APRIL 1988/$2

AIR FORCE

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MAGAZINE

The Ups and Downs of Tactical Air Power

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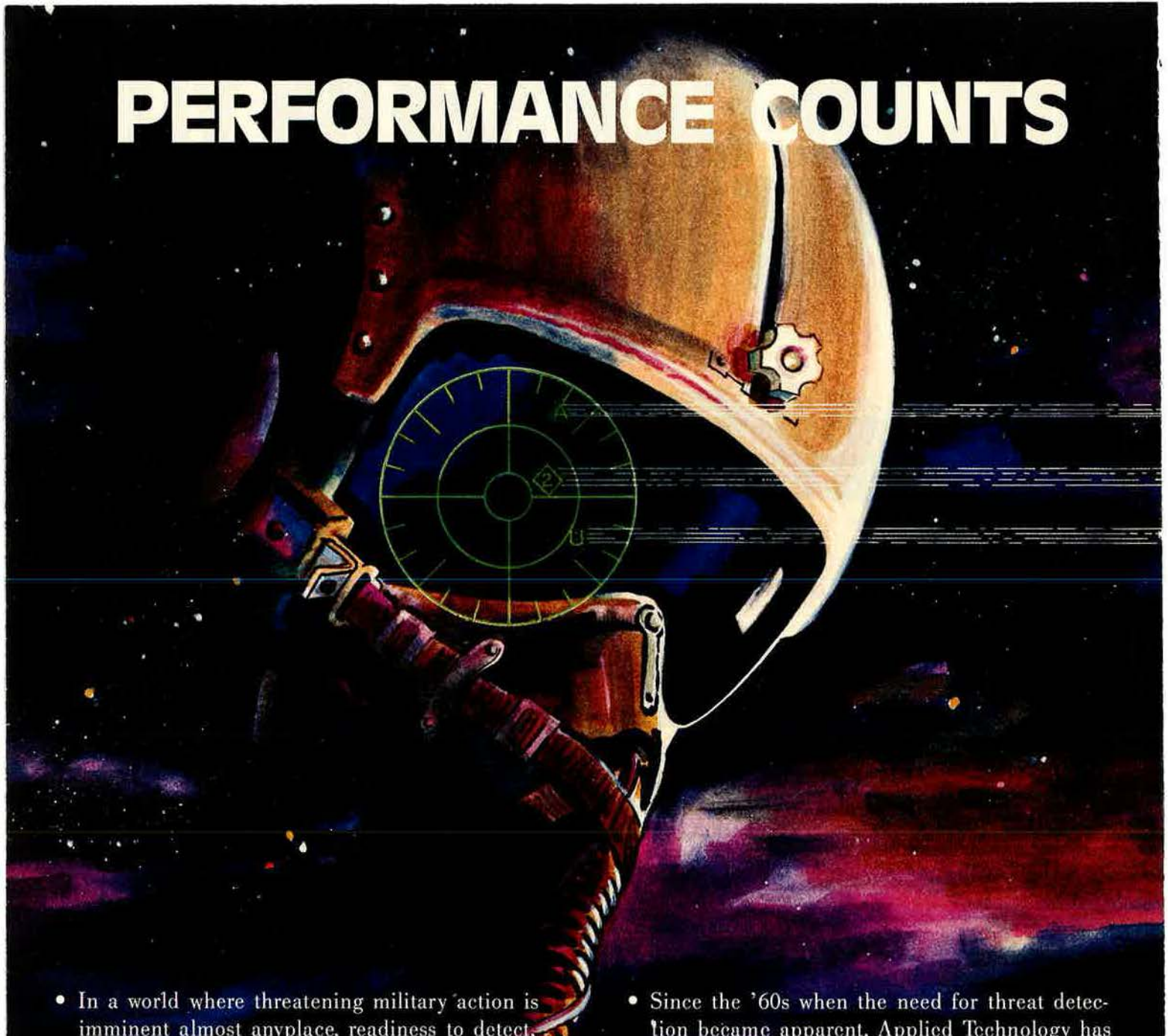

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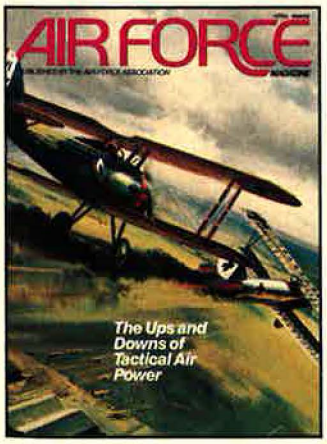

About the cover: First US World War I air victory came in April 1918, as recorded here by artist Frank Wootton. See p. 68 for details of this action. Our "Tactical Forces" section begins on p. 38.

Special Section: Tactical Forces

Features

Departments

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An Editorial

Paste This in Your Hat

By John T. Correll, EDITOR IN CHIEF

THIS is a year of momentous change for national defense. In the name of relieving the federal deficit, the armed forces are deactivating combat units, canceling programs, and reducing their strength by 69,000 military and civilian personnel. Even before they began implementing a $20.5 billion cut to the FY '88 budget—which dropped on them late, nearly three months after the fiscal year had begun—they were told to "reshape" their spending plans downward by ten to twelve percent in each of the next five years.

New Secretary of Defense Frank C. Carlucci said he was bowing to reality with the budget he submitted. He warns that radical reductions are "not in the best interest of our national security posture." Mr. Carlucci has been congratulated for his reasonableness. Early reaction from Congress to his austerity budget was favorable, but the game isn't over yet.

The nation will soon discover that decimation of defense did not make our economic troubles go away. The deficit is still there. As pressure builds for the next wave of budget cuts, look for special interest pitchmen to step forward with seductive explanations of why the least painful solution is further cuts to defense. Here are some essential numbers and facts that defense-bashers often overlook or ignore. Paste them in your hat for easy reference as the budget season rolls along.

• The program that Mr. Carlucci presented provides $299 billion in *budget authority* (the amount that can be obligated against expenditures, including some in later years) and $294 billion in *outlays* (money paid out in the budget year). This includes $8.7 billion in budget authority and $8.5 billion in outlays for defense work in the Department of Energy and other agencies.

• The defense cuts had no relationship whatsoever to requirements. The numbers were picked for purely financial reasons with the impact to be figured out later. When the Defense Department computed its needs on the basis of mission requirements, it came up with $332 billion in budget authority for FY '89.

• The Pentagon has said clearly that the armed forces will have to be smaller and less capable in the years ahead. Mr. Carlucci told Congress February 18 that the new budget does not cover all of the contingencies, commitments, and threats and that we will henceforth be living with more risk to our national security.

• Counting everything, federal outlays will rise by $38.3 billion in FY '89. Defense outlays will be $8.6 billion above the FY '88 level, but that is not enough to cover the expected rate of inflation.

• Surveys consistently find that the American public thinks defense consumes more of the tax dollar than it actually does. If the FY '89 budget is approved without change, defense will take 5.7 percent of the Gross National Product and 26.1 percent of the federal budget. (In 1955, defense spending was 11.1 percent of GNP; in 1960, it was 9.5 percent; and in 1970, it was 8.3 percent.)

• A favorite trick for defense-bashers is to speak only of what has happened since 1980 and cite the increase in defense spending since then. This produces an impressive-sounding statistic because defense funding was severely depressed in 1980. It had declined, after inflation, by more than twenty percent in the 1970s, leaving huge shortfalls in military readiness, sustainability, and force structure.

• It is also popular to blame defense for the federal deficit. But in the 1950s and 1960s—when forty to fifty percent of the budget went to defense—the deficit was almost nonexistent. As the deficit grew in the 1970s, defense took about twenty-five percent of the budget. In the 1980s, when the budget deficit reached alarming levels, the defense share of the budget has never been higher than 27.3 percent.

• In 1969, the last year the budget was in balance, outlays for an aggregate of social and benefit programs called the "Human Resources Superfunction" were $17 billion less than defense outlays. By 1987, expenditures for this Superfunction had increased by 655 percent and are now equal to 180 percent of total defense outlays.

• President Reagan's defense recovery program did not last as long as many people believe. Its high-water mark was in 1985. Since then, defense budgets have declined by ten percent when inflation is factored out. The FY '89 budget gives the Pentagon roughly the same spending power it had in 1983. After inflation, it is thirty-seven percent higher than the "hollow forces" budget was in 1980.

• Circumstances might cut the defense budget again, even if Congress doesn't. If the deficit is $146 billion or higher—and the Administration and Congress fail to take action—the Gramm-Rudman-Hollings deficit-reduction machinery will switch on automatically in October. The White House projects the defict at $130 billion. Others believe it may be as high as $175 billion. If Gramm-Rudman-Hollings sequestration does occur, fully half of the automatic reductions must come from defense, although defense is allotted only a fourth of the outlays. This is because numerous social and entitlement programs are, by law, exempt from cuts. ■

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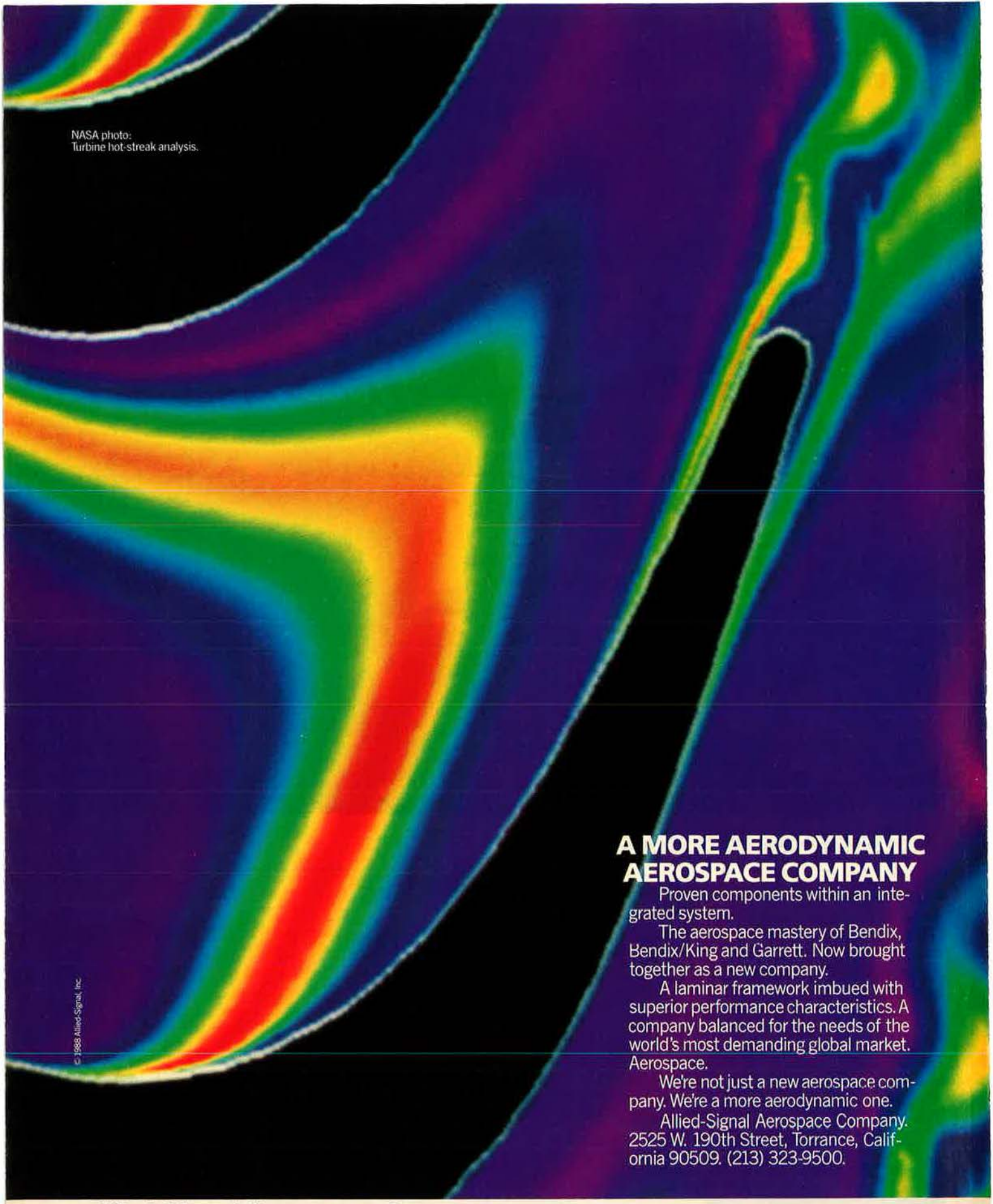

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Airmail

The Trouble With Mobiles

Barry R. Schneider made a powerful case for mobile land-based missiles in "The Case for Mobile ICBMs" *(February 1988 issue, p. 60).* Unfortunately, though he describes a weapons mix that would be most desirable, his prescriptions fit the Soviet polity far better than they fit our own.

The argument against them (particularly the SICBM) is: How do you get them off the reservation? In the February 19, 1988, *National Review,* Tom Bethell advises us that it was "impossible to drive the Pershings so much as a few kilometers down the Autobahn without stirring up numberless West Germans." In England, the GLCMs never had a successful scramble. There were either protesters who would prostrate themselves in front of the vehicles or Greenham Common women who would follow the missiles to their individual locations, note them, and then report the data to their friends and press contacts, notably those with the *Guardian.* It was also widely suspected that a number of Greenham Common women were sleeper agents of the Soviet *Spetsnaz* variety.

In our own country, one has only to read the morning newspaper to learn of the latest "peace" protest interfering with the movement of military assets. We have in my state our own Greenham Common types, the Women's Encampment for a Future of Peace and Justice, who have built a permanent harassment facility outside the Seneca Arms Depot.

Would SICBMs squash protesters if the balloon went up? Probably. But the number of scenarios in which the situation would be sufficiently ambiguous means they probably would not, and that would of course preclude practice exercises.

While I would like to see a good mix of rapidly dispersible retaliatory missiles, I'm not sure it's politically possible in a democracy. And politics usually wins out over technology, even over national security, as the Air Force can certainly attest.

John T. Cody
Pittsford, N. Y.

Liquid Launchpads?

In the article "Our Blind Spots in Space" *(February 1988 issue, p. 44),* Gen. John L. Piotrowski is quoted as decrying our readiness-to-launch situation and the problems associated with "downloading the whole system" in the event that a different satellite needs to be launched. The General notes that the Soviets have twice as many launchpads as the US. I agree with him 100 percent that we "have to get away from using the launchpads to stack satellites and test systems out" and must do this "off the pads," using "the SAC or the TAC or the MAC approach."

There is a technically proven means for doing all that the General asks for and more. It is called the "Hydra," or vertical floating launch. It essentially uses the water (in oceans or lakes) as a "no-cost, self-healing launchpad." The rockets are floated vertically in the water in the manner of a spar buoy. Actually, transition from a horizontal to a vertical position has been easily accomplished in a minute or two. Underwater ignition has proven to be no problem.

The US Navy has launched ICBM-size missile simulators using the Hydra method. Also, scientific payloads for research were launched from remote locations in the Atlantic and Pacific Oceans to altitudes in excess of 100 nm. In August 1984, the Starstruck Corp. successfully launched a prototype satellite booster from the Pacific Ocean.

I see no reason why the vast amounts spent on land launchpads in concrete, steel, and so forth could not be largely eliminated by going to a military Hydra operational launch satellite boost system. Not only are the costs lower, but you will never again have to "tie up a launchpad."

John E. Draim
Arlington, Va.

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

The Ultralight Alternative

I just felt that I had to write to comment on your February 1988 article "The Low-Level World of the Bug-Smashers."

When I retired from the Air Force fourteen years ago, I was one of those who wished I had learned to fly through the aero club on base when the cost was still "reasonable," but between family, TDYs, and other priorities, I let the opportunity slip by. After the passing of what I thought was to be my last chance to fly at a reasonable cost, up popped ultralights.

Ultralights may not be for everyone—especially if you're very overweight or don't like to do your own maintenance and preflight inspections—but they can offer the most satisfying form of flight that you'll ever experience, even if you fly regular aircraft of any size, speed, or performance. Even Chuck Yeager flies one.

I personally had never flown before. I learned on my own at a big open-field area. I would recommend that one should get qualified training in a regular aircraft or a two-place ultralight.

Most ultralight flying is done at altitudes of between five feet and 3,000 feet and at speeds of thirty mph to fifty-five mph. There are very lenient FAA rules governing ultralights, and they are quite easy to comply with. Best of all, no federal license or medical exam are required.

Ultralights come in almost every style, design, color, and size and are equipped with engines ranging in power from fifteen hp to sixty-plus hp. Most will take off and land in fewer than 150 feet, and the majority of states don't mind what or where your "runway" is so long as you don't endanger anyone else. Hangar rental space is usually a high-cost option for

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Airmail

any airplane, but most ultralights break down easily so that you can trailer them to your flying site. So long as you stay out of controlled airspace, you are as free as a bird. No instruments are required, but many ultralight pilots upgrade their freedom machines by adding an altimeter, an airspeed indicator, a compass, and basic engine monitoring gauges.

I have been flying ultralights for almost six years now and feel that they are as safe as the degree of care one is willing to put into them. Most of the pilots in this area have parachutes that will safely bring down the whole aircraft and pilot—no jumping out is necessary. The ballistically fired units have been deployed successfully at fewer than seventy-five feet above the ground.

The Experimental Aircraft Association (EAA) has chapters of ultralight clubs around the US. There are also local ultralight groups. Ultralighters like to talk about flying as much as fishermen like to bend your ear about fishing, so be forewarned.

It's not an activity for everyone, but for those of us who are into low-cost, minimum-hassle, pure-pleasure flying, it sure beats all the other sports and recreational pleasures that I've tried. Best of all, you never get tired of the exhilaration of being able to fly in your own aircraft.

Charlie Kudolis
Haughton, La.

Saluting the Supporting Cast

Your article "Thunderbirds Over Beijing" in the February 1988 issue was a fine account of the air show in China. This event was made possible by the efforts of countless people.

I'd like to recognize the men and women of the 22d and 452d Air Refueling Wings located at March AFB, Calif. They provided three active-duty and three Reserve aircrews, four KC-10s, and the necessary maintenance people for the Thunderbirds' deployment to the Pacific. "Thunderbird 25" carried everything from the required fuel and PR leaflets to T-Bird flight suits. The "warehouse" was always there whenever needed. In addition, the 63d Military Airlift Wing at Norton AFB, Calif., provided two C-141s and crews for the trip.

Without a doubt, the T-Birds were the stars of the show, dazzling crowds at every stop. But I'm sure the T-Birds will agree that without the C-141s and the KC-10s, they would have never flown over Beijing.

Capt. Mike Spain, USAF
March AFB, Calif.

Pilot Retention

Capt. Clay B. Cook's letter "Real Changes" *(see "Airmail," February '88 issue, p. 8)* makes me wonder if anyone out there is listening.

As an Air Force major with nearly twelve years in the service, I can clearly recall the letters written by equally disgruntled pilots during the last pilot exodus to the airlines during the late 1970s. I believed then, as I do now, that these guys who claim they just want to fly—and, if need be, fight—have a point. If they do not want to become managers or leaders, then leave them in the cockpit as limited-duty officers (LDOs) or, better yet, as warrant officers.

Of course, I understand that the Air Force's current policy is that LDOs are too restrictive and that every pilot should also be able to lead, manage, and command. But is this realistic? We also used to say that every pilot must be able to crosstrain into any cockpit—from C-5 to F-15 to B-52. This policy went by the boards when women began graduating from UPT and were restricted to noncombat flying positions (as if there is such a mission in modern aerial warfare). Why then do we continue to adhere to the notion that every pilot must learn a highly technical and expensive skill *and* be a manager and leader at the same time? I'm not a rated officer—though I am a pilot—and I am simply unable to understand why we must continue to demand that our Air Force pilots be not only "good sticks" but accomplished managers as well.

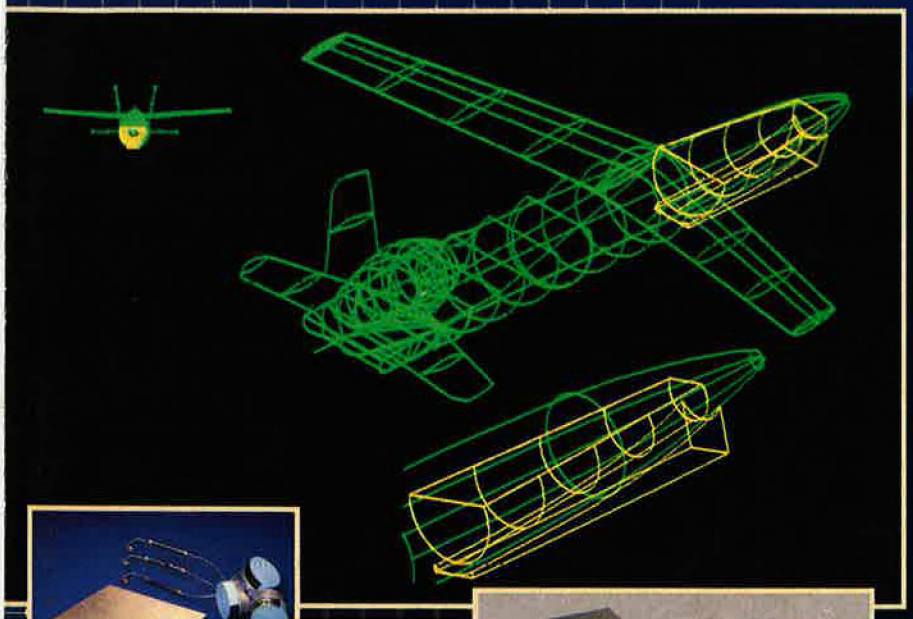
Certainly, we do need pilots who can also manage. Captain Cook's comments to the contrary, he would definitely be a superior asset for the Air Force if he not only flew well but had also mastered the intricacies of a staff summary sheet. But does *every* pilot need to be a manager?

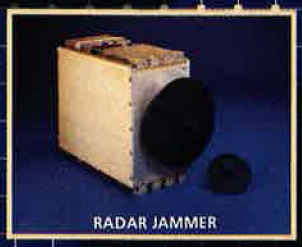
Of course, the maxim of leadership by example dictates that flyers should always be commanded by other flyers. But how many wing, numbered air force, and command leadership positions are there? Is it really cost-effective to continue to lose pilots who cannot or will not become managers in order to pursue the goal of maintaining a force of flyers who can perform flying and managerial tasks with equal competence?

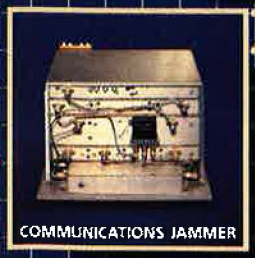
I think not.

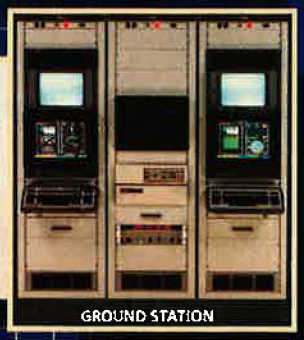
Maj. Donald J. Hanle, USAF
Bolling AFB, D. C.

My hat is off to Capt. Clay B. Cook for his very articulate and insightful letter published in the "Airmail" col-









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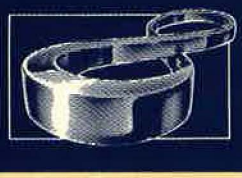

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umn in your February 1988 issue.

The Captain—cogently, effectively, constructively, and without malice—discussed the issues that affect not only pilot retention but overall morale and force effectiveness.

My only other commentary is that I could have written that same letter thirty years ago. No one appears to listen; nothing seems to change.

John Holm
Wichita, Kan.

Buying American

In spite of the fact that John W. R. Taylor is highly regarded worldwide as a writer on aerospace affairs, I strongly disagree with him about "the dangers of military 'buy American'" *(see "Jane's Aerospace Survey 1988," January '88 issue, p. 46).*

Mr. Taylor should not forget that Europeans themselves have put into practice such a policy for many years now. Examples are numerous and include the following:

- In spite of ever-rising costs and technical problems, Great Britain preferred to keep alive the Tornado program rather than to buy US F-15s.
- It has taken many years for Great Britain to abandon—not too soon and with regrets, mind you—the Nimrod AWACS program in favor of the off-the-shelf American Boeing E-3.
- The French and the West Germans chose a yet-to-be-designed helicopter instead of the proven US AH-64 Apache.
- European governments wish to replace US helicopters in their inventories with the NH-90 and EH-101.
- A program has now been established to replace the F-16 deployed with European air forces with an aircraft designed and built in Europe and powered by a European engine.
- Finally, the civilian market is not free from such practices. European governments pressure their state-owned airlines to purchase Airbus aircraft instead of US-built jetliners from Boeing and McDonnell Douglas.

In conclusion, in this context, I find it outrageous that a European should try to teach Americans about how to prevent protectionism.

Philippe Cauchi
Montreal, Quebec
Canada

Reformers Revisited

Fred Reed's January 1988 article "The Reformers" seems to ignore the truism that life is full of change.

In his feeble attempts to belittle the reform movement, Mr. Reed does a great disservice to the military. He sets us into a granite *status quo*, firmly entrenched against any criticism from the outside. Following the debacle of the officer strength cuts and Congress's continuing efforts to micromanage the military, isn't it time we learned that if we aren't willing to address problems and face our critics, someone will impose inferior solutions on us?

Attacking the reformers personally and offering some anecdotal evidence doesn't nullify the reformers or their critiques. Such attacks beg the central questions the reformers raise. Questions about aircraft design philosophy, strategy, and professionalism are just some that we should continually address within the military community, but don't until reformers begin writing and Congress gets involved. Additionally, Mr. Reed satisfies himself with attacking the fringes of the reform movement; he ignored James Fallows's seminal work, *National Defense*, and the scholarly works of Edward Luttwak.

If we accept Mr. Reed's defense of the military, we will continue to be perceived as uniformed bureaucrats hiding behind our apologists. To handle the reformers' arguments properly, we must be willing to face our critics and arm ourselves with reason. We must be able to defend our stands rationally and—if proved wrong—be willing to admit our flaws and work to correct them.

