for each mission. While early sorties are devoted to attack planning, later sorties are devoted to executing rapidly planned attacks in an even more intense, combat-like environment. These rapid planning exercises allow a student only two hours to develop a complete plan, brief it, and get airborne—another tough task for even the most experienced tactical aviators.

Success in the phase is determined by a student's ability to integrate a multitude of planning factors into the mission. For a given target these factors include determining the right weapon and delivery parameters to achieve the desired level of destruction against a given target, selecting the correct attack axis for optimum weapon effectiveness, locating a dominant feature along the preferred attack track to serve as a visual initial point (IP) for the final target run, developing a route to the IP which avoids simulated enemy defenses, and, finally, planning defensive reactions against potential enemy interceptors and enemy surface defenses.

These planning factors are not all inclusive, but they do exemplify the complexity of the task confronting the student. While there is never a perfect solution to any given tactical problem, by integrating these factors into SAP mission planning the student is unconsciously developing a sixth sense for tactical planning. That's an essential element of the true fighter pilot.

After the mission is planned, it's time to fly the plan. Mission execu-

tion at 250 feet using only heading, airspeed, map, and stopwatch is difficult enough, but throw in a "bounce" and at times the task seems impossible. The bounce is another Hawk flown by an instructor pilot simulating an enemy interceptor. His mission is to disrupt the student's plan. This is a stress test of the young aviator's ability to counter an air threat, regain formation support and integrity, and continue the attack.

Surprisingly enough, most of these young lads do an excellent job of getting to the target on time and within required parameters for a simulated weapon release. I've seen a lot of old heads miss the target in similar circumstances. And I'm talking about old heads in a variety of exercises and from a variety of tactical aircraft with far more sophisticated navigation equipment than that in the Hawk.

Mission exercises in the SAP phase are particularly valuable for a nav student. He assists in the planning process and is an active participant in the flying phase of the mission. As a crew member in the attack formation, he must back up the student pilot's navigation, maintain a good lookout for the bounce, and use the radio to maneuver the formation for defense if the bounce is sighted. Flying with the bounce instructor, a student nav assists in navigating to an intercept point. He must also monitor the actions of the unengaged member in the attack flight during an engagement, keeping the bounce pilot informed so as to prevent an opposing flight member from gaining an advantageous position for simulated air-to-air weapons firing.

Equally important, while operating as the bounce the student nav must "free nav" his way to a new intercept point after each engagement. This entails mentally developing a route plan to the next intercept point and map reading to it. All of this is a lot of work for a skilled "fightergator" and, once again, it's a pleasant surprise to see how many of these young navs cope.

The End Product

At the end of all these phases a new tactical aviator emerges. The student pilot will now get his final aircraft assignment based on the needs of the RAF and a thorough examination of his tactical skills. Armed with terminology, a bag of tricks, and tactical thinking, he's ready to learn the peculiarities of his new weapon system. While transitioning to his new aircraft, many elements of his TWU training will be rehashed. However, the time he must devote to basic tactical concepts has been significantly reduced.

It's taken a lot of work for these young men to complete the TWU course, but they all agree it's worth it. Flight Lieutenant Simon Tranter, a recent TWU graduate, said, "I thought the course was absolutely magnificent. When you leave Valley, you're current in the Hawk, so at the TWU you can concentrate on learning the tactics.

"Our first day at Chivenor, Squadron Leader Neil Buckland, OC (Officer Commanding) of 63 Squadron, told us that after a couple of weeks our learning curve would really start to go up. We didn't believe it, but he was right. It was really a magnificent course. You learn a lot and it's good fun. Sometimes, a guy may leave Valley and not be a particularly good pilot, but by the time he's finished the TWU, he's learned a lot and improved so much that he may become above average. There's a lot of pressure there, but it's certainly well worth it," he added.

Not only is it worth it to the student, it's also worth it to the RAF. Basic tactical training in the Hawk is incredibly cheap when compared with the cost of conducting such training in any other RAF fighter. And it's not just monetary savings that make the TWU so advantageous. Wing Commander Wally Willman at RAF Chivenor summed up the true benefit: "At the end of all this the student has seen as much as some pilots who have had three or four years in a squadron."

I concur. When my peers and I left basic flying training for fighter assignments, we weren't nearly so well prepared as a TWU graduate. A lot of valuable time in our fighter conversion training was spent learning about basic concepts of weapons, tactics, tactical formations, and low-level flying. Because we didn't know these basics, we weren't able to integrate them adequately into the operating capabilities of our weapon systems. In most cases we could do so only after a few years of flying in our designated weapon system. That's a long time and an expensive process. By comparison, the TWU is pure gold.

Skills developed at the TWU will be used for the rest of a graduate's career. Because of this strong foundation, a TWU graduate destined for fighter-interceptors won't have to undergo specialized training should he be reassigned to ground-attack fighters a few years later. He's well rounded in tactical aviation, capable of adapting to any tactical aircraft operations.

As with all good training programs, the TWU is constantly undergoing self-scrutiny and extensive external evaluations. Lack of a nav training syllabus is a recognized deficiency and one that is being addressed. Wing Commander Willman noted that in practical terms there are multiple "problems of meeting the demands of different aircraft and roles using a single syllabus." Unquestionably, there are agonizing arguments as to how much of what should be included. In my mind, I'm convinced the RAF has developed an outstanding program for budding fighter pilots. They have thoroughly impressed me and my associates in the exchange program.

As long as the RAF continues with such comprehensive TWU training, I've no doubt RAF fighter pilots will continue their world-renowned tradition of excellence in tactical aviation. ■

Capt. Darrel R. Greer was commissioned from Officer Training School in 1973. Prior to his present assignment in the USAF/RAF Exchange Program, Captain Greer served with F-111 units in Thailand and at Nellis AFB, Nev. He served for five years as an F-111 Instructor Weapon Systems Officer, including three years as a Fighter Weapons Instructor with the Fighter Weapons School detachment at Mountain Home AFB, Idaho. He is also a graduate of the Squadron Officer School. Captain Greer holds a bachelor's degree in physics from the University of West Florida and a master's degree in business administration and management from the University of Northern Colorado.

Hawk XX 220, in the markings of RAF's No. 63 Squadron, flies over the Welsh countryside during a low-level training mission. (Photo by Philip Birtles)

Weapons Delivery In the RAF

The Royal Air Force now uses the Hawk aircraft for advanced weapons and tactics training, preparing its fast jet pilots for assignment to operational units and transition to front-line aircraft.

BY F. CLIFTON BERRY, JR.
EDITOR IN CHIEF

No. 1 Tactical Weapons Unit (TWU) of the Royal Air Force is at RAF Brawdy in southwest Wales. Wing Commander Brian Hoskins is Officer Commanding Ops Wing and the Chief Instructor of No. 1 TWU. Before assuming his present post, he commanded the Red Arrows, the Royal Air Force's aerial demonstration team, for three years.

RAF Brawdy, a former Fleet Air Arm base, is noted for its high winds and persistent precipitation. However, for the purposes of the TWU training, those are not severe limiting factors. The training is advanced, and student pilots flying in Brawdy courses are already qualified on the Hawk or other aircraft.

The unit title suggests the purpose of the courses at Brawdy (and its sister base in North Devon, RAF Chivenor): tactical weapons training. This includes both air-to-air and air-to-ground work. Two courses are run by No. 1 TWU at Brawdy. The long course, lasting four months, is for *ab initio* students from the RAF's undergraduate pilot training. It is conducted by 234 Squadron. The students have 150 hours in the Jet Provost and eighty in the Hawk on arrival. They log fifty-six more hours in tactical training while at Brawdy. Usually six students are in each course. Six courses are run each year.

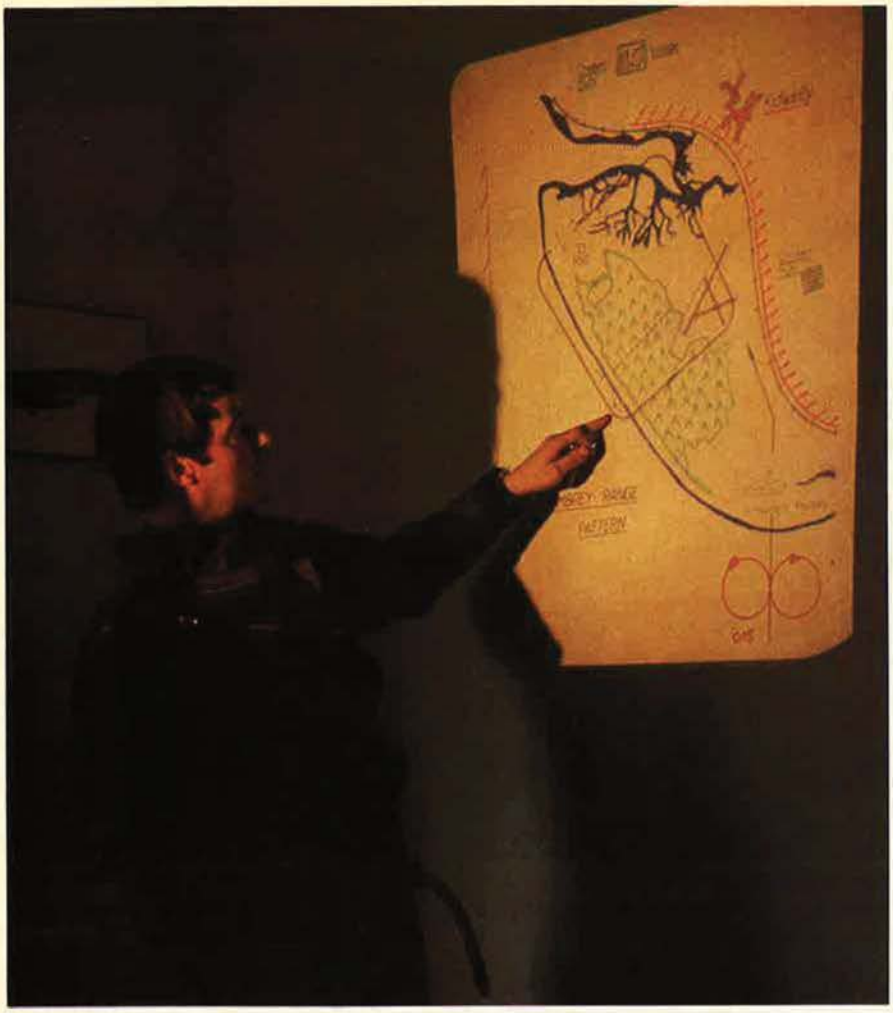
The short course is conducted by 79 Squadron. It is for RAF aircrew already qualified, and for aircrew from other air forces, such as USAF exchange officers. They fly ten hours on Brawdy's Jet Provost, then are oriented to tactical weapons training in air defense or attack, as their intended assignments dictate. The course includes twenty-five to thirty hours in the Hawk.

Cockpit Familiarization

Brian Hoskins had laid on a multiple weapons delivery training flight for me, including low-level navigation flying. The Instructor Pilot was Flight Lieutenant Glenn L. Torpy, leader of the Weapons Instruction Flight. Glenn is a former Jaguar reconnaissance pilot who has also flown on a squadron exchange with the RF-4C-equipped 152d Tactical Reconnaissance Group, Nevada Air National Guard. We dressed for the mission first: my own boots, long johns, flight suit, and gloves; the RAF's G-suit, helmet, oxygen mask, survival kit, and immersion suit. Then into a hangar for cockpit familiarization.

I was to fly the Hawk from the rear seat this time. The production aircraft instrumentation differs a bit from the prototype G-HAWK I had flown before, so the "look and touch" time was welcome. Flight Lieutenant Torpy covered the general cockpit layout, reviewed emergency procedures, then focused on the gunsight and weapons controls.

Both pilots have gunsights. Because the instructor's rear cockpit is higher than the front, he has an unimpeded gunsight picture. The front-seat pilot's weapons selector console is at the upper left of his panel. Repeater lights inform the back-seater of the weapons selected in the front. Firing buttons on the



Flt. Lt. Glenn Torpy briefs the weapons delivery training flight. Using a drawing of the Pembrey Range in Wales, he describes the flight pattern that will be flown, including headings, airspeeds, and altitudes throughout. (Air Force Magazine photo)

control stick are covered in the "safe" position by black panels. They are moved by thumb or finger to engage the red bombing pickle button or the gun trigger.

Mission Briefing

Glenn Torpy briefed the attack mission. We would fly as a single ship. Flight time to Pembrey Range would be seven minutes, putting us on station a minute before our allotted half hour of range time. He briefed the flight route, covered the range layout, and explained the patterns we would fly for the three training situations we would execute: ten-degree bombing, strafing with the 30-mm Aden gun, and level bombing from low altitude. Each pass was expected to take about one minute and forty-five seconds, so we could practice up to fifteen passes before leaving the range for low-level navigation practice. Glenn's plan was for me to fly to the range under his direction, then for him to demonstrate the pattern for each attack while I got familiar with the range layout and landmarks on the circuit. Then he'd make live passes while I followed through on the controls. After that, I'd do dry passes. When he was satisfied, then I'd deliver the ordnance.

After a final check of all times and events, we gathered up our kit and walked to the maintenance office to sign for the airplane. The maintenance is centralized, with the flying wing specifying the number of aircraft in specified configurations needed each day. On the average, each ready aircraft flies three or four sorties daily. We had aircraft with tail number XX 324 for this mission, its third of the day. Glenn checked the records, signed for the aircraft, and we walked down the windy ramp to the plane. Eight practice bombs were loaded in the pod on the left wing pylon. The 30-mm Aden gun on the centerline was armed with 100 rounds.

After the walkaround inspection, we boarded XX 324 and linked in with the Martin-Baker ejection seat and survival system and the single-point hookup for communications and oxygen. Glenn rebriefed on emergency procedures. Engine start was smooth, and all instrument indications were correct. Cleared to taxi, we rolled out of the parking place and headed along the taxiway to Brawdy's Runway 33. I found taxiing with differential braking easier this time. (The US Navy's Hawk T-45s will have nosewheel steering.)

Brawdy Tower cleared us for takeoff. The wind down Runway 33 was now steady from 330 degrees at twenty-five knots. I lined up, stood on the brakes, advanced power to one hundred percent, and, on Glenn's command, released the brakes. XX 324 accelerated immediately. A light toe touch on the brakes kept us straight. Within a few seconds, airspeed passed ninety-five knots. At 105 knots, I applied back pressure, rotating the nose. At 115 knots, XX 324 flew off.

As airspeed approached 300 knots in a gentle climb to 2,000 feet, Glenn directed a power reduction to ninety-two percent. I did so, and executed his heading directions to the holding pattern outside Pembrey Range airspace. As he had predicted, we were there in just under seven minutes. Two Hawks from RAF Chivenor were still working on the range, so Glenn took the controls and flew a holding pattern over Worm's Head, a distinctive rock outcropping on the Welsh coast.

At the Range

While we flew the holding pattern, Glenn pointed out the Pembrey Range layout and key landmarks. The Chivenor Hawks finished training and departed south for their home, also about seven minutes from the range. Range Control cleared us in. Glenn flew the first pattern for familiarization: altitude 2,000 feet above ground level (AGL), indicated airspeed 360 knots, power setting ninety-two percent. Downwind leg was flown south of the disused airfield at Pembrey. A left turn inside the rail line kept the aircraft within the

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Ready to start the engine of Hawk XX 324. The crew chief makes final check with Flt. Lt. Glenn Torpy in front seat before the canopy is closed. (Air Force Magazine photo)

range boundary and minimized noise on people outside but near the range.

On the base leg, we aligned with a farm in the distance while acquiring the range targets visually in the left front sector. When the targets were at our nine o'clock, Glenn broke into a ninety-degree bank to the left for final run-in, intentionally overbanking slightly and rolling back dead on the target for the final run-in. The G-meter needle whipped to 3.0 in the bank, falling back as Glenn began the final run. On a heading of 250 degrees, he began the ten-degree dive, descending ultimately to 450 feet AGL in the run. He had already set in the gunsight corrections: drift twenty knots right, depression 100 mils, and selector in "B" (bomb) mode.

With the gunsight flight bug centered on the target, Glenn held course until its gyro cross moved upward into view from the bottom of the sight. When it reached the base of the target, he simulated pickling a bomb. This occurred at 550 yards from the target. With the simulated bomb pickled, Glenn began a 6.0-G pullout, turning hard left and resuming the racetrack pattern.

On the next pass, I felt more at home with the range and the flight pattern. This time, Glenn Torpy dropped a practice bomb. Range Control reported its impact as thirty feet at eight o'clock from the bull's-eye.

I flew a dry pass next. The aircraft performed flawlessly, but I did not. I overcontrolled while trying to fly the pattern and acquire the target, roll in, put the gunsight flight bug on target, and make the 6.0-G pullout at the right time. Glenn's coaching helped mightily, even through the pullout when I soared us to 2,500 feet and had to pull back down to pattern altitude promptly for the next run. The next pass was a bit better, but still not up to standard, so Glenn demonstrated again. His bomb hit within twenty feet of the bull's-eye this time.

I tried again, but it was clear that my skills were not up to the standards needed for safe bomb passes. We decided that Glenn should demonstrate strafing, then level bombing, and then we'd fly low-level in the time remaining. As one would expect, his hot 30-mm gun burst was smack into the killing zone of the audio-scored target.

His level bombing pass required reorienting the pattern to parallel the coastline, and dropping down to 200 feet above ground level (AGL) for the run-in at 400 knots. The barometric altimeter in XX 324 had been calibrated to yield 200 feet AGL when indicating 150 feet, so that's the level he flew. Again, his bombs were right on target, well within the lethal bursting radius of any iron bombs a Hawk might carry.

Low-Level Flight

In thirty minutes on the range we had flown fourteen passes with G-loads varying from less than 1.0 to 6.2. I was beginning to look forward to the low-level flying when Glenn called Range Control. He cleared us off the range and passed the word on the low-level route we would be flying.

Off we flew, heading north over the coastal towns at 1,500 feet. In less than two minutes they were behind us, and Glenn let down to 250 feet AGL in a north-south valley. The slopes on both sides blurred in my peripheral vision, but the view ahead from the back seat was clear. Glenn threaded through a succession of valleys, and suddenly the face of a concrete dam loomed ahead and above us. He climbed and leveled out as we crossed the spillway, skimming across the ruffled waters like the "Dam Busters" of 617 Squadron in World War II.

This low-level flying is a hallmark of RAF fast jet training, aimed at building proficiency at successively lower levels. Pilots in the No. 1 TWU courses work low-level navigation flights first at 500 feet AGL, then, when competent, at 250 feet AGL. This is done in single ship, then two-ship and four-ship flights. During all the low-level flying training, the students are liable to be "bounced" by instructor attackers flying RAF Hunters from Brawdy. The training culminates in attack missions that the students plan and lead.

Past the dam, Glenn turned over the controls to me and I climbed a bit. He called out headings and warned of obstructions ahead (a slim radio tower was one) while I flew, enjoying the Hawk's stability and responsiveness. It made the flight a confidence-builder; I feel safer on an RAF low-level route than driving in London.

At the north end of the practice route we turned left and headed southwest to Brawdy. Blending into the traffic flow there, Glenn flew a touch-and-go landing. He turned the aircraft over to me for a circuit and landing. Speed over the threshold on Runway 33 was 117 knots. We touched down on the hump of Runway 33 at 100 knots, rolled to the turnoff, and taxied into the parking spot after 1.1 hours of flying.

Debrief and Summary

No maintenance squawks were required after the flight. We turned in the aircraft books, then returned to the classroom for debriefing. That included gun camera film of all the passes. It was a pleasure to see Glenn's precise runs. Seeing my own wobbling was less pleasurable but mighty edifying, especially when his coaching and critique showed how to improve next time. Of course, that is the objective of No. 1 TWU: to improve on each mission flown, in order to deliver qualified fast jet pilots to the operational units.

Back in London, we learned that the RAF is retrofitting ninety (and perhaps more) of its training Hawks with improved avionics, instrumentation, wiring, and pylons for installation of AIM-9L all-aspect Sidewinder missiles. The project was planned before the Falklands conflict, but gained urgency as a result of the lessons learned there. The upgraded trainers will be expected to augment the RAF's first-line interceptors when needed. ■

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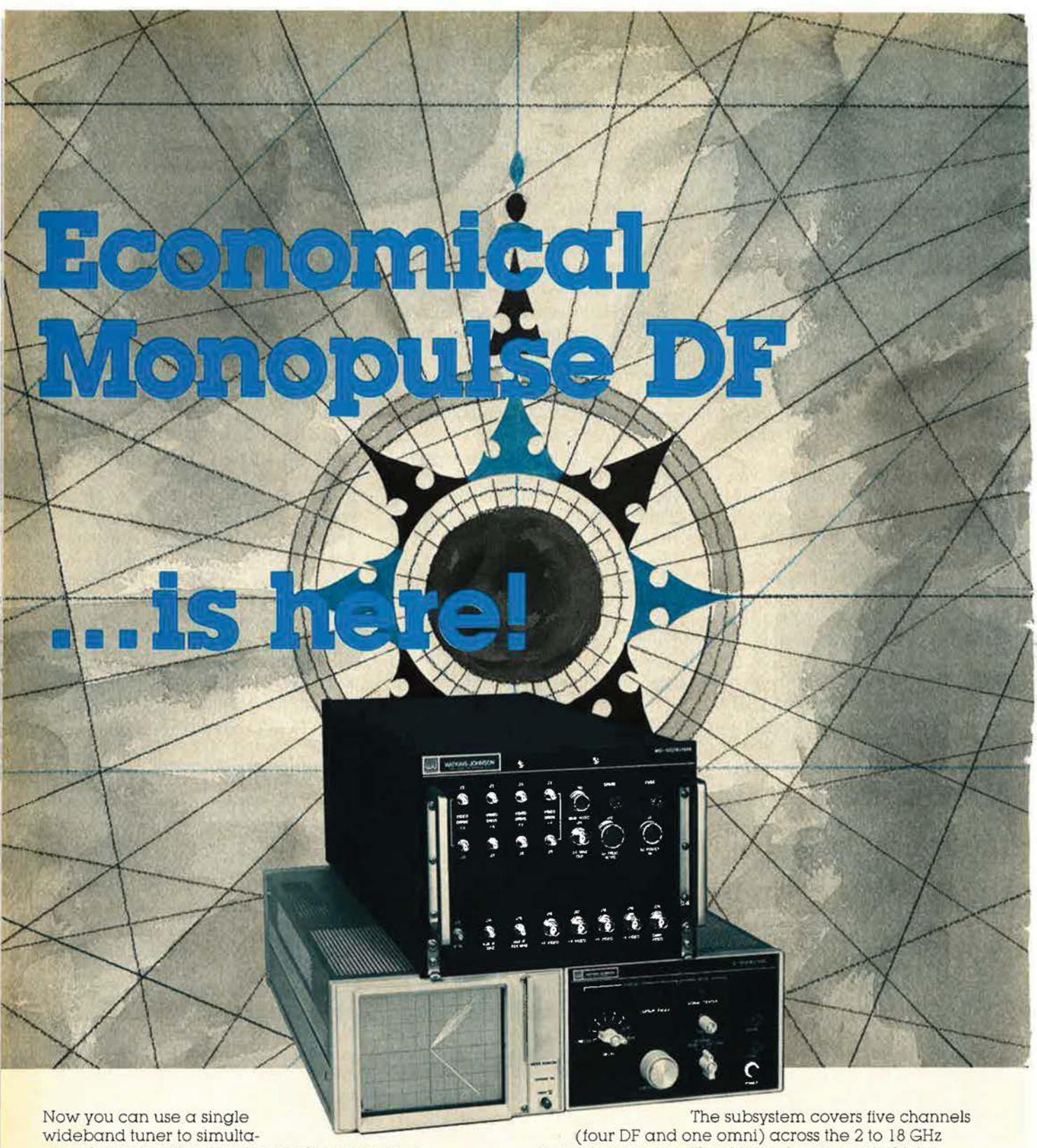

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Watkins-Johnson's WJ-1988 Amplitude Monopulse DF Processor is designed to be used with a static antenna array covering multiple azimuth sectors. The equipment includes an active multiplexer to be mounted adjacent to the antennas, a DF processor unit and a control and display module.

The subsystem covers five channels (four DF and one omni) across the 2 to 18 GHz frequency range without incurring unwanted interferometry effects. Monopulse DF information is displayed in digital and polar form for maximum operator flexibility.

To find out how the WJ-1988 suits your monopulse DF processing need, contact the Watkins-Johnson Field Sales Office in your area or telephone Recon Applications Engineering in San Jose, California at (408) 262-1411.

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One Turning and One Burning

The odds said Bill Lawley couldn't keep the crippled B-17—with its eight wounded—in the air for another five hours.

BY JOHN L. FRISBEE

FEBRUARY 20, 1944, was the first day of Big Week, those six days when USAAF bombers and fighters broke the back of the Luftwaffe and gained control of the air over Europe. All the pieces had at last fallen in place. Weather on the Continent was clear and forecast to remain good; for the first time, the Eighth Air Force could muster more than 1,000 heavy bombers; auxiliary tanks had extended the range of escort fighters. Only the English weather refused to cooperate that Sunday morning. At US Strategic Air Force headquarters, Lt. Gen. "Tooey" Spaatz considered the risks of launching nearly 2,000 bombers and fighters into the soup that lay thousands of feet thick over East Anglia, and made his decision: "Let 'em go."

Now, several hours later, the 364th Squadron, 305th Bomb Group was on its bomb run at 28,000 feet, the target a Messerschmitt assembly plant at Leipzig, deep in the heart of Germany. Already it had been a long day—the nerve-racking climb up through overcast skies teeming with aircraft, heavy flak en route, attacks by enemy fighters, and now the ultimate frustration for 1st Lt. William R. Lawley and his crew. The bombs in the bay of their B-17 would not release.

As they came off target, Bill Lawley worked hard to keep his bomb-laden B-17 in formation. Glancing ahead, he saw enemy fighters boring in head-on, their guns blazing. Then, suddenly, the cockpit exploded into a screaming, icy maelstrom. Lawley's head was slammed back against the seat, and, through a crimson haze, he saw the copilot slumped over the controls. Sensing that the bomber was in an almost vertical dive, he automatically chopped the throttles, forced the copilot's body off the control column, and with his left hand fought for control of the stricken plane.

For what seemed an eternity, the Fortress plunged earthward, subjected to stresses it was never designed to withstand. At 12,000 feet, Lawley, using every trick he knew, regained enough control to assess the situation. A 20-mm shell had knocked out the right windshield and killed the copilot. One engine was burning furiously, the aircraft controls were badly damaged, and Lawley was bleeding profusely from deep cuts on his face, neck, and hands. Flight instruments, covered with blood, were useless; there was virtually no forward visibility through what remained of the bloodstained windshield.

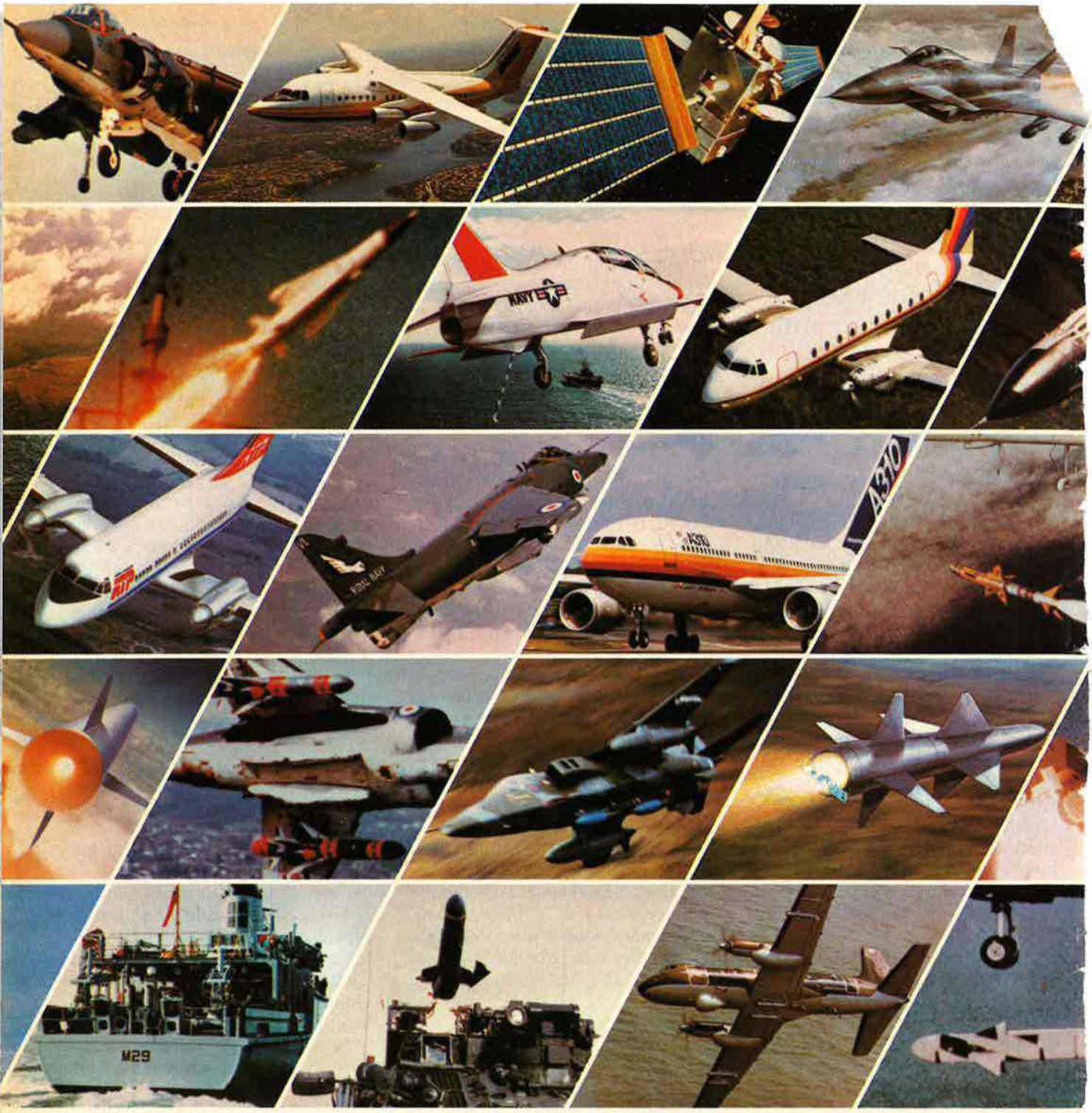
Lawley reached for the bailout bell, hoping to get his crew out before fire reached a fuel tank and the bomber exploded. As the bell rang, a crewman brought word that eight of the crew were wounded, two so seriously that they couldn't use their chutes. Lawley decided there was only one thing to do: try to put out the fire, then nurse the shattered bomber with its wounded over several hundred miles of enemy-held territory back to England. If the machine held out, maybe he could, too.

Bill Lawley—despite his injuries—refused to give up on his plane and crew.

The flight engineer elected to parachute to safety—and to a POW camp. Lawley, with no copilot or engineer to help, finally extinguished the engine fire and headed on three engines for France, where the crew might find help from the underground if they had to crash-land. Flying in the clouds as much as possible, he managed, with the help of bombardier Lt. Harry Mason, to evade enemy fighters and to put out a second engine fire. They couldn't get the copilot's body out of the seat, so Mason tied it to the seat back with a parka. He then stood between the seats and helped Lawley with the controls when Lawley's strength ran out.

Over France, Lawley, who had refused to leave the controls to receive first aid, collapsed from loss of blood and exposure. Revived by Mason, he was able at last to salvo his bombs as they approached the Channel. With the bombs gone, the chance of making those last fifty miles over the gray, icy waters of the Channel improved. But near the English coast, a second engine quit. Then one of the two remaining good engines caught fire and continued to burn until Lawley found Redhill, a small fighter strip south of London, and brought the Fortress in for a crash landing nearly five hours after it was hit over Leipzig. All of the wounded, whom Bill Lawley had refused to abandon, survived the long ordeal.

On August 4, 1944, Lieutenant Lawley was awarded the Medal of Honor for his heroic performance on that first day of Big Week. He remained on active duty until his retirement in 1972, and now lives in Montgomery, Ala. ■



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BAe 136

JANE'S

ALL THE WORLD'S AIRCRAFT SUPPLEMENT

JUNE 1983

Artist's impression of the new Lockheed C-5B Galaxy in European One camouflage

LOCKHEED-GEORGIA

LOCKHEED-GEORGIA COMPANY: Head Office and Works: 86 South Cobb Drive, Marietta, Georgia 30063, USA

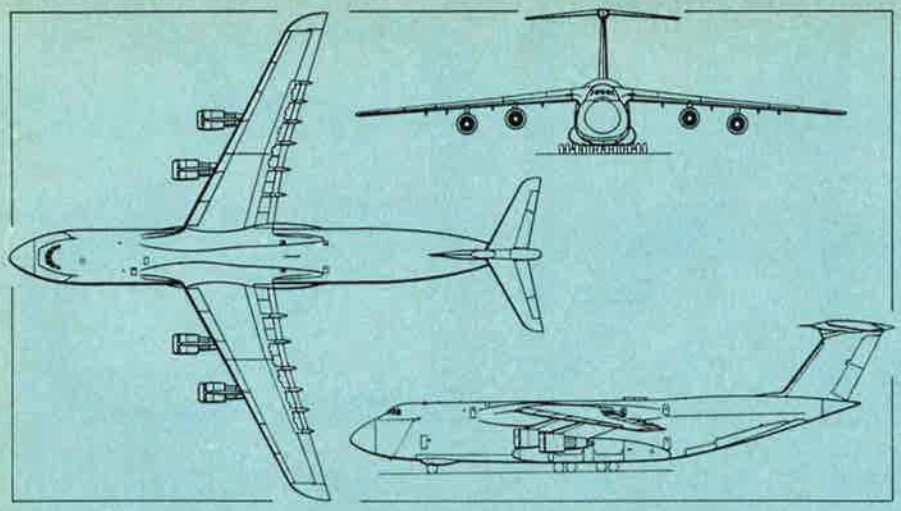
LOCKHEED C-5B GALAXY

In the Summer of 1982, Congress approved a Lockheed proposal to manufacture a C-5N (N: new) version of the Galaxy, largest aircraft currently in service, to meet an urgent US Air Force requirement for additional heavy airlift capacity. A total of 50 of these transports is requested, under the service designation C-5B. FY 1983 funding, under two contracts valued at a total of $659 million, the last finalised on December 31, 1982, covers procurement of the first C-5B production aircraft and data, support equipment, spares, startup, and long lead items. There are options for 49 more aircraft, dependent on the annual congressional funding cycle applied normally to major defence programmes, and extending over several years. The C-5B is to be produced under a fixed-price contract, with economic price adjustment. Present plans call for four aircraft in FY 1984 and 10 in FY 1985.

The aircraft internal arrangements and external aerodynamic configuration are the same as those of the C-5A (last described fully in 1975–76 *Jane's*); but the new version will include all of the changes, improvements, and modifications incorporated in its predecessor during 12 years of service with the US Air Force. Delivery of the first C-5B is scheduled for December 1985.

TYPE: Heavy logistics transport aircraft.

WINGS: Cantilever high-wing monoplane. Wing section NACA 0012 (mod) at 20% span, NACA 0011 (mod) at 43.7% and 70% span. Anhedral 5° 30′ at quarter-chord. Incidence 3° 30′ at root. Sweepback at quarter-chord 25°. Conventional fail-safe box structure of built-up spars and machined aluminium alloy extruded skin panels. Statically balanced aluminium alloy ailerons. Modified Fowler-type aluminium alloy trailing-edge flaps. Simple hinged aluminium alloy spoilers forward of flaps. No trim tabs. Sealed inboard slats and slotted outboard slats on leading-edges.



Lockheed C-5B Galaxy heavy logistics transport aircraft *(Pilot Press)*

Ailerons and spoilers operated by hydraulic servo actuators. Trailing-edge flaps and leading-edge slats actuated by ball screwjack and torque tube system.

FUSELAGE: Conventional semi-monocoque fail-safe structure of 7049-T73, 7050-T736, 7075-T73, and 7475 aluminium alloys.

TAIL UNIT: Cantilever all-metal T tail. All surfaces swept; anhedral on tailplane. All components are single-cell box structures with integrally stiffened aluminium alloy skin panels. Variable incidence tailplane. Elevators in four sections; rudder in two sections. No trim tabs. Rudder and elevators operated through hydraulic servo actuators. Tailplane actuated through hydraulically powered screwjack. No anti-icing equipment.

LANDING GEAR: Retractable tricycle type. Nose unit retracted rearward by hydraulically driven ballscrews. Main units rotated through 90° and retracted inward via hydraulically driven gearbox. Single nose shock absorber and four main gear shock absorbers are of Bendix oleo-pneumatic dual-chamber type. Four wheels on nose unit. Four main units (two in tandem on each side) each comprise a 'triangular footprint' six-wheel bogie made up of a pair of wheels forward of the shock absorber and two pairs aft. All 28 tyres size 49 × 17-20 type VII 26-ply. Tyre pressures: nosewheels 9.45 bars (137 lb/sq in), mainwheels 7.65 bars (111 lb/sq in) with in-flight deflation capability. Goodrich aircooled beryllium disc brakes. Hydro-Aire fully modulating anti-skid units. Ground manoeuvrability enhanced by castoring rear main units.

POWER PLANT: Four General Electric TF39-GE-C turbofan engines, each rated at 191.2 kN (43,000 lb st). Twelve integral fuel tanks in wings, between front and rear spars, comprising two outboard main tanks (each 13,874 litres; 3,665 US gallons), two inboard main tanks (each 14,755 litres; 3,898 US gallons), two outboard auxiliary tanks (each 18,034 litres; 4,764 US gallons), two inboard auxiliary tanks (each 18,401 litres; 4,861 US gallons); two outboard extended range tanks (each 15,865 litres; 4,191 US gallons), and two inboard extended range tanks (each 15,883 litres; 4,196 US gallons). Total capacity 193,624 litres (51,150 US gallons). Two refuelling points each side, in forward part of main landing gear pods. Flight refuelling capability, via inlet in upper forward fuselage, over flight engineer's station (compatible with KC-135 and KC-10 tankers). Oil capacity 138 litres (36.4 US gallons).

ACCOMMODATION: Standard crew of five, consisting of pilot, co-pilot, flight engineer, navigator, and loadmaster, with rest area for 15 people (relief crew, couriers, etc) at front of upper deck. Basic version has seats for 75 troops on rear part of upper deck, aft of wing box. Provision for carrying 270 troops on lower deck, but aircraft will be employed primarily as freighter. Typical freight loads include two M1 tanks or sixteen ¼ ton lorries; or one M1 and two Bell Iroquois helicopters, five M-113 personnel carriers, one M-59 2½ ton truck, and an M-151 ¼ ton truck; or 10 Pershing missiles with tow and launch vehicles; or 36 standard 463L load pallets. 'Visor' type upward-hinged nose, and loading ramp, permit straight-in loading into front of hold, under flight deck. Rear straight-in loading via ramp which forms undersurface of rear fuselage. Side panels of rear fuselage, by ramp, hinge outward to improve access on ground but do not need to open for airdrop operations in view of width of ramp. Provision for aerial delivery system (ADS) kits for paratroops or cargo. Two passenger doors on port side, at rear end of upper and lower decks. Two crew doors on port side, at forward end of upper and lower decks. Entire accommodation pressurised and air-conditioned.

SYSTEMS: Electronically controlled air-conditioning and pressurisation systems: pressure differential 0.57 bars (8.2 lb/sq in). Four separate hydraulic systems, pressure 207 bars (3,000 lb/sq in) each, supply flying control and utility systems. Electrical system includes four 60/80kVA AC engine driven generators. Two APUs provide auxiliary pneumatic, hydraulic, and electrical power.

AVIONICS AND EQUIPMENT: Communications and navigation equipment to military requirements. Bendix colour weather radar. Three Delco inertial navigation units with triple-mix capabilities. Special equipment includes electronic malfunction detection, analysis, and recording subsystem (MADAR) which scans and analyses more than 800 test points.