If we fail to do that, maybe we deserve to have everyone telling us how to carry out our business.

Capt. Jeffrey W. Ray, USAF
Springfield, Va.

Tactical Reconnaissance

I am an RF-4 pilot currently assigned as the Assistant Deputy for Resources at Bergstrom AFB, Tex. Prior to this assignment, I was the RF-4C Program Element Monitor on the Air Staff and worked the sensor development along with other modifications to the RF-4.

The article on tactical reconnaissance, "Getting the Picture Behind the Lines," in the November '87 issue was excellent. However, I feel that I must correct two misconceptions expressed by Lt. Col. Richard T. White, USAF (Ret.), in his letter to you *(see "Airmail," January '88 issue, p. 11).*

First, the advent of digital electro-optical and infrared sensors will in no way diminish the importance of photo-interpreters (PIs) in the reconnaissance cycle. Instead, they will acquire new skills and equipment. Currently, PIs are limited to the visual spectrum; they can only see what is on the film. With digital sensors (not analog TV tapes), the image goes beyond the visual spectrum. No more magnifying glasses—instead, automated magnification will be done by a computer. A computer-enhanced image can overcome the historic problems of traditional aerial photography, such as shadows, camouflage, and distortion, to name a few. A digital-format data base will also give instant change detection, which is so necessary in a fluid tactical combat situation.

Second, and most important, is the easy transmission of information (intelligence or pictures) that digital imagery provides. Colonel White refers to teletype reports, the insurmountable problem hindering tactical reconnaissance for decades. While time of transmission may be one hour, time of receipt averages more than eight hours. Digital imagery with annotation (coordinates, time, direction, etc.) can be stored onboard the RF-4 and transmitted directly to a unit commander, a tactical operations center, or even another aircraft—*instantly!*

Once the RF-4 recovers, the digital intelligence information is further distributed by computer modems, local area networks, or even disk (or tape) transfer. None of these information-processing advantages is available with film.

The overriding reason why TAC supports development of digital sensors is their reduced cost. Careful cost analysis by the Air Staff and private industry has proved it will be more expensive in terms of men and equipment to operate current photo-processing and interpretation facilities than it will be to develop, acquire, and operate a digital sensor system.

Thanks to Colonel White for his confidence in reconnaissance pilot visual reports, but in my experience, I have never found any commander who believed them.

Lt. Col. Richard B. Cardiel, USAF
Bergstrom AFB, Tex.

Linebacker II

I am researching the American operation during the Vietnam War called Linebacker II. This was the bombing campaign against North Vietnam from December 17–18, 1972, when the mining operation began, through December 30, 1972 (excluding Christmas).

I am interested in corresponding with crew members of B-52s, fighter-

bombers, and other aircraft (electronic warfare, rescue, mine-laying, etc.) and with ground crews, those who planned the operation, and POWs being held in Hanoi at the time and those who became POWs as a result of the operation.

I would like to include in the book as many photos as possible of crews, aircraft, damage to aircraft, bomb damage inflicted on the enemy, bases, etc. All correspondence will be appreciated and answered.

Michael J. Cundiff
3822 E. Ayr-Lawn Dr.
St. Joseph, Mo. 64503

Chopper Flight Teams

I am writing a book about US military helicopter precision flight demonstration teams and am trying to find out if the Air Force ever had any such groups that may have been assigned to training schools or other bases from the late 1940s to the present. These teams would be ones that may have performed at local base shows, other Air Force functions, or as part of other military or civilian air shows or special events.

Anyone with any knowledge of any such Air Force helicopter team is asked to contact me at the address below.

H. E. Gilliland, Jr.
624 Merrill Dr.
Bedford, Tex. 76022

Choppers in Vietnam

I am researching a book about US Army and Air Force helicopters that supported Australian infantry, New Zealand artillery, Korean infantry, and US Marine ground units in Vietnam from 1965 to 1967.

I would welcome any information concerning aviation units, types of helicopters flown, missions, dates, units supported, etc. Please contact the address below.

John Mateyko
Box 24030
Cincinnati, Ohio 45224

313th TFS

We are in the process of assembling a comprehensive history of the 313th Tactical Fighter Squadron from its origin in 1942 to the present.

The unit started as the 313th Pursuit Squadron. It moved from the United States to England in 1944 and then to France and Germany during 1944–45.

We are looking for pictures of squadron personnel, aircraft, and facilities. Any official or unofficial documents, anecdotes, "hog logs," etc., would be greatly appreciated. All items will be copied and returned on sender's request.

Capt. Gary Bozarth, USAF
313th TFS
APO New York 09109-5000

Luftwaffe's Last Stand

Does anyone know the name of the airstrip or place where the Luftwaffe made its last stand of World War II?

As I recall, it was on about May 1, 1945, in the Munich area or possibly in the mountains of Austria. My squadron, the 526th Fighter-Bomber Squadron of the 86th Fighter-Bomber Group, got the assignment.

Clyde H. "Hoss" Hailes
P. O. Box 302
Pearlington, Miss. 39572

Ammo Troops

Here in USAFE, we name hardened aircraft shelters after Air Force heroes. Finding the names of famous flyers to put on signs was easy. At RAF Lakenheath, we want to try a new twist—naming munitions igloos after famous ammo troops.

Ammo troops know there's little glory in what they do—just a lot of pride in knowing that the mission couldn't be done without them. With so little glory attached to the job, however, there's little emphasis on remembering the names of genuine heroes among these personnel. Can readers suggest any candidates?

These candidates must have been members of the Air Force or its predecessor organizations and be deceased (so that we can comply with AFR 900-9). Please tell us briefly why your ammo troop was a genuine hero.

Capt. Douglas K. Fidler, USAF
P. O. Box 4259/48th TFW
APO New York 09179-5374

Fourteenth Air Force

I am writing a book on Fourteenth Air Force from October 1941, when all we had going for the US was the AVG, to the end of World War II. I am seeking personal accounts of experiences from anyone who served in the AVG, CTAF, or Fourteenth for any time during this period.

I am interested in hearing from anyone who can contribute to this book. I am sure that you agree with me that the Fourteenth was a fantastic outfit and that the experiences of its members deserve to be published.

Contact me at the address below.

Lt. Col. Wallace H. Little,
USAF (Ret.)
P. O. Box 161476
Memphis, Tenn. 38186-1476

Tac Comm Division

AFCC's Hq. Tactical Communications Division is preparing a twenty-five-year (1963–88) pictorial history of the unit. Captioned photos of significant equipment, exercises, buildings, and personnel of the headquarters and assigned units would be greatly appreciated.

Please contact the address below.

William R. McClintock
Chief, Office of History
Hq. TCD/HO
Langley AFB, Va. 23665-6343
Phone: (804) 764-3366
AUTOVON: 574-3366

Chipyong-ni Airmen

The US Eighth Army historian would like to contact pilots, tactical air control parties, and air crews who participated in the battle of Chipyong-ni in Korea on February 13–14, 1951.

Please contact the address below.

Thomas M. Ryan
Command Historian
Hq. USFK/EUSA, Attn: SJS-H
APO San Francisco
96301-0009

Roll Call

I am gathering information on two possible relatives who were USAF officers.

The first is Col. Donald E. Westbrook, who was listed as an MIA/POW on March 13, 1968, when he was in Laos.

The second is Lt. Col. Robert B. Westbrook, an AAF ace from World War II. As an ROTC cadet a few years ago, I stumbled on his picture at Columbus AFB, Miss., while taking an introductory T-37 ride. I've been on a quest ever since.

As a new lieutenant about to enter UPT, I would appreciate any information on either of these two men.

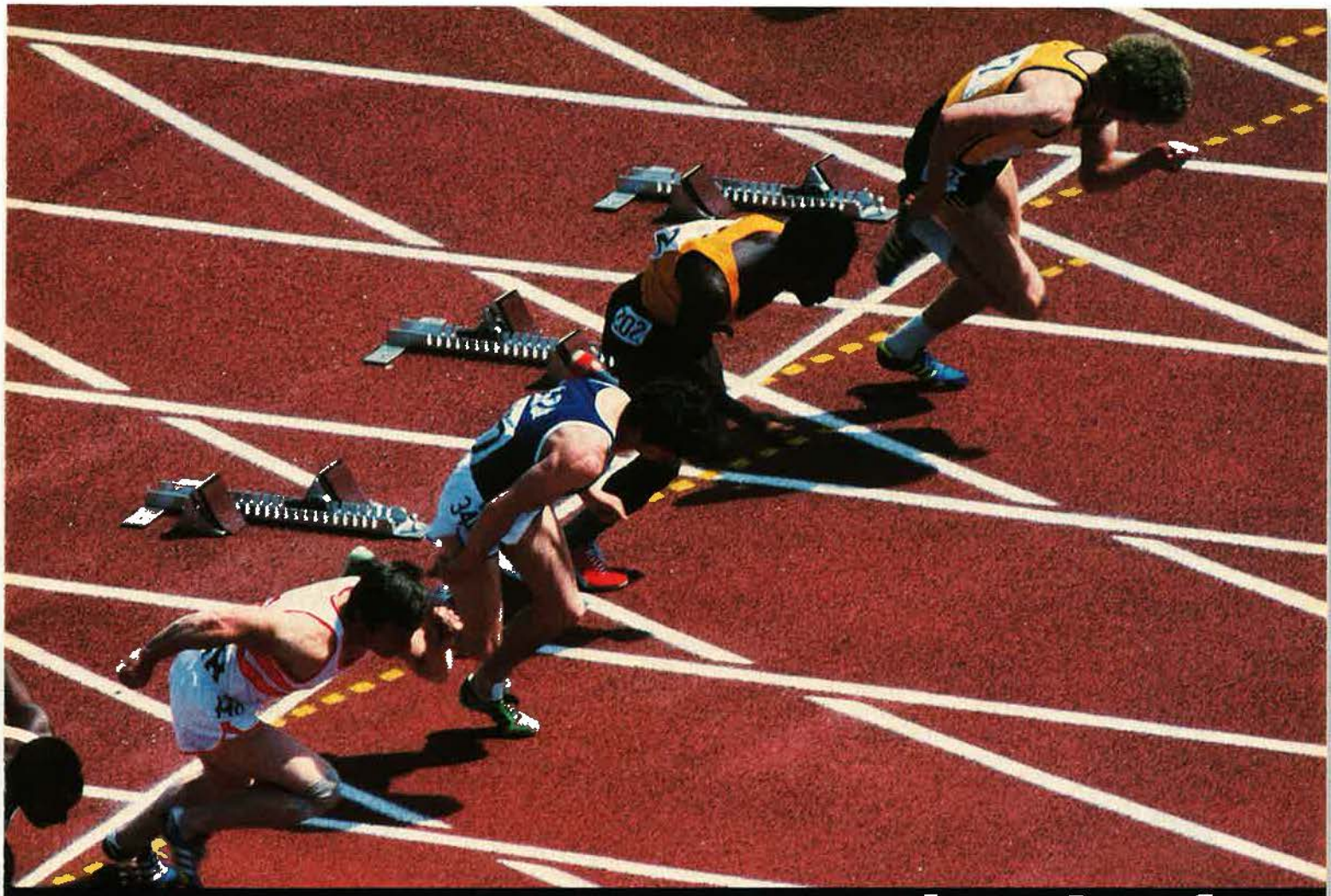
Lt. Daniel Westbrook, USAF
5 Brookline Rd.
Ballston Spa, N. Y. 12020

Paul E. Chaufty was a P-47 fighter pilot with the 23d Fighter Squadron, 36th Fighter Group, Ninth Air Force, during World War II. He was killed in action in, I believe, 1944.

Paul was my wife's uncle, and we would like to correspond with anyone who flew with Paul. We would like to learn details of his last flight and of his squadron. Any photos would also be appreciated.

Please contact us at the address below.

Layton A. Morrison
1 Morrison Lane
Carthage, N. Y. 13619



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The Services Take Their Cuts

By Robert S. Dudney, SENIOR EDITOR

A key round of deliberations is about to begin. Decisions made now about budget reductions will influence the level and distribution of defense funding for years to come.

Washington, D. C. The Air Force will be coming up against its own window of vulnerability when the Pentagon opens a key round of deliberations this month. These negotiations on the next defense budget will provide the service its final chance to halt or slow the unraveling of its rearmament plans.

The new biennial 1990–91 military budget that Air Force leaders will be asked to help shape will do much more than set the magnitude of defense spending for the first two years of the coming decade. It will dictate the level and distribution of funds for the services for the 1990s.

The reason is simple: The forthcoming spending blueprint, as it is now broadly drafted, will lock the military services into a number of directions whose course will continue for years. Once the decisions are taken, the Air Force will have little if any room for maneuver to alter its course.

The Air Force, like the other services, will be under immense pressures to stem the erosion of its program in the face of competing claims. The question now is whether—and how—it will succeed as Washington embarks on the biggest retrenchment of forces since the winddown of the Vietnam War.

Working from sharply cut fiscal guidance, the services put the finishing touches this month on their Program Objective Memoranda—the spending plans—for Fiscal 1990–91 and beyond. The POMs, taken together, aim for reductions of $40 billion, each year, from previously approved plans. The exercise has been one that Air Force Secretary Edward C. Aldridge describes as cause for "wearing black armbands." Yet it's only the start of the turnaround forced by Congress.

The Five-Year Defense Program projected one year ago by former Secretary Caspar W. Weinberger has collapsed. His successor, Frank C. Carlucci, seeks two percent real increases each year, rather than Weinberger's three percent. The net loss, over five years, is eye-popping. It totals approximately $230 billion.

The question of how to apportion this loss will be thrashed out by Pentagon leaders between now and Labor Day. Arguments are certain to be heated. All services will be hit, some perhaps more than others. It will be, in Secretary Carlucci's understated prediction, "a very intense summer program review."

Where will cuts be directed? From the Pentagon's Comptroller, Robert Helm, comes a blunt answer: "To the extent that new things will not fit in [budgetary limits], you will drop them. The choices are, very simply, to either cut force structure more, to terminate programs more, or to decide not to move into new modernization programs."

The prospect of taking reductions in any of these areas is sure to meet resistance from Air Force leaders, who prefer to spread them more broadly over the full range of accounts. Their argument runs in the following fashion:

- *Force structure.* There's no fat left. Under prior decisions, the Air Force abandoned its longstanding goal of building forty tactical fighter wings and will instead cut back from the thirty-eight it fields today to thirty-five. Much of the SR-71 fleet is headed for mothballs. What's more, the active force of 607,000 runs three percent short of requirement—and it will go down further by October.
- *Weapons programs.* There are no orphans. With marginal arms programs winnowed out in recent years, those that remain—the Advanced Tactical Fighter, F-15E, F-16, various missiles, Peacekeeper ICBM, B-2A Advanced Technology Bomber, and so forth—form the bedrock of airpower in years to come.
- *High technology.* There's no alternative. It takes major, upfront R&D funding just to determine whether or not it's feasible to develop new advanced weapons. R&D cuts, to quote Secretary Aldridge, would mean "it's going to be tougher for us to get new high-leverage technologies. We are going to tend to focus on things that we are sure will work, which means lower technology"—a virtual sacrilege.

Whether Secretary Carlucci and his lieutenants will find these arguments persuasive is rated by most experts as doubtful. They point out that each service will be advancing identical arguments with equal vigor and perhaps equal justification. In this circumstance, the Air Force task in the summer struggle may well be to conduct a damage-limitation operation.

In fact, what seems likely to happen to the defense program in weeks just ahead probably can be discerned by looking at what happened in the weeks just past.

With the unveiling on February 18 of the Pentagon's newest budget request for the 1989 fiscal year, President Reagan reversed his course as was expected *(see "The Five-Year Drought," February 1988 issue)* and proposed a negative-growth budget.

This time last year, the President planned to seek $332 billion in new appropriations for 1989. The final version, worked out in advance with congressional leaders, came in at only $299.5 billion—a $33 billion cut.

The Air Force's portion of this budget, which only a few months ago had been expected to rise to $107.2 billion, was capped at $97.2 billion—a straight $10 billion loss in expected revenues. For the Army, Navy, and Marine Corps, the story was much the same.

After being discounted for inflation, the 1989 budget will be the fourth budget in a row that has been below the previous year's. The big difference is this is the first time that President

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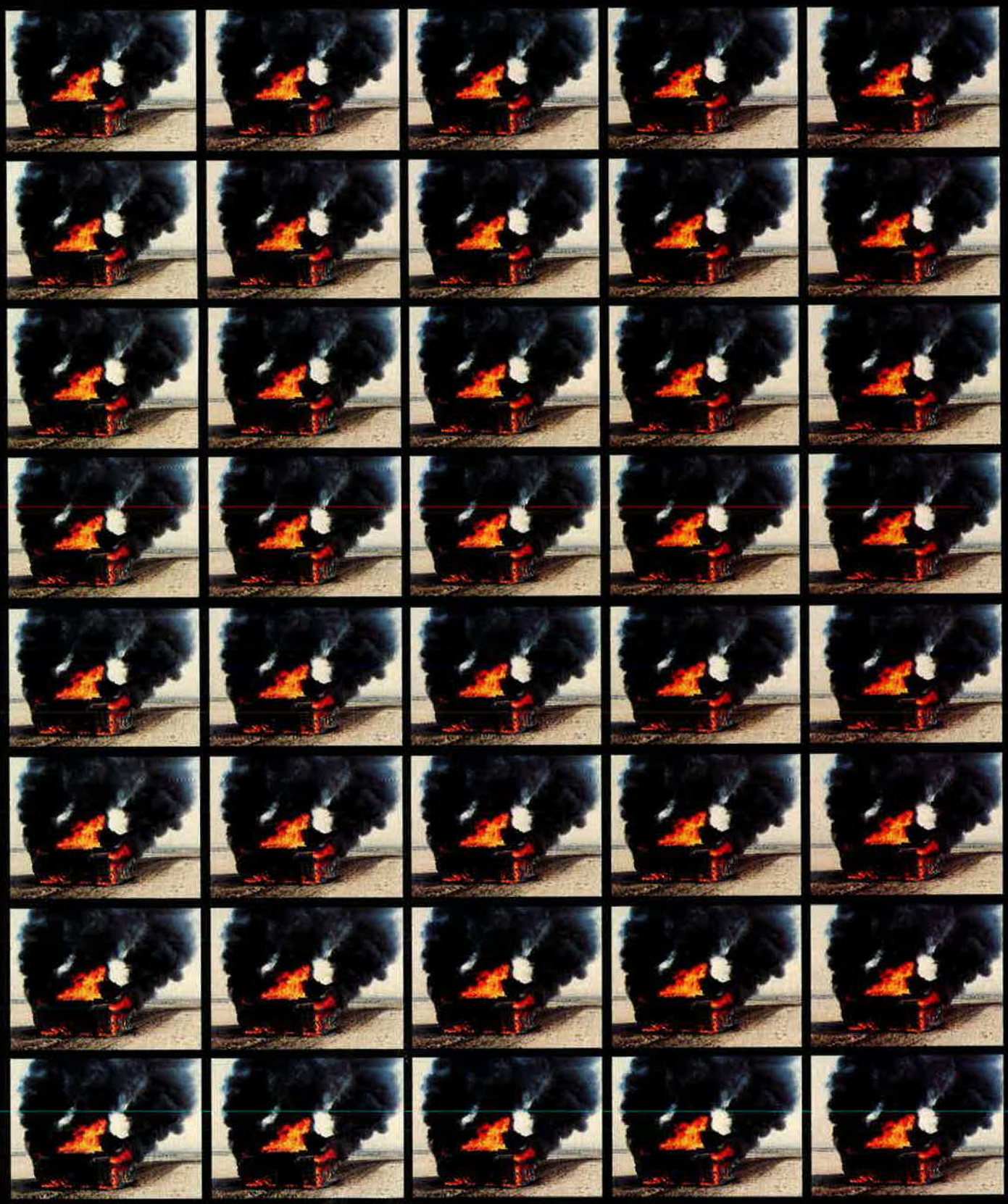

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Reagan himself has proposed this.

The way that the Pentagon administered these reductions makes plain that it intends to thin out force structure and weapons programs to hold down costs.

Secretary Carlucci maintains he has established firm priorities for 1989—military personnel, readiness, and efficient production of weapons. His explanation: "We have traded off a smaller force in order to maintain a [higher] quality force."

Budget documents show that Carlucci has, in fact, evidenced a strong commitment to readiness and sustainability of the US fighting forces, refusing to let budget cuts "hollow out" the forces to a shell, as was the case in the late 1970s. He is staying within his budget targets by making those forces smaller but giving them a bigger and longer lasting punch with modern weapons and skilled manpower.

In the case of the Air Force, O&M accounts received real, after-inflation increases of 6.7 percent—good news that is offset somewhat by the fact that the leanness of previous years will require quite a lot of new spending to cure. The cumulative decline since 1987 has been 3.7 percent in O&M accounts. The big news is that healthier operations funding will permit the service to hold the level of flying time for tactical air crews at 19.3 hours per month. This figure had seemed sure to decline.

The 1989 reductions that have been made public fall into two major funding areas.

• *Arms Programs.* The biggest hit came in investment programs. Budget documents show that procurement and R&D accounts were taken down by a combined $20.7 billion from the amount previously planned.

While most of this trimming was achieved through routine cuts in the number of weapons to be bought, eighteen major existing development and procurement programs will be terminated for an immediate savings of some $4.8 billion and $52 billion in coming years. Other programs will be delayed or deferred.

For the Air Force's part, Secretary Aldridge says he terminated twenty programs, large and small.

The most controversial step came in the virtual scrapping of the "Midgetman" Small ICBM, which is expected to yield a 1989 savings of $2.2 billion and $40 billion overall.

A small, mobile, single-warhead strategic weapon, the Midgetman initially was proposed by Democratic members of Congress as a way of making the US ICBM force less vulnerable to Soviet attack. They also liked it because it was less threatening to Moscow and thus less likely, in their view, to be destabilizing.

The Air Force, preferring the ten-warhead Peacekeeper, never developed much enthusiasm for the costly SICBM and wasn't upset to see it go. The Pentagon, however, backed away from outright cancellation. It provides a last installment of $200 million, enough to keep the SICBM on life support should the next President desire to revive it.

The Air Force proposes to save another $786 million by scrapping development of an Air-Launched Miniature Vehicle antisatellite weapon, recognizing that Congress has repeatedly refused to fund testing anyhow. The action effectively leaves the Air Force with three weapons on ice. If Congress relents on ASAT testing, says a Pentagon official, "the Department will be up the next day to restart this program."

The Air Force found the balance of its investment reductions in actions involving lesser-known projects, including: The Minuteman III penetration aids program, canceled, $129 million; the AGM-130 standoff weapon, canceled, $92 million; the C-27 light aircraft, canceled, $65 million; the Airborne Command Post Replacement plane, canceled, $14 million; B-1B bomber avionics enhancements, deferred, $165 million; Sensor Fuzed Weapon tank-hunter program, deferred, $111 million.

• *Force Structure Reductions.* To keep high-priority weapons and operations adequately funded, the Pentagon is proposing that hardware be mothballed and entire units disbanded.

Reducing "force structure" would produce net overall savings of $3.2 billion in the military budget this year. It will also take total military personnel down from 2,174,000 to 2,138,000 by October—a drop of 36,000. There it would remain frozen for at least a year.

The Air Force is called on to deactivate two front-line fighter wings. One candidate is the seventy-two-plane 474th Tactical Fighter Wing at Nellis AFB, Nev. The Air Force tried to eliminate it last year, but Congress refused. If Congress accepts, deactivation would begin in late 1989.

The second candidate for deactivation is the 401st Tactical Fighter Wing based at Torrejon AB in Spain, which Madrid has ordered the US to remove. The US is still looking for another base in Europe. If it succeeds, the 401st will stay in business, and another wing will be identified and disbanded.

Also being phased out, for a savings of $119 million, will be four of the Air Force's costly fleet of eleven or twelve SR-71 strategic reconnaissance aircraft. The judgment is that satellites can perform the same job better and more cheaply.

In other actions, the Air Force seeks to thin out twelve Air National Guard and Reserve tactical fighter squadrons by the equivalent of one full wing, cutting each squadron by six aircraft; deactivate two helicopter-equipped tactical air support squadrons; convert an Air National Guard RF-4C squadron to other purposes; and mothball the Space Launch Facility at Vandenberg AFB, Calif.

The plans envision that these moves, in conjunction with additional cuts in end strength, will shrink the Air Force by 31,400 airmen to a new level of 575,600. Total projected savings in these force structure cuts: $626 million this year, more later.

The savings from the four services' force cuts might have been higher. Secretary Carlucci proposed a 4.3 percent military pay increase in 1989, covering inflation, to the tune of $2.2 billion. But Carlucci says that pay in the private sector has gone up eleven percent more than military pay since 1982 and that the raise is needed to maintain high morale.

The sacrifices in these areas, however painful, appear to have had a beneficial impact on the remainder of the Air Force procurement accounts. The usual nibbling and stretching out of programs, by and large, were avoided this time out.

Details of the combat aircraft budget show that the Air Force is requesting a robust tactical fighter program. The $702.3 million that USAF seeks for its Advanced Tactical Fighter, boosted from $498 million this year, will keep that pivotal program on track as a going concern. The Air Force is shooting for fielding the ATF in the mid-1990s.

The Air Force plans to buy another 180 single-engine F-16 warplanes at a cost of $3.7 billion. In addition, there is more money to investigate the possibilities of new, advanced derivatives of the F-16 for the later 1990s. These aircraft would complement the ATF in its mission over future battlefields.

The budget provides some $2 billion to increase the purchase of new C-17 transports from two to four. Furthermore, the service plans to spend

$366 million to produce new AC-130U special operations gunships. More money hidden in secret accounts is earmarked for the Air Force version of the Navy's Advanced Tactical Aircraft, which is a tactical bomber, and for unspecified "classified programs."

The principal aircraft loser in the 1989 budget is the F-15E, built for the dual-role air-to-air and interdiction mission. The Air Force is being permitted to spend only $1.6 billion for another thirty-six of the planes, six fewer than the forty-two this year, and the Carlucci budget papers report that the program is "phasing down" to thirty in 1990.