DIMENSIONS, EXTERNAL:

Wing span	67.88 m (222 ft 8½ in)
Wing chord:	
at root	13.85 m (45 ft 5¼ in)
at tip	4.67 m (15 ft 4 in)
Wing aspect ratio	7.75
Length overall	75.54 m (247 ft 10 in)
Length of fuselage	70.29 m (230 ft 7¼ in)
Height overall	19.85 m (65 ft 1½ in)
Tailplane span	20.94 m (68 ft 8½ in)
Wheel track (between outer wheels)	11.42 m (37 ft 5½ in)
Wheelbase (c/l main gear to c/l nose gear)	22.22 m (72 ft 11 in)
Crew door (lower deck):	
Height	1.80 m (5 ft 11 in)
Width	1.02 m (3 ft 4 in)
Height to sill	3.94 m (12 ft 11 in)
Passenger door (lower deck):	
Height	1.83 m (6 ft 0 in)
Width	0.91 m (3 ft 0 in)
Height to sill	3.56 m (11 ft 8 in)
Aft loading opening (ramp lowered):	
Max height	3.93 m (12 ft 10¾ in)
Max width	5.79 m (19 ft 0 in)
Aft straight-in loading:	
Max height	2.90 m (9 ft 6 in)
Max width	5.79 m (19 ft 0 in)

DIMENSIONS, INTERNAL:

Cabins, excl flight deck:	
Length:	
upper deck, forward	11.99 m (39 ft 4 in)
upper deck, aft	18.20 m (59 ft 8½ in)
lower deck, without ramp	36.91 m (121 ft 1 in)
lower deck, with ramp	44.07 m (144 ft 7 in)
Max width:	
upper deck, forward	4.20 m (13 ft 9½ in)
upper deck, aft	3.96 m (13 ft 0 in)
lower deck	5.79 m (19 ft 0 in)
Max height:	
upper deck	2.29 m (7 ft 6 in)
lower deck	4.11 m (13 ft 6 in)
Floor area:	
upper deck, forward	50.17 m² (540 sq ft)
upper deck, aft	72.10 m² (776.1 sq ft)
lower deck, without ramp	213.76 m² (2,300.9 sq ft)
Height to floor (kneeled):	
forward	1.34 m (4 ft 4¾ in)
aft	1.45 m (4 ft 9 in)
Volume:	
upper deck, forward	56.91 m³ (2,010 cu ft)
upper deck, aft	170.46 m³ (6,020 cu ft)
lower deck	985.29 m³ (34,795 cu ft)

AREAS:

Wings, gross	576.0 m² (6,200 sq ft)
Ailerons (total)	23.49 m² (252.8 sq ft)

Externally, the C-5B will be almost indistinguishable from this current operational C-5A model

Trailing-edge flaps (total) 92.13 m² (991.7 sq ft)
Leading-edge slats (total) 60.25 m² (648.5 sq ft)
Spoilers (total) 40.01 m² (430.7 sq ft)
Fin 89.29 m² (961.1 sq ft)
Rudder 21.06 m² (226.7 sq ft)
Tailplane 89.73 m² (965.8 sq ft)
Elevators 24.03 m² (258.7 sq ft)

WEIGHTS AND LOADINGS (for 2.25*g*):
Operating weight, equipped 167,965 kg (370,300 lb)
Max payload 120,065 kg (264,700 lb)
Max fuel weight 150,815 kg (332,500 lb)
Max T-O weight 362,870 kg (800,000 lb)
Max zero-fuel weight 288,030 kg (635,000 lb)
*Max landing weight 288,415 kg (635,850 lb)
Max wing loading 630 kg/m² (129.03 lb/sq ft)
Max power loading 474.5 kg/kN (4.65 lb/lb st)

*at 2.7 m (9 ft)/sec descent rate

PERFORMANCE (estimated at max T-O weight, except where indicated):
Never-exceed speed 402 knots (745 km/h; 463 mph) CAS or Mach 0.875
Max level speed at 7,620 m (25,000 ft) 496 knots (919 km/h; 571 mph)
Max cruising speed at 7,620 m (25,000 ft) 480–490 knots (888–908 km/h; 552–564 mph)
Econ cruising speed at 7,620 m (25,000 ft) 450 knots (833 km/h; 518 mph)
Stalling speed at max landing weight, 40° flaps, power off 104 knots (193 km/h; 120 mph)
Max rate of climb at S/L 525 m (1,725 ft)/min
Service ceiling at AUW of 278,960 kg (615,000 lb) 10,895 m (35,750 ft)
Min ground turning radius 50.90 m (167 ft 0 in)
Runway LCN:
Asphalt 69
Concrete 44
T-O run at S/L, ISA 2,530 m (8,300 ft)
T-O to 15 m (50 ft) at S/L, ISA 2,987 m (9,800 ft)
Landing from 15 m (50 ft), max landing weight at S/L, ISA 1,164 m (3,820 ft)
Landing run, max landing weight at S/L, ISA 725 m (2,380 ft)
Range with max fuel, ISA, cargo weight 44,090 kg (97,200 lb), fuel reserves 5% of initial fuel plus 30 min loiter at 3,050 m (10,000 ft) 5,950 nm (11,024 km; 6,850 miles)
Range with max payload, ISA, reserves as above 2,370 nm (4,391 km; 2,729 miles)

IAI

ISRAEL AIRCRAFT INDUSTRIES LTD; Head Office and Works: Ben-Gurion International Airport, 70100 Lydda (Lod), Israel

IAI KFIR (LION CUB)

First details of a new version of the Kfir were released by Israel Aircraft Industries at the 1983 Paris Air Show. Earlier in the year the company clarified for *Jane's* the correct style for designating previous models of this important combat aircraft.

The original version, which first flew in prototype form in 1973, was (and still is) known simply as the **Kfir.** The major production version is the **Kfir-C2,** which entered production in 1974. This introduced several important modifications (detailed in current editions of *Jane's All the World's Aircraft*), including the addition of sweptback canard surfaces mounted on the engine air intakes. Many of these modifications, but specifically *not* the canard surfaces, have been incorporated retrospectively in existing examples of the original production version. It is therefore incorrect—since the letter C indicates 'canard'—to refer to these modified aircraft as Kfir-C1.

The new version, designated **Kfir-C7,** differs from the C2 principally in having improved payload/range capability, and in the addition of a HOTAS (hands on throttle and stick) cockpit installation, with new avionics, designed to ease the pilot's workload while at the same time improving the combat performance of the aircraft.

A two-seat Kfir-TC2 version of the C2 has already been produced for the Israeli Air Force; a Kfir-TC7 version of the C7 will also appear in due course.

The following details highlight the principal differences between the Kfir-C2 and C7:

POWER PLANT (C2 and C7): One General Electric J79-J1E engine (modified GE-17), rated at 52.89 kN (11,890 lb st) dry and 79.62 kN (17,900 lb st) with afterburning. Internal fuel in five fuselage and four integral wing tanks, total capacity 3,243 litres (713 Imp gallons). Wet points for the carriage of one or two drop tanks beneath each wing and one under fuselage; these may be of 500, 600, 825, 1,300, or 1,700 litres capacity (110, 132, 181.5, 286, or 374 Imp gallons). Max external fuel capacity 3,900 litres (858 Imp gallons).

AVIONICS AND EQUIPMENT: C2 equipped with MBT twin-computer flight control system (ASW-41 control augmentation and ASW-42 stability augmentation systems), with Tamam inertial measurement unit (IMU), angle of attack transmitter and indicator, and accelerometer indicator. Elbit S-8600 multi-mode navigation (Singer-Kearfott licence) and weapons delivery system or IAI/Elbit WDNS-141 weapons delivery and navigation system; Tamam central air data computer; Elta EL/M-2001B or EL/M-2021 X-band air-to-air and air-to-surface pulse-Doppler target acquisition and tracking radar; IFF/SIF and fire control; Israel Electro-optics head-up display and automatic gunsight; two Elta AN/ARC-51 UHF transceivers. HOTAS (hands on throttle and stick) system in C7 is facilitated by new avionics which include adoption of the WDNS-141 as the standard weapons delivery and navigation system; a computerised stores management release system (SMRS); video subsystems; 'smart weapons' delivery capability; and updated electronic warfare systems.

ARMAMENT: One IAI-built 30 mm DEFA 552 cannon in underside of each engine air intake, with 140 rds/gun. Five hardpoints under fuselage and two under each wing for external weapons, ECM pods, or drop tanks. For interceptor duties, one Rafael Shafrir 2 infra-red homing air-to-air missile can be carried under each outer wing. Ground attack version can carry two 800 or 1,000 lb bombs, up to four 500 lb bombs, or a Rafael Luz-1 or similar air-to-surface missile under the fuselage, and two 1,000 lb or six 500 lb bombs (conventional or 'concrete dibber' type) under the wings. Alternative weapons can include IMI rocket pods, napalm, and Shrike, Maverick, or Hobos air-to-surface missiles.

WEIGHTS AND LOADING (C2 and C7):
Weight empty (interceptor) approx 7,285 kg (16,060 lb)
Max fuel:
internal 2,572 kg (5,670 lb)
external 3,075 kg (6,780 lb)
Max external stores 5,775 kg (12,730 lb)
Typical combat weight:
interceptor, 50% internal fuel, two Shafrir missiles 9,390 kg (20,700 lb)
interceptor, two 500 litre drop tanks, two Shafrir missiles 11,603 kg (25,580 lb)
combat air patrol, three 1,300 litre drop tanks, two Shafrir missiles 14,270 kg (31,460 lb)
ground attack, two 1,300 litre drop tanks, seven 500 lb bombs, two Shafrir missiles 14,670 kg (32,340 lb)
Max combat T-O weight 16,200 kg (35,715 lb)
Wing loading at 9,390 kg (20,700 lb) combat weight 270 kg/m² (55.3 lb/sq ft)
Thrust/weight ratio at 9,390 kg (20,700 lb) combat weight 0.87

PERFORMANCE:
Max level speed above 11,000 m (36,000 ft) over Mach 2.3 (1,317 knots; 2,440 km/h; 1,516 mph)
Max sustained level speed at height, 'clean' Mach 2.0
Max level speed at S/L, 'clean' 750 knots (1,389 km/h; 863 mph)
Max rate of climb at S/L 14,000 m (45,930 ft)/min
Time to 15,240 m (50,000 ft), full internal fuel, two Shafrir missiles 5 min 10 s
Height attainable in zoom climb 22,860 m (75,000 ft)
Stabilised ceiling (combat configuration) 17,680 m (58,000 ft)
T-O run at max T-O weight 1,450 m (4,750 ft)
Landing from 15 m (50 ft) at 11,566 kg (25,500 lb) landing weight 1,555 m (5,100 ft)
Landing run at above landing weight 1,280 m (4,200 ft)
Combat radius, 20 min fuel reserves:
C2 interceptor with two 500 litre drop tanks and two Shafrir missiles, at T-O weight of 11,603 kg (25,580 lb) 187 nm (346 km; 215 miles)
C7 interceptor with one 825 litre and two 1,300 litre drop tanks and two Shafrir missiles 419 nm (776 km; 482 miles)
C2 combat air patrol with three 1,300 litre drop tanks and two Shafrir missiles, at T-O weight of 14,270 kg (31,460 lb), incl 60 min patrol at Mach 0.75 377 nm (699 km; 434 miles)
C7 combat air patrol with one 1,300 litre and two 1,700 litre drop tanks and two Shafrir missiles, incl 60 min loiter 476 nm (882 km; 548 miles)
C2 ground attack, hi-lo-hi, with seven 500 lb bombs, two 1,300 litre drop tanks and two Shafrir missiles, at T-O weight of 14,670 kg (32,340 lb) 415 nm (768 km; 477 miles)
C7 ground attack, hi-lo-hi, with two 800 lb and two 500 lb bombs, one 1,300 litre and two 1,700 litre drop tanks and two Shafrir missiles 670 nm (1,242 km; 772 miles)

SAAB-FAIRCHILD

SAAB-SCANIA AKTIEBOLAG: Address: S-581 88 Linköping, Sweden; and FAIRCHILD INDUSTRIES INC; Address: 20301 Century Boulevard, Germantown, Maryland 20767, USA

Saab-Scania and Fairchild Industries announced in January 1980 that the two companies had signed an agreement jointly to develop, produce, and market a new transport aircraft. This aircraft, the Saab-Fairchild 340, is the first collaborative venture of its kind between members of the European and US aerospace industries, and will be certificated to both FAR and JAR standards for entry into service in 1984. Fairchild Republic builds the wings, tail unit, and engine nacelles; Saab-Scania is responsible for fuselage construction, final assembly, flight testing, and certification. A 25,000 m² (269,100 sq ft) factory at Linköping, for final assembly of the Saab-Fairchild 340, was completed in July 1982.

SAAB-FAIRCHILD 340

First details of this twin-turboprop transport aircraft were announced in January 1980. Engine selection was announced in June, and the project definition phase was completed in September 1980, when agreement was reached for a full go-ahead on joint design, development, production, and marketing programmes. Fairchild Aircraft Corporation is responsible for marketing the aircraft in the USA, Canada, and Mexico, and Saab-Fairchild HB of Sweden for sales in all other parts of the world.

Design emphasis is on simplicity of systems, operation, and maintenance, with quick turnarounds made possible by a number of built-in features which will make the aircraft independent of ground handling equipment. It is designed specially for short-haul low-density routes, and has two new-generation turboprop engines offering low fuel consumption, low operating costs, and low operating noise levels. It is available in both airliner and corporate transport versions.

Flight testing of the General Electric CT7 engine and Dowty Rotol composite propellers began in September 1982, in a Gulfstream I testbed aircraft. Rollout of the first prototype Saab-Fairchild 340 took place on schedule on October 27, 1982. This aircraft (SE-ISF) made its first flight on January 25,

1983; it was due to be followed in May by the second prototype and in August 1983 by the first production example. All three aircraft will take part in the flight test and certification programmes; certification, scheduled for March 1984, will be to JAR Pt 25 and to FAR Pts 21, 25, and 36. Static and fatigue test airframes have been completed in the USA and Sweden respectively.

Initial deliveries of the Saab-Fairchild 340 are scheduled for the Spring of 1984. By Spring 1983 orders and options totalled just over 100, of which approximately half were from US customers; the remainder were from operators in Europe, the Middle East, Asia/Australasia, and Latin America. Approximately 20% of the orders were for the corporate version. The production schedule calls for 24 aircraft to be completed by the end of 1984, rising to an output of 50 during 1985, 63 during 1986, and a peak rate of 72 in 1987.

TYPE: Twin-turboprop transport aircraft.

WINGS: Cantilever low-wing monoplane. Wing sections NASA MS(1)-0316 at root, MS(1)-0312 at tip, with thickness/chord ratios of 16% and 12% respectively. Dihedral 7° from roots. Incidence 2° at root. Sweepback 3° 36' at quarter-chord. Tapered two-spar wings embodying fail-safe principles. Stringers and skins of 2024/7075 aluminium alloy. Wing-root/fuselage fairings of Kevlar sandwich. Hydraulically actuated single-slotted trailing-edge flaps with aluminium alloy spars, honeycomb panels faced with aluminium sheet, and leading/trailing-edges of Kevlar. Ailerons are of Kevlar, with glassfibre leading-edges. Electrically operated geared/trim tab in each aileron. Pneumatic-boot de-icing of leading-edges outboard of engine nacelles.

FUSELAGE: Conventional fail-safe/safe-life semi-monocoque pressurised metal structure, of circular cross-section. Built in three portions: nose (incl flight deck), passenger compartment, and tail section (incorporating baggage compartment). All doors of aluminium honeycomb. Nosecone and cabin floor of glassfibre/glassfibre sandwich.

TAIL UNIT: Cantilever structure, with sweptback vertical and non-swept horizontal surfaces, the latter having marked dihedral. Fin integral with fuselage. Construction similar to that of wings, with tailplane and fin of aluminium honeycomb. Rudder and elevators are of Kevlar, with glassfibre leading-edges. Geared/trim tab in rudder and each elevator.

LANDING GEAR: Retractable tricycle type, of AP Precision Hydraulics design and manufacture, with twin Goodyear wheels and oleo-pneumatic shock absorber on each unit. Hydraulic actuation. All units retract forward, main units into engine nacelles. Mainwheel doors of Kevlar sandwich. Hydraulically steerable nose unit (60° to left and right), with shimmy damper. Mainwheel tyres size 24 × 7.7-10, pressure 6.89 bars (100 lb/sq in); nosewheel tyres size 18 × 6.0-6, pressure 3.79 bars (55 lb/sq in). Independent Goodyear hydraulic disc brakes on main units, with anti-skid control.

Prototype of the Saab-Fairchild 340, with test boom on nose

POWER PLANT: Two General Electric CT7-5A turboprop engines in airliner version, each rated at 1,215 kW (1,630 shp). Dowty Rotol four-blade slow-turning variable-pitch propellers, each with spinner and glassfibre/polyurethane foam/carbonfibre moulded blades. Corporate version has 1,193 kW (1,600 shp) CT7-7E engines. Fuel in two integral tanks in each wing; total capacity 3,331 litres (733 Imp gallons; 880 US gallons). Single-point pressure refuelling inlet in starboard outer wing panel. Overwing gravity refuelling point in each wing. Engine intake ducts of Kevlar sandwich.

ACCOMMODATION: Two pilots and provision for observer on flight deck; attendant's seat (forward, port) in passenger cabin. Main cabin accommodates up to 34 passengers, in ten rows of three, with aisle, and a final row of four. Seat pitch 76 cm (30 in). Movable bulkhead aft of last row of seats. Toilet and wardrobe on starboard side at forward end of cabin; provision for optional galley. Aircraft can be converted quickly to various passenger/freight combinations (*e.g.*, 15 passengers and 1,814 kg; 4,000 lb of cargo). A 16-seat corporate/executive version is also available. Passenger door at front of cabin on port side, with separate airstair. Type II emergency exit opposite this on starboard side; Type III emergency exit over wing on each side. Baggage space under each passenger seat; overhead storage bins optional. Main baggage/cargo compartment aft of passenger cabin, with large door on port side. Entire accommodation pressurised, including baggage compartment.

SYSTEMS: Hamilton Standard environmental control system (max pressure differential 0.48 bars; 7.0 lb/sq in) maintains a S/L cabin environment up to an altitude of 3,660 m (12,000 ft) and a 1,525 m (5,000 ft) environment up to the max cruising altitude of 7,620 m (25,000 ft). Hydraulic system, operating at 138–207 bars (2,000–3,000 lb/sq in), for actuation of landing gear, wheel and propeller

SE-ISF has Air Midwest insignia on the starboard side, Crossair insignia on the port side

braking, nosewheel steering, anti-skid control, and wing flaps. Electric power supplied by two 28V 400A DC engine-driven starter/generators, each connected to a separate busbar. One main solid-state inverter provides 115V AC power at 400Hz. Two 27Ah (optionally 37Ah) nickel-cadmium batteries for ground power and engine starting. Pneumatic-boot de-icing of outer wing and tailplane leading-edges, using engine bleed air. Flight deck windows have electric anti-icing and electrically driven windscreen wipers. Electric anti-icing is provided also for engine air intakes, propellers, and pitot heads. Demisting by means of air-conditioning system. Plug-in connections for oxygen masks. Kidde engine fire detection system.

AVIONICS AND EQUIPMENT: Standard avionics include all equipment required for FAR Pt 121 operations. The aircraft is equipped as standard with a Collins integrated digital flight guidance and autopilot system (FGAS) consisting of attitude and heading reference units, electronic (CRT) flight display units, fail-passive autopilot/flight director system, colour weather radar, air data system with servo instruments, and radio altimeter. Lucas Aerospace electroluminescent flight deck instrument panel array. Dowty Electronics microprocessor-based flight deck central warning system. Rosemount pitot static tubes, total temperature sensors, and stall warning system. Provision for additional avionics to customer's requirements. Landing light in each wing leading-edge.

DIMENSIONS, EXTERNAL:

Wing span	21.44 m (70 ft 4 in)
Wing chord:	
at root	2.837 m (9 ft 3.7 in)
at tip	1.0645 m (3 ft 5.9 in)
Wing aspect ratio	11
Length overall	19.71 m (64 ft 8 in)
Fuselage: Max diameter	2.31 m (7 ft 7 in)
Height overall	6.87 m (22 ft 6½ in)
Wheel track	6.71 m (22 ft 0 in)
Wheelbase	7.27 m (23 ft 10¼ in)
Propeller diameter	3.20 m (10 ft 6 in)
Propeller ground clearance	0.58 m (1 ft 11 in)
Distance between propeller centres	6.71 m (22 ft 0 in)
Passenger door:	
Height	1.60 m (5 ft 3 in)
Width	0.69 m (2 ft 3 in)
Height to sill	1.63 m (5 ft 4 in)
Cargo door:	
Height	1.29 m (4 ft 3 in)
Width	1.35 m (4 ft 5 in)
Height to sill	1.63 m (5 ft 4 in)
Emergency exit (fwd, stbd):	
Height	1.32 m (4 ft 4 in)
Width	0.51 m (1 ft 8 in)
Emergency exits (overwing, each):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck, incl toilet and galley:	
Length	10.57 m (34 ft 8 in)
Max width	2.16 m (7 ft 1 in)
Width at floor	1.70 m (5 ft 7 in)
Max height	1.83 m (6 ft 0 in)
Baggage/cargo compartment volume	6.4 m³ (225.0 cu ft)

AREAS:

Wings, gross	41.81 m² (450.0 sq ft)
Ailerons (total)	2.12 m² (22.84 sq ft)
Trailing-edge flaps (total)	8.07 m² (86.84 sq ft)
Fin, incl dorsal fin	10.405 m² (112.0 sq ft)
Rudder, incl tab	2.72 m² (29.27 sq ft)
Tailplane	13.30 m² (143.16 sq ft)
Elevators (total, incl tabs)	3.46 m² (37.24 sq ft)

WEIGHTS AND LOADINGS:

Typical operating weight empty	7,194 kg (15,860 lb)
Nominal payload (34 passengers)	2,476 kg (5,460 lb)
Max payload (weight-limited)	3,238 kg (7,140 lb)
Max fuel load	2,676 kg (5,900 lb)
Max T-O weight	11,793 kg (26,000 lb)
Max landing weight	11,566 kg (25,500 lb)
Max zero-fuel weight	10,342 kg (23,000 lb)
Max wing loading	282.1 kg/m² (57.8 lb/sq ft)
Max power loading	4.85 kg/kW (7.97 lb/shp)

PERFORMANCE (estimated at max T-O weight, ISA, except where indicated):

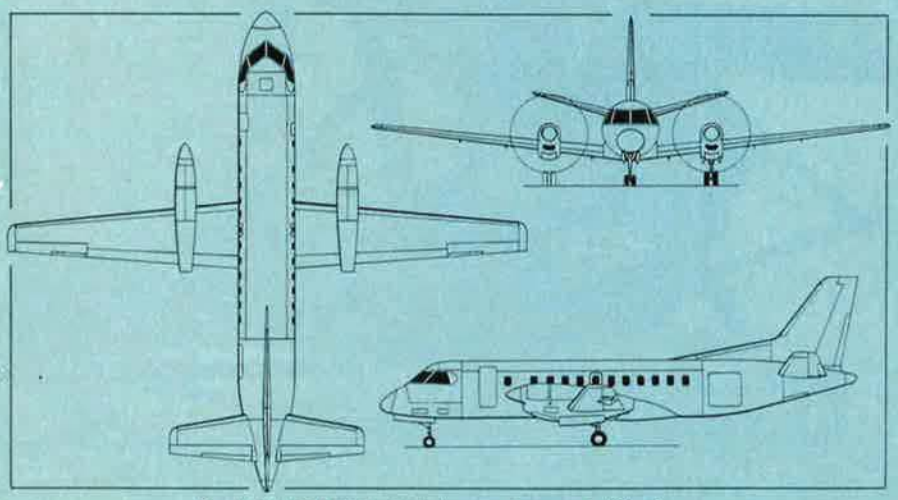
Max operating speed (VMO)	250 knots (463 km/h; 288 mph) EAS
Max operating Mach No. (MMO)	0.5
Max cruising speed at 4,570 m (15,000 ft), AUW of 11,204 kg (24,700 lb)	274 knots (508 km/h; 315 mph)
Econ cruising speed at 7,620 m (25,000 ft)	232 knots (430 km/h; 267 mph)
Stalling speed:	
0° flap	102 knots (189 km/h; 118 mph)
T-O flap setting	90 knots (167 km/h; 104 mph)
approach flap setting	84 knots (156 km/h; 97 mph)
landing flap setting	79 knots (147 km/h; 91 mph)
Max rate of climb at S/L	549 m (1,800 ft)/min
Rate of climb at S/L, one engine out	183 m (600 ft)/min
Service ceiling	7,620 m (25,000 ft)
Service ceiling, one engine out	3,505 m (11,500 ft)
FAR Pt 25 required T-O field length:	
at S/L, ISA	1,174 m (3,850 ft)
at S/L, ISA + 15°C	1,340 m (4,400 ft)
at 1,525 m (5,000 ft), ISA	1,585 m (5,200 ft)
at 1,525 m (5,000 ft), ISA + 15°C	1,830 m (6,000 ft)
FAR Pt 25 landing field length at max landing weight (S/L)	1,158 m (3,800 ft)
Landing field length at 10,205 kg (22,500 lb) weight:	
at S/L	1,036 m (3,400 ft)
at 1,525 m (5,000 ft)	1,158 m (3,800 ft)
Min ground turning radius	15.17 m (49 ft 9.2 in)
Runway LCN:	
flexible pavement	8
rigid pavement	10
Range, allowances for 100 nm (185 km; 115 mile) diversion and 45 min hold:	
with max passenger payload	910 nm (1,686 km; 1,048 miles)
with max fuel	1,750 nm (3,243 km; 2,015 miles)

ESTIMATED PERFORMANCE, TYPICAL MISSION (150 nm; 278 km; 173 mile stage with 34 passengers and 308 kg; 680 lb baggage, T-O weight of 11,158 kg; 24,600 lb):

Block speed	193 knots (357 km/h; 222 mph)
Required T-O field length (S/L, ISA)	1,052 m (3,450 ft)
Block fuel	340 kg (750 lb)
Reserve fuel for 100 nm (185 km; 115 mile) diversion and 45 min hold	385 kg (850 lb)
Block time	47 min

OPERATIONAL NOISE LEVELS (FAR Pt 36, estimated):

T-O	84 EPNdB
Sideline	90 EPNdB
Approach	93 EPNdB



Saab-Fairchild 340 twin-turboprop transport *(Pilot Press)*

LUSCOMBE

LUSCOMBE AIRCRAFT LTD: Terminal Buildings, Ashford Airport, Lympne, Kent CT21 4LR, England

Luscombe Aircraft was formed by ex-Royal Navy pilot Patrick Luscombe in 1981, initially to design and build lightweight sporting aircraft for private operators. The first project, of which design was initiated in 1971, was the Luscombe Vitality. Since then the company has developed a lightweight military version of this aircraft, known as the Rattler, and plans to gain certification in 1984 of a new ultralight two-seat civil development identified currently as the Valiant. This will combine the basic Vitality airframe with the power plant selected for the Rattler and a new glassfibre wing designed specifically for the military version.

LUSCOMBE VALIANT

Design of an ultralight two-seat aircraft known as the Vitality began in 1971. Subsequent testing and development of two prototypes led to construction of a third aircraft in 1981. This is now identified as the prototype of the Luscombe Valiant (G-BKPH), flown for the first time in September 1982, and since that time two further examples have been completed. It is planned to use these aircraft to gain type certification by 1984, after which production will be initiated. Both Japanese and United States agencies are negotiating to import this aircraft.

Of unusual canard configuration, the Valiant has easily removable wings for storage or for towing, a special trailer being available to carry the aircraft with the wings stowed alongside the fuselage. Float landing gear is under development.

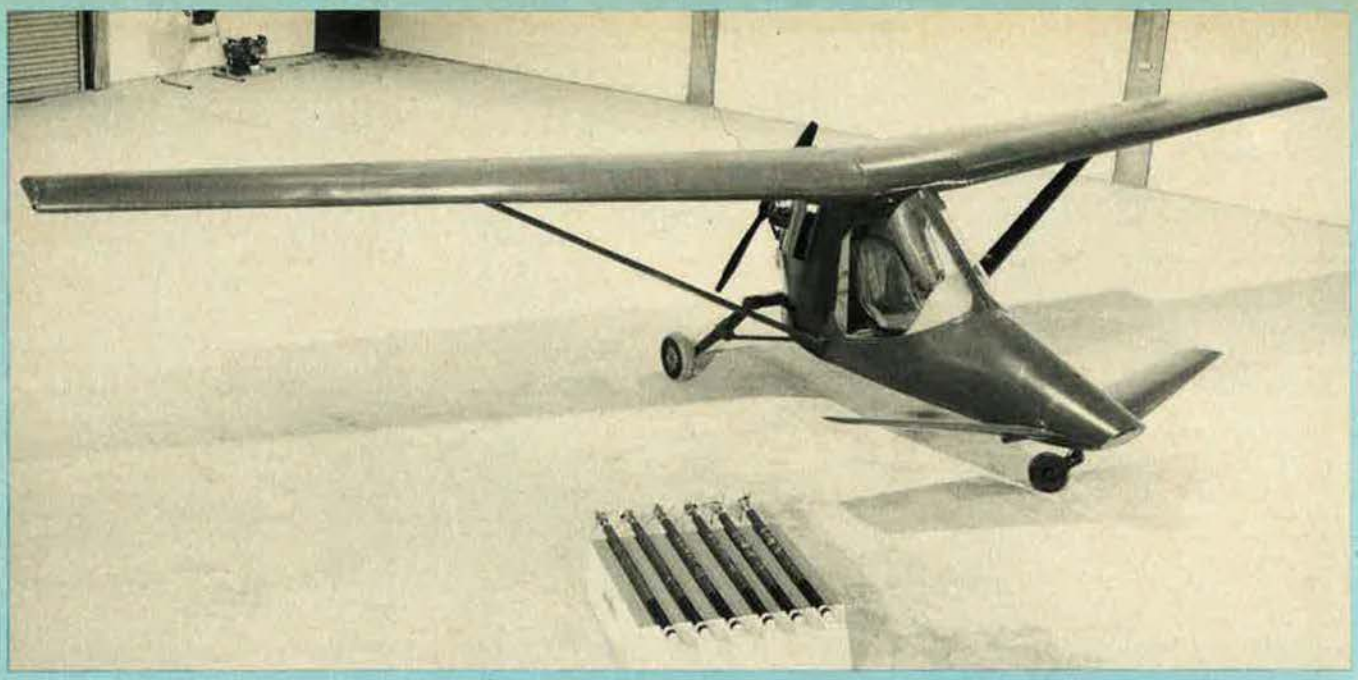
TYPE: Two-seat ultralight sport, training, or agricultural aircraft.

WINGS: Braced high-wing monoplane with single streamlined bracing strut each side. Structure primarily of glassfibre. Ailerons for roll control. No trailing-edge flaps or spoilers. A fin and rudder, of composite construction, are mounted at the trailing-edge of each wing at approximately semi-span.

FUSELAGE: Basic structure of light alloy tube, with composite materials used for skins, floor, and engine intake ducts.

FOREPLANES: Cantilever all-moving surfaces of composite construction, mounted at each side of fuselage nose.

LANDING GEAR: Non-retractable tricycle type with steerable nosewheel. Mainwheel tyres size 5.00-5. Wheel brakes standard.



Pacesetter for a new generation of ultralight combat aircraft, Luscombe's Rattler is already attracting Middle East interest

POWER PLANT: One Normalair-Garrett WAM 684 flat-four two-stroke engine, or Risborough 3-cylinder four-stroke radial engine, or Weslake flat-four four-stroke engine, mounted in the rear fuselage to drive through reduction gearing a two-blade fixed-pitch wooden pusher propeller. Fuel in three tanks, below and to rear of seat and in wing centre-section, with combined capacity of 91 litres (20 Imp gallons).

ACCOMMODATION: Pilot and passenger, seated side by side, in enclosed cabin. Windscreen opens forward and upward to provide access. Accommodation heated and ventilated.

DIMENSIONS EXTERNAL:

Wing span	12.19 m (40 ft 0 in)
Wing area, gross	13.66 m² (147.0 sq ft)
Wing aspect ratio	10.8
Length overall	4.42 m (14 ft 6 in)
Height overall	1.83 m (6 ft 0 in)
Propeller diameter	1.47 m (4 ft 10 in)

WEIGHTS AND LOADING:

Weight empty	204 kg (450 lb)
Max T-O weight	454 kg (1,000 lb)
Max wing loading	33.24 kg/m² (6.80 lb/sq ft)

PERFORMANCE (provisional at S/L, ISA):

Never-exceed speed	110 knots (202 km/h; 126 mph)
Max level speed	100 knots (185 km/h; 115 mph)
Max cruising speed	86 knots (159 km/h; 99 mph)
Econ cruising speed	70 knots (130 km/h; 81 mph)
Stalling speed	23 knots (42 km/h; 26 mph)
Max rate of climb at S/L	183 m (600 ft)/min
Service ceiling	4,570 m (15,000 ft)
T-O run, still air	46 m (150 ft)
Range with max fuel	477 nm (885 km; 550 miles)
Endurance with max fuel	7 h
g limits	+6/−3

LUSCOMBE P3 RATTLER

Developed from the Vitality, and generally of the same size and configuration, the Luscombe P3 Rattler has as its power plant the most powerful of the engines that are listed for the Valiant, and it is expected that this will provide optimum performance. Design of the P3 was initiated in September 1972; construction of a prototype began during July 1975 and this has led to the current pre-production aircraft (G-BKPG), which is expected to make its first flight during early June 1983. It has been reported that negotiations are under way for the supply of Rattlers to an unnamed Arab country, and a market may exist in that area for some 400 of these aircraft.

In early 1983 the Royal Ordnance Factory was giving advice on the most effective offensive stores mix. While no definitive armament can be finalised until testing has been carried out, provisional weapons include the 7.62 mm Hughes Chain Gun, unguided 2 in air-to-ground rockets carried in two seven-round launchers, one beneath each wing, or a Ranger four-tube anti-personnel mine dispenser under each wing able to launch a combined total of 144 mines.

Easy breakdown and re-erection are features of the P3 design, and are seen as being important for a military aircraft of this class, enabling it to be transported in a disassembled state to a battle area, and then reassembled by semi-skilled labour in little more than 15 minutes. Once assembly is complete, it can be operated from a road or grass strips, to provide quick-reaction close support. Furthermore, a package will be available to convert Rattler into an RPV that can serve as an observation platform, carrying a TV or conventional camera, or as a radar jammer.

Flight testing of the Vitality, Valiant, and Rattler prototypes now totals more than 1,300 hours, and the company is confident that Rattler will be able to perform effectively a number of military tasks, at a fraction of the cost of conventional fixed- or rotating-wing aircraft.

TYPE: Single-seat ultralight general purpose aircraft.

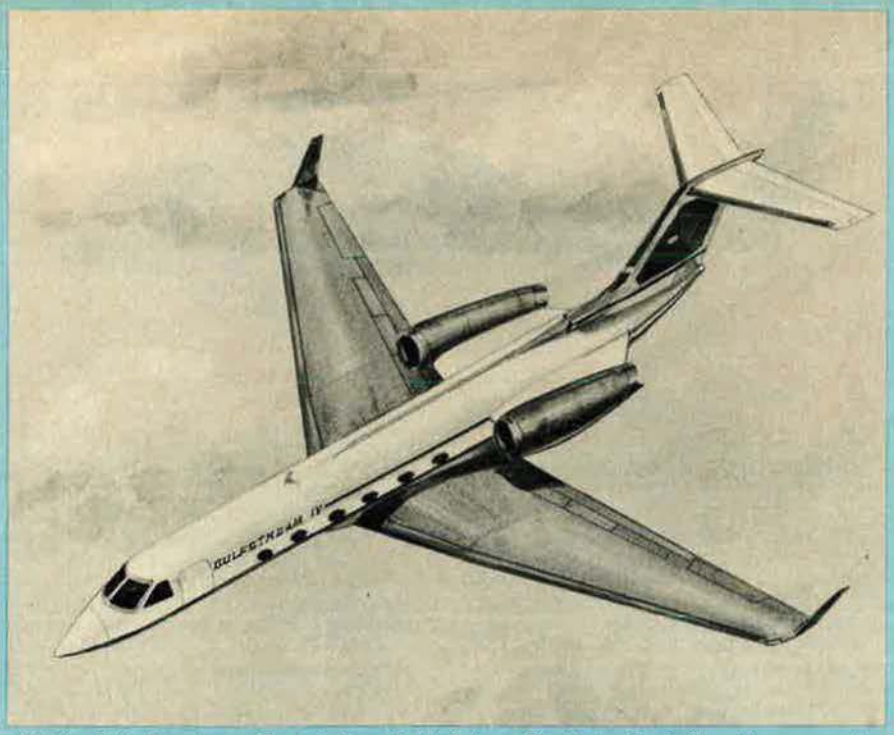
WINGS: Braced high-wing monoplane with single bracing strut each side. Wing section NACA 63412. Dihedral 5°. Incidence 1°. Fail-safe structure, primarily of glassfibre, with honeycomb sandwich composites and aluminium. Ailerons of composite construction for roll control. No trailing-edge flaps or spoilers. Rudders of composite construction for control in yaw, mounted at the trailing-edge of each wing at approximately semi-span.

FUSELAGE: Fail-safe structure of welded aluminium construction with glassfibre skins.

FOREPLANES: All-moving surfaces of glassfibre construction, on each side of nose. Electric anti-icing of foreplane leading-edges optional.

LANDING GEAR: Non-retractable tricycle type with

Close-up of the cockpit of the tail-first Rattler



Utilising Rolls-Royce's new Tay turbofans, the Gulfstream IV will provide significant improvements in range, fuel efficiency, noise reduction, and passenger accommodation compared with the current Gulfstream III

single wheel on each unit. Steerable nosewheel. Shock absorption by coil spring in compression. Wheel brakes.

POWER PLANT: One 60 kW (80 hp) Weslake 65/80-118-2 flat-four engine, driving a two-blade fixed-pitch wooden, or Hoffmann variable-pitch, pusher propeller. Fuel in two tanks below floor of rear cabin, with combined capacity of 91 litres (40 Imp gallons). Refuelling point on side of fuselage.

ACCOMMODATION: Pilot seated in an enclosed cabin. Windscreen opens upward and forward to provide access. Accommodation is heated and ventilated.

AVIONICS: ATR-720C com and Narco ADA 141 standard.

ARMAMENT: Hughes 7.62 mm Chain Gun standard, but a variety of optional stores including 2 in rocket launchers, anti-personnel mine dispensers, and chaff dispensers will be available to customer requirements.

DIMENSIONS, EXTERNAL:

Wing span	12.19 m (40 ft 0 in)
Wing chord:	
at root	1.52 m (5 ft 0 in)
at tip	0.91 m (3 ft 0 in)
Wing aspect ratio	10.8
Length overall	4.57 m (15 ft 0 in)
Max diameter of fuselage	1.22 m (4 ft 0 in)
Width, wings stowed for towing	1.52 m (5 ft 0 in)
Height overall	1.83 m (6 ft 0 in)
Foreplane span	2.29 m (7 ft 6 in)
Wheel track	2.13 m (7 ft 0 in)
Wheelbase	3.51 m (11 ft 6 in)
Propeller diameter	1.47 m (4 ft 10 in)

AREAS:

Wings, gross	13.66 m² (147.0 sq ft)
Ailerons (total)	1.11 m² (12.0 sq ft)
Foreplanes (total)	1.23 m² (13.27 sq ft)
Rudders (total)	0.74 m² (8.0 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty	204 kg (450 lb)
Max T-O weight	454 kg (1,000 lb)
Max wing loading	33.2 kg/m² (6.8 lb/sq ft)
Max power loading	7.57 kg/kW (12.5 lb/hp)

PERFORMANCE (estimated):

Econ cruising speed at 1,525 m (5,000 ft)	78 knots (145 km/h; 90 mph)
Max endurance	11 h

GULFSTREAM AEROSPACE

GULFSTREAM AEROSPACE CORPORATION: Head Office and Works: PO Box 2206, Savannah, Georgia 31402, USA

GULFSTREAM AEROSPACE GULFSTREAM IV

Gulfstream Aerospace Corporation (formerly Gulfstream American Corporation) has designed and intends to develop an improved version of the Gulfstream III which is designated G1159C Gulfstream IV. Its design was initiated in April 1982, and construction of a prototype is planned to begin during the first quarter of 1985, with a first flight scheduled for December 1985. It is anticipated that manufacture of production aircraft will start in early 1986, with the first aircraft flying at the end of that year. Generally similar to the Gulfstream III, this new aircraft will differ primarily in having a structurally redesigned wing, a fuselage lengthened by 0.61 m (2 ft), sixth window on each side of the cabin, a rudder made of carbonfibre, new Rolls-Royce RB183-03 Tay turbofan engines, and a flight deck incorporationg advanced CRT displays and digital avionics.

TYPE: Twin-turbofan executive transport.

WINGS: Cantilever low-wing monoplane of light alloy construction. Advanced sonic rooftop wing section. Thickness/chord ratio of 10% at wing station 50 and 8.6% at wing station 414. Dihedral 3°. Incidence 3° 30' at root, − 1° at tip. Sweepback at quarter-chord 27° 40'. Plain ailerons, hydraulically powered with manual reversion. Single-slotted Fowler-type trailing-edge flaps. Three spoilers on upper surface of each wing at 12% chord, immediately forward of trailing-edge flaps, can be operated differentially to complement ailerons for roll control, and collectively to serve as airbrakes. Trim tab in port aileron. Anti-icing of leading-edges by engine bleed air.

FUSELAGE: Conventional semi-monocoque fail-safe pressurised structure of light alloy.

TAIL UNIT: Cantilever T tail of light alloy, except for rudder of carbonfibre. Swept horizontal and vertical surfaces. Trim tab in rudder and each elevator. Hydraulically-powered controls with manual reversion.

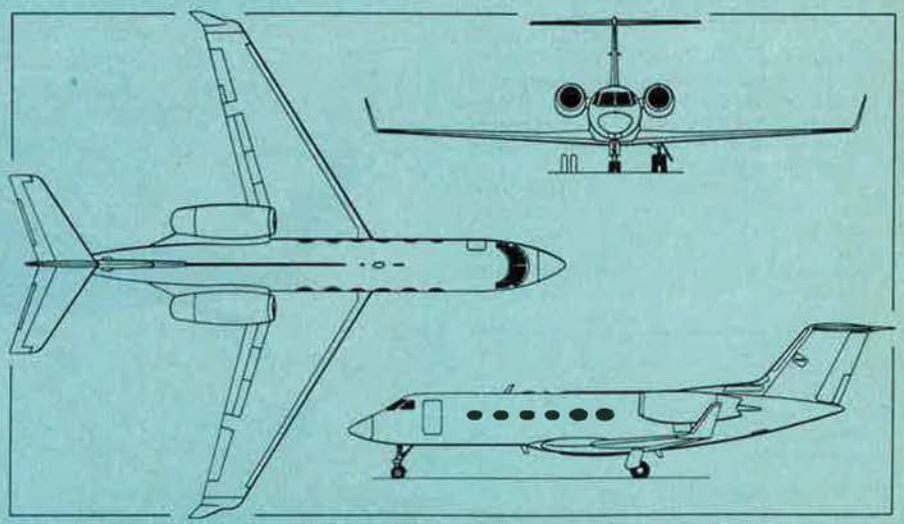
LANDING GEAR: Retractable tricycle type with twin wheels on each unit. Main units retract inward, steerable nose unit forward. Mainwheel tyres size 34 × 9.25-16, pressure 12.0 bars (174 lb/sq in). Nosewheel tyres size 21 × 7.25-10, pressure 7.8 bars (113 lb/sq in). Goodyear air-cooled carbon brakes, with Goodyear fully modulating anti-skid units.