The cut is clearly due to high cost rather than production constraints. A recent Congressional Budget Office report, for example, pegged the minimum efficient procurement rate of the F-15E at 120 aircraft a year.

The F-15E slowdown is a sensitive one. For the generals, it is a top-priority program. Air Force officials say that the service will decide later this year whether to stretch out or cut future buys of the F-15E. Originally, the Air Force wanted 392 of the aircraft, but that was before the onset of the budget crunch.

Other tactical programs are getting big boosts. The planned purchase of the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system is set to jump from 250 sets in 1988 to 471 in 1989. There is $831 million in the budget for 1,470 Advanced Medium-Range Air-to-Air Missiles (AMRAAM). Though this is 280 fewer than USAF hoped to buy, it represents a big jump from the 400 purchased this year. Other missile buys remained constant.

In the field of electronic combat, the Pentagon says, the US will move forward this year into production of the multiservice Tacit Rainbow system, a loitering defense-suppression missile to attack Soviet air defense radars.

"Smart" weapons programs in general seem due for a major expansion. Secretary Carlucci told Congress that Pentagon R&D programs will focus new intensity on highly accurate conventional cruise missiles capable of being launched from air and sea platforms to locate and strike critical targets deep in Warsaw Pact territory. The Pentagon also says it is "considering" approval of a new, dual-capable Tactical Air-to-Surface Missile to extend the combat range of US and Allied aircraft in Europe.

In the apportionment of money for weapons for deterring or waging strategic nuclear war, it is clear that the Air Force also was able to protect major programs—save Midgetman, which the Air Force itself proposed to kill as an economy measure.

The Pentagon budget shows that the 1989 outlay plan contains higher funding of an unspecified magnitude for the classified Air Force B-2A Advanced Technology Bomber. To improve the effectiveness of the bomber fleet in penetrating Soviet airspace, there are stepped-up funds to continue development of an improved short-range attack missile—the SRAM II. The Pentagon confirms that work is proceeding reasonably well on the stealthy Advanced Cruise Missile, saying it will become operational "before the end of the decade."

Among the strategic forces, however, it is the Peacekeeper Rail-Garrison concept that emerged as a big winner. The Pentagon proposes to step up research into putting the large missile on railroad cars that could be flushed from garrisons on military bases after receiving strategic warning of a Soviet attack.

The budget provides development and construction funds totaling $837.3 million to develop the basing system. Also contained in the proposal: $808.7 million to buy an additional twelve supermissiles, nine fewer than previously planned for this year. Eight of these new Peacekeepers would eventually be set on the rails in operational Rail-Garrison deployment. The other four are destined for testing purposes.

The Defense Secretary's endorsement of the mobile Peacekeeper over the mobile Midgetman appeared unequivocal. "It's no secret," says Mr. Carlucci, "that we in this building feel that two such systems, given the resource constraints, are unaffordable. Obliged to choose, we think the Rail-Garrison [Peacekeeper] system is much more cost-effective and equally promising in terms of [securing] a survivable deterrent."

Left up in the air, however, was a key aspect of the Peacekeeper program: What is the plan for the first fifty missiles that will be deployed in vulnerable fixed silos?

In Carlucci's estimation, they should be made mobile almost immediately. He states that it is "my overall plan, my personal plan" to remove them from their silos over the next few years and put them on the rails. Afterward, the Pentagon would seek approval for another fifty Peacekeepers, for a total of 100 missiles packing 1,000 warheads.

Secretary Aldridge, however, demurs. "I think Mr. Carlucci put it the proper way—that it's his personal preference that we have all the Peacekeepers on rail cars," says he. "The question is, what do I have to give up in other parts of the Air Force budget to get there?" This question is expected to create major controversy in the forthcoming budget decisions.

When it came to funding for the Strategic Defense Initiative, there was a major concession to Congress. For the first time, President Reagan voluntarily consented to a reduction of research money for his high-priority "Star Wars" missile defense system—a program in which the Air Force has a major role with its handling of the Boost Surveillance and Tracking System and the Space Surveillance and Tracking System.

Instead of a previously projected $6.3 billion request, the Reagan Administration asked for $4.6 billion for 1989. SDI officials warn that the cutbacks, on top of last year's reduction, are causing the restructuring of the program and may result in a one- to two-year delay in achieving its goals. The SDI program, even in reduced form, is among the items most likely to meet congressional resistance.

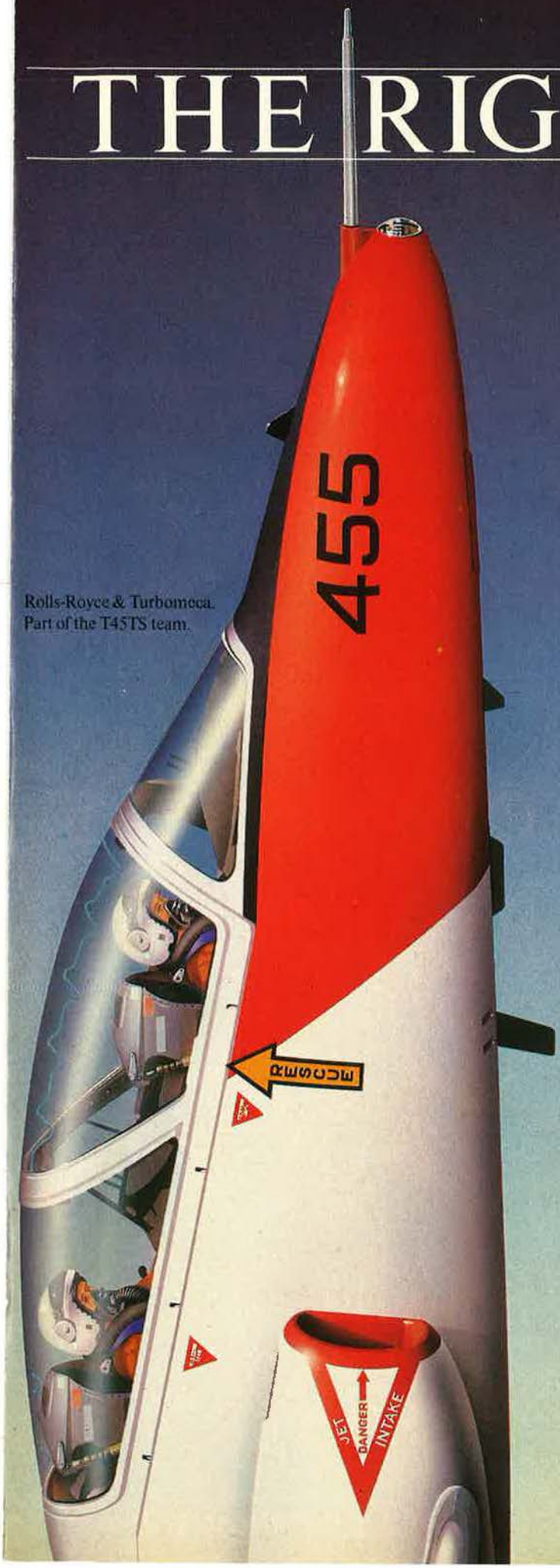
Squeezing $33 billion from the previous 1989 defense blueprint, Secretary Carlucci said, means the US will face new risks. But the present situation, he makes plain, is neither desperate nor beyond repair. Much improvement in the military, the Secretary says, has taken place in recent years. And the level of Pentagon spending, after discounting inflation, remains thirty-seven percent higher at the end of the 1980s than at the start of the decade.

Even so, any further economizing on the national defense, says the new Defense Secretary, would reduce US power to deter the Soviet Union.

He is calling on Congress to live up to the budget summit agreement of last November 20 by approving the Pentagon's spending plan rather than taking the request as a target for further cuts. Early reaction from Congress to the budget in hand was favorable.

Few, however, are persuaded that lawmakers will provide the services the two percent growth in spending power in years ahead. The consensus is that flat defense budgets, for years, are the most that the Pentagon can expect. That guarantees that the long-term effects of decisions made this summer will be even more pronounced and difficult to reverse. ■

THE RIGHT STUFF



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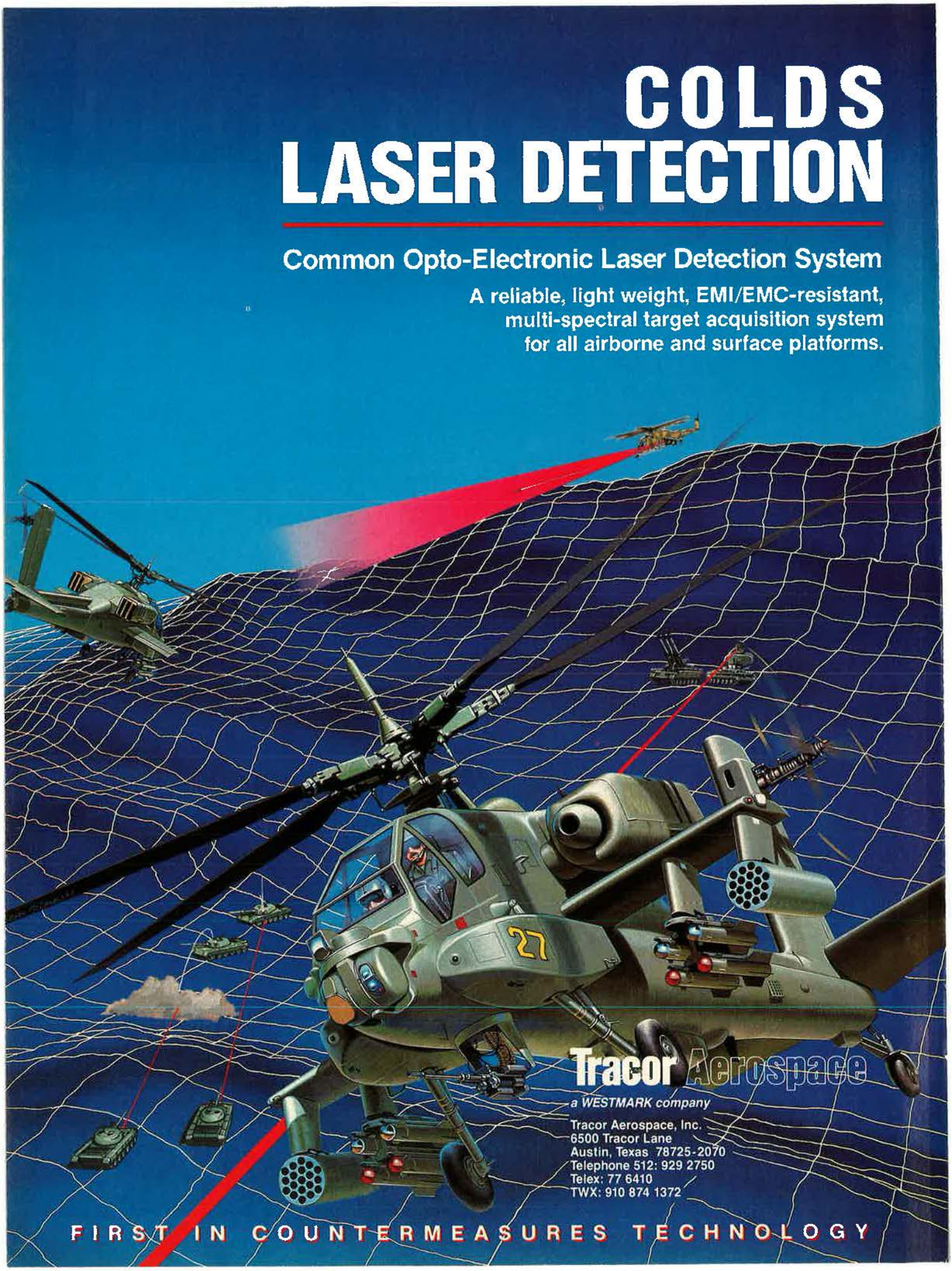

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Capitol Hill

By Brian Green, CONGRESSIONAL EDITOR

Washington, D. C.

The Budget Picture

President Reagan and Secretary of Defense Frank Carlucci sent to Congress an FY '89 Department of Defense budget of $290.8 billion in budget authority (BA, the amount the Department can obligate to be spent) and $285.5 billion in outlays (the amount that will actually be spent). Adjusted for the effects of inflation, this year's defense request is the smallest since the Reagan Administration started submitting defense budgets for FY '83.

Overall defense spending is pegged at $299.5 billion in BA and $294 billion in outlays. Budget authority requested for the Air Force is $97.2 billion. The DoD budget request is about one percent less than that approved for FY '88 and nearly eleven percent lower than in the FY '85 budget. The budget proposes significant program and force structure cuts *(see also "Washington Watch," p. 16 of this issue).*

The DoD request of $290.8 billion includes all defense spending except that for the Department of Energy (DoE) defense program (primarily nuclear weapons research and production) and for other minor expenditures, such as for the civil defense program administered by the Federal Emergency Management Agency. Totals of $8.1 billion for DoE defense programs and $600 million for other defense programs have been requested for FY '89.

This FY '89 defense budget is a revision of the FY '89 budget offered in January 1987 as part of a two-year spending plan. Higher-than-expected deficits and pressure to meet the deficit targets imposed by the Gramm-Rudman-Hollings (GRH) balanced-budget law prompted an agreement to reduce the original FY '89 plan by $33 billion.

At $97.2 billion, the Air Force is slated to get a 6.6 percent increase over FY '88. That increase, however, follows an eleven percent cut of last year's request and a thirteen percent inflation-adjusted decline over the past four years and is $10 billion less than the original FY '89 figure. Air Force spending, even if the entire amount is approved by Congress, will still not equal the FY '84 level.

Shadow of Gramm-Rudman

The deficit and GRH may conspire to reduce the FY '89 budget—and even the FY '88 budget—even further.

The federal deficit limit mandated by GRH is $136 billion. The Administration projects the FY '89 federal deficit at $129.7 billion. Many consider that to be an unrealistic projection, since the economy is expected to slow down. The Congressional Budget Office has pegged the FY '89 "baseline deficit" (a deficit based on a continuation of FY '88 spending rates and certain assumptions about economic growth) at $176 billion. Such high deficit estimates could lead to intense pressures to cut the defense budget even further.

If Congress can't meet the FY '89 deficit goal, the Gramm-Rudman-Hollings automatic across-the-board cuts would be imposed to reduce spending further. Those cuts would be imposed on FY '89 BA and outlays but would also hit prior-year budget authority, in effect reducing FY '88 defense spending even further. The FY '88 defense budget already reflects a three percent decline from FY '87.

NATO Defense Program

Funding was uneven for programs singled out as key to NATO modernization, in spite of a new emphasis in Secretary Carlucci's testimony and report to Congress. In his congressional testimony, he argued that the INF Treaty highlighted the significance of programs aimed at modernizing and strengthening NATO conventional and nuclear forces. Chairman of the Joint Chiefs of Staff Adm. William Crowe noted that "the FY '89 budget recognizes that a coalition strategy has become more—not less—important to the United States."

Programs identified as key to improving NATO's nuclear capabilities include modernization of dual-capable aircraft and nuclear-artillery munitions, the standoff Tactical Air-to-Surface Missile (TASM), and a follow-on to the short-range Lance missile. Conventional programs include the F-15E, the Tacit Rainbow defense-suppression loitering missile, the conventionally armed TASM, AMRAAM, the Joint Surveillance and Target Attack Radar System (Joint STARS), the Mark XV system for aircraft identification, and development of highly accurate conventional cruise missiles.

The F-15E request, however, was cut from forty-two planes in FY '88 to thirty-six in FY '89 and will drop to only thirty in FY '90. The AMRAAM program was slowed compared to earlier Air Force projections. In a recent forum, Gen. Robert H. Reed, SHAPE Chief of Staff, stated his belief that the Mark XV IFF system would be too costly to deploy and that another answer to the problem of aircraft identification would have to be found. The TASM proposal was not ready for inclusion in the FY '89 budget. In all, procurement of conventional military equipment was cut sixteen percent from the original FY '89 proposal.

Chief Backs INF Treaty

Air Force Chief of Staff Gen. Larry D. Welch voiced unequivocal support for the Intermediate-range Nuclear Forces (INF) Treaty, the agreement with the Soviet Union that will eliminate all nuclear-armed cruise and ballistic missiles with ranges of 300–3,000 miles.

While General Welch stated that he is dissatisfied with the conventional balance in Europe—and strongly implied that the balance in tactical air forces is getting worse—he argued that the INF Treaty will improve the overall balance of forces in Europe. He opposed linking approval of the INF Treaty to breakthroughs in conventional arms control.

General Welch also argued that differences between US intelligence estimates of Soviet deployments and Soviet-supplied data on their own deployments are within the expected range of uncertainty that inheres in such estimates. ■

Aerospace World

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C.

★ News in the world of the Rockwell B-1B bomber program encompasses a first, a last, an explanation, and a modification effort.

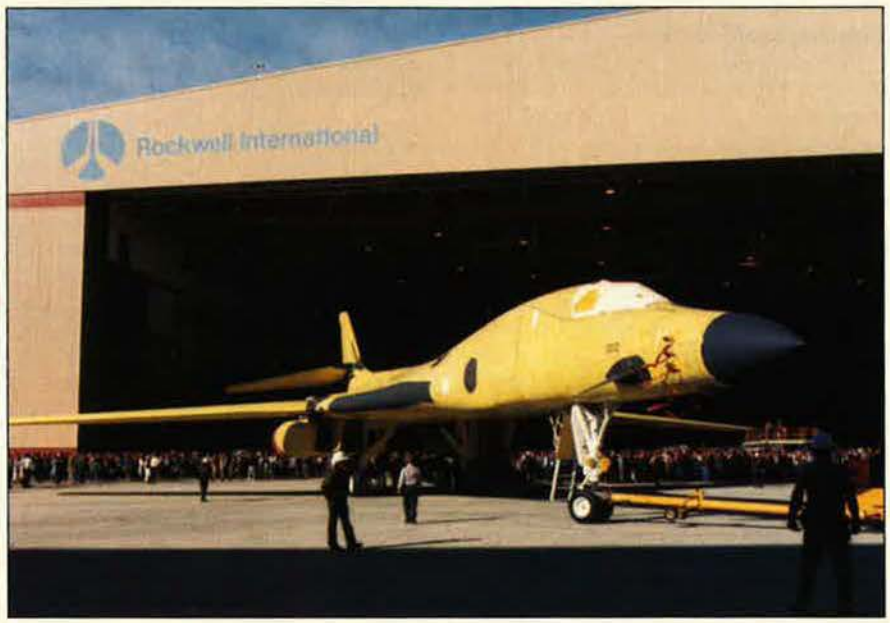
The first of seventeen aircraft to be based at McConnell AFB, Kan., arrived on January 4, eight weeks ahead of the contract delivery date. McConnell is the fourth and final base where the planes will be assigned. Col. Phil Ford, Commander of the 384th Bomb Wing, and Lt. Col. Mike Kenney, Commander of the 28th Bombardment Squadron at the base, flew the aircraft from the Rockwell facility in Palmdale, Calif.

At the plant, Rockwell rolled out the 100th and final B-1B in ceremonies on January 20 that were attended by approximately 3,000 people. The rollout was two months ahead of schedule. The aircraft will undergo some final checkouts and will have to be painted before it is delivered to McConnell in late April.

Rockwell will reportedly complete the B-1B program about three percent ($500 million) over its contract target of $16 billion (another $12 billion went to subcontractors), but the overall cost cap for the program will not be exceeded. Rockwell expects to record an after-tax profit of nearly $800 million on the B-1B effort. On the downside, however, layoffs totaling nearly 20,000 people will have been made by late summer.

The same day as the rollout, the Air Force announced its findings on the September 28, 1987, crash of a B-1B at the La Junta Strategic Training Range in Colorado. That aircraft, assigned to the 96th Bomb Wing at Dyess AFB, Tex., collided with a fifteen- to twenty-pound bird (probably a white pelican) while traveling at 560 knots at an altitude of 600 feet.

After the bird penetrated the airframe, a fire broke out and caused three of the plane's four hydraulic systems to fail. Control of the aircraft was then lost, and the crash ensued. The crash occurred about three minutes after the birdstrike. Three of the plane's four ejection seats worked, but the copilot's seat malfunctioned, and he and two student flyers were killed.



And then there were none. The 100th and final Rockwell B-1B bomber built was rolled out at the company's plant in Palmdale, Calif., on January 20. The aircraft's jaundiced look will be replaced with camouflage colors before the plane is delivered to the Air Force this spring.

To prevent future catastrophic birdstrikes, the Air Force awarded Rockwell two contracts totaling $38.54 million for a B-1B Birdstrike Vulnerability Reduction program. That contract also includes installation of the kit on the first twenty B-1B aicraft.

The kit consists of reinforcements along the leading edge of the wing, the base of the vertical stabilizer, and along the wing pivot. A splitter plate will also be installed in the area between the engine nacelles and the bottom of the wing (where the bird is believed to have hit before the crash). Steel, Kevlar, and reinforced aluminum are the major materials to be used. Weight of the modifications is expected to be less than 500 pounds. A modification will also be made to the ejection seat launch sequence.

The first aircraft are expected to be modified by late April, and low-level training flights (which have been prohibited since shortly after the crash) are expected to begin after that.

In other bomber news, Northrop and the Air Force confirmed in late January that the firm had received a $2 billion contract for costs associated with the start of production on the B-2A Stealth bomber. The B-2 program is expected to cost $36 billion (in FY '81 dollars) for 132 aircraft. The development schedule for the bomber has allegedly slipped several months. First flight of the B-2 is expected this summer.

★ Some 84,000 civilian employees in Air Force Logistics Command will be furloughed for up to ten days this year as part of the effort to keep spending levels within limits set by the FY '88 appropriations bill. The furloughs were approved to offset some $1.7 billion in cuts in operations and maintenance accounts.

The unpaid days off will be staggered if possible so that employees will only have to take one day off per month. Overtime hours in AFLC will also be cut, and some 2,000 temporary employees were expected to have been laid off by the end of March.

Other methods AFLC has imple-

mented to cover the shortfalls include a hiring freeze and an early retirement option to eligible employees.

Furloughs are also under consideration by Strategic Air Command and Air Training Command. ATC has already instituted a hiring freeze and termination of temporary employees.

In related news, the Air Force has also announced that Air Force Reserve Officer Training Corps units at thirty colleges and universities in twenty-three states will be closed to save $10 million. Seven other AFROTC units will be merged with units at nearby colleges as part of the cutback.

Of the thirty schools with unit closures, eighteen of them will still have a military presence on campus in the form of an Army or Navy ROTC detachment. The closures were determined by a weighted point system that included such elements as cost, officer production, academic quality, and undergraduate market size and share.

The closeouts and consolidations will take place over an eighteen-month period to permit upperclassmen to graduate and be commissioned on schedule. Underclassmen in the first two years of ROTC will be offered the option to transfer to another detachment or elect to disenroll without penalty.

The ROTC program is currently active on 151 campuses, and up to 3,400 officers are being produced annually. There are currently 7,500 ROTC scholarships distributed to the freshman through senior classes. With the closures, 2,500 to 3,000 officers can be produced annually with only 6,900 scholarships.

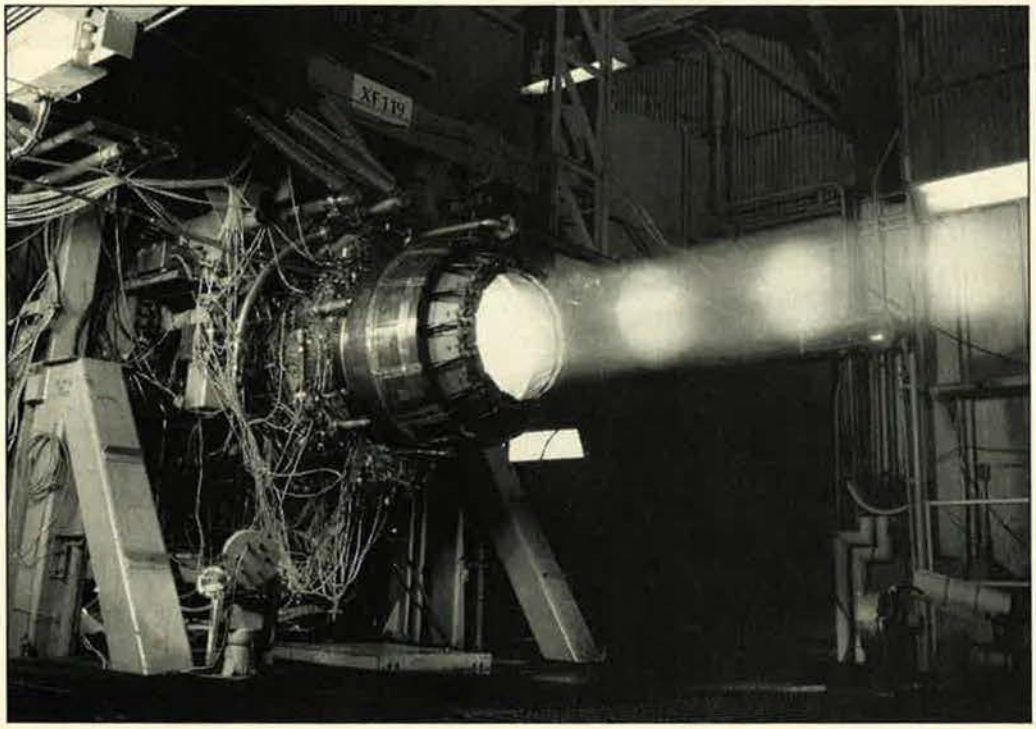
—Nebraska ANG photo by TSgt. John Muir

Lt. Col. Ricardo Albert Puche, left, of the Spanish Air Force, and Col. Marco Tulio Rivera, middle, of the Honduran Air Force, were two of nearly forty foreign officers to visit the Nebraska Air National Guard in Lincoln recently as part of their curriculum at the Air War College. SrA. Don Fruehling, right, is explaining US photo-intelligence interpretation to the officers.

★ Round five of what has been called "The Great Engine War" has been settled, and the winner is Pratt & Whitney. The Air Force will buy approximately fifty-five percent of the FY '89 purchase of 289 fighter engines from P&W, while General Electric will build the remaining forty-five percent of the engines.