POWER PLANT: Two Rolls-Royce RB183-03 Tay turbofan engines, each 55.4 kN (12,450 lb st) flat rated to ISA + 20°C. Two integral wing tanks with combined capacity of 15,868 litres (4,192 US gallons). Single pressure fuelling point in leading-edge of starboard wing.

ACCOMMODATION: Crew of two or three. Standard seating for 19 passengers in pressurised and air-conditioned cabin. Large baggage compartment at rear of cabin, capacity 907 kg (2,000 lb). Integral airstair door at front of cabin on port side. Electrically heated wraparound windscreen.

SYSTEMS: Cabin pressurisation system max differential 0.65 bars (9.45 lb/sq in). Air-conditioning system. Two independent hydraulic systems, each 103.5 bars (1,500 lb/sq in). APU in tail compartment. Electrical system includes two 36kVA alternators with two solid-state converters to provide 23kVA 115/200V 400Hz AC power and 250A of regulated 28V DC power; two 24V nickel-cadmium storage batteries and external power socket.

AVIONICS AND EQUIPMENT: Standard items will include advanced CRT displays and an all-digital avionics system.



Gulfstream Aerospace Gulfstream IV twin-turbofan executive transport *(Pilot Press)*

DIMENSIONS, EXTERNAL:

Wing span	23.72 m (77 ft 10 in)
Wing chord:	
at root	5.94 m (19 ft 6 in)
at tip	1.66 m (5 ft 5¼ in)
Wing aspect ratio	6
Length overall	25.93 m (85 ft 1 in)
Fuselage length	23.27 m (76 ft 4 in)
Fuselage: Max diameter	2.39 m (7 ft 10 in)
Height overall	7.42 m (24 ft 4 in)
Tailplane span	8.23 m (27 ft 0 in)
Wheel track	4.17 m (13 ft 8 in)
Wheelbase	11.33 m (37 ft 2 in)
Passenger door (fwd, port):	
Height	1.57 m (5 ft 2 in)
Width	0.91 m (3 ft 0 in)
Baggage door (rear):	
Height	0.72 m (2 ft 4½ in)
Width	0.91 m (2 ft 11¾ in)

DIMENSIONS, INTERNAL:

Cabin:	
Length, incl galley and toilet	12.98 m (42 ft 7 in)
Max width	2.24 m (7 ft 4 in)
Max height	1.85 m (6 ft 1 in)
Floor area	21.8 m² (235 sq ft)
Volume	45.02 m³ (1,590 cu ft)
Rear baggage compartment volume	4.81 m³ (170 cu ft)

AREAS:

Wings, gross	86.82 m² (934.6 sq ft)
Ailerons (total)	2.68 m² (28.86 sq ft)
Trailing-edge flaps (total)	11.97 m² (128.84 sq ft)
Spoilers (total)	4.59 m² (49.39 sq ft)
Fin	10.92 m² (117.53 sq ft)
Rudder, incl tab	4.16 m² (44.75 sq ft)
Tailplane	12.70 m² (136.69 sq ft)
Elevators, incl tabs	5.22 m² (56.22 sq ft)

WEIGHTS AND LOADINGS (estimated):

Manufacturer's weight empty	14,923 kg (32,900 lb)
Typical operating weight empty	18,098 kg (39,900 lb)
Max payload	1,860 kg (4,100 lb)
Max fuel weight	12,837 kg (28,300 lb)
Max T-O weight	31,615 kg (69,700 lb)
Max ramp weight	31,842 kg (70,200 lb)
Max zero-fuel weight	19,958 kg (44,000 lb)
Max landing weight	26,535 kg (58,500 lb)
Max wing loading	364.1 kg/m² (74.6 lb/sq ft)
Max power loading	285.5 kg/kN (2.8 lb/lb st)

PERFORMANCE (estimated at max T-O weight except where indicated):

Max operating speed	340 knots (629 km/h; 391 mph) CAS or Mach 0.85
Max level speed and max cruising speed at 10,670 m (35,000 ft)	490 knots (908 km/h; 564 mph)
Econ cruising speed at 13,715 m (45,000 ft)	Mach 0.80 (459 knots; 850 km/h; 528 mph)
Stalling speed at max landing weight	105 knots (195 km/h; 121 mph)
Max operating altitude	13,715 m (45,000 ft)
FAA balanced T-O field length	1,554 m (5,100 ft)
Landing from 15 m (50 ft)	975 m (3,200 ft)
Range with max fuel, 726 kg (1,600 lb) payload, at econ cruising speed and with NBAA IFR reserves	4,000 nm (7,410 km; 4,605 miles)
Range with max payload, econ cruising speed and NBAA IFR reserves	3,550 nm (6,575 km; 4,085 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36, estimated):

T-O	81 EPNdB
Approach	95 EPNdB
Sideline	91 EPNdB

SIKORSKY

SIKORSKY AIRCRAFT, DIVISION OF UNITED TECHNOLOGIES CORPORATION: Head Office and Works: North Main Street, Stratford, Connecticut 06601, USA

SIKORSKY S-70

US Air Force designations: UH-60A and HH-60D

Sikorsky's S-70, already in series production for the US Army and Navy, has been selected to meet the US Air Force's HX requirement for a new-generation search and rescue helicopter to replace HH-3s and HH-53s of the Jolly Green Giant family. Two versions are being acquired:

UH-60A Black Hawk. Under a procurement arrangement between the Army and Air Force, 11 standard Army UH-60As built between December 1982 and June 1983 have been taken over by the Air Force. Two remain at Sikorsky for conversion into prototypes of the Night Hawk. The remainder will be used by USAF units for aircrew training and familiarisation. The first five were accepted in a ceremony at the Stratford works on December 7, 1982.

HH-60D Night Hawk. Fully developed all-weather combat search and rescue helicopter for USAF. Designed to fly up to 250 nm (463 km; 287 miles) behind enemy lines, unescorted, to locate and retrieve downed aircrew.

The basic airframe of the HH-60D is similar to that of the UH-60A, but it will be fitted with the uprated 1,260 kW (1,690 shp) General Electric T700-GE-401 turboshaft engines, main transmission, rotor brake, approach/hover coupler, and rescue hoist of the Navy's SH-60B Seahawk. Other modifications will include the addition of terrain following/terrain avoidance radar, a forward looking infra-red sensing and display system, internal and external auxiliary fuel tanks, and a flight refuelling probe, with provisions for 7.62 mm Miniguns and air-to-air missiles for self-defence, as well as cabin litters and medical equipment. The first HH-60D prototype is expected to fly in 1984. Deliveries of production aircraft are planned to begin in mid-1986, with an estimated requirement for 243 aircraft.

One of the Sikorsky UH-60A Black Hawks acquired by USAF for crew training and familiarisation, under the Night Hawk programme

DIMENSIONS, EXTERNAL (HH-60D):

Main rotor diameter	16.36 m (53 ft 8 in)
Main rotor blade chord	0.53 m (1 ft 8¾ in)
Tail rotor diameter	3.35 m (11 ft 0 in)
Length overall (rotors turning, refuelling probe retracted)	19.76 m (64 ft 10 in)
Length of fuselage, including retracted refuelling probe	17.38 m (57 ft 0¼ in)
Width of fuselage (max)	2.36 m (7 ft 9 in)
Width over external tanks	5.46 m (17 ft 11 in)
Depth of fuselage (max)	1.75 m (5 ft 9 in)
Height overall, tail rotor turning	5.13 m (16 ft 10 in)
Height to top of rotor head	3.76 m (12 ft 4 in)
Tailplane span	4.38 m (14 ft 4½ in)
Wheel track	2.71 m (8 ft 10½ in)
Wheelbase	8.84 m (29 ft 0 in)
Tail rotor ground clearance	1.98 m (6 ft 6 in)
Cabin doors (each):	
Height	1.37 m (4 ft 6 in)
Width	1.75 m (5 ft 9 in)

DIMENSION, INTERNAL (HH-60D):

Cabin volume	10.90 m³ (385 cu ft)

WEIGHTS (HH-60D):

Weight empty	5,734 kg (12,642 lb)
Mission T-O weight	9,259 kg (20,413 lb)
Max T-O weight	9,979 kg (22,000 lb)

PERFORMANCE (HH-60D, estimated at mission T-O weight):

Max level speed	145 knots (268 km/h; 167 mph)
Max cruising speed	128 knots (237 km/h; 147 mph)
Max vertical rate of climb at S/L	203 m (665 ft)/min
Endurance with max fuel	4 h 51 min

Features of the HH-60D Night Hawk, including the retractable flight refuelling probe, external fuel tanks, nose radar, and other avionics, are shown in this drawing

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THE BULLETIN BOARD

By James A. McDonnell, Jr., MILITARY RELATIONS EDITOR

POW-MIA Recognition Day Marked

Government-wide ceremonies in early April marked observance of POW-MIA Recognition Day. Particular emphasis was given by the White House, the Department of Defense, the VA, and the Department of State. A special POW-MIA flag flew over all four agencies.

With the Air Force as Executive Agency, the Pentagon held an "observance ceremony" on Friday, April 8. It included massed troops, an Air Force band concert, and a keynote address by VA's Deputy Administrator Everett Alvarez, Jr., the man who was held POW in North Vietnam longer than anyone else. A flyover concluded the observance.

Also attending the Pentagon ceremony were thirty-one women survivors of POW camps at Bataan and Corregidor. Mostly nurses, they represented the eighty-one women prisoners liberated when American troops retook the Philippines in 1945 *(see related item, p. 31).*

The VA held some form of recognition at each of its 172 hospitals and fifty-eight regional offices. VA Administrator Harry N. Walters reminded field units that "the Veterans Administration has an above-the-call-of-duty obligation to former prisoners of war."

Meeting at the VA's Washington headquarters was VA's Advisory Committee on Former Prisoners of War, headed by retired Air Force Lt. Gen. John P. Flynn, America's highest ranking POW *(see related item, "Bulletin Board," April '82 issue).* This sixteen-member advisory group consults with and advises the VA Administrator on the needs of former POWs with respect to compensation, health care, and rehabilitation. The committee's newest member is Madeline M. Ullom of Tucson, Ariz., a retired Army nurse who was a POW for nearly three years during World War II.

In its report, the committee complimented the VA on accelerating actions aimed at serving the POW community better. It praised the VA's establishment of a special adjudication team at each regional office to process all former POW claims for benefits. Also, the committee has developed a list of additional presumptive diseases not presently identified as being service-connected to the ex-POW experience and has turned this list over to the VA.

Meanwhile, in Congress, Sen. Allan Simpson (R-Wyo.) has introduced a bill to establish a POW Recognition Medal. The proposed legislation would award medals to those Americans who had "acted courageously and honorably" when taken prisoner by enemy forces during World War I, World War II, Korea, Vietnam, or the USS *Pueblo* incident.

Following are the current data pertaining to servicemen and women captured and interned since World War I:

	WW I	WW II	Korea	Vietnam	Total
Captured and interned	4,120	130,201	7,140	826	142,287
Died while POW	147	14,072	2,701	101	17,021
Returned to US control	3,973	116,129	4,418	725	125,245
Missing or unaccounted for	3,350	78,751	8,177	2,494	92,772

Military Pay/Benefits Package Takes Shape

In recent congressional testimony, DoD spokesmen have outlined the military pay and benefits package that the Department would like to see enacted for FY '84.

Included are:

- A program that would fund an annual overseas round trip for dependent students who remain in CONUS to attend secondary school or college while their parent(s) serve overseas;
- Entitlement to a second dislocation allowance when unusual circumstances require members to relocate their household twice during one PCS move;
- Funding for storage of motor vehicles when regulations restrict members from taking cars with them overseas; and
- Authority for the services to implement the Temporary Lodging Expense allowance. This legislation, which reimburses members for the food and temporary lodging expenses involved in a PCS move, was passed by Congress in 1981. Unfortunately, Congress has never provided the funds to go along with the authorization.

Testimony also was heard indicating that DoD will move shortly to ask Congress to sever the linkage that currently ties military pay raises to Civil Service increases. DoD would like to see annual changes in the Employment Cost Index—a measure based on the overall economy—used as the gauge for setting military pay raises. Whether or not Congress will go along with this remains to be seen.

VA's 11,000,000th Home Loan

Almost thirty-nine years ago the first World War II veteran to sign up for a VA-guaranteed home loan bought a $7,500 row house with no down payment.

Recently, Vietnam era veteran Robert L. Phillips became the eleven millionth veteran to receive a credit boost from VA when he purchased a $48,000, three-bedroom home in Peoria, Ill.—also with no money down. Phillips, a radio announcer, will pay twelve percent interest—VA's current rate. The first purchaser paid four percent.

The 11,000,000 homes purchased with the help of VA loan guarantees add up to a loan balance of $204 billion. Only 3.8 percent of the loans have resulted in default, an enviable record for such a lengthy program.

The home-loan program was part of the World War II GI Bill signed into law in 1944 by President Franklin D. Roosevelt. More than 4,900,000 World War II veterans have used it. So have almost 3,000,000 Korean and post-Korean veterans and almost 2,000,000 Vietnam vets. It has been called "the

most effective social legislation since the nineteenth century 'Homestead Act.'"

· Over the years, the program has expanded to include loan guarantees for condominiums and mobile homes. Veterans who have used it once can get their eligibility reinstated under certain circumstances (VA offices have details). Today the VA will guarantee a mortgage lender against loss up to sixty percent of the home loan with a maximum guarantee of $27,500.

FAMCAMPs: Big Money Saver

As both the vacation and PCS seasons get into full swing, Air Force recreation officials have reminded members that they can cut travel costs considerably by staying at on-base Air Force family campgrounds (FAMCAMPs).

There are forty-three FAMCAMP sites throughout the US. Both active-duty members—on a priority basis—and retirees and DoD civilians—on a space-available basis—are eligible to use the low-cost facilities. All FAMCAMPs have some parking space for recreational vehicles. Most have utility hookups. Many boast central service buildings featuring restrooms, showers, and laundry rooms.

The camps normally operate on a first-come, first-serve basis, although some will take advance reservations. Some are open all year while others are seasonal. Those interested in FAMCAMPs should check with the MWR office at any Air Force base for detailed information.

VA Cemetery System Expands

With appropriate ceremony, the VA's newest national cemetery—at Quantico, Va., twenty-five miles south of Washington, D. C.—opened for burials last month. Located on land that was originally part of Quantico Marine Base, the 775-acre site will eventually provide space for 200,000 graves.

VA officials stress that while this 108th VA cemetery will be open to all eligible veterans, it is expected primarily to serve veterans from the metropolitan Washington area. Only sixty cemeteries in the VA system have grave space available. Two more sites are under design.

Meanwhile, under another program, Wyoming's Oregon Trail Veterans Cemetery, near Casper, will be established with the aid of a $672,306 matching fund grant from VA. Six states—Illinois, Maine, Arizona, Rhode Island, Maryland, and Wyoming—have been awarded federal funds under this Cemetery Grants program, which aids states in the establishment, expansion, and improvement of veterans' cemeteries.

The Wyoming site is expected to have eleven acres developed in June of 1984. Eventually, it is planned that almost 100 acres will be available. VA points out that "state cemeteries will continue to be a valuable resource complementing VA's national cemeteries."

The grants program provides financial assistance to state-owned cemeteries on a fifty-fifty matching-fund basis. To date, some $4 million has been granted.

Burial in national cemeteries is available to veterans discharged under other than dishonorable conditions. Burial is also available to an eligible veteran's spouse and minor children. The spouse or dependent of a veteran already buried may be interred in the family grave site even though the cemetery is "closed" to burials that require new grave sites.

Brig. Gen. Stanton R. Musser, Vice Commander of the Ogden Air Logistics Center, Hill AFB, Utah, presents twenty-year civilian engineer Rex Young a Red Cross pin marking donation of a total of twenty gallons of blood during the past forty-two years. Mr. Young has been giving to the Red Cross blood bank since he began work at Hill in 1962. He now works in the industrial radiography section of the Missile and Aircraft Systems Division in the Directorate of Maintenance, where he assists in the inspection of Minuteman missile motors. Mrs. Carol Young looks on. (USAF photo by Gregg Wixom)

In what may be a record, Air Force ROTC Detachment 770, Clemson University, had five of its six staffers promoted this past school year. They are, from left: TSgts. Bobby Barksdale and Dave Amidon to master sergeant; 1st Lt. Rick Sorrenti to captain; Capt. Richard Sutherland to major; and Maj. Tony Frazier to lieutenant colonel. Proud of his people is Col. Lewis Jordan, Professor of Aerospace Studies. (Clemson University photo by Ben Hendricks)

Military Women's Pentagon Corridor

The Pentagon, already a popular stop on the Washington tourist circuit because of its extensive collection of military art and special memorial and commemorative displays, is about to create another focal point of interest.

Secretary of Defense Caspar Weinberger has approved establishment of a permanent corridor in the Pentagon to honor military women. It will be another in the several Pentagon corridor displays that currently honor combat correspondents, NCOs, the Air Force's Outstanding Airmen, Medal of Honor recipients, and many others.

The planned corridor will highlight the history of women in the military and will incorporate authentic artifacts and memorabilia ranging from the Revolutionary War to the present. The Pentagon is looking for help in gathering appropriate items, and any information pertaining to suitable artifacts, photographs, or other items will be gratefully acknowledged.

AIR FORCE Magazine readers with helpful information may contact J. B. Hudson, Military Women's Corridor Project Officer, Office of the Administrative Assistant to the Secretary of the Army, Room 3E749, Pentagon, Washington, D. C. 20319. Mr. Hudson urges respondents *not* to send any artifacts or photographs that must be returned.

THE BULLETIN BOARD

USAF Lieutenant Karate Expert

Second Lt. Karen Lundeen, from AFSC's antisatellite program office at Los Angeles AFS, is the holder of a second-degree black belt in karate and has won top spots in several competitions *(see photo)*.

Lieutenant Lundeen, a mechanical engineer graduate of Temple University in Philadelphia, Pa., began taking karate lessons at Temple as a means of self-improvement. Last November she was a member of a team that took first place at the National Karate Championships. Since then her team won second place at the Pan-American Karate Championship in Caracas, Venezuela—only her first international competition—and she herself placed sixth in individual competition there. Her next goal is to compete as a

Second Lt. Karen Lundeen finished in second place in the recent Pan-American Karate Championships. (USAF photo by Mike Keefe)

member of the American team that will go to the World Karate Tournament in Cairo, Egypt, next November.

Relating karate to her military duties, she notes that "karate helps me as an officer. The military structure of rank and discipline is similar."

Agent Orange Study Update

The Air Force has released some findings from its "Ranch Hand" study on crew members involved in herbicide spraying missions in Vietnam from 1962 to 1971. Officials stress that these are preliminary evaluations and that more extensive analyses and comparisons of the data remain to be done.

In general, the study is finding that the Ranch Hand participants are not experiencing a greater mortality rate than a companion research group made up of individuals similar in most respects except for exposure to the defoliant. In fact, mortality statistics for both groups were lower than for a similarly aged US white male population. However, officials caution that very few deaths have occurred in any of the groups, statistically speaking, and further analysis is needed.

Of the original 2,486 subjects chosen for the study, begun in October 1981, only one Ranch Hand and four comparison subjects cannot now be located. This location rate of 99.8 percent is very high for an epidemiological study. Ninety-seven percent of the Ranch Hand subjects agreed to participate in the face-to-face interview portion of the study. Interviews with current and former wives and next of kin of deceased individuals also are included in the study. Other elements include in-depth physical and psychological examinations.

More definite findings are expected to be released in a few months. Follow-up examinations will be administered to the study subjects at the three-, five-, ten-, fifteen-, and twenty-year points.

Short Bursts

The **Vietnam Veterans Memorial,** dedicated only last November on the Washington Mall, has already drawn more than 1,000,000 visitors. Park Service officials look for traffic to pass the 4,000,000 mark before its first anniversary.

Army and Air Force Exchange Service sales for last year topped the $4.6 billion level, a new record. Exchange officials stress that each dollar earned goes back to the customers in one way or another. Direct contributions last year to Army and Air Force MWR activities totaled **$103 million.** Construction costs for new facilities, salaries for Exchange employees (none of whom is under Civil Service), operation of clothing sales stores, etc., all serve to save appropriated fund dollars.

Alaska Gov. Bill Sheffield presents Maj. (Dr.) Lyonio Nunes with the Governor's Award during the annual Alaskan of the Year Banquet held at the Anchorage Sheraton Hotel. The Major, selected as the Air Force flight surgeon of the year, was one of six recipients to be honored at the banquet. The Governor's Award program was established in 1978. (USAF photo by A1C Emmett Stinson)

Sen. John East (R-N. C.) continues his attempt to get an adjustment in retired pay for a **small group of Marine Corps retirees** who were invited back on active duty during the Vietnam War. He says they were promised recomputation of their retired pay after their voluntary stint, but this never happened.

Female Air Force members have been authorized **optional wear of a woman's flight cap,** similar in appearance to the one men have been wearing for years. Clothing sales stores don't have it yet, but several commercial manufacturers have come out with one.

Winding up this month is an ambitious six-month data collection program called DARTS— for **Drug Abuse Response Tracking System**—that the Air Force hopes will give it a comprehensive look at what happened to drug abusers from a management standpoint. Were Article 15s given? Courts-martial? Other administrative action? Rehabilitation? Separation, either voluntary or involuntary? Ultimate aim is to develop an integrated Air Force-wide policy.

The Air Force has changed the names of most of its uniforms for easier identification. For example, the previously designated Men's Combination 3 now is simply called the **Dark Blue Shirt.** Interestingly, the new name of the "Field Utility Uniform" is **"Fatigues,"** which might be an acknowledgment that that is what the troops always called them anyway.

Last year, the **Air Force Aid Society** provided nearly 25,000 needy Air Force members more than $9 million in emergency financial assistance.

This is up some thirty percent from the previous year. AFAS officials note that AFAS "stands ready to expand yet further to meet the emergency financial needs of Air Force people."

The VA is making "serious efforts" to **collect old educational overpayments.** Debtors who still owe money from the mid-1970s are now being dunned. VA is willing to accept "reasonable repayment agreements."

Working its way through the congressional process is a bill authorizing a **postage stamp honoring the Vietnam veterans.** Backers would like to get it enacted during 1983, which marks a decade since the end of that conflict. ■

SENIOR STAFF CHANGES

PROMOTIONS: To be **General:** James E. **Dalton;** Andrew P. **Iosue.**

To be **Lieutenant General:** Carl H. **Cathey,** Jr.; Jack I. **Gregory;** Robert E. **Kelley;** Kenneth L. **Peek,** Jr.; John L. **Pickitt.**

RETIREMENTS: Gen. James R. **Allen;** L/G Hans H. **Driessnack;** B/G David M. **Hall;** B/G Delbert H. **Jacobs;** B/G Avon C. **James;** M/G Doyle E. **Larson;** B/G Sheldon J. **Lustig;** L/G William R. **Nelson;** B/G Walter H. **Poore;** B/G Henry J. **Sechler;** M/G Richard V. **Secord;** Gen. William Y. **Smith.**

CHANGES: M/G William P. Acker, from Vice Cmdr., Hq. ATC, Randolph AFB, Tex., to Cmdr., 3d AF, USAFE, RAF Mildenhall, UK, replacing M/G (L/G selectee) Carl H. Cathey, Jr. . . . **B/G Joseph A. Ahearn,** from Chief, Prgms. Div., Dir. of Engineering & Services, DCS/L&E, Hq. USAF, Washington, D. C., to DCS/Engineering & Services, Hq. USAFE, Ramstein AB, Germany, replacing retiring B/G Sheldon J. Lustig . . . **Col. (B/G selectee) Charles W. Bartholomew,** from Cmdr., 513th TAW, USAFE, RAF Mildenhall, UK, to Command Dir., NORAD Combat Ops., J-31, NORAD/SPACECOM, Cheyenne Mountain Complex, Colo. . . . **L/G Robert W. Bazley,** from Vice CINC, Hq. USAFE, Ramstein AB, Germany, to IG, Hq. USAF, Washington, D. C., replacing L/G Howard W. Leaf.

M/G (L/G selectee) Carl H. Cathey, Jr., from Cmdr., 3d AF, USAFE, RAF Mildenhall, UK, to Vice CINC, Hq. USAFE, Ramstein AB, Germany, replacing L/G Robert W. Bazley . . . **Col. (B/G selectee) Larry D. Church,** from Ass't DCS/Intel., Hq. PACAF, Hickam AFB, Hawaii, to Dep. Ass't C/S, C-2, Combined Forces Command, Seoul, Korea, replacing B/G Jimmy C. Pettyjohn . . . **L/G (Gen. selectee) James E. Dalton,** from Dir., Joint Staff, OJCS, Washington, D. C., to C/S, SHAPE, Mons, Belgium, replacing Gen. Richard L. Lawson . . . **B/G Michael J. Dugan,** from Ass't DCS/Ops., Hq. TAC, Langley AFB, Va., to IG, Hq. TAC, Langley AFB, Va., replacing B/G (M/G selectee) Russell L. Violett . . . **Col. (B/G selectee) Robert F. Durkin,** from Cmdr., 28th Bomb Wg., SAC, Ellsworth AFB, S. D., to Dep. for General Purpose Forces, DCS/RD&A, Hq. USAF, Washington, D. C., replacing retired B/G Delbert H. Jacobs.

B/G Eugene H. Fischer, from Cmdr., 1st TFW, Hq. TAC, Langley AFB, Va., to Cmdr., TFWC, TAC, Nellis AFB, Nev., replacing M/G (L/G selectee) Jack I. Gregory . . . **B/G Lee V. Greer,** from Vice Cmdr., Sacramento ALC, AFLC, McClellan AFB, Calif., to Vice Cmdr., Oklahoma City ALC, AFLC, Tinker AFB, Okla., replacing retired B/G Walter H. Poore . . . **M/G (L/G selectee) Jack I. Gregory,** from Cmdr., TFWC, TAC, Nellis AFB, Nev., to Cmdr., 12th AF, TAC, Bergstrom AFB, Tex., replacing retired L/G William R. Nelson . . . **Col. (B/G selectee) William J. Grove, Jr.,** from Cmdr., 93d Bomb Wg., SAC, Castle AFB, Calif., to Cmdt., AFROTC, ATC, Maxwell AFB, Ala., replacing B/G Chris O. Divich.

Col. (B/G selectee) Trevor A. Hammond, from Cmdr., 509th Bomb Wg., SAC, Pease AFB, N. H., to Vice Cmdr., Sacramento ALC, AFLC, McClellan AFB, Calif., replacing B/G Lee V. Greer . . . **B/G Ralph E. Havens,** from Ass't for General Officer Matters, DCS/M&P, Hq. USAF, Washington, D. C., to Cmdr., 86th TFW, Hq. USAFE, Ramstein AB, Germany, replacing B/G (M/G selectee) Robert C. Oaks . . . **B/G Charles A. Horner,** from Cmdr., 833d AD, TAC, Holloman AFB, N. M., to Cmdr., 23d AD, TAC, Tyndall AFB, Fla. . . . **L/G (Gen. selectee) Andrew P. Iosue,** from DCS/M&P, Hq. USAF, Washington, D. C., to Cmdr., Hq. ATC, Randolph AFB, Tex., replacing Gen. Thomas M. Ryan, Jr.

M/G (L/G selectee) Robert E. Kelley, from Superintendent, USAFA, Colorado Springs, Colo., to Vice Cmdr., Hq. TAC, Langley AFB, Va., replacing M/G (L/G selectee) Robert D. Russ . . . **Col. (B/G selectee) James D. Kellim,** from Vice Cmdr., Lowry TTC, ATC, Lowry AFB, Colo., to Cmdr., ARPC, Denver, Colo. . . . **Col. (B/G selectee) Peter T. Kempf,** from Student, Nat'l Defense Univ., Washington, D. C., to Cmdr., 833d AD, TAC, Holloman AFB, N. M., replacing B/G Charles A. Horner . . . **Gen. Richard L. Lawson,** from C/S, SHAPE, Mons, Belgium, to Dep. CINC, Hq. USEUCOM, Vaihingen, Germany, replacing retiring Gen. William Y. Smith.

L/G Howard W. Leaf, from IG, Hq. USAF, Washington, D. C., to Ass't Vice C/S, Hq. USAF, Washington, D. C., and Senior USAF Member, UN Mil. Staff Committee, replacing retiring L/G Hans H. Driessnack . . . **B/G (M/G selectee) Donald P. Litke,** from Dep., J-4/J-7, Hq. USEUCOM, Vaihingen, Germany, to Cmdr., TUSLOG, Ankara, Turkey, replacing M/G James P. Smothermon . . . **Col. (B/G selectee) John M. Loh,** from Ass't DCS/Requirements, Hq. TAC, Langley AFB, Va., to Ass't DCS/Ops., Hq. TAC, Langley AFB, Va., replacing B/G Michael J. Dugan.

M/G John B. Marks, from Ass't C/S for Intel., Hq. USAF, Washington, D. C., to Cmdr., Hq. ESC, San Antonio, Tex., replacing retiring M/G Doyle E. Larson . . . **B/G (M/G selectee) Thomas G. McInerney,** from Cmdr., 313th AD, PACAF, Kadena AB, Japan, to DCS/Ops. & Intel., Hq. PACAF, Hickam AFB, Hawaii, replacing retired M/G Ernest A. Bedke . . . **B/G Michael A. Nelson,** from Dep. Dir., J-3, Hq. PACOM, Camp Smith, Hawaii, to Cmdr., 313th AD, PACAF, Kadena AB, Japan, replacing B/G (M/G selectee) Thomas G. McInerney . . . **B/G (M/G selectee) Robert C. Oaks,** from Cmdr., 86th TFW, Hq. USAFE, Ramstein AB, Germany, to Dir. of Personnel Plans, DCS/M&P, Hq. USAF, Washington, D. C., replacing M/G (L/G selectee) Kenneth L. Peek, Jr.

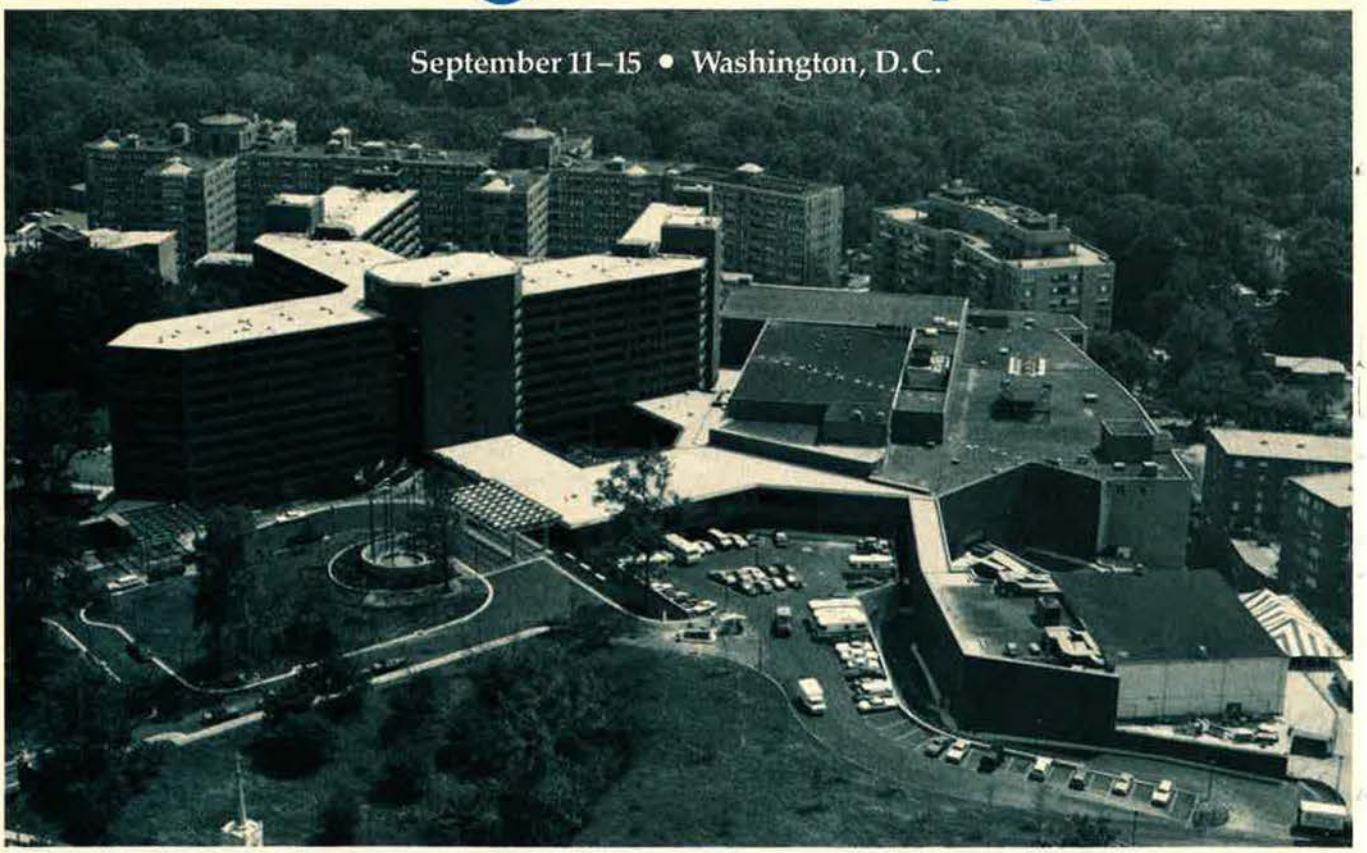
Col. (B/G selectee) Thomas R. Olsen, from Cmdr., 51st TFW, PACAF, Osan AB, Korea, to Dep. Dir., J-3, Hq. PACOM, Camp Smith, Hawaii, replacing B/G Michael A. Nelson . . . **M/G (L/G selectee) Kenneth L. Peek, Jr.,** from Dir. of Personnel Plans, DCS/M&P, Hq. USAF, Washington, D. C., to DCS/M&P, Hq. USAF, Washington, D. C., replacing L/G (Gen. selectee) Andrew P. Iosue . . . **B/G Jimmy C. Pettyjohn,** from Dep. Ass't C/S, C-2, Combined Forces Command, Seoul, Korea, to Dir. for Intel., J-2, Hq. PACOM, Camp Smith, Hawaii, replacing M/G James C. Pfautz . . . **M/G James C. Pfautz,** from Dir. for Intel., J-2, Hq. PACOM, Camp Smith, Hawaii, to Ass't C/S for Intel., Hq. USAF, Washington, D. C., replacing M/G John B. Marks.

M/G (L/G selectee) John L. Pickitt, from Dep. Cmdr. for Air Defense, Hq. TAC, Langley AFB, Va., to C/S, Combined Forces Command; Dep. Cmdr., US Forces, Korea; and Dep. CINC, UN Command Korea, Seoul, Korea, replacing L/G Winfield W. Scott, Jr. . . . **Gen. Thomas M. Ryan, Jr.,** from Cmdr., Hq. ATC, Randolph AFB, Tex., to CINC, Hq. MAC, Scott AFB, Ill., replacing retiring Gen. James R. Allen . . . **B/G Roger P. Scheer,** from Cmdr., 301st TFW (AFRES), Carswell AFB, Tex., to Dep. to Chief, AFRES, Hq. USAF, Washington, D. C., replacing B/G James C. Wahleithner.

L/G Winfield W. Scott, Jr., from C/S, Combined Forces Command; Dep. Cmdr., US Forces, Korea; and Dep. CINC, UN Command Korea, Seoul, Korea, to Superintendent, USAFA, Colorado Springs, Colo., replacing M/G (L/G selectee) Robert E. Kelley . . . **M/G James P. Smothermon,** from Cmdr., TUSLOG, Ankara, Turkey, to Vice Cmdr., Hq. ATC, Randolph AFB, Tex., replacing M/G William P. Acker . . . **B/G Marion F. Tidwell,** from Dep. Dir., Nat'l Mil. Command Ctr. (#4), J-3, OJCS, Washington, D. C., to Dep., J-4/J-7, Hq. USEUCOM, Vaihingen, Germany, replacing B/G (M/G selectee) Donald P. Litke.

B/G (M/G selectee) Russell L. Violett, from IG, Hq. TAC, Langley AFB, Va., to Spec. Ass't to Dep. Cmdr. for Air Defense, Hq. TAC, Langley AFB, Va. . . . **B/G James C. Wahleithner,** from Dep. to Chief, AFRES, Hq. USAF, Washington, D. C., to Vice Cmdr., 10th AF (AFRES), Bergstrom AFB, Tex. ■

AFA's 1983 National Convention and Aerospace Development Briefings and Displays



Plan now to attend: AFA's 1983 National Convention and Aerospace Development Briefings and Displays at the new Sheraton Washington Hotel. Additional rooms available at the Shoreham Hotel across the street and the Dupont Plaza Hotel served by Metro, at substantially lower rates than the Sheraton Washington.

Hotel reservation requests: for the Sheraton Washington, send to: Sheraton Washington Hotel, 2660 Woodley Road, N.W., Washington, D.C. 20008; for the Shoreham Hotel, send to: 2500 Calvert St., N.W., Washington, D.C. 20008; and the Dupont Plaza Hotel, 1500 New Hampshire Ave., N.W., Washington, D.C. 20036. Make your reservations as soon as possible. *All three hotels have a cutoff date of August 19.* To assure acceptance of your reservation requests, please refer to the AFA National Convention. All reservation requests must be accompanied by one night's deposit or an American Express number and expiration date. Deposited reservations must be canceled by 4:00 p.m. on the date of arrival to avoid being charged for that night.

Convention activities include: Opening Ceremonies, Business Sessions, Symposia, luncheons honoring the Secretary of the Air Force and the Air Force Chief of Staff, Aerospace Education Foundation Awards Luncheon, the Annual Reception, and the black-tie 36th Air Force Anniversary Reception and Dinner Dance.

- A first this year will be an all-day symposium, Wednesday, September 14, highlighting the changes and challenges of Tactical Air Warfare. Also, on Thursday, September 15, the Aerospace Education Foundation will mount a major National Laboratory for the Advancement of Education. This one-day seminar with interested industrialists and educators will seek specific measures to stop our national drift toward scientific and technological illiteracy.

AFA Intercom

AFA Iron Gate Chapter President Fred Glass (center) presents the Maxwell A. Kriendler Memorial Award to Rep. Samuel S. Stratton (D-N. Y.). Assisting Mr. Glass is the late Mr. Kriendler's nephew, Sheldon J. Tanner (right). See item.

Discussing the charity event are (left to right): Senator Goldwater, AEF Chairman of the Board; Jim McDonnell of AFA's National Headquarters staff; Secretary of the Air Force Verne Orr; AFA National President David L. Blankenship; and Air Force Chief of Staff Gen. Charles A. Gabriel. See item. (Photo by Sid Burns)

Iron Gate Honors Nine Air Pioneers During 1983 Air Force Salute

AFA's New York Iron Gate Chapter outdid even itself with its Twentieth National Air Force Salute in mid-March. The charity balls, which have now raised more than $1 million for Air Force-related beneficiaries, are an institution on the New York social scene.

This year's Salute, recognizing the Air and Space Bicentennial, was themed to the 200th anniversary of man's first ascent in a hot-air balloon.

Those honored at the event—by being designated as Aerospace Education Foundation Jimmy Doolittle or Ira Eaker Fellows—are a key part of this heritage. As Sen. Barry M. Goldwater (R-Ariz.) said when making the presentations: "You know, *Time* Magazine recently said that the computer was the 'Man of the Year.' I don't believe that, and I hope you don't either. I say *people* are much more important than computers—and as we honor our four Jimmy Doolittle and five Ira Eaker recipients, I want to emphasize the *human* things they did that led to their honoring tonight."

Presented with Ira Eaker Fellows (each Doolittle and Eaker Fellow represents a $1,000 donation to AFA's Aerospace Education Foundation) were Scott Crossfield, the first test pilot assigned to the rocket-powered X-15 research program; Maj. Gen. Patrick J. Halloran, USAF (Ret.), a pioneer in U-2 and SR-71 operations; Maj. Gen. J. Stanley Holtoner, USAF (Ret.), a participant in many of the early R&D programs for all services and the winner of the Thompson Trophy in 1953 for setting a world speed record of almost 700 mph in an F-86; Gen. B. A. Schriever, USAF (Ret.), longtime commander of Air Force Systems Command and the man credited with playing the major role in the initial development of USAF missile and space systems; and George M. Skurla, who, in almost forty years with Grumman Aerospace Corp.—he's currently President and Chairman of the Board—was involved in testing such famous Grumman aircraft as the F-8 and A-6, and who also brought together the management team that built the Apollo lunar excursion module (LEM).

The Jimmy Doolittle recipients included NASA's current project pilot for the YF-12 program and winner of the 1962 Harmon Trophy for setting an altitude record of 85,360 feet in the B-58, Fitzhugh L. Fulton, Jr. The other Doolittle recipients are AFLC Commander Gen. James P. Mullins, who piloted

And Still Champ

With this year's contribution, AFA's Iron Gate Chapter maintains its position as the largest contributor to both the AEF Jimmy Doolittle and Ira Eaker Individual Fellow programs. The Chapter has sponsored eighty-five Jimmy Doolittle and nine Ira Eaker Fellow recipients.