This is the second consecutive year Pratt & Whitney got the majority of the contract award. As in the past, the Pratt & Whitney F100-PW-220 engines will go into both F-15s and F-16s, while the General Electric F110-GE-100 will be used to power only F-16s.

After the initial Alternate Fighter Engine (AFE) buy in February 1984, savings of between $2 billion and $3 billion over the life cycle of the six-year program were predicted because of the competition. The two competitors have bettered their offers (and their engines), and the savings now are expected to be in excess of $3



The competition in the Air Force's Advanced Tactical Fighter program is not limited to just airframes. Pratt & Whitney and General Electric are building prototype engines that will be fitted into one of each of the aircraft (YF-22 and YF-23) that will be involved in the flyoff. This is the Pratt & Whitney entry, the YF119, undergoing sea-level testing at the company's plant in West Palm Beach, Fla. The YF119 is a low-bypass, augmented turbofan designed to cruise at supersonic speed for extended periods without afterburner.

billion, even though the total buy will be approximately 800 engines fewer than the forecast 2,500 powerplants.

Of the 1,825 AFE engines contracted for so far, GE has already built or will be building 946 F110s (fifty-one percent), while Pratt & Whitney is committed to 879 F100s (forty-nine percent). The FY '90 buy will be the last for the AFE program. The two companies will then vie for contracts for their Improved Performance Engines (IPEs), the P&W F100-PW-229 and the GE F100-GE-129.

In related news, the Air Force has awarded contract modifications worth $341.9 million to Pratt & Whitney and General Electric for flightworthy Advanced Tactical Fighter (ATF) engine candidates.

During this phase, P&W will test its YF119 prototype engine at sea level and altitude conditions and will also build test engines for both the Lockheed YF-22A and Northrop YF-23A ATF flyoff participants. General Electric's YF120 engine will also be fitted into one of each of the aircraft prototypes.

First flight of the ATF prototypes and engines is expected in 1990, and the full-scale development (FSD) contract for the engine is expected in 1991.

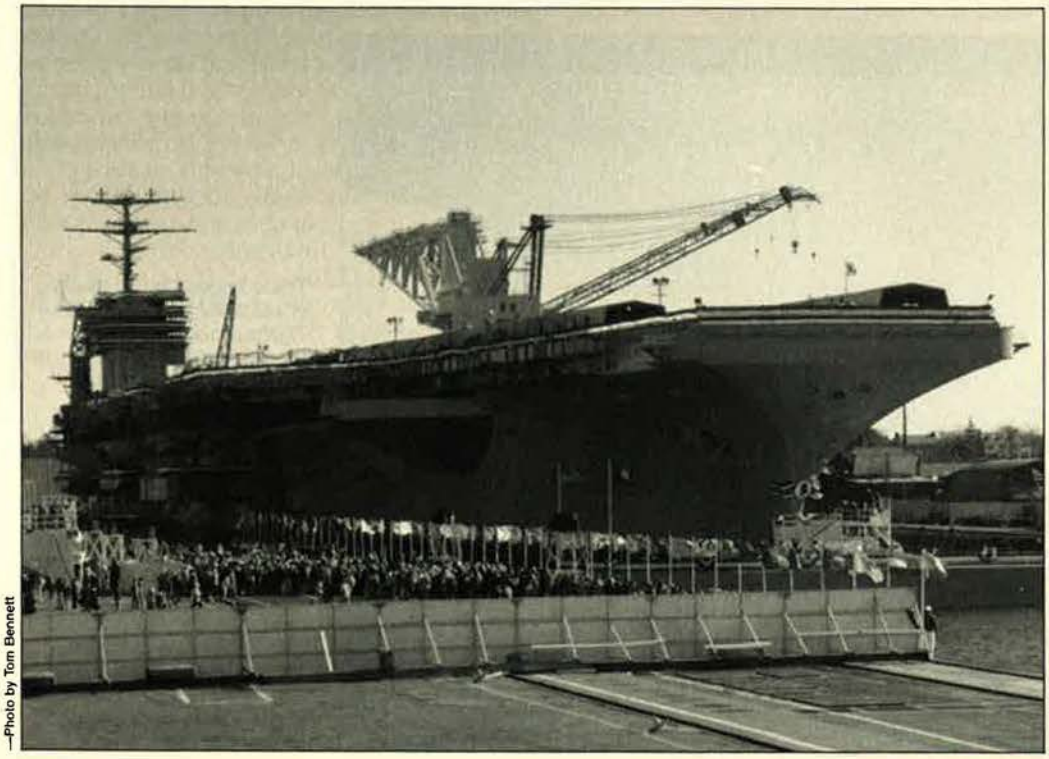
★ It was an aircraft rollout of a different sort when the Northrop X-4 Bantam, one of the smallest research aircraft ever built, was unveiled on January 20 after being restored at the Western Museum of Flight in Hawthorne, Calif.

***The Northrop X-4 Bantam was recently rolled out after being restored. The X-4, designed in the 1940s to test "compressibility" effects in the transonic regime, will be displayed at the Air Force Museum at Wright-Patterson AFB, Ohio* (see item).**

Next stop for the semi-tailless aircraft (it has no horizontal stabilizer) will be the Air Force Museum at Wright-Patterson AFB, Ohio.

The aircraft was restored at the Air Force Museum's request by the Southern California Historical Aviation Foundation, a nonprofit organization dedicated to the preservation of aviation history and promoting interest in Southern California's aviation heritage. A special guest at the rollout ceremony was Charles Tucker, the Northrop test pilot who was the first to fly in the X-4, on December 16, 1948.

As jet aircraft were edging closer to the speed of sound after World War II, aerodynamicists believed that many of the undesirable "compressibility" effects experienced near Mach 1 were partially caused by the horizontal tail



—Photo by Tom Bennett

The Navy's fifth* Nimitz-*class aircraft carrier, the USS* Abraham Lincoln *(CVN-72), was christened and launched in ceremonies at the Newport News (Va.) Shipbuilding yards on February 13. The* Lincoln, *like her sister ships* Nimitz, Dwight D. Eisenhower, Carl Vinson, *and* Theodore Roosevelt, *is 1,092 feet long, displaces 91,000 tons, and will carry approximately eighty aircraft and 6,000 sailors. The ship's sponsor is JoAnn Webb, wife of then-Secretary of the Navy James Webb, and the prospective commanding officer is Capt. Joseph Dantone. The* Lincoln *is scheduled to be commissioned in late 1989.

surfaces of conventionally designed airplanes. The Air Force/Navy/NACA-sponsored X-4 was designed small (just over twenty-three feet long and nearly twenty-seven feet wide) because it was felt the diminutive airframe would be sensitive to slight aerodynamic changes at transonic speeds. The contract for two X-4s was let in April 1946.

With its jet engines, the X-4 could make longer flights than its rocket-powered brethren, and the aircraft was very maneuverable. It made eighty-two flights between 1950 and 1954, when the test program was completed. Among the pilots to have flown the X-4 were Chuck Yeager, Pete Everest, and Scott Crossfield. The X-4 proved that tailless aircraft were not suitable for supersonic flight.

The X-4 (serial number 46-677) will be transported to the Air Force Museum, where it will be displayed with the X-1B, X-3, X-15A-2, and other "X" planes in the Museum's new building addition, which should be open by early spring. The other X-4 (46-676) is on display at the Air Force Academy in Colorado Springs, Colo.

★ **APPOINTED—Grant S. Green, Jr.,** was confirmed by the Senate on February 3 as the new Assistant Secretary of Defense for Force Management and Personnel. Mr. Green was previously special assistant to President Reagan for national security affairs and was also the executive secretary of the National Security Council. He came to the NSC last year as an aide to Secretary of Defense Frank Carlucci when Mr. Carlucci was the President's National Security Advisor.

Robert R. Everett has been appointed as the new chairman of the Defense Science Board (DSB). He is currently president emeritus and a member of the board of trustees of the MITRE Corp. Mr. Everett worked at the Massachusetts Institute of Technology's Lincoln Laboratory from 1943 to 1958. The DSB is the senior technical advisory body of the Department of Defense and is composed of members appointed from the private sector. Mr. Everett will serve as board chairman until 1990.

Lt. Col. Stephen E. Trent has been selected to be the new Commander/Leader of the Air Force's Air Demonstration Squadron, the Thunderbirds. Previously assigned at Hq. Tactical Air Command in the Force Structure Analysis Division, Colonel Trent has more than 3,000 hours in F-4, F-15, and A-4 aircraft, and he has nearly 500 combat hours. He has also served a tour as a Navy exchange pilot, flying from the USS *Coral Sea* (CV-43).

It's looking more and more like an actual airplane. The wings of the first Bell-Boeing V-22 Osprey flight-test article were mated to the fuselage in early February at Bell's Arlington, Tex., facility. The procedure took less than twenty-four hours. The first flight is set for early summer.

★ **BESTOWED—Former Secretary of Defense Caspar W. Weinberger was named Honorary Knight Grand Cross of the Most Excellent Order of the British Empire** on February 1. The honorary knighthood was given for his "invaluable contribution to the defense cooperation of Britain and the US." Secretary Weinberger is the fifty-sixth American to receive an honorary knighthood.

★ **MILESTONES**—Employees of the Directorate of Ammunition at **the Letterkenny Army Depot in Chambersburg, Pa., tested and all-up-rounded the 5,000th AIM-7M Sparrow air-to-air missile** on January 13. All-up-rounding is the complete assembly and preparation of a missile for shipment. It takes approximately six hours and $510 to test and all-up-round each of the missiles, which cost roughly $200,000 each in 1987. For the past twenty years, Letterkenny has been the sole installation provid-

—USAF photo by A1C Dana L. Stephenson

Maj. Gen. Robert Patterson, Commander, Twenty-third Air Force, MAC, was recently invested as a member of the Order of the Bayonet, the highest honor of MAC Security Police. The Order recognizes significant contributions to security and the ground defense of air bases. General Patterson, left, accepts the award from Col. Samuel Stocks, right, DCS for MAC Security Police, as members of the 834th Security Police Squadron at Hurlburt Field, Fla., look on.

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SHORTS

ing Sparrow testing for the Air Force. The milestone missile was then shipped to Wheeler AFB, Hawaii.

The Air Force **School of Aerospace Medicine** at Brooks AFB, Tex., **celebrated its seventieth anniversary** on January 19. Opened as the Medical Research Laboratory at Hazelhurst Field near Mineola, N. Y., in 1918, the school today consists of eight divisions—crew technology, education, radiation sciences, clinical sciences, hyperbaric medicine, epidemiology, veterinary sciences, and technical services—that are responsible for research and development in work dealing with the allied aspects of aeromedical research, medical education, clinical evaluation and consultations, and special support activities.

The **2,000th General Dynamics F-16 fighter built worldwide was accepted** by Singapore at the GD plant in Fort Worth, Tex., on February 10. Singapore, which is to receive eight aircraft, is the first of three Association of Southeast Asian Nations (ASEAN) members to receive F-16s. Thailand (eight aircraft) will accept its first aircraft later this year, and Indonesia (twelve aircraft) will receive its first fighter next year. Sixteen nations have orders for or are flying the F-16, and Japan will be building a derivative of the airplane.

The **first** of twenty-three **Martin Marietta Titan IV heavy-lift expendable launch vehicles arrived** in sections at the Kennedy Space Center in Florida on January 12 aboard a C-5A. The Galaxy landed on the Space Shuttle runway, and the rocket was then transported to Cape Canaveral AFS, where it will be assembled. The refurbished Pad 41, from which the Titan IV will be launched in October, was rededicated by the Air Force on January 14. The 204-foot-tall rocket will be able to lift 10,000-pound payloads into geosynchronous orbit.

Technicians at Raytheon's plant in Lowell, Mass., complete checks on the company's first AIM-120A Advanced Medium-Range Air-to-Air Missile (AMRAAM) that was delivered to the Air Force in late January for qualification testing.

Raytheon delivered its **first AIM-120A Advanced Medium-Range Air-to-Air Missile** (AMRAAM) to the Air Force for qualification testing on January 29. Raytheon will build fifteen missiles that will go through a series of environmental, manufacturing reliability, and flight tests this year to demonstrate the company's ability to be a second-source manufacturer for the missile. After qualification testing, Raytheon will deliver seventy-five missiles in an initial production lot

Charles L. Donnelly, Jr., Named AFA Executive Director

Charles L. Donnelly, Jr., has been selected to become Executive Director of the Air Force Association and its affiliate, the Aerospace Education Foundation. He joined the staff March 1 and on May 1 will replace John Gray, the longtime headquarters staff member selected to be AFA Executive Director after the retirement last fall of David L. Gray.

Donnelly retired from the Air Force last year in the grade of general. In his final active-duty assignment, he held the dual positions of Commander in Chief, US Air Forces in Europe, and Commander, Allied Air Forces Central Europe. Before that, he was Commander of United States Forces, Japan, and PACAF's Fifth Air Force.

"Chuck Donnelly will serve AFA very, very well," said National President Sam E. Keith, Jr., in making the announcement. "On top of thirty-six years in the Air Force, he is a longtime activist in AFA. He joined in 1958, is a Life Member, and volunteered his time in helping AFA set up thirty-plus overseas chapters throughout Europe and the Far East. He participated numerous times as a speaker at key AFA national events and symposia and has been supportive of grass-roots AFA in ways that have been above and beyond what might be hoped for from a very busy man."

A native of Barberton, Ohio, Donnelly entered the Air Force in 1951 as an aviation cadet. He is a command pilot with more than 8,000 flying hours in thirty-eight different aircraft types. He holds a B.A. degree in history and government from Otterbein College and a master's degree in public administration from the George Washington University. He is a graduate of Squadron Officer School, Air Command and Staff College, the Air War College, and the Royal College of Defence Studies in London. During the Vietnam War, he flew 100 combat missions over North Vietnam and twenty-seven over Laos.

He and his wife, the former Carolyn M. Vandersall of Amherst, Ohio, now live in Arlington, Va. They have one daughter, Linda Wieland.

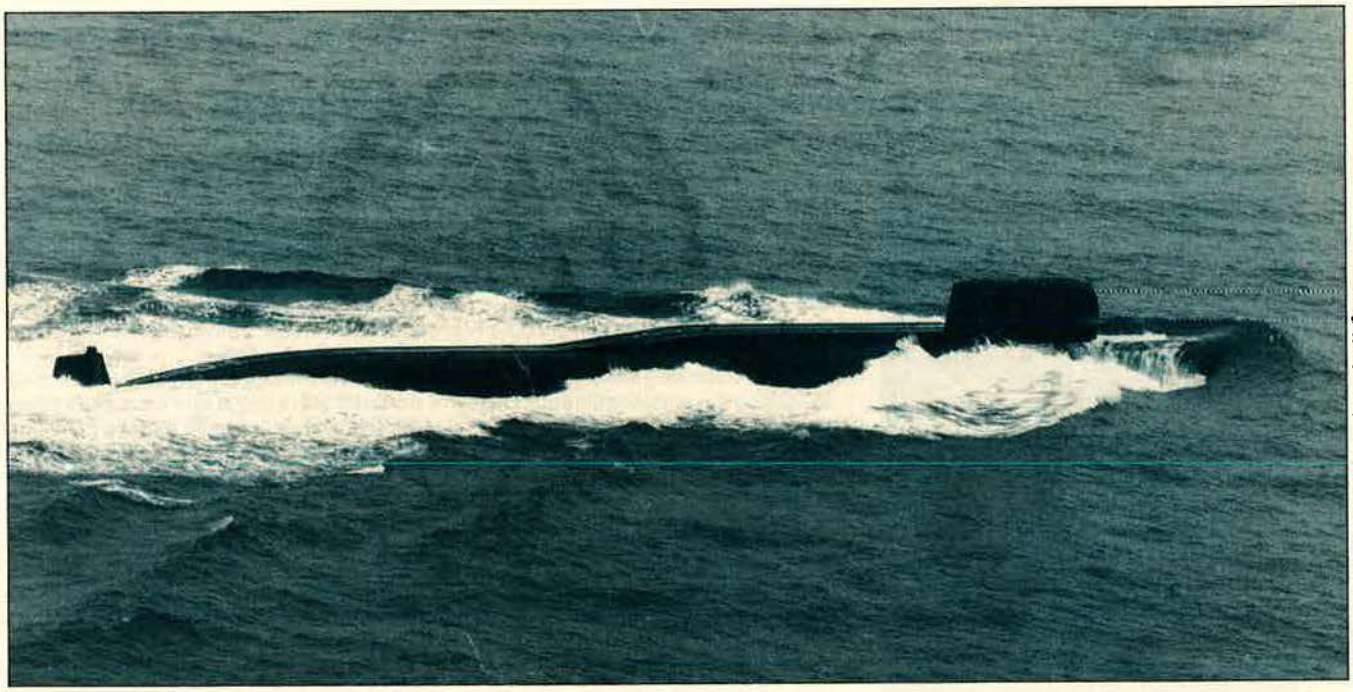
and will begin bidding against Hughes for the FY '89 production lot.

Sir Thomas Octave Murdoch Sopwith, famed British pilot and aircraft designer, **celebrated his 100th birthday** at his home in Brooklands on January 18. Sir Thomas learned to fly in one day in 1910 and became a test and racing pilot in 1911. He set up a flying school a year later and then turned to aircraft manufacture. Noted mostly for its Baby, 1½-Strutter, Pup, Triplane, Dolphin, Snipe, and Camel designs in World War I, Sir Thomas's company later became Hawker Aircraft, Ltd. His legacy continued with his involvement with the Hurricane in World War II, the Hunter in the 1950s, and the world's first production vertical/short takeoff and landing (V/STOL) aircraft, the Harrier, in the 1960s. Sir Thomas is quoted as saying he attributed his success to "pure luck."

★ **NEWS NOTES**—"Power projection" will not be a medal sport in the Seoul Summer Olympics this fall, but if it were, the Department of Defense would certainly get the gold medal. **One, and possibly two, aircraft carriers and their escort ships, along with some Air Force assets, will be conducting exercises** in the Sea of Japan **while the Games are being held** in late September and early October. These exercises are part of a campaign to deter North Korea from

April Anniversaries

- *April 27, 1913:* First flight across the isthmus of Panama. Pilot Robert G. Fowler and cameraman R. A. Duhem are arrested upon publication of the story and pictures of the flight.
- *April 21, 1918: Rittmeister* Manfred von Richthofen, the Red Baron, is shot down in action over France by Capt. Roy A. Brown, a Canadian. The German ace, killed in the battle, had eighty aerial victories.
- *April 15–21, 1928:* Capt. Sir George Hubert Wilkins and Carl B. Eielson fly from Point Barrow, Alaska, across the Artic Ocean to Spitsbergen, Norway, in a Lockheed Vega. This first west-east trip over the top of the world took only twenty-one hours of flying, but the duo was delayed by the weather.
- *April 4, 1933:* The Navy dirigible USS *Akron* (ZRS-4) hits the sea during a training flight off the east coast and breaks up. Of a crew of nearly eighty, only three survive. Among the casualties is Rear Adm. William A. Moffett, head of the Navy's Bureau of Aeronautics. Seventeen days later, the USS *Macon* (ZRS-5) makes its first flight.
- *April 22, 1938:* World War I ace Eddie Rickenbacker buys Eastern Air Lines from North American Aviation, Inc., for $3.5 million. That sum would roughly cover the cost of one engine for a Boeing 757 today.
- *April 18, 1943:* Japanese Adm. Isoroku Yamamoto's Mitsubishi G4M "Betty" bomber is intercepted and shot down over Bougainville by P-38s of the 339th Fighter Squadron. The body of Admiral Yamamoto, who planned the 1941 Pearl Harbor attack, is cremated and taken back to Japan.
- *April 21, 1948:* Secretary of Defense James V. Forrestal assigns the primary responsibility for air defense of the United States to the Air Force.
- *April 7, 1953:* The Atomic Energy Commission reveals it is using QF-80 drone aircraft at the Nevada Proving Ground. The drones are flown directly through atomic bomb blast clouds to collect samples for later examination.
- *April 8, 1958:* An Air Force KC-135 Stratotanker flies 10,229.3 miles nonstop and unrefueled from Tokyo to Lajes Field in the Azores in eighteen hours and fifty minutes.
- *April 5, 1963:* As a result of the Cuban missile crisis, the US-Soviet "hot line" is established for instant urgent communications between the superpowers.
- *April 11, 1963:* The first successful launch of an LGM-30 Minuteman ICBM is conducted at Vandenberg AFB, Calif.
- *April 10, 1973:* First flight of the Boeing T-43A navigation trainer occurs. The T-43 was developed from the 737-200 civil transport.



—Photo courtesy of 333 Squadron, Royal Norwegian Air Force

This is the first picture of a Soviet Yankee-class ballistic missile-carrying submarine that has been modified to carry cruise missiles, probably twenty to forty SS-N-21s. The boat's hull has been lengthened by about ten meters, and the sail is three meters longer than its predecessors' and more rounded in shape. A Royal Norwegian Air Force P-3 crew photographed this "wasp-waisted Yankee" off the Norwegian coast.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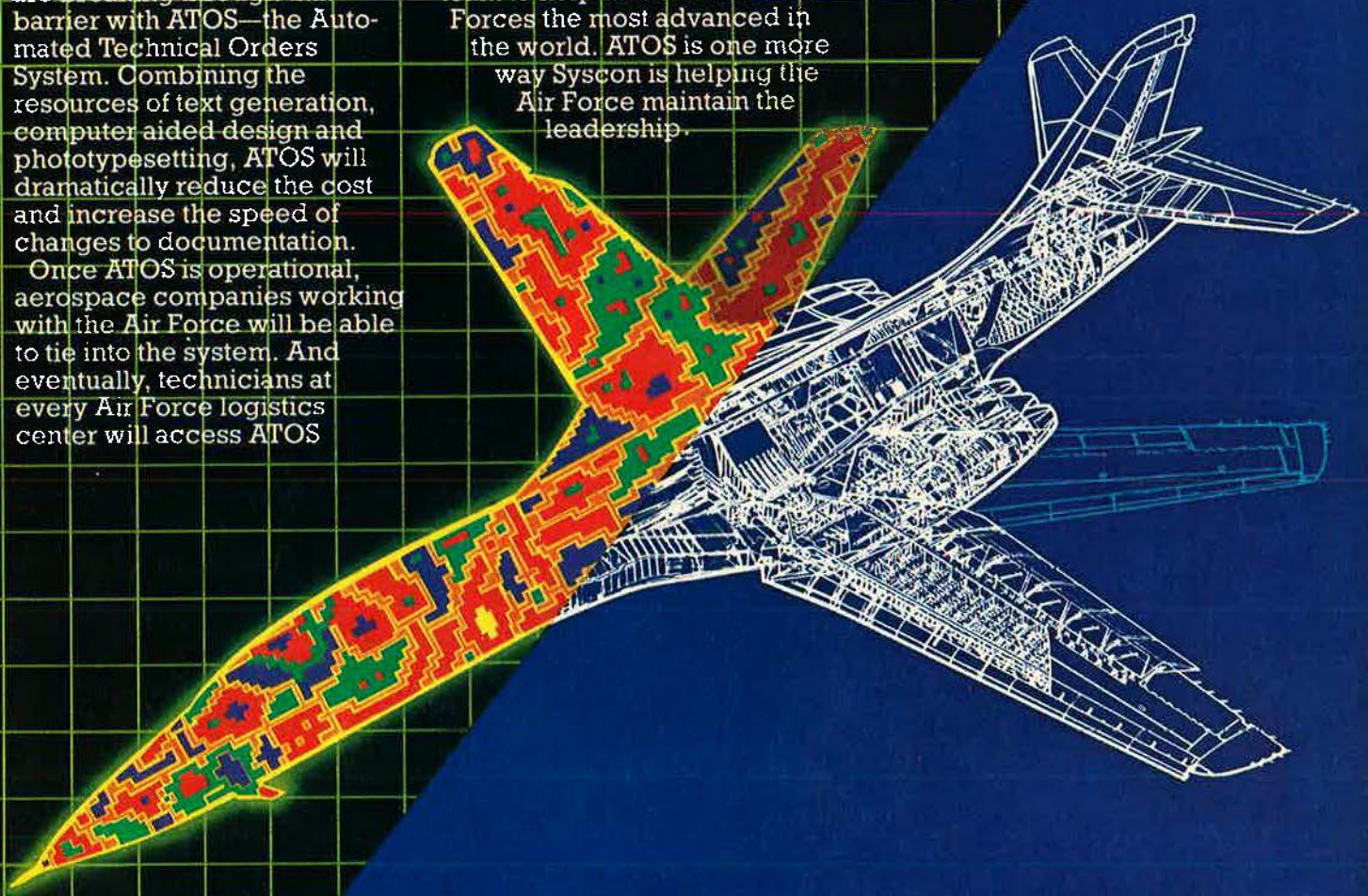

&SYSCON

interfering with the Olympics. It is feared the North Koreans may try some terrorist or military action because the Pyongyang government was turned down in its efforts to co-host the Olympics.

The **Air Force saved a record $309 million as the result of suggestions** made by personnel and civilian employees in FY '87. Of the 65,000 suggestions received last year, more than 17,000 were approved. The end figures show that the Air Force saved $35 for every dollar it spent for cash awards to the suggesters and for personnel costs.

Fighter pilots won't be able to receive a master's degree in hand flying, but the **American Council on Education has determined that graduates of the Air Force Fighter Weapons School** at Nellis AFB, Nev., **will be granted graduate-level credit.** The amount of credit, depending on course length and content, ranges from three to eleven semester hours in such areas as applied aerodynamics, advanced aircraft systems, advanced avionics/electronics, information systems, and instructional methodology. Most graduate schools will allow up to twelve credit hours to transfer into advanced degree programs.

A UGM-96 **Trident I missile self-destructed** eighteen seconds after launch on February 6. The demonstration and shakedown (DASO) launch was intended to qualify the crew of the USS *Simon Bolivar* (SSBN-641) with the Trident I, or C4, missile. Originally built to carry Poseidon (UGM-73) missiles, the *Bolivar* was modified to carry the Trident Is. The C4 missile was launched in bad weather while the submarine was submerged fifty miles off the coast of Cape Canaveral AFS, Fla. This was the second straight Trident I failure. Cause of the malfunction is under investigation.