B-47s for SAC and flew 110 Vietnam combat missions in RF-4Cs; Godfrey F. Santini, an Iron Gate Chapter member and an independent New York businessman who has supported Air Force and defense efforts over the years; and, finally, Gen. Charles A. Gabriel, Air Force Chief of Staff.

The Iron Gate Chapter also presented its top award, the Maxwell A. Kriendler Memorial Award, to Rep. Samuel S. Stratton (D-N. Y.). Representative Stratton was honored for "a lifetime of effective service to our nation as an active member of the military service, a responsible and concerned citizen, and an influential congressional leader." Once the mayor of Schenectady, Representative Stratton, a thirteen-term House veteran, is the Chairman of the Procurement and Military Nuclear Systems Subcommittee of the House Committee on Armed Services.

Adding an authentic New York touch to the evening, the world-famous Radio City Music Hall Rockettes, along with some singers and dancers from "The Big Apple Show" that has introduced the world to the joys of visiting New York, performed to enthusiastic applause from the record-setting crowd of more than 1,100.

Proceeds from the Chapter's Salute go to the Air Force Aid Society, the Air Force Enlisted Widows Home, the Air Force Village Foundation, the Falcon Foundation, the Air Force Historical Foundation, and the Aerospace Education Foundation.

Next year's salute will be on Saturday, March 24.

—*By James A. McDonnell, Jr.*

Chicagoland-O'Hare Chapter Hosts Sixth Defense Symposium

"The Total Force Approach to National Defense" was the theme of this year's symposium sponsored by AFA's Chicagoland-O'Hare Chapter. The symposium took place in Chicago on March 12 and was attended by more than 600 community, military, and business leaders. The event drew both local and national media coverage.

The Total Force theme was reinforced by the composition of the panel of speakers. Sen. Charles H. Percy (R-Ill.) delivered the keynote address. Other speakers included Dr. George A. Keyworth, Science Advisor to President Reagan; Gen. Bennie L. Davis, USAF, SAC Commander in Chief; Gen. John A. Wickham, Jr., Army Chief of Staff; Lt. Gen. Robert C. Kingston, USA, Commander of US Central Command; Maj. Gen. Thomas R. Morgan, USMC, Deputy Chief of Staff for Requirements and Programs; Rear Adm. Norman C. Venzke, USCG, Chief, Office of Operations; and Melvyn R. Paisley, Assistant Secretary of the Navy for Research, Engineering and Systems.

Sen. Charles H. Percy (R-Ill.) holds silver mug presented to him by Kevin Clary, President of AFA's Chicagoland-O'Hare Chapter. Senator Percy, who was the keynote speaker at the Chapter's defense symposium, presented Mr. Clary with a copy of Soviet Military Power. *See item. (Photo by Bernard J. Minardi)*

Andy Anderson, AFA Deputy Executive Director, and Edgar Ulsamer, AIR FORCE Magazine Senior Editor for Policy and Technology, were the moderators of the symposium.

By all accounts, this year's symposium was one of the best ever. Once again, Chicagoland-O'Hare Chapter officers and members presented a successful and informative program.

AFA Charters Lauris Norstad Chapter; First On European Continent

AFA has chartered its first chapter in Europe. A special chartering night for the new General Lauris Norstad Chapter (named for the only Air Force officer to have served as Supreme Allied Commander, Europe) took place on March 23.

The event, which was held at Supreme Headquarters, Allied Powers Europe (SHAPE) in Mons, Belgium, attracted an impressive lineup of guests, including Chapter President Gen. Richard L. Lawson, USAF, then SHAPE Chief of Staff; Gen. Bernard W. Rogers, USA, Supreme Allied Commander, Europe; Gen. William Y. Smith, USAF, then Deputy Chief of Staff for US European Command; and David L. Blankenship, AFA National President.

The Air Force Strolling Strings entertained the gathering of more than 150 AFA members and guests. Also in attendance were European aerospace industry executives and leaders from several allied air forces.

There were previously no active AFA chapters in Europe because only since 1981—when AFA amended its constitution—have overseas military personnel been permitted to hold chapter elective posts.

The first officers of the Norstad Chapter are: General Lawson, President; Col. Kenneth F. Keller, Vice President; Lt. Col. Michael J. Dandar, Secretary; and Col. James A. Nelson, Treasurer.

AFA National President David L. Blankenship (third from right) presents charter to the officers of the General Lauris Norstad Chapter. Accepting the charter are (from left): Col. James A. Nelson, Gen. Richard L. Lawson, Col. Kenneth F. Keller, and Lt. Col. Michael J. Dandar. See item. (Photo by José Rodriguez)

Former astronaut Lt. Col. James B. Irwin, USAF (Ret.), recently received an Aerospace Education Foundation Scott Associate Plaque from AFA's Llano Estacado Chapter in Clovis, N. M. Pictured are (from left): Joe Turner, AFA Vice President for the Southwest Region; Col. Joseph K. Stapleton, USAF, Commander of the 27th Tactical Fighter Wing at Cannon AFB, N. M.; Colonel Irwin; Louie T. Evers, New Mexico State AFA President; and Ed Bigelow, Llano Estacado Chapter President.

Unit Reunions

AACS
Airways and Air Communications Service (AAF/USAF) alumni will hold their seventh reunion on September 29–October 2, 1983, in San Rafael, Calif. **Contact:** Les Porter, 187 Ridgecrest Dr., Napa, Calif. 94558. Phone: (707) 253-2855.

Air Rescue Ass'n
Members assigned to the Air Rescue Service are invited to attend the eighth annual Air Rescue reunion on September 21–24, 1983, in Colorado Springs, Colo. **Contact:** Air Rescue Association, 8124 E. Gail Rd., Scottsdale, Ariz. 85260.

Ex-POWs, Inc.
The thirty-sixth annual national convention of the American Ex-Prisoners of War will be held on July 20–22, 1983, at the Stouffer's Inn On The Square in Cleveland, Ohio. **Contact:** American Ex-Prisoners of War, Inc., 1983 Convention, P. O. Box 34083, Cleveland, Ohio 44134.

Flying Nurses Ass'n, Inc.
The International Flying Nurses Association convention will be held June 23–25, 1983, at the Tulsa Hilton, Tulsa, Okla. **Contact:** Wanda Mummert, 724 S. 18th St., McAlester, Okla. 74501.

Iceland Vets
The Thor Thors Icelandic Fund Committee will sponsor a reunion of Iceland vets on June 26–30, 1983, at the Kutshers Country Club in Monticello, N. Y. **Contact:** Dave Zinkoff, 2101 Walnut St., #1109, Philadelphia, Pa. 19103.

Nat'l Stearman Fly-In
The twelfth National Stearman Fly-In will be held at the Municipal Airport in Galesburg, Ill., on September 7–11, 1983. **Contact:** Ted McCullough, 43 Indiana Ave., Galesburg, Ill. 61401. Phone: (309) 342-2298.

Roswell AAF
The seventeenth annual reunion of the Roswell Army Air Field (Walker AFB) Veterans Association will be held on September 23–25, 1983, at the Roswell Inn, Roswell, N. M. **Contact:** RAAF Veterans Association, P. O. Box 1023, Roswell, N. M. 88201.

Sherman Field
Veterans of Sherman Field will hold their sixth annual reunion on September 9–11, 1983, at the Ramada Inn in Leavenworth, Kan. **Contact:** Roscoe Swenson, 2053 Highland Ave., Salina, Kan. 67401. Phone: (913) 827-2577.

Warbirds
This year's Gathering of Warbirds will honor the Eighth Air Force and will be held on August 19–21, 1983, at the Madera, Calif., Municipal Airport. **Contact:** James H. Estep, P. O. Box 5138, Fresno, Calif. 93755. Phone: (209) 255-5812.

4th Strategic Air Depot
Members of the 4th Strategic Air Depot, Eighth Air Force, stationed at Wattisham-Hitcham, England (1943–45), will hold their fifth reunion in conjunction with the 8th Air Force Historical Society in Houston, Tex., on October 12–15, 1983. **Contact:** 4th SAD Association, 909 North I St., Apt. 106, Tacoma, Wash. 98403.

7th Photo Group Ass'n
Veterans of the 7th Photo Group, Eighth Air Force, stationed at Mount Farm and Chalgrove, England (1943–45), and the 13th, 14th, 22d, and 27th Photo Reconnaissance Squadrons and all attached service organizations will hold their reunion on October 13–16, 1983, in Houston, Tex. **Contact:** Claude Murray, 1933 E. Marshall, Phoenix, Ariz. 85016. Phone: (602) 274-5871.

14th Fighter Group
Members of the 37th, 48th, 49th, and 50th Fighter Squadrons, 14th Fighter Group, will hold a reunion on August 11–14, 1983, in Englewood, Colo. **Contact:** Val Phillips, 8116 E. Windwood Way, Parker, Colo. 80134. Phone: (303) 841-2605.

14th Air Force Ass'n
The Flying Tigers of the Fourteenth Air Force will hold their thirty-fifth annual convention on August 31–September 3, 1983. **Contact:** Robert P. Kennedy, 444 W. 58th Terrace, Kansas City, Mo. 64113.

18th Weather Sqdn.
Veterans of the 18th Weather Squadron will hold a reunion in conjunction with the 8th AFHS in Houston, Tex., on October 12–16, 1983. **Contact:** Arthur W. Gulliver, 5119 S. 81st St., Omaha, Neb. 68127.

34th Bomb Group
The 34th Bomb Group will hold a reunion in conjunction with the 8th AFHS in Houston, Tex., on October 13–16, 1983. **Contact:** Ray L. Summa, 2910 Bittersweet Lane, Anderson, Ind. 46011. Phone: (317) 644-6027.

Class 43-G
Advanced Pilot Training Class 43-G (Brooks Field, Tex.) will hold a reunion on July 29–30, 1983, in San Antonio, Tex. **Contact:** Lt. Col. Hector Santa Anna, USAF (Ret.), 79 One Main Pl., Fort Worth, Tex. 76126.

New Jersey Gov. Thomas H. Kean (left) was recently presented a certificate designating him an AFA Life Member. Presenting the certificate are Maj. Gen. Francis Gerard, USAF (center), Chief of Staff of the New Jersey State Department of Defense; and Gilbert R. Freeman, past president of AFA's Passaic-Bergen Chapter. The life membership was sponsored by the Chapter.

65th Troop Carrier Sqdn.
A reunion for the 65th TCS will be held August 4–6, 1983, in Washington, Pa. **Contact:** Bud Hawkey, 106 Union Dr., New Madison, Ohio 45346. Phone: (513) 996-3851.

66th Fighter Wing Ass'n
The 66th Fighter Wing will hold its seventh annual reunion in Chelsea, Mass., on September 16–17, 1983. **Contact:** Harry Teague, 600 E. 96th St., Indianapolis, Ind. 46240. Phone: (317) 846-0853. Edward P. Rhatigan, 9281 Shore Rd., Brooklyn, N. Y. 11209. Phone: (212) 836-7255.

68th Air Service Group
The 68th Air Service Group (stationed in China during WW II) will hold a reunion in conjunction with the Flying Tigers convention on September 1–3, 1983. **Contact:** Bob Pierce, P. O. Box 15061, Denver, Colo. 80215. Phone: (303) 985-1933.

Class 69-07
Pilot Training Class 69-07 (Craig AFB, Ala.) will hold a reunion on June 24–26, 1983, in Dayton, Ohio. **Contact:** Mrs. Larry K. Hillman, 2827 Kemp Dr., Dayton, Ohio 45431. Mrs. William M. Babb, 125 Alabama, Jacksonville, Ariz. 72076.

79th Fighter Group
Members of the 85th, 86th, and 87th Fighter Squadrons, 79th Fighter Group "Falcons," will hold a reunion on September 1–6, 1983, at the Marriott Crystal Gateway Hotel in Arlington, Va. **Contact:** Ed Newbould, 1206 S. E. 27th Terrace, Cape Coral, Fla. 33904. Phone: (813) 574-7098.

89th Military Airlift Wing
The "Sam Fox" gala reunion will be held on August 26–27, 1983, at Andrews AFB, Md. All former officers and NCOs who served with the 89th MAW, the 1254th, 1298th, and 1299th ATSs, or predecessor units flying VIP and Presidential Support missions from Washington National Airport and Andrews AFB are invited. **Contact:** Lt. Col. Newt Carpenter, USAF, 1st MAS/DO, Andrews AFB, Md. 20331. Phone: (301) 981-5833. AUTOVON: 858-5833. Maj. Doug Howder, USAF, 89th MAW/DOV, Andrews AFB, Md. 20331. Phone: (301) 981-3625. AUTOVON: 858-3625.

94th Bomb Group
Former members of the 94th Bomb Group (stationed at Rougham Aerodrome, Bury Saint Edmunds, England) will hold their fifth reunion in Dallas, Tex., on October 14–16, 1983. **Contact:** Col. R. H. Voss, USAF (Ret.), 4351 Balboa Dr., Fort Worth, Tex. 76133. Phone: (817) 292-4737.

96th Bomb Group
A minireunion of the 96th Bomb Group will be held in conjunction with the 8th AFHS on October 12–16, 1983, in Houston, Tex. **Contact:** 8th Air Force Historical Society, P. O. Box 3556, Hollywood, Fla. 33083. T. L. Thomas, 1607 E. Willow Ave., Wheaton, Ill. 60187.

119th Observation Sqdn. Ass'n
The 119th Observation Squadron and all former attached Air Corps units, NJANG, or AUS (1930–1942) will hold a reunion on September 15–16, 1983, at McGuire AFB, N. J. **Contact:** Damien G. Nagle, 71 Robbins Rd., Bricktown, N. J. 08723. Phone: (201) 840-1540.

305th Bomb Group
Veterans of the 305th Bomb Group, Eighth Air Force (Chelveston, England), will hold their reunion on October 13–15, 1983. **Contact:** Abe Millar, P. O. Box 757, Sanger, Tex. 76266. Phone: (817) 458-3516.

319th Bomb Group
The 319th Bomb Group, including the 437th, 438th, 439th, and 440th Squadrons (stationed in North Africa, Sardinia, Corsica, and Okinawa), will hold a reunion in Washington, D. C., on October 19–23, 1983. **Contact:** Harold E. Oyster, 662 Deering Dr., Akron, Ohio 44313. Phone: (216) 836-4716.

340th Bomb Wing
Former members of the 340th Bomb Wing (SAC), Whiteman AFB, Mo., and attached units (1951–64) will hold a reunion on October 13–16, 1983, in Colorado Springs, Colo. **Contact:** Col. Arthur H. James, USAF (Ret.), 2010 Devon St., Colorado Springs, Colo. 80909. Phone: (303) 597-6386.

361st Fighter Group
The 361st Fighter Group reunion will be held in conjunction with the 8th AFHS in Houston, Tex., on October 12–16, 1983. **Contact:** Glenn Fielding, 1000 Clubland Pt., N. E., Marietta, Ga. 30067.

369th Fighter Sqdn. Ass'n
The 369th Fighter Squadron, 359th Fighter Group, will hold its memorial dedication and minireunion on August 4–6, 1983, at the Dayton Marriott, Wright-Patterson AFB, Ohio. **Contact:** Anthony Chardella, 105 Mohawk Trail Dr., Pittsburgh, Pa. 15235. Phone: (412) 793-9010.

380th Bomb Group Ass'n
The "Flying Circus" 380th Bomb Group, Fifth Air Force, will hold its reunion on September 29–October 2, 1983, in Plattsburgh, N. Y. **Contact:** Lt. Col. Forrest "Tommy" Thompson, USAF (Ret.), 2401 Lakeview Dr., Heber Springs, Ark. 72543.

398th Bomb Group Memorial Ass'n
Members of the 398th Bomb Group Memorial Ass'n will hold their reunion in Houston, Tex., on October 13–16, 1983. **Contact:** George R. Hilliard, 7841 Quar-

AFA's General E. W. Rawlings Chapter recently held a dinner meeting in Minneapolis, Minn. The chapter, one of AFA's newest, now boasts more than 200 members, among them Vice President George Bush and former Minnesota Governors Elmer Anderson and Wendell Anderson. Pictured above are (from left): Russell E. Dougherty, AFA Executive Director and guest speaker at the meeting; George Griebenow, master of ceremonies for the event; Gen. Edwin W. Rawlings, USAF (Ret.); Jan Laitos, AFA Vice President for the North Central Region; Hoadley Dean, AFA National Director; and Paul Markgraf, Rawlings Chapter President. The General E. W. Rawlings Chapter will hold a "Wing Ding" on July 8–9 of this year at the Radisson South Hotel in Minneapolis. Those interested in attending the event should contact Paul Markgraf at 2102 E. 3d St., St. Paul, Minn. 55119. Phone: (612) 735-4411.

termaine Ave., Cincinnati, Ohio 45236.

429th Bomb Sqdn.
Members of the 429th Bomb Squadron, 2d Bomb Group, will hold their reunion in Colorado Springs, Colo., on September 23–24, 1983. **Contact:** Jack Emrick, 367 S. Pontiac Way, Denver, Colo. 80224.

451st Bomb Sqdn.
Veterans of the 451st Bomb Squadron, 322d Bomb Group, Ninth Air Force, will hold their thirty-fifth annual reunion on October 13–16, 1983, in Las Cruces, N. M. **Contact:** James J. Crumbliss, 2014 Shady Grove Dr., Bossier City, La. 71112. Phone: (318) 742-1225.

459th Bomb Group
Veterans of the 459th Bomb Group will meet for their fortieth anniversary reunion and will plan the formation of a permanent association in New Orleans, La., in October 1983. **Contact:** Ed Murphy, 3711 Rue Delphine, New Orleans, La. 70114. Phone: (504) 394-6853.

483d Bomb Group
The 483d Bomb Group, Fifteenth Air Force (stationed in Sterparone, Italy), will hold its fortieth anniversary reunion at the Dayton Plaza Hotel in Dayton, Ohio, on September 29–October 1, 1983. **Contact:** Donald R. Speegle, 2808 Canongate Dr., Arlington, Tex. 76015.

485th Bomb Group
The 485th Bomb Group reunion will be held on August 5–7, 1983, in Chicago, Ill. **Contact:** E. L. Bundy, 5773 Middlefield Dr., Columbus, Ohio 43220.

801st/492d Bomb Groups
The 801st/492d Bomb Groups (Carpetbaggers) out of Harrington, England, will hold a reunion in Houston, Tex., on October 14–16, 1983, with the 8th Air Force Historical Society. **Contact:** Sebastian H. Corriere, 4939 N. 89th St., Milwaukee, Wis. 53225. Phone: (414) 464-8264.

1369th Audiovisual Sqdn.
The 1369th Audiovisual Squadron will celebrate its twenty-fifth year of service to USAF with a silver anniversary reunion on August 17–19, 1983, at Vandenberg AFB, Calif. All former members are invited. **Contact:** 1369th AVS (Reunion), Vandenberg AFB, Calif. 93437. Phone: (805) 866-9588. AUTOVON: 276-9588.

6147th Tactical Control Group
The "Mosquitoes," stationed in Korea (1950–58), will hold their reunion on July 14–17, 1983, in San Antonio, Tex. **Contact:** Bill Turner, 8702 Midcrown Dr., San Antonio, Tex. 78239.

AACS/AFCS
Former members of AACS/AFCS Flight Check organizations are planning a reunion during the summer of 1983. Please contact the address below and indicate during which month you would like the reunion to take place.

Howard G. Lewis
108 E. Tiller
Midwest City, Okla. 73110

Sixth Air Force
I would like to hear from anyone who served in the Sixth Air Force during WW II. Please contact the address below.

Tom Gresham
61 Mt. Vernon Highway
Atlanta, Ga. 30328

1st Air Transport Sqdn.
I am trying to form an association for the 1st Air Transport Squadron. The 1st ATS flew C-54s, C-124s, and C-133s, and was the best air transport squadron in MATS. Please contact the address below if you are interested in forming an association.

Tom Cameron
403 Wayne Ave.
Pine Beach, N. J. 08741
Phone: (201) 349-0570

2d Fighter Sqdn.
I am trying to organize a reunion for the

AFA State Contacts

Following each state name, in parentheses, are the names of the localities in which AFA Chapters are located. Information regarding these Chapters, or any place of AFA's activities within the state, may be obtained from the state contact.

ALABAMA (Auburn, Birmingham, Huntsville, Mobile, Montgomery, Selma): **Don Krekelberg,** 904 Delcris Drive, Birmingham, Ala. 35226 (phone 205-942-0784).

ALASKA (Anchorage, Fairbanks): **William M. Mack,** 610 McKay Bldg., 338 Denali St., Anchorage, Alaska 99501 (phone 907-266-1253).

ARIZONA (Phoenix, Sedona, Sun City, Tucson): **Thomas W. Henderson,** 4820 N. Camino Real, Tucson, Ariz. 85718 (phone 602-299-6467).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Little Rock): **Charles E. Hoffman,** 1041 Rockwood Trail, Fayetteville, Ark. 72701 (phone 501-521-7614).

CALIFORNIA (Apple Valley, Edwards, Fairfield, Fresno, Hermosa Beach, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Jose, Santa Barbara, Santa Monica, Sunnyvale, Vandenberg AFB, Yuba City): **Scott Norwood,** 19561 Moray Court, Saratoga, Calif. 95070 (phone 408-867-9466).

COLORADO (Aurora, Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo, Waterton): **William R. Morris,** 5521 S. Telluride Court, Aurora, Colo. 80015 (phone 303-693-4464).

CONNECTICUT (East Hartford, North Haven, Storrs, Stratford, Westport, Windsor Locks): **Raymond E. Choquette,** 16 Tonica Springs Trail, Manchester, Conn. 06040 (phone 203-646-4818).

DELAWARE (Dover, Wilmington): **Joseph H. Allen, Jr.,** 537 Roberta Ave., Dover, Del. 19901 (phone 302-674-3472).

DISTRICT OF COLUMBIA (Washington, D. C.): **A. B. Outlaw,** 1750 Pa. Ave., N. W., Suite 400, Washington, D. C. 20006 (phone 202-637-3346).

FLORIDA (Broward, Cape Coral, Fort Walton Beach, Gainesville, Jacksonville, Naples, New Port Richey, Orlando, Panama City, Patrick AFB, Redington Beach, Sarasota, Tallahassee, Tampa, West Palm Beach, Winter Haven): **Morgan S. Tyler, Jr.,** 1776 6th St., N. W., Apt. 606, Winter Haven, Fla. 33880 (phone 813-299-2773).

GEORGIA (Athens, Atlanta, Columbus, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **Edward I. Wexler,** 8 E. Back St., Savannah, Ga. 31406 (phone 912-964-1941, ext. 253).

GUAM (Agana): **Joe Gyulavics,** P. O. Box 21543, Guam 96921 (phone 671-734-2369).

HAWAII (Honolulu): **Don J. Daley,** P. O. Box 3200, Honolulu, Hawaii 96847 (phone 808-525-6296).

IDAHO (Boise, Mountain Home, Twin Falls): **John W. Logan,** 3131 Malad St., Boise, Idaho 83705 (phone 208-385-5475).

ILLINOIS (Belleville, Champaign, Chicago, Decatur, Elmhurst, Peoria): **Richard H. Becker,** 7 Devonshire Drive, Oak Brook, Ill. 60521 (phone 312-654-3938).

INDIANA (Bloomfield, Fort Wayne, Indianapolis, Lafayette, Logansport, Marion, Mentone, South Bend): **John Kagel,** 1029 Riverside Drive, South Bend, Ind. 46616 (phone 219-234-8855).

IOWA (Des Moines): **Carl B. Zimmerman,** 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

KANSAS (Topeka, Wichita): **Cletus J. Pottebaum,** 6503 E. Murdock, Wichita, Kan. 67206 (phone 316-683-3963).

KENTUCKY (Louisville): **Elmo C. Burgess,** 116 S. 5th St., Louisville, Ky. 40202 (phone 502-585-5169).

LOUISIANA (Alexandria, Baton Rouge, Bossier City, Monroe, New Orleans, Shreveport): **James S. Kendall,** 4428 Parkridge Drive, Benton, La. 71006 (phone 318-965-9164).

MAINE (Bangor, Limestone, N. Berwick): **Arley McQueen, Jr.,** Route 1, Box 215, Wells, Me. 04090 (phone 207-676-9511, ext. 2354).

MARYLAND (Andrews area, Baltimore): **William L. Ryon, Jr.,** 8711 Liberty Lane, Potomac, Md. 20854 (phone 301-299-8717).

MASSACHUSETTS (Bedford, Boston, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **Zaven Kaprielian,** 428 Mt. Auburn St., Watertown, Mass. 02172 (phone 617-924-5010).

MICHIGAN (Battle Creek, Detroit, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): **Jeryl L. Marlatt,** 740 S. Cranbrook Rd., Birmingham, Mich. 48009 (phone 313-362-0511).

MINNESOTA (Duluth, Minneapolis-St. Paul): **Edward A. Orman,** 368 Pike Lake, Duluth, Minn. 55811 (phone 218-727-8381).

MISSISSIPPI (Biloxi, Columbus, Jackson): **Clarence Ball, Jr.,** 5813 David Davis Pl., Ocean Springs, Miss. 39564 (phone 601-875-5883).

MISSOURI (Kansas City, Knob Noster, Springfield, St. Louis): **James R. Hopkins,** 316 Hillcrest Drive, Warrensburg, Mo. 64093 (phone 816-747-6087).

MONTANA (Great Falls): **Dick Barnes,** P. O. Box 685, Great Falls, Mont. 59403 (phone 406-727-3807).

NEBRASKA (Lincoln, Omaha): **Edward A. Crouchley,** 1314 Douglas On the Mall, Omaha, Neb. 68102 (phone 402-633-2125).

NEVADA (Las Vegas, Reno): **William J. Becker,** 1709 Valmora, Las Vegas, Nev. 89102 (phone 702-873-5945).

NEW HAMPSHIRE (Manchester, Pease AFB): **Charles J. Sattan,** 53 Gale Ave., Laconia, N. H. 03246 (phone 603-524-5407).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, E. Rutherford, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Middlesex County, Newark, Old Bridge, Trenton, Wallington, Whitehouse Station, West Orange): **Frank Kula,** 264 Edgewood Drive, Toms River, N. J. 08753 (phone 201-244-2491).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): **Louie T. Evers,** P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

NEW YORK (Albany, Brooklyn, Buffalo, Chautauqua, Garden City, Hempstead, Hudson Valley, New York City, Niagara Falls, Plattsburgh, Queens, Rochester, Rome/Utica, Southern Tier, Staten Island, Suffolk County, Syosset, Syracuse, Westchester): **Robert E. Holland,** 750-75A Lido Blvd., Lido Beach, N. Y. 11561 (phone 516-889-1571).

NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh): **Hal Davis,** 1034 Manchester Drive, Cary, N. C. 27511 (phone 919-467-6511).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): **Maurice M. Rothkopf,** 3210 Cherry St., Grand Forks, N. D. 58201 (phone 701-746-5493).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Newark, Youngstown): **Charles B. Spencer,** 333 West 1st St., Suite 252, Dayton, Ohio 45402 (phone 513-228-1175).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **Aaron C. Burleson,** P. O. Box 757, Altus, Okla. 73522 (phone 405-482-0005).

OREGON (Eugene, Portland): **William Gleaves,** 2353 Oakway Terrace, Eugene, Ore. 97401 (phone 503-687-2269).

PENNSYLVANIA (Allentown, Beaver Falls, Drexel Hill, Dormont, Erie, Harrisburg, Homestead, Lewistown, Philadelphia, Pittsburgh, Scranton, State College, Washington, Willow Grove, York): **Tillie Metzger,** 2285 Valera Ave., Pittsburgh, Pa. 15210 (phone 412-881-1991).

PUERTO RICO (San Juan): **Fred Brown,** 1991 Jose F. Diaz, Rio Piedras, P. R. 00928 (phone 809-790-5288).

RHODE ISLAND (Warwick): **King Odell,** 413 Atlantic Ave., Warwick, R. I. 02888 (phone 401-941-5472).

SOUTH CAROLINA (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **William B. Gemmill,** 11 Victoria Ave., Myrtle Beach, S. C. 29577 (phone 803-626-9628).

SOUTH DAKOTA (Rapid City, Sioux Falls): **Duane L. Corning,** Box 901 RR 4, Rapid City, S. D. 57701.

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): **Arthur MacFadden,** 4501 Amnicola Highway, Chattanooga, Tenn. 37406 (phone 615-622-6262).

TEXAS (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Laredo, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **John Sparks,** 118 Broadway, Suite 234, San Antonio, Tex. 78205 (phone 817-723-2741).

UTAH (Brigham City, Clearfield, Ogden, Provo, Salt Lake City): **Nuel Sanders,** 370 S. 500 East, Suite 120, Clearfield, Utah 84015 (phone 801-776-2101).

VERMONT (Burlington): **John D. Navin,** 350 Spear St., Unit 64, South Burlington, Vt. 05401 (phone 802-863-1510).

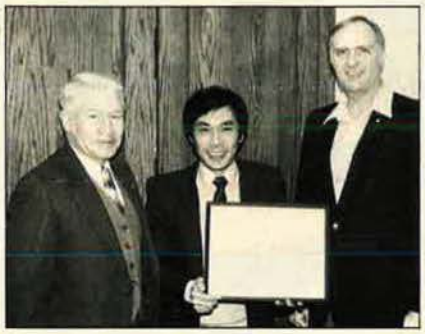
VIRGINIA (Arlington, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **Ivan R. Frey,** 73 James Landing Rd., Newport News, Va. 23606 (phone 804-595-5617).

WASHINGTON (Seattle, Spokane, Tacoma): **E. A. Kees, Jr.,** 7710 Ruby Drive, S. W., Tacoma, Wash. 98498.

WEST VIRGINIA (Huntington): **David Bush,** 2317 S. Walnut Drive, St. Albans, W. Va. 25177 (phone 304-722-3583).

WISCONSIN (Madison, Milwaukee): **Kenneth Kuenn,** 3239 N. 81st St., Milwaukee, Wis. 53222 (phone 414-871-3766).

WYOMING (Cheyenne): **Al Guidotti,** P. O. Box 811, Cheyenne, Wyo. 82001 (phone 307-638-3361).



Mr. Duc Pham, a former South Vietnamese F-5E pilot, recently received an AFA citation from Charles Hoffman (left), Arkansas State AFA President; and Gene McVay, Fort Smith Chapter President. (Photo by David Harris)

one and only "Beagle Squadron." I would like to hear from all fighter pilots and officers of the 2d Fighter Squadron, 52d Fighter Group, who served during WW II.

Dick Alexander
105 E. Market
Piper City, Ill. 60959

29th Troop Carrier Sqdn.

A reunion is being planned for the 29th Troop Carrier Squadron, 313th Troop Carrier Group, in October 1983. The exact date and location will be determined after the addresses of attendees are known.

Please contact one of the addresses below for further details.

Chester Barber
P. O. Box 489
Kissimmee, Fla. 32742
or
Joe Harkiewicz
2911 S. M. U. Blvd.
Orlando, Fla. 32817

Class 42-D

I would like to hear from anyone from Class 42-D (Tulare, Taft, and Victorville) who would be interested in having a reunion. I know you are out there.

Please contact the address below.

G. P. Harry
2419 Ormsby Circle
Jacksonville, Fla. 32210
Phone: (904) 778-2528

Class 44-C

Attention: fighter/reconnaissance pilots of Class 44-C, Pinellas AAB and/or Key Field (summer/autumn 1944): I would like to get current addresses for the purpose of a reunion.

Please contact the address below.

Maj. Gen. Stanley F. H. Newman, OklaANG
1400 Dorchester Dr.
Oklahoma City, Okla. 73114

Class 61-G

I would like to hear from all former members of Class 61-G1 or -G2 for the purpose of planning a reunion in Munich, Germany, during *Oktoberfest.*

Please contact the address below.

Lt. Col. Paul J. Reinman, USAF
OL Det. 3 FTD
Box 38
APO New York 09245

91st Troop Carrier Sqdn.

I would like to hear from all veterans of the 91st Troop Carrier Squadron and the 439th Troop Carrier Group for the purpose of holding a reunion.

Dr. Milton Dank
1022 Serpentine Lane
Wyncote, Pa. 19095

97th Bomb Group Reunion Ass'n

I am looking for former members of the 340th, 341st, 342d, and 414th Bomb Squadrons, 97th Bomb Group.

Thirty-nine years have passed since the last days of WW II, and we are holding a reunion in St. Louis, Mo., for the men of the 97th.

Please contact the address below for more information about the 97th Bomb Group Reunion Association.

Don Hayes
1640 Cambridge Dr.
Walla Walla, Wash. 99362

MOBILITY

Key to Global Deterrence

A National Symposium of the Air Force Association
(Conducted in conjunction with the Military Airlift Command)

June 23–24, 1983, at Stouffer's Riverfront Towers, St. Louis, Mo.

AFA's Symposium "Mobility: Key to Global Deterrence" will highlight the contributions that airlift, sealift, and prepositioning of war supplies make to our nation's security—through reinforcement of our forward deployed forces and support for force projection. Key government and military leaders will discuss our critical requirements in mobility and force projection forces and examine what it takes to attain them.

SPEAKERS INCLUDE:

Gen. James R. Allen, USAF—Keynote Address
Commander in Chief, MAC

The Hon. Richard D. DeLauer
Under Secretary of Defense for Research and Engineering

Gen. Jerome F. O'Malley, USAF
Vice Chief of Staff, USAF

Lt. Gen. Robert T. Herres, USAF
Director of C^3 Systems/OJCS

Lt. Gen. Robert Kingston, USA (tentative)
Commander in Chief, US Central Command

Lt. Gen. Lawrence A. Skantze, USAF
Deputy Chief of Staff, Research, Development and Acquisition

Maj. Gen. Robert A. Rosenberg, USAF
Assistant Chief of Staff for Studies and Analyses, USAF

Dr. George James
Senior Vice President, Air Transport Association

Registration fee for all symposium events is $175 ($200 for non-AFA members). This fee includes all presentation sessions, coffee breaks, continental breakfast, and a dinner. For information and registration, call Jim McDonnell or Dottie Flanagan at (202) 637-3300, Air Force Association, 1750 Pennsylvania Ave., N.W., Suite 400, Washington, D.C. 20006.

AFA Intercom

AFA's Colin P. Kelly Chapter hosted a reunion for USAF Medal of Honor recipients late last year in Rome, N. Y. Above, Chapter member Joseph Zyla (left) chats with MOH holder Henry E. Erwin as Mrs. Erwin looks on.

364th Fighter Group

"Come in Sunhat!" The first general reunion for the 364th Fighter Group, Eighth Air Force, is planned for September 22–25, 1983.

Members of the 364th should contact the address below to be placed on the group's mailing list.

Chelius H. Carter
9730 Evander Rd.
Millington, Tenn. 38053
Phone: (901) 872-1110
(901) 872-7777

454th Bomb Group

All members of the 454th Bomb Group (Cerignola, Italy) are invited to an organizational meeting in July 1983, in Hollywood, Fla., or Orlando, Fla., to formulate plans for next year's reunion.

Please contact the address below.

A. P. Riccardi
8637 Bridle Path Ct.
Davie, Fla. 33328

486th Bomb Group Ass'n

A minireunion for the 486th is being planned for late July 1983, in the Twin Cities.

For more details, please contact the address below.

Ray Prozinski
3027 Hampshire North
Minneapolis, Minn. 55427
Phone: (612) 544-7351

Coming Events

June 3–4, **Arkansas State Convention,** Little Rock . . . June 3–4, **Ohio State Convention,** Newark . . . June 10–11, **Oklahoma State Convention,** Tulsa . . . June 11, **Illinois State Convention,** Scott AFB . . . June 18, **Virginia State Convention,** Harrisonburg . . . June 24–26, **New Jersey State Convention,** Cape May . . . July 15–17, **Pennsylvania State Convention,** Philadelphia . . . July 16, **Michigan State Convention,** Southfield . . . July 22–24, **Georgia State Convention,** Athens . . . July 22–24, **Texas State Convention,** Bryan/College Station . . . July 29–31, **Florida State Convention,** Orlando . . . July 31, **Louisiana State Convention,** Barksdale AFB . . . August 11–13, **California State Convention,** Sunnyvale . . . August 12–13, **Missouri State Convention,** Whiteman AFB . . . August 12–14, **New York State Convention,** Rome . . . August 13–14, **North Dakota State Convention,** Minot . . . August 18–20, **Utah State Convention,** Ogden . . . August 19–20, **Wisconsin State Convention,** Milwaukee . . . August 26–28, **Oregon State Convention,** Portland . . . August 27, **Arizona State Convention,** Tucson . . . September 11–15, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C. . . . October 20–22, **Aerospace Education Symposium,** Montgomery, Ala.

Bob Stevens'

"There I was..."

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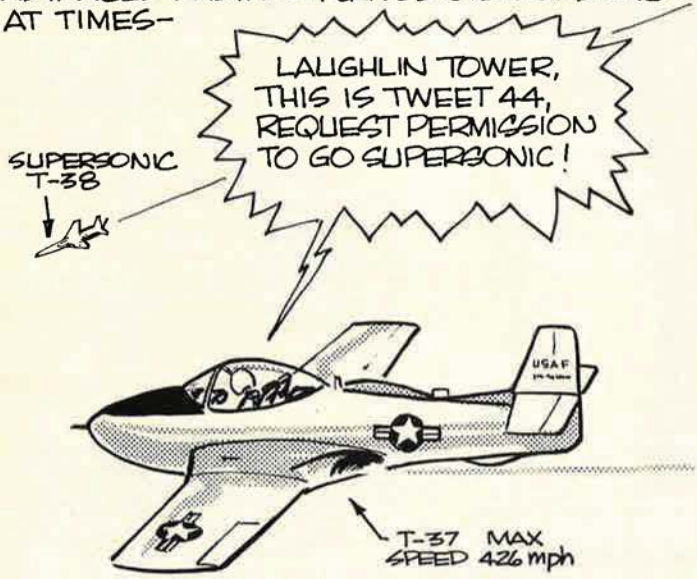
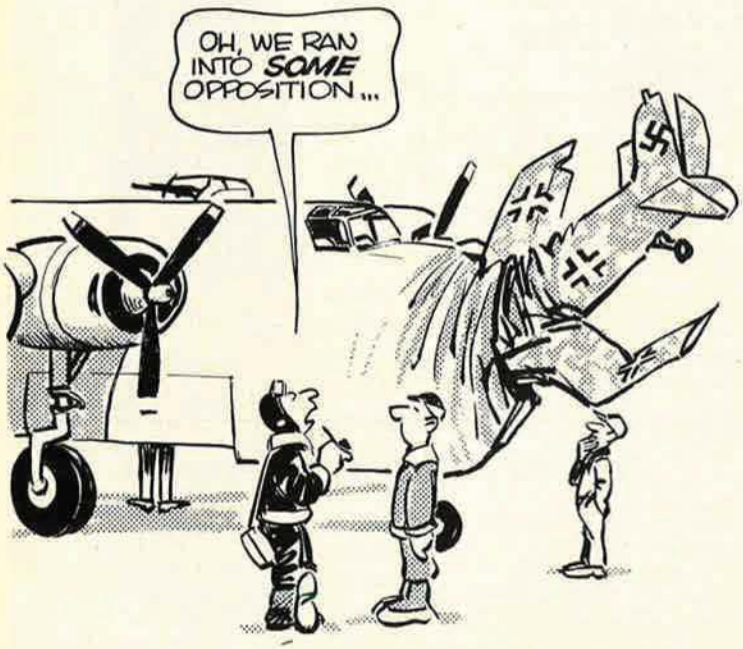
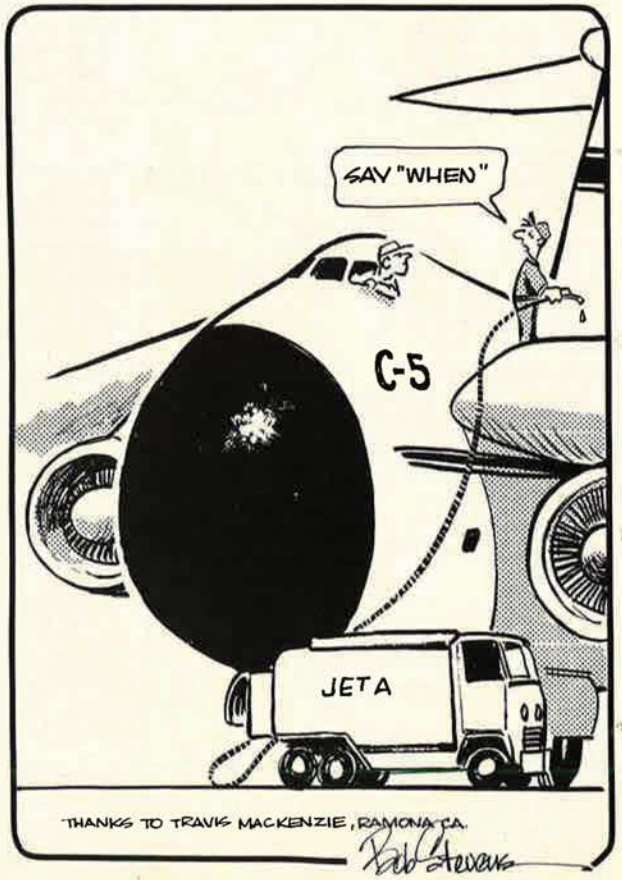
THE FRUSTRATION OF BEING A PRIMARY STUDENT WHILE SHARING A BASE WITH YOUR ADVANCED BRETHREN CAN BE OVERPOWERING AT TIMES-



390TH BG(H) REUNION DAYTON, O. JULY 20-24

HERE'S A CLASSIC FROM A COPY OF WWII'S *YANK*- COURTESY OF THE LIBERATOR CLUB:





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