Some changes occurred to two Air Force units in January. **At Malmstrom AFB, Mont., the 301st Air Refueling Wing was reactivated** after several years of dormancy. In 1964, the 301st AREFW became the first all-jet tanker wing, and the reactivation of the unit also marks the return of a flying mission to Malmstrom, which is home to the 341st Strategic Missile Wing. The first KC-135 will arrive at Malmstrom in October.

The **95th Fighter Interceptor Training Squadron at Tyndall AFB, Fla., began converting** from Lockheed T-33 Shooting Stars to McDonnell Douglas F-15 Eagles during the month. The unit's mission is changing from fighter-interceptor training to tactical fighter training. Tyndall will get twenty F-15s from Luke AFB, Ariz., which is converting to F-15Es. The 95th's T-33s will be retired, and part of the unit's training mission will be taken over by Flight International, a private contractor.

Eight months before the congressionally mandated deadline, **a check for $2.5 million in local matching funds was presented** to the Army Corps of Engineers **to begin construction of the new Army Aviation Museum** at Fort Rucker, Ala. Congress had set a deadline of September for the local citizens and communities to match the $2.5 million allocated from reprogrammed Army funds. Rep. Bill Dickinson (R-Ala.) spearheaded the fund-raising drive for the new building, which is expected to draw 250,000 visitors annually.

Gen. Alfred M. Gray, the Marine Corps's feisty new Commandant, **has ordered a name change in Marine units.** The word "Amphibious" has been dropped in favor of "Expeditionary" in descriptions of Marine units, brigades, and forces. The purpose of

Senior Staff Changes

PROMOTIONS: To be **Brigadier General:** Thad A. **Wolfe.**

To be **AFRES Major General:** Ronald C. **Allen,** Jr.; Norman J. **DeBack,** Jr.; George D. **Eggert;** Ralph D. **Erwin;** Jack L. **Lively;** Harvey J. **McCarter;** David S. **Trump.**

To be **AFRES Brigadier General:** Nora A. **Astafan;** James B. **Cobb;** Esker K. **Davis;** Gary L. **Eichhorn;** Duane L. **Foster;** John A. **Hurley;** Robert H. **Jones;** Rodney L. **Linkous;** Robert A. **McIntosh;** James E. **Sherrard III;** Richard K. **Vogel;** Charles R. **White;** Jerry E. **White;** Forrest S. **Winebarger.**

To be **ANG Major General:** Timothy T. **Flaherty.**

RETIREMENTS: M/G John P. **Hyde;** ANG M/G Robert W. **Parét;** M/G John T. **Stihl.**

CHANGES: Col. (B/G selectee) Richard A. Browning, from Dir., Maintenance, Ogden ALC, AFLC, Hill AFB, Utah, to DCS/Log., and Staff Dir., Log., PACOPS, Hq. PACAF, Hickam AFB, Hawaii, replacing B/G (M/G selectee) Joseph K. Spiers . . . **M/G Hugh L. Cox III,** from Dir., Ops., Hq. USSOCOM, MacDill AFB, Fla., to Dep. CINC, Hq. USSOCOM, MacDill AFB, Fla., replacing L/G Harry A. Goodall . . . **ANG B/G (ANG M/G selectee) Timothy T. Flaherty,** from ANG Ass't to Command Surgeon/SAC, Hq. WiscANG, Madison, Wisc., to ANG Ass't to Surgeon General of the Air Force, Hq. USAF, Bolling AFB, D. C., replacing retiring ANG M/G Robert W. Parét . . . **M/G Richard F. Gillis,** from Cmdr., AFALC, Hq. AFLC, Wright-Patterson AFB, Ohio, to Cmdr., Warner Robins ALC, AFLC, Robins AFB, Ga., replacing retiring M/G Cornelius Nugteren . . . **L/G Harry A. Goodall,** from Dep. CINC, Hq. USSOCOM, MacDill AFB, Fla., to Cmdr., AAFSE, and Dep. CINC for the Southern Area, USAFE, Naples, Italy, replacing L/G Robert C. Oaks . . . **Col. (B/G selectee) Walter C. Hersman,** from Chief, O&P Div., Nat'l Guard Bureau, Hq. USAF, Washington, D. C., to Dep. Dir., OP&T, Hq. DIA, Washington, D. C.

B/G (M/G selectee) Frank J. Kelly, Jr., from Dep. Cmdr., Joint Spec. Ops. Command, USSOCOM, Ft. Bragg, N. C., to Dir., Ops., Hq. USSOCOM, MacDill AFB, Fla., replacing M/G Hugh L. Cox III . . . **B/G Bruce J. Lotzbire,** from Chief, Joint Ops. Div., J-3, OJCS, Washington, D. C., to Ass't DCS/Ops., and Ass't Dep. Dir., Ops., EACOS, Hq. USAFE, Ramstein AB, Germany, replacing B/G (M/G selectee) Dale C. Tabor . . . **L/G Robert C. Oaks,** from Cmdr., AAFSE, and Dep. CINC for the Southern Area, USAFE, Naples, Italy, to Cmdr., Hq. ATC, Randolph AFB, Tex., replacing L/G John A. Shaud . . . **B/G Gary W. O'Shaughnessy,** from DCS/Intel., and Cmdr., 7455th TIW, Hq. USAFE, Ramstein AB, Germany, to Dir., Intel., J-2, Hq. USEUCOM, Vaihingen, Germany, replacing M/G C. Norman Wood . . . **Col. (B/G selectee) Joseph J. Redden,** from Cmdr., 354th TFW, TAC, Myrtle Beach AFB, S. C., to Spec. Ass't to Cmdr., Hq. TAC, Langley AFB, Va. . . . **L/G John A. Shaud,** from Cmdr., Hq. ATC, Randolph AFB, Tex., to C/S, SHAPE, Mons, Belgium, replacing retiring Gen. Robert H. Reed.

B/G (M/G selectee) Joseph K. Spiers, from DCS/Log., and Staff Dir., Log., PACOPS, Hq. PACAF, Hickam AFB, Hawaii, to Cmdr., AFALC, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing M/G Richard F. Gillis . . . **B/G (M/G selectee) Dale C. Tabor,** from Ass't DCS/Ops., and Ass't Dep. Dir., Ops., EACOS, Hq. USAFE, Ramstein AB, Germany, to Cmdr., Lowry TTC, ATC, Lowry AFB, Colo., replacing M/G Larry N. Tibbetts . . . **M/G Larry N. Tibbetts,** from Cmdr., Lowry TTC, ATC, Lowry AFB, Colo., to Cmdr., AFMTC, ATC, Lackland AFB, Tex., replacing retiring M/G Chris O. Divich . . . **Col. (B/G selectee) Thad A. Wolfe,** from Cmdr., 509th BMW, SAC, Pease AFB, N. H., to Spec. Ass't to CINC, Hq. SAC, Offutt AFB, Neb. . . . **M/G C. Norman Wood,** from Dir., Intel., J-2, Hq. USEUCOM, Vaihingen, Germany, to Ass't C/S, Intel., Hq. USAF, Washington, D. C., replacing retiring M/G Schuyler Bissell. ■

the change, in General Gray's words, is to "affect how Marines think and refer to themselves." He noted that Marine units are self-sustaining, and the return to "expeditionary" designations will reinforce that notion. This is the latest in General Gray's initiatives to get the Corps to return to a "true warrior" mindset.

Air Force Systems Command's **Electronic Systems Division** at Hanscom AFB, Mass., **awarded a five-year $508 million contract to Martin Marietta Information and Communications Division** in Denver, Colo., **for management of the** Strategic Defense Initiative's **National Test-Bed (NTB) program.** The NTB will consist of numerous facilities linked by secure communication networks so that antiballistic defense concepts can be tested and evaluated in simulations. The NTB will be managed by the National Test Facility at Falcon AFS, Colo.

Secretary of Defense Frank Carlucci has approved the recommendations of a special task force and has ordered that **up to 4,000 jobs in the armed forces previously closed to women now be opened.** The jobs had been closed by military regulations barring women from combat. Some of the now-opened jobs will allow women to fly the Air Force's TR-1/U-2 and SR-71 and the Navy's EP-3 reconnaissance aircraft, serve as part of the Marine guard contingent at US embassies, and be assigned to such combat logistics ships as ammunition vessels and fleet oilers. A number of positions in Army forward support battalions are also expected to be opened. Women now make up ten percent of US military forces.

Military Airlift Command announced on February 22 that **the 437th Military Airlift Wing** at Charleston AFB, S. C., **will be the first unit to operate the new McDonnell Douglas C-17A airlifter.** The first C-17 will arrive at Charleston in the fall of 1991, and the first squadron will become fully operational by late 1992. The base will eventually get more than fifty C-17s, or just under one-fourth of the total planned production run of 210 aircraft. Training systems and equipment for aircrews and maintenance personnel will be in place at least four months before arrival of the new airplanes. The 437th MAW's C-141 StarLifters are expected to be transferred to Air National Guard and Air Force Reserve units. The 437th MAW was also the first operational C-5A unit in 1970, although the planes are no longer assigned there. ■

James H. Douglas, left, the fifth Secretary of the Air Force, died February 24 at his home in Lake Forest, Ill. He was eighty-eight. Mr. Douglas (shown here with then-Vice Chief of Staff Gen Thomas D. White) joined the Eisenhower Administration as Under Secretary of the Air Force in 1953. He served as Secretary from 1957 to 1959 and later was Deputy Secretary of Defense.

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Never before have tactical forces been so impressive in basic combat skills. But what happens to quality if funding dries up?

Battle Damage From the Budget Wars

BY JOHN T. CORRELL
EDITOR IN CHIEF

THE most impressive thing about US tactical forces today is their solid competence in basic, everyday tasks of combat. Well trained and superbly equipped, they go about their duties with a steady assurance. In one demonstration after another, they sustain operations at a punishing pace and put down firepower with great accuracy.

Speaking at AFA's tactical warfare symposium in Orlando, Fla., on January 21–22, Gen. Robert D. Russ, Commander of TAC, recounted as an example the results of a sortie surge exercise by the 19th Tactical Fighter Squadron at Shaw AFB, S. C.

Working with twenty-four F-16 aircraft, the squadron launched 160 sorties in 12.5 hours for a rate of 6.7 sorties per aircraft. There were no aborts. (By contrast, fighter aircraft in World War II averaged one combat sortie every four days. One sor-

Giving a vivid description of what direction military budgets will be taking in the next few years, these F-16s are from the 169th Tactical Fighter Group at McEntire ANGB, S. C.


SC
322
SC
306

tie a day was still considered pretty good in the Vietnam era.)

All of the aircraft reached the range and delivered their ordnance. Forty percent of the bombs dropped were bull's-eyes. The F-16s returned from 150 of the sorties in Code One condition, ready to fly again without maintenance. The ten aircraft with problems were back in commission within two hours.

"That sort of reliability has not been seen before in our tactical forces," General Russ said. Results like those seen at Shaw also depend on bright, highly motivated sortie-generation crews who can bring out the best in good systems. "These men and women are not born that way," General Russ said. "They're taught that way by some damn good NCOs."

The question is whether tactical forces can keep up such quality through the next five years when defense budgets drop, perhaps by hundreds of billions of dollars.

The Air Force stands to lose three of the thirty-eight fighter and attack wings it has at present. General Russ said that deployments and exercises will be reduced and that Red Flag—the world-famous training program for fighter pilots that simulates combat—will also be cut back.

Production of fighter aircraft is expected to decline, too. USAF hopes to preserve intact its most critical modernization programs, including the Advanced Tactical Fighter (ATF), but is sorting with some anguish its other requirements into "nice to have" and "need to have" piles.

"Voice-activated switches are nice to have," General Russ said. "Manual switches are need to have. A new 20-mm gun is nice to have; the old gun with maybe some improved ammo is need to have."

Allocating the Reductions

The tactical forces will take their wing structure cuts by retiring older airplanes, mainly F-4s, General Russ said. The newer aircraft will be redistributed among the wings that remain, and the Air Force will concentrate on keeping them at peak readiness.

That will be a trying job in itself, since the Operations & Maintenance account has been hard hit already in the first wave of budget reductions. O&M pays for fuel, flying hours, spare parts, and general upkeep of the force.

Tidal W. McCoy, Assistant Secretary of the Air Force for Readiness Support, told the symposium audience that combat sustainability will soon begin to suffer. It hasn't happened yet, he said, because spare parts are budgeted two or three years before they show up in squadron supply bins.

By 1991, Mr. McCoy said, "we could have a serious downward spiral in our military capability. . . . If we're not careful, we could be in the same situation as we were in 1979 and 1980 when the forces were in an unready and dangerous situation."

General Russ said that, as budget reductions proceed, the trick will be to strike the right funding balance between strategic and tactical forces, the procurement and operating accounts, and R&D and the rest of the budget.

—Photo by Randy Chapman

RUSS: ***Forget the "nice to have" feature.***

"We won't have the luxury of the broad-based R&D program we currently have," he said. "We'll have to trim that somewhat and direct our efforts more toward solving known problems. Second, we'll have to cut some of our options sooner. It's nice to be able to look at a problem two or three different ways and then pick the best solution," but budget circumstances force early foreclosure of options and acceptance of the development risk that goes along with that approach.

There will be heavy emphasis on system reliability. "The tactical forces won't support a production decision on any program without demonstrated reliability," General Russ said. "We can't afford to buy ourselves out of problems."

Reliability saves both maintenance costs and manpower. General Russ expects an Advanced Tactical

Fighter (ATF) squadron to operate with thirty percent fewer people than an F-15 squadron does. Improved mean time between failures (MTBF) of systems on the new fighter will reduce all kinds of support requirements, ranging from spare parts to the number of C-130 airlifters that accompany the squadron on a deployment.

Airpower for the Army

Here and there, the interservice feud about close air support continues to bubble *(see also "Sorting Out the AirLand Partnership" on p. 50 of this issue).* Former Under Secretary of the Army James Ambrose has complained that "we are not getting the fixed-wing close air support that we need." A substantial faction in the Army bitterly opposes the Air Force's plan to employ a modified fighter, the A-16, for close air support rather than designing a new airplane from scratch for that role.

The organizations that should know the requirement best—Tactical Air Command and the Army's Training and Doctrine Command (TRADOC)—have no argument with each other, though, at least not at the top levels.

Gen. Maxwell R. Thurman, TRADOC Commander, says that "I won't get drawn into [a discussion of] Mr. Ambrose's comments" and that he will leave choice of airframes to people who understand flying better than he does.

"Bob [Russ] and I are clear on interoperability," General Thurman told the symposium. "We put up the requirements. They satisfy them. So far, we're a satisfied customer." Responding to a question from the floor about his preference for a forward air control platform for the future, General Thurman declared himself for "whatever it takes [for] Bob to do the job."

And as General Russ explains it, the Army could hardly be more central to TAC planning. "The tactical air forces have two missions—[to provide] air defense of the continental United States and to support the Army," he said. "Historically, most people have thought that our support for the Army was close air support.

"In reality, all tacair missions are to support the Army. We keep enemy fighters off the Army's back. That's counterair. We delay and disrupt the enemy before [his force] can be brought to bear. That's interdiction. And of course we do close air support."

The New, Improved Army

General Thurman said the Army has held its active-duty strength constant in recent years (although adding considerably in Reservists and Guardsmen) so that it could invest in modernization of weapon systems. That equipment is now in the field, and the new, improved Army moves faster, reaches deeper, and hits harder than ever before.

Rate of advance with the old M60 tank was nineteen kilometers an hour. The M1, which General Thurman calls "the world's best tank," churns along at forty-five kilometers an hour. And when it gets where it's going, it is lethally effective.

"I took one a year ago and fired four out of five rounds into a target at two kilometers," General Thurman said. "If a fifty-five-year-old, one-eyed field-artillery officer can do that, think what some nineteen-year-old kid who's been trained on it can do!"

He also gives top marks to the M2 Bradley Fighting Vehicle. Allegations of its vulnerability are based on dumb interpretation of test results, he claims.

"What they've asked us to do is shoot a tank round at [the M2] and see if it will do any damage," General Thurman said. "Yes, it will do some damage. In fact, it might deadline it.

"Let me give you an analogy. If I took an F-16 and put it at the end of the runway, fully loaded with munitions and fuel, revved it up, and fired an AIM-9L at it, what do you think would happen? You would say

—Photo by Randy Chapman

THURMAN: **Moving faster and shooting deeper.**

that's stupid. You take the thing off and fly it, and through the capabilities of the man and the machine, we kill the other guy before he kills us." The same principle applies to survivability of the M2 in combat, he said.

Also in service is the Multiple-Launch Rocket System (MLRS), which enables the Army to attack from thirty kilometers away. When the Tactical Missile System (TACMS) is fielded in 1990, the Army will have a hundred-kilometer weapon, too. These systems would work in concert with the Air Force in pounding the enemy's rear echelons to disrupt his flow of reinforcements to the forward line of troops.

The Army eagerly awaits Joint STARS, an airborne system being developed in cooperation with the Air Force. It will look deep and sort out targets on the ground. It should be ready in the early 1990s, shortly after the Army's deep attack capability is operational.

—Photo by Arthur Hyland

McCARTHY: SAC bombers on flanking attack.

B-52s on the Flanks

The deepest counterattack of all would be carried out by conventionally armed B-52G bombers on loan from Strategic Air Command. During the symposium, Lt. Gen. James P. McCarthy, then Commander of SAC's Eighth Air Force, described the new concept.

In wartime, the heavy bombers would deploy to forward operating locations on the periphery of Europe. Forty-five suitable airfields have already been identified. SAC would "chop" operational control of these forces to the theater commander and furnish him a SAC general officer to advise in their employment.

Thus deployed, the B-52Gs would operate against preassigned "strategic areas of responsibility" deep in enemy territory and go after targets that lie beyond the reach of fighters. The big bombers would not need refueling en route, so they will not compete for scarce tanker resources.

General McCarthy said that sixty-one B-52Gs will be assigned to a purely conventional role in FY '89. These aircraft will not be equipped to carry cruise missiles, but later on, they will be augmented by up to eighty-nine more B-52Gs that will have cruise missile capability.

The concept of operation gives the B-52s a good chance of reaching their targets and getting out again, General McCarthy said. The bombers will penetrate along routes that bypass the concentrated defenses of the central battle. They will fly low—never above 400 feet—mainly at night, with fifty-mile spacing between aircraft. They will strike simultaneously from different points of the compass.

A typical target, General McCarthy said, might be a rail transloading yard in Hungary. Each B-52 can carry fifty 1,000-pound bombs. In the near future, the weapons load may include Tacit Rainbow loitering missiles for defense suppression and Israeli-developed Popeye guided munitions—which USAF calls "Have Nap"—for point attack.

Such operations would disrupt the enemy's war effort, impede his flow of reinforcements and supplies to the central fight, and force him to divert military assets to defend rear areas against attack.

This is a completely new concept for SAC bomb wings, which, unlike tactical units, are unaccustomed to working from forward operating locations. To prepare, they have begun practice deployments to austere bases in the United States and will proceed by stages to more difficult deployments with larger forces. They are also flying more low-level training missions at night, using the equipment, techniques, and tactics needed to penetrate enemy airspace under the cover of darkness.

Operating Under Attack

In 1985, the Air Force ran a major wartime survival test called "Salty Demo" for two weeks at Spangdahlem AB, Germany. It was known ahead of time that European bases

were vulnerable to some degree, but results of the exercise told a worse story than officials had expected. A moderate attack on the base would be enough to severely restrict its ability to generate sorties. Salty Demo led to a recovery effort called "Air Base Operability," which is just now shifting into high gear.

"This is not a small program with a few widgets and a couple of generators," Secretary McCoy said at the symposium. "We will be spending three or four billion dollars in the next five to eight years in this area, and there are unfunded needs in the range of another four to five billion."

European bases are threatened in various ways. Newer Soviet attack aircraft have the range and weapons accuracy to do serious damage. Spetsnaz commando forces would have airfields high on their list of targets. Tactical ballistic missiles are another means of assaulting bases. Chemical and biological weapons pose yet another kind of danger.

Secretary McCoy said there are two basic approaches to air base operability. One relies on hardening of facilities, active defense, and rapid repair capability. The other emphasizes dispersal, mobility, concealment, and deception. The Air Force program will employ both approaches. Defense beyond the base perimeter is the Army's job, and Secretary McCoy said "we will start holding the Army's feet to the fire" to ensure that the protection is there.

"We must also make certain that all of our airmen are prepared to contribute to base recovery after an air attack and to defense of the base during ground attack," he said. "We cannot afford to have the sortie generators standing around watching while fifty civil engineers fill holes in the runway or 150 security policemen repel a Spetsnaz assault."

Exploring Better Methods

Tactical units all the way down to squadron level now have Air Base Operability sections. Training and exercise programs are under way. Meanwhile, the Air Force is exploring better methods of fighting fires, repairing bomb damage, and operating in a chemically contaminated environment. It is also following up on a 1983 suggestion by the Defense Science Board that the cover and deception program be rejuvenated.

Mr. McCoy said that the first phase of the cover and deception program would consist of such things as dummy aircraft and fake landing strips. The second phase will add signature emitters to the dummy aircraft to confuse enemy sensors that try to sniff out the fakes.

In a recent demonstration, black mesh cloth in the shape of aircraft was laid on concrete, with some real aircraft parked nearby. "We had some pilots run in on it, and ten out of fifteen times they went after the black cloth rather than the real aircraft," Mr. McCoy said. "Sometimes even the simplest kind of deception can be effective."

Another goal of Air Base Operability is to make it easier for fighters to work from damaged runways. This has put Secretary McCoy at odds with others in the tactical community on specifications for the Advanced Tactical Fighter.

Secretary McCoy told the symposium audience that in Pentagon meetings, "McCoy is saying I want thrust reversers on it because I want it to be able to stop fairly short." Pressed on this point by questioners, he said he'd "like it to be proven that it's impossible to come up with a technology or an approach—braking systems, thrust reversers, or something—that would give us that capability."

Earlier, General Russ had made the case against thrust reversers for the ATF. He said that the Air Force believed initially that it could have this feature at moderate cost and without a big penalty in additional weight of the aircraft. It then found that the cost was appreciable and

—Photo by John Aseltt

McCOY: ***Our air bases are vulnerable.***

the additional weight was 1,000 pounds. With thrust reversers, the ATF could land in about 2,000 feet. Without them, it needs 3,000. General Russ said that the tactical forces had considered the value of the 1,000-foot difference and decided it wasn't worth the extra money and weight required to get it.

Watch on the DMZ

The armistice in Korea has held for thirty-five years, but peace is far from secure. North Korea makes no secret of its desire to consolidate the peninsula under Northern control. If and when that desire achieves critical mass, the South Koreans and their US allies could, at best, expect a few hours' warning of invasion.

Brig. Gen. James E. Chambers, PACAF Deputy Chief of Staff for Operations, brought the symposium audience up to date on allied concerns about the North Korean order of battle.

At the time of the armistice, each side backed off two kilometers, creating a Demilitarized Zone (DMZ) in between. Soon, however, they began inching up, seeking slight advantages of terrain and better observation points. As a result of these incursions, the hostile guard posts are now separated by several hundred yards rather than four kilometers, and exchange of gunfire is not unusual.

General Chambers said that the North Koreans learned some military lessons from the war, when their human-wave tactics failed and allied fighters broke up their long logistics lines. Today, sixty-five percent of the North Korean military force is massed along the DMZ. Ten thousand AAA guns defend against airplanes. The artillery is heavily bunkered, some of it in caves, and is virtually inaccessible to air attack. North Korean aircraft and armor are also kept in underground shelters.

—Photo by Randy Chapman

CHAMBERS: Big problem is North Korea's special forces.

The allies do not know how many tunnels the North Koreans have dug under the DMZ, but the number is significant. They provide concealed routes for invasion.

North Korea has a large fleet of tactical aircraft, but most of them are old. More important, General Chambers said, North Korean pilots fly only three to six sorties each per month, not enough for real proficiency. The South Koreans and their US colleagues average fourteen to eighteen sorties a month.

"The biggest problem is North Korean special forces," General Chambers said. "They are 80,000 to 100,000 strong, and about half of them are forward-deployed. They can come over land, under land, by water, or by air."

The North has about 250 An-2 Colt aircraft, each able to carry about twelve special forces paratroopers and their gear. "It's a simple airplane—high wing, great visibility," General Chambers said. "It takes off at 100 knots, flies at 100 knots, and lands at 100 knots. It's a difficult target to pick up on radar. When you do pick it up, it's hard to shoot down. It has a fabric cover, and it's a low heat source."

Some of the An-2s would likely get through, but a great many of them would be lost. The North Koreans would be flying them over mountains and down valleys mainly at night and at altitudes of fifty to 100 feet. That should generate heavy attrition, even if the Colts could avoid defensive fire. Land and sea penetration routes would probably work better for the commandos.

A fundamental goal of the allied war plan is that Seoul, the South Korean capital, not fall. Since Seoul is a scant thirty miles from the DMZ, the defense cannot afford to yield much ground.

In case of war, the allies would try to hold the main invasion forces near the DMZ, beat back special forces attacks where they occur, use tactical airpower to go after chokepoints on the invasion routes, and buy enough time for reinforcements to arrive. ■

A combination of political, budgetary, and technological influences is steering military airpower in new directions.

Winds of Change in Tactical Warfare

BY EDGAR ULSAMER

THE winds of change—mainly political and budgetary in nature—are vectoring US tactical airpower in new directions at an accelerating rate. A combination of factors ranging from arms-control provisions and precipitous budgetary declines to adjustments in national strategy and revisions of allied relationships points to changes in the force structure of the tactical air forces (TAFs). These findings emerged from AFA's national symposium "Tactical Air Warfare—Status and Prospects," held January 21–22 in Orlando, Fla.

SHAPE's Chief of Staff, Gen. Robert H. Reed, told the AFA meeting that the pending INF accord is a pivotal factor. Because the INF accord eliminates this country's INFs *in toto*—from short-range to long-range versions—and thus "puts us back into the situation we had in 1979," tactical airpower once again becomes the principal provider of "deliberate nuclear escalation," one of three pillars suporting the Alliance's "flexible-response" strategy. Tacair's tasks associated with the conventional warfare component of NATO's flexible defense strategy—direct forward defense of the Alliance's territory—remain unchanged, General Reed pointed out. Direct defense is the initial phase of flexible response.

The direct defense task—supporting NATO's ground and naval forces—potentially involves six land and three maritime campaigns in or near different regions of the Alliance and, of and by itself, necessitates major upgrades of US and NATO tactical airpower, he pointed out. Deliberate nuclear escalation interposes a firewall between the possible crumbling of direct defense and general nuclear war, the third element of flexible response. Deliberate escalation, meaning the selective employment of in-theater nuclear weapons, is intended under NATO's doctrine to send a "primarily political signal to our enemies of our determination to do whatever is necessary to defend the integrity of NATO's territory," SHAPE's Chief of Staff underscored.

Three Categories

The first rung of the escalatory ladder is formed by nuclear artillery (with a range of up to twenty kilometers) and the twenty-five-year-old, obsolescent Lance short-range nuclear missile with an effective reach of up to seventy-five km. The second component of the "deliberate escalation" deterrent force is furnished by both shorter- and longer-range dual-capable

aircraft (DCA), in the main F-16s, F-111s, and Tornados. The third component of deliberate nuclear escalation at present is made up of INFs that, because of their extensive range, "can bring a large target base in the USSR under threat [and thus have] enormous deterrence value," General Reed emphasized.

Three types of nuclear weapon systems make up the INF force and are to be eliminated under the INF accord. The first type is the German-operated Pershing IA missiles—whose nuclear warheads are under US control—with a range of some 250 km. The Pershing IAs will be phased out within three years. Because of aging, these missiles would have had to be replaced within five years. The second system covered by the INF Treaty is the extremely potent, 1,800-km-range, US-operated, new Pershing IIs that can neutralize Warsaw Pact reinforcements and other targets all the way to Moscow. The equally formidable ground-launched cruise missile (GLCM), which can reach "beyond Moscow," is the third system slated for removal under the provisions of the INF agreement.

—Photo by Randy Chapman

SHAPE's Chief of Staff Gen. Robert H. Reed says that with the INF Treaty, tactical airpower will again become the principal provider of what he calls "deliberate nuclear escalation."

Theoretically, General Reed acknowledged, it is possible to argue that the US has sufficient strategic nuclear forces to make up for any shortfalls in NATO's theater nuclear forces (INFs) that will result from drawdowns decreed by the INF accord. By extension, General Reed pointed out, it could be argued also that these US deterrent forces should be based primarily in the CONUS, configured for a "dual-capable" role, and moved to Europe during periods of crisis or tension to serve as a highly visible nuclear deterrent. But there is consensus within NATO that such a scheme would not be credible and, hence, not effective.

"Nuclear burden-sharing" within NATO, he emphasized, is quintessential for credible deterrence. US willingness to use its nuclear forces solely in defense of Europe—"trading, for example, Chicago for Frankfurt"—is not plausible to the Soviets. The considered judgment within the Alliance, therefore, is that a maximum number of European NATO states must share in the nuclear deterrence burden and mission. At present, he explained, eight NATO nations share in this task. But once the GLCMs and Pershings are scuttled, that number drops to only two, the US and Britain.

Because the INF Treaty shifts the bulk of the theater nuclear deterrence role to tactical airpower, the resulting central modernization requirement is for a "tactical air-to-surface standoff missile [TASM] with a range of between 250 km and 400 km to allow us to broaden the target base that we could bring under threat," General Reed continued. Such a TASM, he explained, would not only compensate for some of the lost range and capabilities incurred with the demise of the INFs but also—by dint of its nuclear standoff capability—"help work the penetration problem for tacair." TASM, he emphasized, ought to be an air-to-surface weapon that can be put on F-16s, F-111s, Tornados, and, when operational, F-15Es.

The European NATO nations, General Reed told the AFA meeting, "have indicated that they would support and buy such a system—but it is essential that the US take the lead" in the design and production of such a weapon. SHAPE's position on TASM, General Reed elaborated, is that the missile must be cost-effective, preferably should have a range of 400 km but definitely not less than 250 km, and ought to be operationally available "as soon as the GLCMs and Pershings leave." Stressing that SHAPE by no means wants "to tell USAF how to build it," General Reed acknowledged, however, that a version of SRAM II, dubbed SRAM IV, is seen within NATO as a candidate for the TASM role.

"In the current budget environment . . . adapting SRAM II [rather than starting a new design at high cost and with a development time of about fifteen years] makes sense economically." He hinted that Britain might want to participate with the US in the development of a SRAM-derived TASM. While agreeing that under certain circumstances air- and sea-launched cruise missiles could serve as a backup for TASM or be configured as conventionally armed standoff weapons, SHAPE's Chief of Staff suggested that any cruise missiles with a range greater than 500 km might not be compatible with the provisions of the INF Treaty. That would be especially true if such cruise missiles were to be based in Europe.

Filling the INF Void

Another aspect of tactical airpower deserves immediate attention and could compensate for the loss in deterrent capabilities resulting from the scrapping of the INFs, according to General Reed—the longer-range component of USAF's European tacair assets, which must be beefed up rapidly and broadly. One way of accomplishing this end, he pointed out, would be "increased deployments [of F-111 aircraft] from the US."

Another pressing modernization requirement that flows from the INF Treaty's provisions involves NATO's short-range nuclear forces. NATO's sole short-range nuclear missile, the Lance, General Reed said, was first fielded in Europe in 1963 and "will become totally obsolete by about 1993." He conceded, however, that replacing the Lance could entail political agonies in Europe akin to those encountered when the GLCMs and Pershing IIs were fielded several years ago. Ideally, the Lance replacement system should have a range of between 250 km and 400 km.

In pegging basic NATO counterair requirements over the next two decades, a number of Western misconcep-

tions and some deliberate obfuscations floated by the Soviets need to be cleared up, according to SHAPE's Chief of Staff. He placed under the rubric of "dubious assumptions" the US "Counter-Air 90" study's categoric contention that, in the future, tacair would neither be survivable nor be able to penetrate and that the Warsaw Pact almost certainly would put NATO's airfields out of commission. Counter-Air 90's nostrum, therefore, became the ballistic missile, which was touted as the central force structure requirement. These theater ballistic missiles, the study postulated, would be used at the outset of a conflict to devastate Warsaw Pact airfields. Once the airfields were put out of commission, fixed-wing aircraft from the US and elsewhere would be brought in from outside the European theater. This tenuous scenario obviously skews NATO's real force structure requirements in the counterair sector, General Reed pointed out.

Building on persistent, nagging questions about offensive counterair vs. defensive counterair issues, the Soviets are now offering to trade some of their tank forces for a cut in NATO's "offensive" fighter force, meaning mainly US fighters. The catch, General Reed stressed, is that the equation supporting this offer ignores the fact that 1,715 Soviet aircraft portrayed as defense interceptors are in fact dual-role aircraft equipped also to perform offensive air-to-ground missions.

Dispelling the notion in vogue with US "think tanks" that NATO has overstated the Soviet threat in Europe, especially in terms of tacair, General Reed reported that SHAPE's analyses show that a state of approximate parity exists in the NATO vs. Warsaw Pact aircraft force balance. When "in-place" forces along with reinforcements and strategic reserves on both sides are counted, the overall fixed-wing aircraft balance shows a ratio of 1.2 Warsaw Pact aircraft for every NATO aircraft. On the other hand, the ratio of multirole ground-attack fighters (FTR GA/MR) is 1.13:1 in favor of NATO.

Based on these factors in combination with NATO's agreed-on threat projections and modernization requirements, SHAPE recently completed a two-band study of Allied Command Europe's (ACE) air force structure requirements, with emphasis on counterair capability, projected out to the year 2005, General Reed told the AFA meeting. The study covered a range of capabilities and specified recommended force levels to be in place by 2005.

While the specific cost and force level figures are classified, General Reed was able to cite relative percentage values. In the more moderate "base case," the recommended growth over already programmed 1995 force levels comes to thirteen percent in air-to-ground and five percent in air-to-air capability. Corresponding boosts in multirole capability are pegged at eight percent, in EW at twenty-two percent, and in drones (mainly radar attack drones, of which 400 are expected to be in NATO's 1995 inventory) at ten percent. The number of medium-range SAMs is to go up by fifteen percent, SHORAD air base defenses by eighteen percent, and airfield damage-repair capabilities are to be doubled at forty-four bases by 2005, according to the NATO "base case" recommendation.

The Alliance, in principle, has "signed off" on this force structure plan for 2005, General Reed reported. It is "less certain" that the Alliance will approve the more ambitious "growth case" recommended and deemed essential by twenty-five ranking NATO military experts. These recommendations are more ambitious, calling, for instance, for boosts in air-to-ground capability as well as in multirole force levels of twenty-five percent and in air-to-air and EW capability of about seventy percent.

—Photo by Arthur Hyland

Among the challenges facing Air Force Systems Command's Gen. Bernard P. Randolph is bringing the Joint STARS program up to speed and developing a new generation of standoff weapons.

The More-for-Less Dilemma

After declines in the US defense budgets over the past two years, the most optimistic, authoritative forecasts about the outyears through FY '94 are "for no more than two percent real growth per year," AFSC Commander Gen. Bernard P. Randolph told the AFA symposium.

The Joint Surveillance and Target Attack Radar System, or Joint STARS—a "revolutionary system that will be the TAFs' AWACS for the ground war" and a weapon that General Reed and other symposium speakers identified as imperative for enhancing NATO's tactical warfare capabilities—typifies AFSC's current budget plight, according to General Randolph. Even though Congress over the past two years took some $100 million out of Joint STARS, AFSC is expected to maintain the original schedule. Joint STARS's purpose, he explained, is to look "day or night and in weather beyond the forward line of troops deep into enemy territory, detecting, locating, tracking, and classifying tanks, trucks, and other slow-moving targets. With that data, the right Army or Air Force weapon can be applied."

First flight of the Joint STARS platform, a heavily modified Boeing 707, or EC-18C, is now scheduled for this spring and confined to safety-of-flight and antenna tests. The funding cuts sustained by the program made it impossible to provide the test vehicle with full-up systems capabilities, he added. Joint STARS's operational testing, meant to "get the bugs out and prove operational value for the user before production," is to get under way in Europe in FY '90. While the original schedule called for start of production in FY '91, the AFSC Commander said that this goal probably would not be met. Early next year, the Defense Acquisition Board

(DAB) is to review the program in terms of schedule and available funds, he reported.

The biggest challenge AFSC faces in Joint STARS's development involves the software associated with the system's twenty-seven major processors. This represents some 500,000 lines of code, "most of it new." The system's software function is to "draw the targets out of the clutter and display them in usable form, [which turned out to be a job tougher than we thought], but certainly doable," commented Lt. Gen. Melvin F. Chubb, Jr., the Commander of AFSC's Electronic Systems Division. He added that "it's going to take us one year longer to get the software done, [but] I guarantee we will get it done. It's going to be one of the greatest weapon systems we ever had."

The first Joint STARS aircraft is at a contractor's facility in Florida, and "we have . . . the software to lay out all of Florida and a good part of Europe," the ESD Commander reported. The key hardware challenge associated with the Joint STARS program, he said, is the system's twenty-foot-long antenna, which is "crammed full of electronics [that in practical terms represents] roughly 400 little radars. That's tough to build, and it's going to be even tougher to test." Building the Joint STARS antenna is "at least ten times more difficult than building the AWACS antenna, [because the former needs] to cover roughly a corps area in very rapid sweeps."

AWACS Upgrades

One of ESD's and AFSC's most extensive and important upgrade programs in support of tactical airpower requirements is AWACS. With sixty-eight AWACS E-3s on or approaching operational status—and a strong potential that this number may reach 100 units—this system has "become a winner all over the world," General Chubb pointed out. General Randolph added that USAF operates thirty-three E-3s, NATO eighteen, Saudi Arabia five, France is buying at least three, Britain at least seven, and "Italy, Japan, and others are interested." The central challenge confronting the Air Force, the AFSC Commander pointed out, "is to keep the system viable into the twenty-first century." This, in turn, mainly means improving AWACS's jam resistance and its ability to cope with cruise missiles and other low-radar-cross-section stealthy targets.

Two major E-3 upgrade programs are key here, he explained. One is known as the Integration Contract, or ICON, which adds Navstar GPS (global positioning system) capabilities, memory upgrades, and JTIDS (Joint Tactical Information Distribution System) Class 2H terminals as well as—possibly most important—electronic support measures (ESM).

He added that the US and NATO have signed a joint development contract that allows AFSC to spread development across a larger fleet size and gives a "big boost to interoperability." Discussing part of the E-3's memory upgrade, General Chubb told the AFA meeting, "We are going toward [magnetic] bubble [technologies] and other advanced processing [to] increase computational power at least tenfold."

The second set of upgrades is known as RSIP, for radar sensitivity improvement program. RSIP, which should be ready for production in FY '91, "will preserve our capability to detect increasingly small targets far enough out to effectively engage them. This is vital, as cruise missiles are becoming more and more of an issue." Soviet low-observable systems, General Chubb elaborated, are rapidly "going down" in size, and the US has to "step up to this challenge."

He added confidently that the AWACS upgrades "will see low observables . . . at least until the year 2000." The Air Force, he pointed out, is looking at this challenge "not just in terms of radars but lots of other things." He mentioned bistatic radars in this context as long-term, billion-dollar solutions. The idea is to "illuminate targets from space or aircraft and bistatically [with the radar's receiver on a different platform from that of the transmitter] pick up those signals. This opens up new vistas."

Another way of coping with stealthy targets, the ESD Commander said, is by means of advanced IR cameras employing staring arrays of some 100,000 elements. These devices, he explained, can see the skin and engines of B-52s through "pouring rain" or the separation of a Titan 34D booster system under any weather condition. Representing a "thousandfold improvement" over such existing scanning IR systems as LANTIRN, these new devices "are not only cheap but can look right through smoke and see a tank, aircraft, etc." This capability, combined "with radar, makes obvious what we can do with small targets and low observables regardless of what domain the low-observable [target] is in."

These advances, in turn, "get us ready for 'smart skins,' [some of which] we have already built . . . to look at stealthy targets. We now can detect and track birds, [a capability that] is in the stealth realm." The big question about AWACS, General Chubb pointed out, hinges on one of two choices: either complying with one school of thought that recommends going to entirely new approaches involving bistatic radars—"and here you are talking about a $10 billion kind of program—or to improve AWACS incrementally." The tactical air forces have opted for the latter approach, he added.

Stepped-up Concern With Standoff

Tacair's principal battlefield task is to deliver firepower. But as General Randolph pointed out, increased standoff and true launch-and-leave capabilities will be indispensable for "future [USAF] fighter pilots to fight and win outnumbered." The Soviets, he warned, have fielded more than 10,000 air-surveillance radars "within and beyond [their] borders [along with] 4,800 tactical surface-to-air missile [SAM] launchers—not including handheld—and 12,500 antiaircraft pieces." One of the Air Force's major tactical standoff systems, the AGM-130, is in jeopardy because of the program's "snake-bit" development, the AFSC Commander reported.

The AGM-130—a GBU-15 whose low-altitude range is tripled with the addition of a rocket motor and modified guidance system—is "needed badly" by the tactical air forces, but because of initially poor test performance "has not exactly inspired confidence among decision-makers. . . . The program is on the chopping block." Ironically, a recent test came off flawlessly, contributing to AFSC's conviction that "we have turned the corner after a year and a half of unsuccessful tests."

AFSC could deliver the first AGM-130 to TAC by the early 1990s if production money for the FY '88–94 period is forthcoming. The 2,000-pound-warhead AGM-130, General Randolph pointed out, is "one-half the cost of alternate weapons. Nothing else can kill hard targets with single-shot precision."

The AFSC Commander also reported that "Have Nap, also known as Popeye, an Israeli TV-guided long-range standoff missile, [has been] tested on B-52s for SAC, and over the next year, we will test it on the F-111 for TAC." Israel's Rafael is the prime contractor, with Martin Marietta the potential US coproduction source. The weapon's first two tests on B-52s suggest "low maintenance requirements and very high availability, [making it SAC's] weapon of choice to meet near-term standoff requirements," according to General Randolph.

But there is a down side: Because of Have Nap's small warhead—720 pounds—"it is only capable against relatively soft targets." He added that "the jury will be out for some time on Have Nap vs. the AGM-130 and the Navy's SLAM."

—Photo by John Aseltl

Joint STARS, a significantly upgraded AWACS, and advanced infrared cameras are among the hurdles facing Electronic Systems Division and its commander, Lt. Gen. Melvin F. Chubb.

Over the longer term, the Air Force is embarking on a seven-nation development effort involving modular standoff weapons (MSOWs) that, depending on module matching, could provide maximum ranges as short as twenty to thirty miles and as long as 300 miles, General Randolph told the AFA meeting. The MSOW program is in source selection, with full-scale development predicted for FY '92.

Four Advanced Concepts for Standoff

The Air Force is working on yet another generation of standoff weapons, "true launch-and-leave weapons for the twenty-first century, called brilliant, autonomously guided munitions," according to the AFSC Commander. In this context, AFSC is exploring four brilliant munitions concepts for TAC as part of the so-called balanced technology initiative (BTI), which involves "dollars set aside by Congress as seed money to finance new technologies with the promise of leapfrogging recent Soviet advances in defensive capabilities." He added wryly that Congress cut the Pentagon's FY '88 BTI request from $300 million to $100 million.

One of the four concepts, labeled AGW, for autonomous guided weapon, is meant to guide a Mk 84 warhead against high-value, fixed targets by means of an imaging infrared seeker. Initial tests have shown that "the seeker works very well in finding and tracking such prebriefed targets" as bridges, powerplants, or runways, even under adverse weather conditions, General Randolph reported.

Another concept, the Millimeter Wave Weapon, involves a standoff technology that relies on an autonomous, lock-on-after-launch feature to allow attack of mobile air defense targets. Maverick missiles guided by millimeter wave sensors underlie this approach, according to the AFSC Commander.

Even more ambitious brilliant standoff technologies are being pursued by AFSC under the headings of tactical Laser Radar (LADAR) and Advanced Synthetic Aperture Radar Guidance (ASARG), respectively. LADAR builds on the successes the Air Force reaped with two-dimensional imaging infrared seekers by adding a third dimension—range—to achieve complete 3-D imagery. LADAR, General Randolph reported, "has done well in picking tactical targets out of clutter because of outstanding resolution." LADAR, he added, is also being looked at by AFSC to provide midcourse navigation, terrain-following, and obstacle avoidance—in addition to the precision terminal homing function—for the cruise missile advanced guidance project.

The fourth concept, ASARG, is meant to overcome limitations in terms of acquisition-range and adverse-weather performance that afflict even the best existing passive and active IR systems. ASARG will provide "an all-weather imaging capability with high-resolution microwave or millimeter wave radar images," according to General Randolph.

Clutched In on ATA and ATF

The Air Force position "is that ATA [the Advanced Tactical Aircraft, now designated A-12 and under development by the US Navy as the lead agency] is something we are going to buy." AFSC, he stressed, is "plugged into the ATA system program office in a big way."

Concomitantly, the Navy is working very closely with the Air Force on the latter's ATF (Advanced Tactical Fighter) program. The Navy funded studies involving the ATF contractors that "have clearly shown that there are no impediments in the current design of ATF that might stop its adaptation to the carrier role," he disclosed.

The Navy has so certified to the Secretary of Defense, who in turn will so certify to Congress.

The ATA and ATF, he stressed, are two very different aircraft with two very different missions; ATF is an air-superiority fighter, and ATA is an air-to-surface attack aircraft. The Air Force leadership has informed the ATF contractors that—budget cuts notwithstanding—"we are sticking with the ATF schedule and funding to the best of the Air Force's ability. We intend to continue this program, we need ATF, and we will keep our commitment with industry." ■

Edgar Ulsamer, a longtime Senior Editor of this magazine, retired last summer, but still keeps close tabs on aerospace issues.

Despite some intramural feuding—mostly at lower levels—the Air Force and the Army are cooperating on doctrine, tactics, and equipment.

Sorting Out the AirLand Partnership

BY JAMES W. CANAN
SENIOR EDITOR

THERE is a deep-seated suspicion in Army ranks, if not at the top, that the Air Force regards close air support of the infantry as a mission of minor importance alongside that of air superiority, in which hot fighters do their stuff high in the sky and at far remove from the grunts on the ground.

According to those of such persuasion, the Air Force's undue fascination with air superiority is reflected in an unspoken policy of favoritism for air-combat fighter pilots that translates into "no medals below 30,000 feet and no promotions below 14,000 feet"—not much exaggeration intended.

This viewpoint is not new. Many in the Army have harbored it ever since the Air Force broke away to become a separate service in 1947. It is being heard more and more, however, as the two services wrestle with topical issues of how best to team up in warfare.

Among these is their mutual prosecution of the close air support (CAS) mission—the Air Force with fixed-wing aircraft, the Army with attack helicopters.

The Air Force is greatly pained by accusations that it slights CAS. The notion is especially galling to Tactical Air Command at Langley AFB, Va., where working with the Army is an accepted way of life and where helping the Army wage and win the decisive land battle is ungrudgingly acknowledged as TAC's reason for being.

TAC Commander Gen. Robert D. Russ takes strong exception to it. He notes that the Air Force "signed up for the close air support mission" right from the start and "has done it superbly" in all combat ever since.

Changes in CAS

"The Army has been delighted with our close air support," the TAC Commander declares. "Army people who have been in battle will tell you what a great thing it has been. The senior leadership of the Army solidly supports the idea of the Air Force doing close air support."

General Russ also points out that

The F-15E dual-role fighter plays a major role in Air Force plans to support the Army's AirLand Battle doctrine with battlefield air interdiction (BAI) sorties against ground targets deep beyond the forward edge of the battle area (FEBA). The first USAF F-15E is shown here at its production rollout. The fighter's versatility is symbolized by its carriage of air-to-air missiles, left, and of air-to-ground munitions, right.

USAF devotes nearly one-third of its tactical fighter wings to CAS and that it puts a premium on air superiority for the most legitimate of reasons—controlling the air makes it possible for ground-attack aircraft on CAS or battlefield air interdiction (BAI) missions to succeed and survive.

This is exactly why the Air Force needs the Advanced Tactical Fighter. The ATF is designed to fly cover for ground-attack aircraft far beyond the forward edge of the battle area (FEBA), a feat that contemporary air-superiority fighters would be hard-pressed to accomplish in the face of increasingly formidable Soviet fighters and surface-to-air missiles. Those fighters and SAMs are changing the nature of conventional warfare that could lie ahead. But they are only part of the picture.

Also in it are many other new weapons and command control communications and intelligence (C^3I) setups for air and ground that are being fielded or developed by the US, the Soviet Union, and their respective allies.

All are making the modern battlefield a much more lethal and mercurial arena, one that is characterized by ever-greater speed, range, precision, and mobility of weapons and forces.

This is most pointedly the case in Europe, where the ability of both sides to engage in conventional warfare assumes greater importance amid the drawdown of intermediate-range nuclear weapons now in the cards.

The key to US prosecution of such warfare is the Army's AirLand Battle doctrine, in which the Air Force is deeply involved. Both services are working harder and more harmoniously than ever to field the forces and weapons and to develop and implement the combined-arms tactics that the doctrine demands.

Ironically, their concerted efforts are giving rise to controversies over roles and missions that are pegged to such questions as:

- Which service should be responsible for close air support, under which circumstances, and with what kinds of aircraft?
- Should the Army, given the increasing ranges of its artillery shells and rockets, have more to say about deep interdiction, a mission traditionally reserved for the Air Force?
- Is the Air Force's control over the offensive counterair mission in danger of being undercut by the Army's move to mount air-to-air missiles on its attack helicopters?

In its development of tactics for AirLand Battle, the Army has come to rely more and more on mobility of troops and on supporting them from the air. The point is made in this scene of a Cobra attack helicopter shepherding armored personnel carriers.

The AirLand Battle doctrine is bringing such questions to the fore—not so much because the services are steeped in parochialism, but because they must iron out their differences in order to make the best use of their increasingly versatile weapons and forces for the benefit of both.

The Key Elements

The key elements of AirLand Battle are the close-in fight at the FLOT (forward line of own troops) that involves CAS, the "deep fight" beyond the FLOT against enemy rear-echelon units moving up as reinforcements, which involves BAI, and the protection of friendly forces in rear areas against enemy operational maneuver groups (OMGs) capable of penetrating there aboard helicopters or over land.

In such circumstances, the linear battlefield is no more, and close air support becomes a much more ubiquitous and perilous mission.

As General Russ explains it: "The traditional understanding of CAS was that of fire support for our troops on this side of a line against theirs on the other side of the line. That's no longer the case. The line has turned fluid.

"Our Army now has the ability to pick up troops with helicopters and drop them on the other side, and the Soviets can do the same.

"So we would find ourselves in a very different situation—a battlefield with some of our troops behind theirs and some of theirs behind ours. There won't be a continuous line. It will look more like a sine wave, with pockets going in both directions."

Consequently, says the TAC Commander, CAS aircraft will almost certainly have to overfly enemy mobile SAMs and increasingly lethal, numerous, and accurate antiaircraft guns while heading to and from their assigned CAS arenas—"and this means that the A-10 becomes outdated. It is a good CAS airplane, excellent at what it does now. But it's too slow to survive the battlefield of the 1990s.

"And that's why we need a modernized CAS airplane."

For CAS in the coming decade, the Air Force has in mind a two-

seat, A-16 variant of the F-16, an inherently superb air-superiority fighter that is now being deployed mainly for ground attack. But the A-16 has its detractors outside the Air Force. They contend that the A-16, unlike the A-10, would not be built for punishment and could not withstand the hits from ground fire that it would inevitably take, no matter how fast it might fly.

General Russ says that this misses the point, which is: "We don't want to get hit. If a CAS airplane is heavily armored, but isn't fast and doesn't go anywhere, sooner or later somebody is going to come up with a shell that will be able to knock it out of the sky."

He adds: "There are those who would like to go back in time. They say to us, 'No, the battlefield of the 1990s won't look the way you see it, and we want all of our airplanes to be on this side of the line in the classic sense of CAS.'

"If their view is correct, then we probably don't need a new CAS airplane, and there's no hurry in getting one. But I believe that if they would look at the realities—the surveillance systems that are seeing deep, the helicopters and their mobility, and other elements, they would see our point."

Critics of fast fighters for CAS also argue that they would lack crucial CAS characteristics peculiar to the A-10 or to the propeller-driven "mudfighters" favored by some. Among such characteristics are the ability to loiter and to eyeball troops on the ground so as to hit the enemy and miss the friendlies.

TAC's view, on the other hand, is this: There is no way that any aircraft will be able to survive while loitering over the lethal modern battlefield, and the air-to-ground accuracy of the F-16 at high speed has been amply demonstrated over and over.

What is more, says Maj. Doug Jenkins, assistant chief of the TAC Commander's Action Group, "CAS aircraft will also have to be able to penetrate through the FLOT to attack targets traditionally associated with BAI."

Why? Because the real-time intelligence of battlefield situations on which AirLand Battle is predicated will make it possible to attack targets of opportunity beyond the FLOT in wide variety and at the drop of a digit from computer-controlled, airborne reconnaissance platforms. As a result, all attack aircraft will be in heavy demand and will have to be versatile.

This makes orphans of single-purpose CAS aircraft. They will not fit into the "force packaging" of air assets that TAC foresees for its contribution to AirLand Battle.

Enter the A-16

Enter the A-16. Whether it will be the airplane to do CAS and double in BAI, as the Air Force is proposing, is a matter that will be settled later this year. As directed by the Office of the Secretary of Defense, Air Force Systems Command's Aeronautical Systems Division has contracted with several military aircraft manufacturers to study the mating of the CAS mission with the A-16 and with other possible aircraft.

Results are expected fairly soon. The Air Force will analyze them and come to a conclusion around August. The betting is that the Air Force will stick with the A-16.

The Army is staying out of this one. Clearly, however, there is much sentiment among green-suiters in favor of heavily gunned, so-called mudfighters for CAS—the kind that some Air Force officers derisively refer to as "disposable, throwaway fighters."

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Says an Army officer in Washington, D. C.: "If we had our way with CAS fixed-wing aircraft, we could make companies like Beech and Cessna rich overnight."

But the Army leadership is not talking this way. The Army's official viewpoint is echoed by Army Lt. Col. David G. Hofstetter, deputy director of the joint TAC-TRADOC AirLand Forces Application (ALFA) agency headquartered at Langley AFB.

Says he: "The Air Force doesn't tell the Army how to fight the land battle, and the Army doesn't tell the Air Force how to fight the air battle. Unless we're willing to tell the Air Force that it shouldn't be the expert in CAS, we've got to give the Air Force our CAS requirements and let it come up with the right airplane."

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The emphasis that the Air Force gives to support of land force is exemplified by this hunter-killer team of an OV-10 observation aircraft and an A-10 close air support (CAS) aircraft over Fort Irwin, Calif. Above right: An insider's view of an OV-10 spotting for an A-10.

Even so, there is—as there has always been—a strong undercurrent of sentiment in Army ranks to the effect that CAS aircraft should come under the full control of the service they exist to support, be they fixed-wing or not.

Meanwhile, the Army is doing some eye-catching things with its AH-64 Apache attack helicopters in CAS exercises. Equipped with armor-busting, laser-guided Hellfire missiles among other weapons, the Apache has demonstrated to the satisfaction of the Air Force and the Army that it is a formidable CAS aircraft in low-threat environments and that it does surprisingly well now and then in high-threat arenas as well.

Especially is this true when the Apaches work with A-10s, as has been the case for some time in joint air attack team exercises at Fort Hood, Tex., and elsewhere. The Apaches have been resoundingly successful at laser-designating targets for A-10s attacking in two-ship and four-ship flights and armed with Maverick antitank missiles.

As the Apaches lase for the A-10s, they also launch their Hellfires. They have pulled this off as far as twenty kilometers beyond the FLOT, with the Apaches jamming the radars of opposing air defense artillery systems in behalf of the Thunderbolt IIs and themselves. At Fort Hood, Apaches have also practiced attacking in concert with F-16s, sometimes at night and quite deep.

The A-10 isn't much good at night—and this is yet another reason why TAC wants the A-16. The A-16 would come equipped a derivative of the LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) system that is already earmarked for USAF's F-15E and F-16C/D BAI fighters.

Night Capability

As General Russ puts it: "An extremely important change in the way we'll conduct air-to-ground warfare comes from our introduction of firepower from aircraft at night. We have talked about night capability over the years, but our accuracy left something to be desired.

"Now we have it. We're talking about the same accuracy at night as we have during the day. We're talking about *surgical strikes* at night that are going to be really, really good. LANTIRN is critical to this.

"So is the F-15E. It will be able to go in deep and accurately take out command posts, bridges, storage sites—everything—at night, before we go in and drop our area bombs that are less accurate."

A prime factor in Air Force planning for air-to-ground combat, says the TAC Commander, is "our ability to see deeper into enemy territory on a recurring basis, to have much better intelligence on what he's doing, where he's moving, where he's massing."

Vital to this will be the computerized Air Force Joint Surveillance and Target Attack Radar System (Joint STARS) aircraft that is being developed to look deep for enemy armored units on the move and to transmit its digital data in quick time to air and ground commanders.

General Russ would like the pace of Joint STARS development to pick up a bit. The system could come into play in the early 1990s. It will team with reconnaissance satellites, AWACS aircraft, TR-1 surveillance aircraft, and penetrating reconnaissance aircraft to "give the ground commander the ability to see the battle area more fully and deeply than he's ever been able to see it before and on an almost real-time basis," declares General Russ.

"This means that the Army commander, who is generally the overall commander, will be able to see interdiction targets that are the Air Force's to go after, and he will want to have more to say about attacking them—because those forces on which he is getting direct intelligence are the forces that will be in his backyard tomorrow, or within twenty-four hours. The Army is developing some systems that will go back there—ATACMS [Army Tactical Missile System] and others. Therefore, our targeting philosophy and how we do the interdiction mission becomes different from what it was in the past."

The Army's Colonel Hofstetter addresses this difference thusly:

"With BAI targets, the ground commander is able to continuously update target coordinates much better than he used to. He is able to provide the Air Force with mission-type BAI requests, rather than with specific targets, as was formerly the case.

"He can tell the Air Force that he wants to prevent an enemy brigade from crossing a grid line between certain hours rather than telling the Air Force to take out a specific bridge, for example, to make that happen. Then he leaves it to the Air Force tactics guys to figure out how to do what he wants."

A US infantry Stinger team on the lookout for intruding aircraft. Such man-portable, shoulder-fired missiles have become formidable threats to attack aircraft over the modern battlefield and have complicated the requirements for such aircraft.

Air Force Col. Cato L. Reaves, who worked with the Army at Fort Hood and who is now director of ALFA, reemphasizes the importance of Joint STARS in all this. He also notes that "deep-attack doctrine is being revised constantly, because new weapons keep coming into the field"—weapons that make the updating of doctrine and tactics not only possible but necessary.

Maybe the most profound change in this regard is the newfound capability and opportunity—for the Air Force with its attack fighters, for the Army with its tanks and helicopters—to fight at night. M1 tank crews, Apache crews, and Black Hawk troop-carrying helicopter crews are getting good at it.

"We're further ahead with our night-fighting tactics than the Russians are with theirs," says Colonel Reaves with evident satisfaction.

Adds TAC's Major Jenkins: "Our future attack forces will have to sustain continuous operations at day and night and under the weather to support the Army. We expect the future battlefield to present a massive array of armor and other valuable targets. And enemy air defenses will make it critical that we destroy those targets on the first pass."

Variegated Tactics

Those defenses, becoming more menacing all the time, are also causing TAC to develop new, variegated tactics for its ground-attack aircraft.

General Russ explains it this way: "I see the challenge to our tactical fighters as being basically the same in terms of the ground threat, but I see it increasing in terms of the air threat.

"The Soviets are doing better with look-down, shoot-down airplanes. They have the capability now. They'll have it in numbers by the mid-1990s.

"That's what's driving our date for [operational capability of] the ATF. It will have the ability to get in there and fight with them.

"But they'll have good look-down, shoot-down capability out in force by then, including their [Mainstay] AWACS airplane, and we are going to have a different regime to worry about—the low-altitude regime in which we now penetrate.

"So I see our tac forces going in at low, medium, and high altitudes, using the whole spectrum. We will need to be unpredictable, though. We may go in low one day and at 10,000 feet the next. Or both."

As Air Force interdiction tactics are fine-tuned to take advantage of the full sweep of the sky, and as Army shells and rockets reach out farther and farther, major problems are looming.

They have to do with interdiction targeting and with management of airspace. And they have generated a behind-the-scenes interservice duel over BAI that is said to be potentially more inflammatory and more divisive than the one over CAS.

The Army's newest 155-mm artillery round has a range of seventeen miles. The Multiple Launch Rocket System (MLRS) now in all-out production for the Army exceeds that range by at least a couple of miles.

ATACMS missiles, ballistic in nature, will outdistance both by far. The first test-launch of an ATACMS missile was scheduled for last month, as was the first flight of the prototype Joint STARS aircraft on which ATACMS batteries ultimately will rely.

Air Force attack pilots have never had to worry about getting hit by the Army's artillery. Chances of that happening were minuscule. It has always been a case of big sky, little bullet.

Now the odds are shortening, especially in situations where low-flying attack aircraft and artillery happen to be shooting at the same target at the same time, which would be a wasteful duplication of effort in itself.

So who will be in charge of seeing to it that this doesn't happen in a given combat theater? The ground-component commander? The air-component commander?

The easy answer is the theater commander, but he may not be able to afford to become preoccupied with interdiction targeting and with allocating air and artillery on all occasions while coping with command and control on a grand scale.

What it comes down to is that there is no easy answer. The issue threatens to cause "a whole lot of table-pounding and yelling" between the Air Force and the Army, one official says.

A Soviet Mi-24 Hind-E ground-attack helicopter bears down on a target. Countering such choppers would not come easily.

Prime Weapons for the Future

One thing is clear: Standoff weapons, such as ATACMS and MLRS (the latter has marginally standoff range), are coming into their own, slowly but surely, as prime weapons for the future.

North American and European companies have teamed up by the dozens to develop a variety of such weapons called MSOWs (Modular Standoff Weapons) to be launched from air and ground in long-range attacks against fixed targets, such as command posts and airfields, and in short-range attacks on fixed targets, such as stationary SAMs, and on mobile targets, such as armored columns.

General Dynamics and Rockwell International are leaders of two transatlantic teams of companies competing in the MSOW program. It has gained great political and military impetus from the INF agreement, which at this writing seems headed for ratification by the US Senate.

Air Force Chief of Staff Gen. Larry D. Welch has made it known that the Air Force, which has been accused of having a negative attitude toward standoff weapons, supports the MSOW program.

USAF has eyed standoff weapons for quite a while, but has not moved out smartly to bring them along. Its AGM-130, a longer-range, partly powered variant of the GBU-15 glide bomb, barely qualifies as a standoff weapon and is in danger of dying for lack of funding.

General Russ sees standoff weapons as being well-suited to attacking some targets. But he warns against regarding them as do-alls and as wholesale replacements for manned attack aircraft.

"I'm all for standoff missiles," he asserts, "but the problem with them is that they are very expensive, and you have to weigh them against the value of the targets you're firing them at. It may be worthwhile to fly them against airfields, but you certainly don't want to fly them against trucks.

"Then what happens to the trucks? Who kills the trucks?

"What we need is a full spectrum of weapons—high-cost weapons against high-value targets and lower-cost weapons against lower-value targets.

"People may argue about what the attrition of airplanes will be, but I'll guarantee you what the attrition of a ballistic missile is. You launch one, and it doesn't come back. And interdiction is not a one-shot effort.

"People also talk about how dense the threat is against airplanes, but sooner or later in warfare, the threat will get less dense, to the point where you can reattack over and over, and it will be much cheaper and more effective to do it with iron carried on airplanes."

The TAC Commander makes the point that standoff weapons may be coming along but are not here yet—and until they are, he must go with what he has, meaning manned fighters.

"There are those who have said that fighters can't penetrate anymore, so let's do away with them and buy a force made up wholly of unmanned fighters—drones. Hey, wait a minute. Remember all the money we've invested in fighters and their weapons?

"I'm not here to provide all fighter pilots with a seat to fly in. I support standoff missiles and drones when they have a purpose. But we can't just divorce ourselves from what we already have. We can't erase that and start with a clean sheet of paper and draw up what the new force is now all of a sudden going to look like.

"Our fighters are tied in with the Army, with the maneuvering and the firepower that the Army and we can deliver. And if we put in a new surface-to-surface missile, for example, we have to figure out how to integrate it with the new look and flexibility of tacair and with our scheme of maneuver with the ground forces."

Two Unmanned Weapons

General Russ's fancy has been caught by two unmanned weapons designed to attack ground targets—Northrop's jet-powered Tacit Rainbow remotely piloted vehicle and Boeing's Seek Spinner prop-driven RPV.

Tacit Rainbow, designed to home on radars, is slated for low-rate initial production late this year, and USAF is seeking a second-source contractor for it. It could also be used for jamming. Northrop describes it as "a low-cost, loitering missile system designed to precede friendly aircraft into selected land or sea target areas, search out hostile radars, and then automatically track and disable those radars to clear a path for tactical aircraft."

Ground-launched variants could be launched from the Army's MLRS. From the air, the drones could be launched by fighters or bombers. General Russ wants to leave his fighters out of the picture.

He calls Tacit Rainbow "a good weapon," but resists mounting it on fighter store stations, preferring to reserve them for bombs.

"I can put a 2,000-pound bomb on that station or a 1,000-pound bomb or a Tacit Rainbow with a forty-pound warhead. When I'm going after something big on the ground, I would like to have the bigger bangs on that station.

"Historically, we have taken the position that we'd rather have Tacit Rainbow ground-launched. And if

The Army is intent on arming its attack helicopters with air-to-air missiles to enable them to defend against Soviet helicopters similarly armed. The top picture shows a Stinger mounted on an Apache alongside ground-attack missiles. In the photo directly above, an Apache launches a Sidewinder during a recent test.

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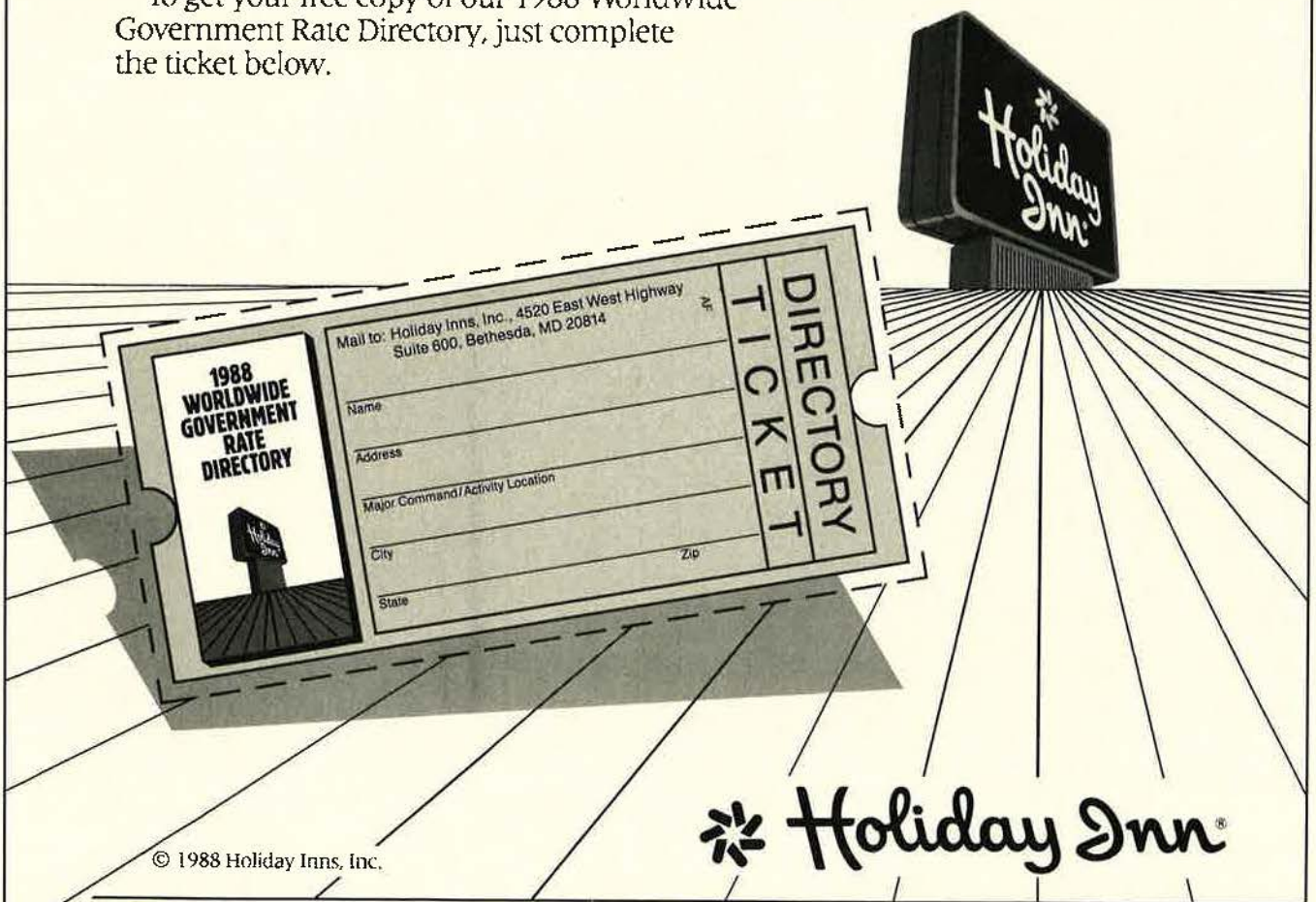

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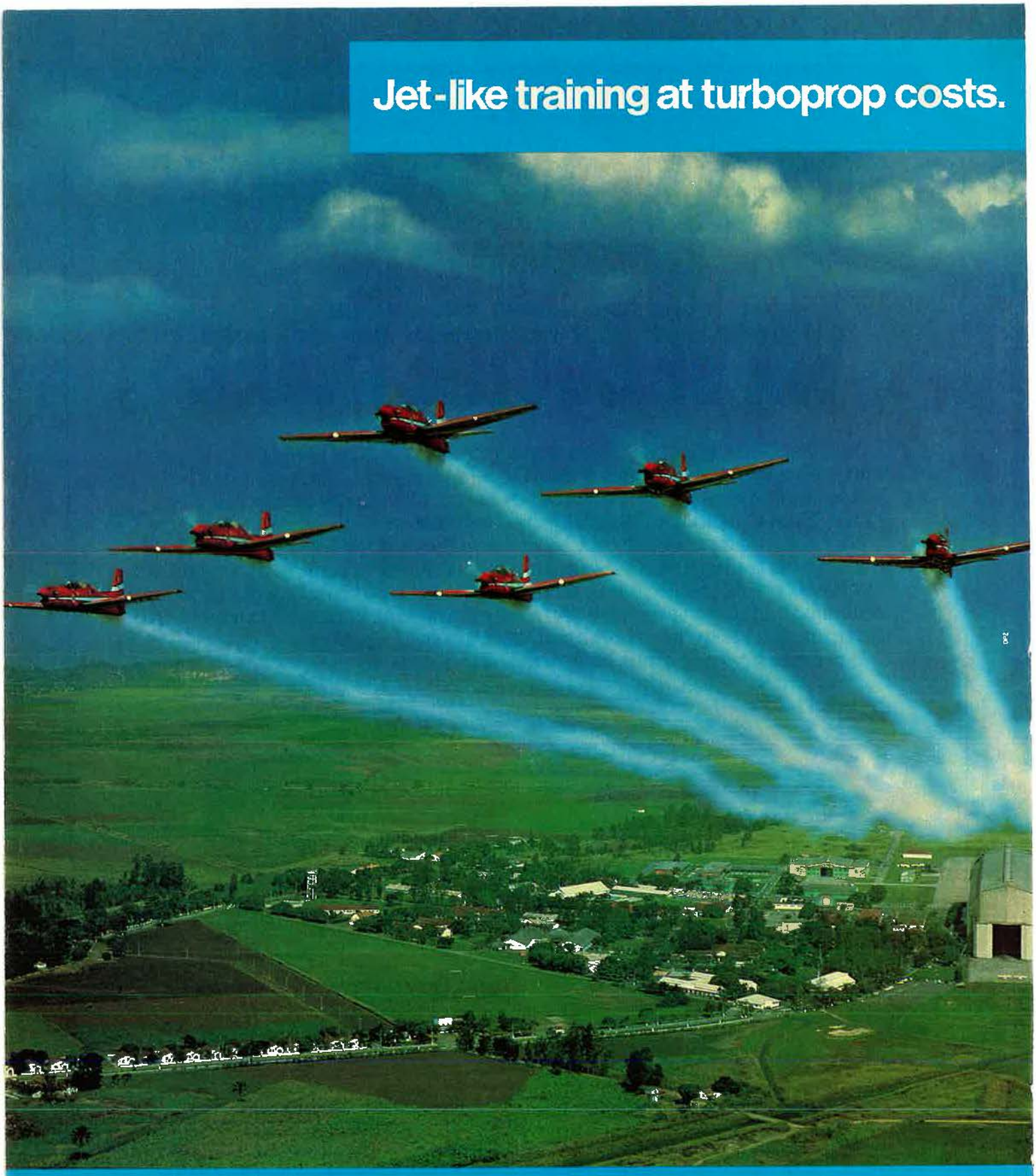

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the Army is going to develop it, why does the Air Force have to, too?

General Russ points out that Seek Spinner, on the other hand, is an exclusively Air Force program tailored to TAC's forces in being.

"The tactical forces like it," he says, "because it's a little putt-putt, with a propeller, that folds its wings, can be taken out on trucks, and launched thirty or sixty at a time or however many you want.

"It does the same things as Tacit Rainbow. Both go about the same distance. Tacit Rainbow is a little faster, but Seek Spinner has more loiter time and costs less.

"We can better integrate Seek Spinner with the tac forces we have. We can launch them from the ground to open up corridors for us and then follow them in with fighters and strike. We would have to take Tacit Rainbows up on fighters and launch them from our side. Why would I want to do that when I can launch Seek Spinners from the ground and have my airplanes fully loaded with bombs?"

He acknowledges that air-launching Tacit Rainbows would come in handy "if you want to take them a long way, like to Saudi Arabia, to do it against Iran. So we say, load them up on B-52s, which can carry a ton of them. But not on fighters."

TAC got a scare earlier this year when it was proposed within OSD that the Air Force abort the F-15E production program and bank the big money thus to be saved against the day that it will begin buying ATFs and, as presently planned, the Navy's air-to-surface A-12 Advanced Tactical Aircraft.

"That was a bankrupt idea," General Russ asserts. "Trading our 'now' capability for future capability and docking ourselves for a number of years would not have been a good thing to do."

TAC will take delivery of its first operational F-15E later this year. The TAC Commander calls the fighter "an absolutely superb airplane," adding:

"When I look at the European situation, assuming that the INF Treaty goes through, I see a greatly increased emphasis on conventional forces. The most important thing that the Air Force can do in that connection is to bring on the F-15E, maybe even at increased production rates, because it is dual-qualified—conventional and nuclear, ground-attack and air-to-air."

A Northrop Tacit Rainbow remotely piloted, radar-homing "loitering missile" takes to the air for a test aboard a Navy A-6. Such unmanned airborne vehicles (UAVs) seem to be catching on in all the military services as the means of augmenting manned aircraft.

Enough F-15Es?

He is concerned about having enough F-15Es in the end. The budget crunch forces USAF to cut its planned F-15E force from four wings to three wings of about 320 aircraft and, in keeping with that, to cut its long-term LANTIRN procurement by commensurate numbers.

"If I'm going to deploy F-15Es Stateside and forward-deploy them in Europe and the Pacific, three wings is the absolute minimum I need," General Russ declares.

Dual-role capability for aircraft is being explored by the Army as well—and this, too, may well induce an interservice dustup.

The Army has successfully test-launched heat-seeking Sidewinder missiles and Stinger missiles from its Apache attack choppers and is looking to outfit its advanced Apaches now in development and its next-generation LHX reconnaissance/attack helicopters, now called Advanced Tactical Helicopters, with such missiles.

The Army contends that it must do this in order to defend the choppers against Soviet Hind attack helicopters that are similarly armed for air-to-air combat.

The Air Force has no quarrel with this. It acknowledges the Army's right to helicopter self-defense, which falls into the category of defensive counterair.

But there is a mighty thin line between defensive counterair and offensive counterair, which would come into play should the Apaches go after the Hinds or after the forward bases from which the Hinds are operating.

Joint Chiefs of Staff mission statements define offensive counterair as a totally Air Force mission. This means that the Army in combat would have to get the resident air commander's okay to indulge in offensive counterair—a requirement that the Air Force is bent on maintaining and that the Army almost certainly will try to get waived.

For all sorts of missions, the Army's development of rotary-wing technologies and aircraft is rapidly taking it into fixed-wing, traditionally Air Force domains. And as an Army officer expressed it: "There is going to be some outstanding 'entertainment' between us and the Air Force as we try to work everything out." ■

C-17

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The C-17 is now in development for first flight in 1990, when it will reach new highs for operational utility and new lows for cost of ownership.

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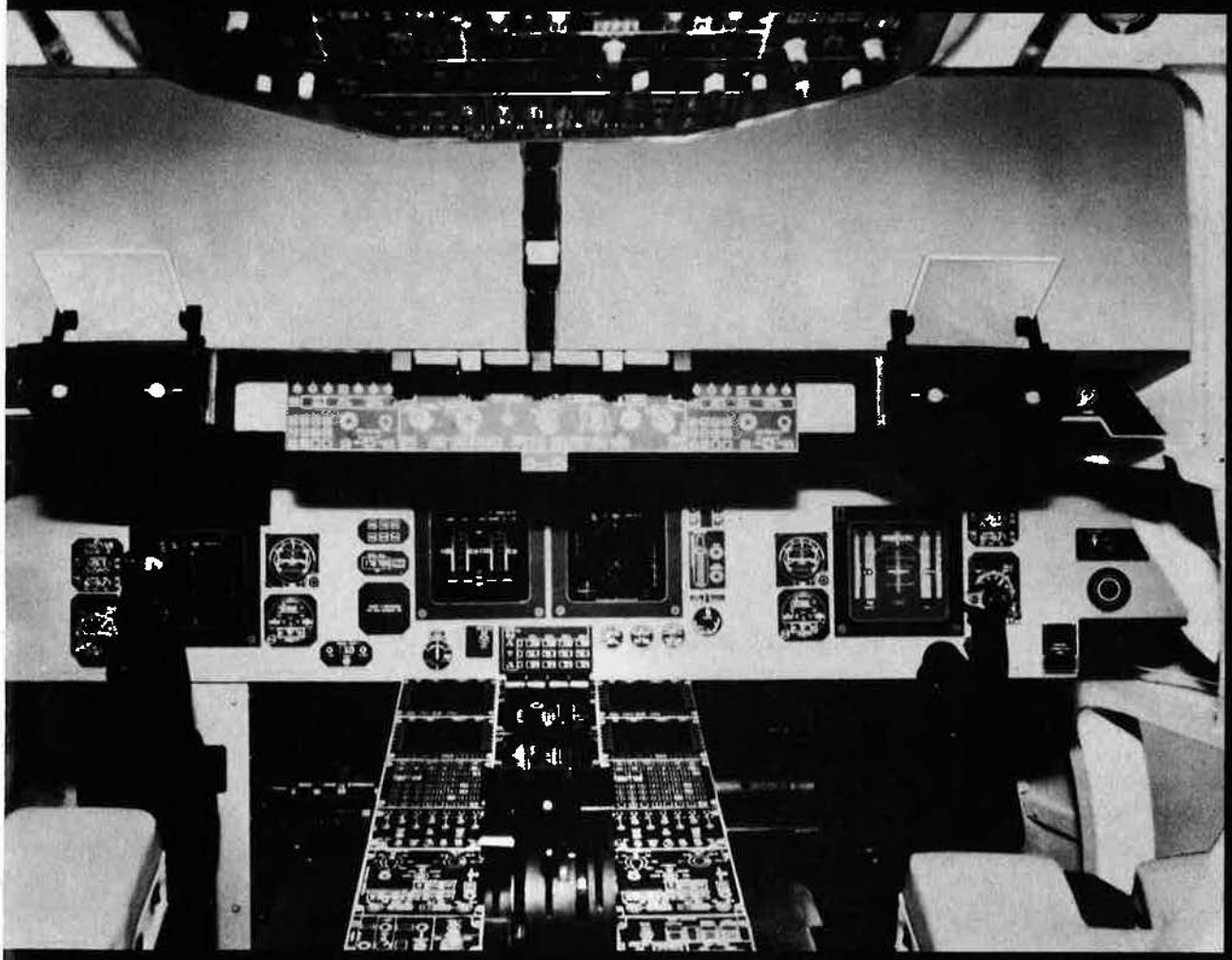


THE way Gen. John R. Galvin sees it, the Intermediate-range Nuclear Forces (INF) talks were the easy part. The next arms negotiation, suggests the Supreme NATO Commander, shapes up as the really hard ride.

Recall that the INF process of which he speaks featured eight years of haggling, hundreds of anti-nuclear protests, and an angry Soviet walkout. Even so, says the US Army General, it was "bean-counting." Because it focused on arms of measurable attributes, it was "pretty easy stuff."

The General's comment is intended to concentrate minds on the magnitude of the challenge ahead in the newest phase of arms control in Europe—the "Atlantic to Urals" talks aimed at reducing nonnuclear, conventional forces, set to open in Vienna this June.

At issue are not only numbers of forces. Also in play will be such esoteric concepts as troop reliability, mobilization capabilities, quality of weapons—even willpower. Sixteen NATO and seven Warsaw Pact powers will face puzzles so complex that they nearly defy solution, a matter much on the mind of General Galvin, who also heads the US European Command.

Sharp, persistent pressure on Moscow to thin out its conventional forces, says Gen. John Galvin, must now be the West's "number-one" priority. Here, the NATO Commander (center) meets with officers of the US 2d Armored Division on an exercise in Germany.

The new Supreme Allied Commander in Europe has firm ideas on what our arms-control objectives in Europe ought to be.

Eight Principles

"There are some abstractions to it," he says of the nonnuclear negotiations coming up in Europe. "But if you don't work those factors in, you might be doing something that is basically suicidal."

With his elevation last June, General Galvin became NATO's ninth Supreme Allied Commander. He also is the most seasoned. With ten years of service on the Continent, General Galvin can claim more experience in Europe than any predecessor—even Gen. Dwight D. Eisenhower.

Given such credentials, General Galvin, fifty-nine, commands the

BY ROBERT S. DUDNEY, SENIOR EDITOR

—Photo by Sp4 Mike Fissell, USA

for NATO

attention and respect accorded to true authorities on Europe. In an extensive discussion with AIR FORCE Magazine and other journals, he offered what amounts to a proposed game plan for the negotiations and Alliance affairs.

Some of what General Galvin has to say may not be welcomed by the White House, Congress, the Pentagon, or NATO political figures, but they can ill-afford to ignore his words—given the fact that he is the one who would lead the Western Alliance in war should it ever come.

From the General's comments, one can discern eight principles that he thinks should underpin the negotiations.

1

Hard-Nosed About Gorbachev

What comes through clearly in the General's words is that there is need for a more realistic view of the adversary's intentions.

In the runup to the conventional forces talks, General Galvin is increasingly concerned about what he regards as Western misperceptions about the long-term goals of the Soviet Union in Europe and about the true aims of Soviet leader Mikhail S. Gorbachev.

Moscow's goal, he is convinced, has always been to split the Alliance, get US nuclear weapons out of Europe, and, most particularly, to bring about the total withdrawal of American forces. Notwithstanding the softer new Kremlin image projected by its youthful, dynamic leader, General Galvin can detect no change in this ambition.

As evidence, the General cites Gorbachev's book, *Perestroika*, which in Russian means "restructuring."

"I find it interesting how many people have read that book and come away so tremendously satisfied that this is a good, kind man who wants peace and nothing more," General Galvin says.

"Actually, *Perestroika* is a hard-nosed book. It says, 'Europe is the home of Europeans.' Meaning: 'Yankee, go home.' It makes it very clear that NATO has got to go."

The fact that Moscow has agreed to discuss reductions of its massive conventional military structure in Europe, he argues, doesn't alter the fact that Western Europe is a prime Soviet target.

"The aim of the Soviets [in Western Europe] is to have a greater influence, to put it mildly. I would put it more strongly and say that the aim is to eventually dominate Western Europe."

2

Asymmetrical Reductions

In General Galvin's view, these Soviet intentions are no reason to shy away from conventional arms negotiations. Quite the contrary.

"I think we should press [Moscow] in that area," he maintains. "In fact, that would be the number-one priority if we're looking for ways to make sure our arms-control strategy and our national and alliance strategy are all linked together." That is because it is in nonnuclear forces that Moscow enjoys the most lopsided advantage.

What he proposes, however, is not an equal reduction by East and West. Far from it. General Galvin argues that new force reductions have to be asymmetrical, weighted against the Soviet bloc, because the Pact begins so far ahead in conventional firepower.

"If you don't want to build up, then try to get the other guy to build down," he sums up. "That's a pretty good piece of strategy."

General Galvin's view is seconded by some in Congress, such as Sen. Sam Nunn, the Georgia Democrat who chairs the Senate Armed Services Committee. The agreement Senator Nunn has in mind might require Moscow to remove thirteen full divisions—tanks, manpower, artillery—to every two for the West.

Lending credence to General Galvin's approach is a Rand Corp. study released January 24. It asserts that Warsaw Pact forces enjoy such an edge over NATO that the West should insist that the East bloc cut five times as many forces as the Alliance. "If we're going to end up with equal forces," writes analyst James A. Thompson of Rand, "we're going to have to start with very unequal reductions."

This view is not universal. Another study, by Michigan Democratic Sen. Carl Levin, stands directly at odds with the Rand report, concluding instead that NATO conventional forces are not substantially weaker than those of the Warsaw Pact.

Though it is critical to determining reductions, measuring the conventional balance is a difficult and imprecise task. In the past six months alone, the General notes, Supreme Headquarters Allied Powers in Europe has produced 160 papers assessing the face-off between NATO and the Warsaw Pact. Each takes a somewhat different view of the problem.

All, however, lead him to the same conclusion: "I think the other side is pretty big in every way that I can see, compared to us. . . . It is going to require asymmetrical reductions. . . . The general principle should be: Asymmetrical reduction to an equal balance, then further reductions."

3

Focus on Capabilities

As General Galvin sees it, obsession with the "bean count," or simple numerical comparisons of manpower and weapons, is a mistake and likely to mislead and confuse.

He argues that Western negotiators should zero in on broader Soviet military capabilities—that is, the ability to achieve certain goals—rather than on the arithmetic of weaponry.

"Wars are not fought on arithmetic," says General Galvin. "They are fought with capabilities."

He explains the situation this way: "If you can outmaneuver the enemy, that has nothing to do with arithmetic. If you are stronger at the decisive point, that's not arithmetic, [nor is it] if you are able to sustain yourself longer than he is, or if your morale is higher than his, or if your soldiers are better trained."

What are the specific Soviet capabilities that worry NATO leaders the most?

One is the Warsaw Pact's capacity to put together massive firepower and keep it in continuous motion. General Galvin maintains that the Soviet military, ever since the World War II battles of Leningrad, Stalingrad, and Kursk, has worked hard to perfect the ability to move heavy forces, rapidly, over long distances, with no pause in operations and with overwhelming momentum.

Another worrisome capability is the Warsaw Pact's increasing ability to prepare such an attack largely undetected. High-density concentrations of armor, munitions, supplies, and transport in the center of Europe are the reason. Says General Galvin: "Of all the principles of war, [for the Soviets] surprise is number one."

These capabilities, among others, shape up as prime targets of Western arms-reduction proposals.

For example, the West might demand that the Soviet Union reduce its stockpiles of bridging equipment, which permit the Warsaw Pact's massed armor forces to push rapidly across key rivers.

Senator Nunn contends that the West ought to seek arms-control agreements that would remove the Warsaw Pact's capacity for a potentially decisive short-warning attack on NATO.

Some Army men say that what they really want is more warning time in order to be able to bring the concept of AirLand Battle into play. Therefore, they say, the West should pursue a mutual pullback of

Eastern and Western forces on the Central Front, a move that would put the enemy beyond range for a quick strike into the heart of West Germany.

General Galvin is keeping his own counsel on which particular proposals should be pursued. But he insists that reductions should go beyond simple removal of forces, unconnected to any larger reality.

The General's words: "We have to say: 'You reinforce across land, whereas ours is [across] sea. Therefore, yours is easier to do. It's also easier to defend the airspace over land than it is to defend airspace over the sea.'"

4

Probe Soft Spots

The way General Galvin looks at it, the West should bear in mind that it is Gorbachev and his supporters who have an incentive to reduce the Soviet effort in the conventional arena. The Russian military, for its part, can be expected to put up fierce resistance to any drawdown of its forces.

Soviet military behavior in the upcoming negotiations will bear little resemblance to its actions in the recent INF talks—talks that resulted in elimination of entire classes of Soviet nuclear systems with barely a public military grumble.

"This is going to be, I think, a little bit hard to sell to the Soviet military," says the NATO chief. "The reason that you have not heard a lot of Russian military complaining about Gorbachev giving things away [in the INF Treaty] is because they are primarily concerned with their conventional forces, not the nuclear forces."

Thus, he believes, the Alliance should look for negotiating leverage to the Soviet General Secretary and like-minded supporters, those who wish to divert resources from military operations to economic renewal in the Soviet Union. They, if not the military, might be persuaded that negotiated reductions would be in the Soviet interest.

"Right now, the Soviets are building several classes of submarines," notes General Galvin. "*Several*, at once. This applies across a lot of other things. I think that Gorbachev is concerned about how much modernization he's doing and how big the force is. I think he wants to drop both of those things down.

"The Soviet Union appears to be motivated to reduce in the conventional area. Now, I said before that there's a big question mark there. How will the military react to that? And I don't know."

5

Modernize NATO Forces

General Galvin argues that Soviet incentives to seek a breather in the conventional arms competition can only be enhanced by evidence that the West plans to continue competing on a serious basis.

How large that effort must be is not clear. Some military-minded members of Congress, surveying the current imbalance of arms in Europe, prescribe a significant buildup. The price tag for such a buildup is put at $75 billion by some estimates.

What General Galvin seeks is not a buildup, in the sense of an expanded force structure, but modernization of forces—"replacing with better stuff, just as that adversary of ours replaces with better stuff."

At the top of General Galvin's modernization list are items to implement the concept of Follow-On Forces Attack (FOFA), formally embraced by the Alliance in 1984. The central idea of FOFA is that a purely static defense has no hope of repelling invasion and that the Alliance must instantly launch air strikes against the enemy's rear to keep his second- and third-echelon forces from "piling on."

One critical need, in the General's view: The Joint STARS program, a standoff surveillance system for detecting moving ground targets. He also endorses the Army Tactical Missile System as a supplement to high-performance aircraft assigned to the interdiction mission.

What's more, front-line aircraft are in need of updating. The Galvin view is that NATO should "do everything we can" to extend the range of aircraft, shelter the force with hardened bunkers and dispersal, and upgrade the avionics.

Can even this pared-down level of modernization continue in light of severe Pentagon budget austerity for at least the next five years?

"That's a big question," General Galvin concedes. "You have to prioritize if you're going to do the modernization and you can't get the kind of money that you want to get. Its hard to say whether you can continue with it."

6

Follow Through on Montebello

Equally critical, believes General Galvin, is the need for the allies to press ahead with modernization of the theater nuclear forces that will remain after the terms of the INF accord go into effect. Without this, he suggests, future cuts in conventional forces would pose unacceptable dangers.

At Montebello, Canada, in October 1983, NATO defense ministers agreed to reduce NATO's stockpile of battlefield nuclear arms by 1,400 warheads, on top of an earlier 1,000-warhead reduction, dropping the total to 4,600. At the same time, however, the Alliance decided to maintain the remaining force in modernized, credible, and survivable condition.

General Galvin has insisted continually to the Western Europeans that the Alliance must follow through on its 1983 decision to replace the Lance missile with a new version. The Lance has a current range of some seventy-five miles; an upgraded replacement would have perhaps double that range. NATO now deploys a total of eighty-eight Lance missiles. These are the only shorter-range land-based missiles in NATO's arsenal that are under the 300-mile INF limit.

General Galvin also endorses production of a new air-launched tactical air-to-surface missile, currently under development by the Air Force. "We need an air-to-surface missile that's carried by a little airplane. That is, it fits on something like a Tornado or an F-16." Range would be in the neighborhood of 250 miles.

General Galvin also calls for modernization of nuclear bombs and artillery projectiles.

The General believes that such updating of the force should be unobjectionable in light of the Alliance's prior commitment to carry it out. But modernization of nuclear arms could send political shock waves through Western Europe by appearing to circumvent or negate the accord just signed.

A major concern is that refusal to modernize could lead NATO down the "slippery slope" of denuclearization and leave Europe facing the weaknesses in its conventional forces.

On this issue, General Galvin is unequivocal in his assessment of the consequences: "Right now, I see no way that we can deter or defend in Western Europe without nuclear weapons. I do not see a way to do that. I have spoken to every senior military commander under my command. None of them [sees a way] either."

7

Reassure the Germans

The positions developing in West Germany on modernization of battlefield nuclear arms and other issues worry some Western officials. They express concern that the Bonn government, a critical player in any Alliance move, is creating the groundwork for another rancorous defense debate, such as that over the INF negotiation.

While NATO agreed in principle in 1983 to deploy an updated version of the Lance missile, Bonn had been resisting pressure from the US and Britain to commit itself to go through with the plan.

German anxieties on this score stem, in part, from the success of the INF negotiation—which removed all nuclear weapons of intermediate range, leaving only those with ranges of 500 kilometers or less.

General Galvin notes that the Germans are becoming "very concerned" about an issue that they are beginning to call "singularity"—meaning, in simplest terms, that most of the nuclear weapons that remain are on German soil and in war would kill mostly Germans.

General Galvin suggests that some reassurance of West Germany is in order, as well as some perspective.

"There are many things," says he, "that need to be considered along with the fact that shorter-range nuclear weapons have a range of 500 kilometers, which means that if the war comes, some of those weapons would fall on East and West Germany.

"There is no way that you can change the geopolitical situation. Germany is in the front lines, in the first trench. But there are a lot of other people up there in the first trench. There are seven countries besides Germany that have troops in Germany, including the United States. Denmark, for example, and Belgium and Holland and Canada and the United Kingdom, and so forth. France.

"I think you have to ask yourself the question: Would the Federal Republic of Germany be the only target? Or would it also be the United Kingdom, which would be a loaded logistical base? Do we think the United States would not be a target?"

The Alliance's task is made more difficult by Soviet pressure on West Germany. Soviet Foreign Minister Eduard Shevardnadze specifically has urged West Germany and other NATO members to drop plans to deploy a new, modernized version of the Lance. He also warned that plans to modernize NATO nuclear weapons would "scuttle everything that has been achieved in the sphere of nuclear disarmament and must not be permitted."

General Galvin dismisses such remarks as pure propaganda. "That [restriction] is not within the INF Treaty, first of all," asserts the General. "And second of all, if you look at what the Soviets are doing, the Soviets have made moves to make sure that their coverage in that area—zero to 500—is available to them. I don't want to try to go into detail there. But they have done restructuring, or they've made moves toward restructuring, so that they will be able to cover the areas that are not within the treaty."

Even so, the General acknowledges that "there will be some receptivity in the West to Soviet propaganda about this, and it worries me."

8

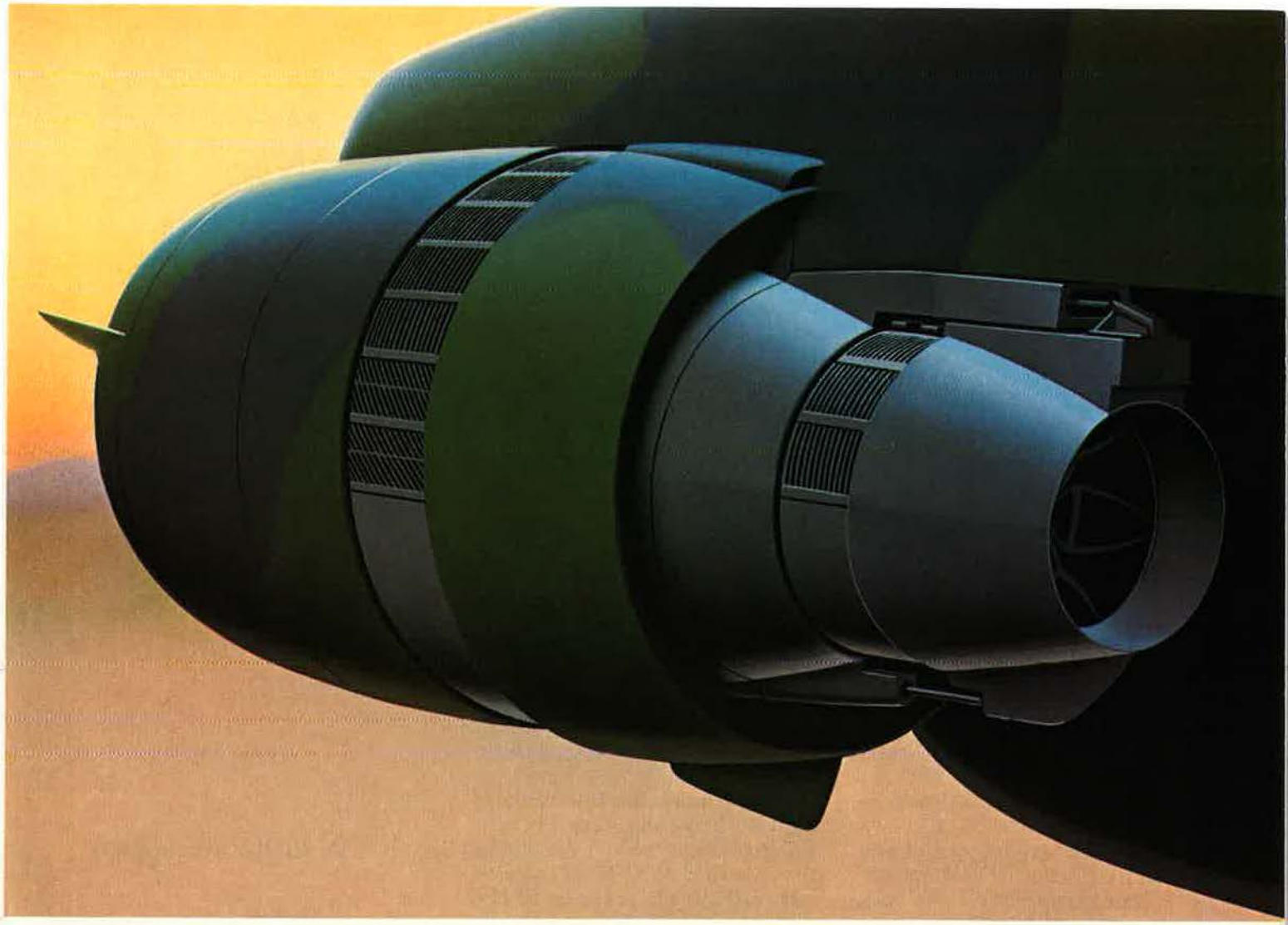
"Nickel-and-Dime" Solutions

General Galvin makes plain that what he is looking for is a serious reduction of forces in Europe. In his view, long and hard-fought talks that bring forth mere cosmetic changes in the European orders of battle might prove to be worse than no cuts at all. In a word, he seems to seek a bit of boldness in the negotiations.

"I would think that the dangerous thing here would be to nickel and dime this," says NATO's commander. "If you go back and look at the recent history of arms negotiations—before World War I, before World War II—the big problem was we [the participants] couldn't bring ourselves to make a deep cut.

"We could build a pocket battleship instead of a battleship and all that sort of thing, you know, but no deep cuts. And that's what wrecked arms-control negotiations all along."

The need for a little boldness, the General suggests, applies mainly to the East, but also to the West. He maintains that Western leaders have to be "flexible" enough to consider "what it is that the Soviets think we look like." There should be a commensurate willingness to reduce Western forces, he says, "if they [the Soviets] can show us that, indeed, we threaten them because we are monstrously bigger in some area." ■



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

Seventy years ago this month, Lts. Alan Winslow and Douglas Campbell claimed the first official US victories in aerial combat.

The First Victory

BY THEODORE HAMADY

AMERICA's fledgling air arm was ready for a fight. The US had declared war on the Central Powers in 1917, but it would be another year before American aviators would go into battle on behalf of their own country. The volunteers of the Lafayette Escadrille had set the stage for participation by American pilots, and by early 1918, the Yanks were operating over France officially.

Lt. Douglas Campbell and Lt. Alan Winslow were on alert the morning of Sunday, April 14. As they began a hand of Russian bank (a card game) in the ready tent near the flight line, three aircraft lifted off from Gengoult Aerodrome on the first war patrol of the 94th Aero Squadron.

The early morning weather was poor. Visibility under the misty overcast, however, was reasonably good. Capt. David Peterson, the patrol leader, considered the weather too bad for flying, and he quickly returned to the field.

Circling the aerodrome and thinking Captain Peterson's airplane had developed engine trouble, Lt. Eddie Rickenbacker and his wingman, Lt. Reed Chambers, decided to continue the mission. They soon became lost in the overcast and were fired on by German antiaircraft guns as they crossed over the enemy lines near Seicheprey. Both managed to return safely.

The 94th Aero Squadron had deployed to Gengoult Aerodrome near Toul, France, only days before. Many of its pilots were American-trained, but the squadron was also heavily leavened with French-trained combat veterans including the renowned Maj. Raoul Lufbery, who had already achieved fifteen victories while flying with the Lafayette Escadrille.

On April 7, the 94th had been designated an independent unit under the VIII French Army, and on April 13, the "Hat-in-the-Ring" Squadron, along with other US pursuit groups, had been made responsible for the sector extending from St.-Mihiel in the west to the village of Pont à Mousson in the east.

Prior to its arrival at Gengoult, the 94th had received an allotment of twenty-two Nieuport 28 C.1 pursuit planes. The airplane was nimble, and it would prove to be more maneuverable than the German aircraft it would encounter in this sector. With its quick-starting rotary engine and high climb rate, the Nieuport 28 could get into the air rapidly. More important, it was what was available to the Aviation Section of the US Army Signal Corps.

The Nieuport 28 was burdened, though, with several design deficiencies, including a propensity for the upper wing to shed its fabric covering when the airplane was

"He was diving at about forty-five degrees, and I was behind him and above him but behind his tail . . . a streak of flame came shooting out of his fuselage near the motor. I . . . watched him . . . crash in a plowed field." So said Lt. Douglas Campbell about his first and America's second aerial victory. In this painting, Campbell, in his Nieuport 28, is following his victim (a Pfalz D.III) down. Meanwhile, Lt. Alan Winslow, who just saw his foe crash, pulls up in a victory pass (at Campbell's left). See the "ribbon chart" on pages 70 and 71, showing in detail the progress of the battle.

pulled out of a high-speed dive and frequent engine fires. Machine guns were also in short supply. On that first day of combat, the squadron's airplanes were fitted with only one Vickers machine gun that had been modified to .30-caliber.

The 94th Aero Squadron's aircraft still retained standard French camouflage colors and insignia, but each of the Nieuport 28s was prominently emblazoned with the "Hat-in-the-Ring" emblem on the fuselage. The device, symbolizing America's throwing its hat into the ring of World War I, had been suggested several weeks before by the squadron's medical officer.

The Battle Begins

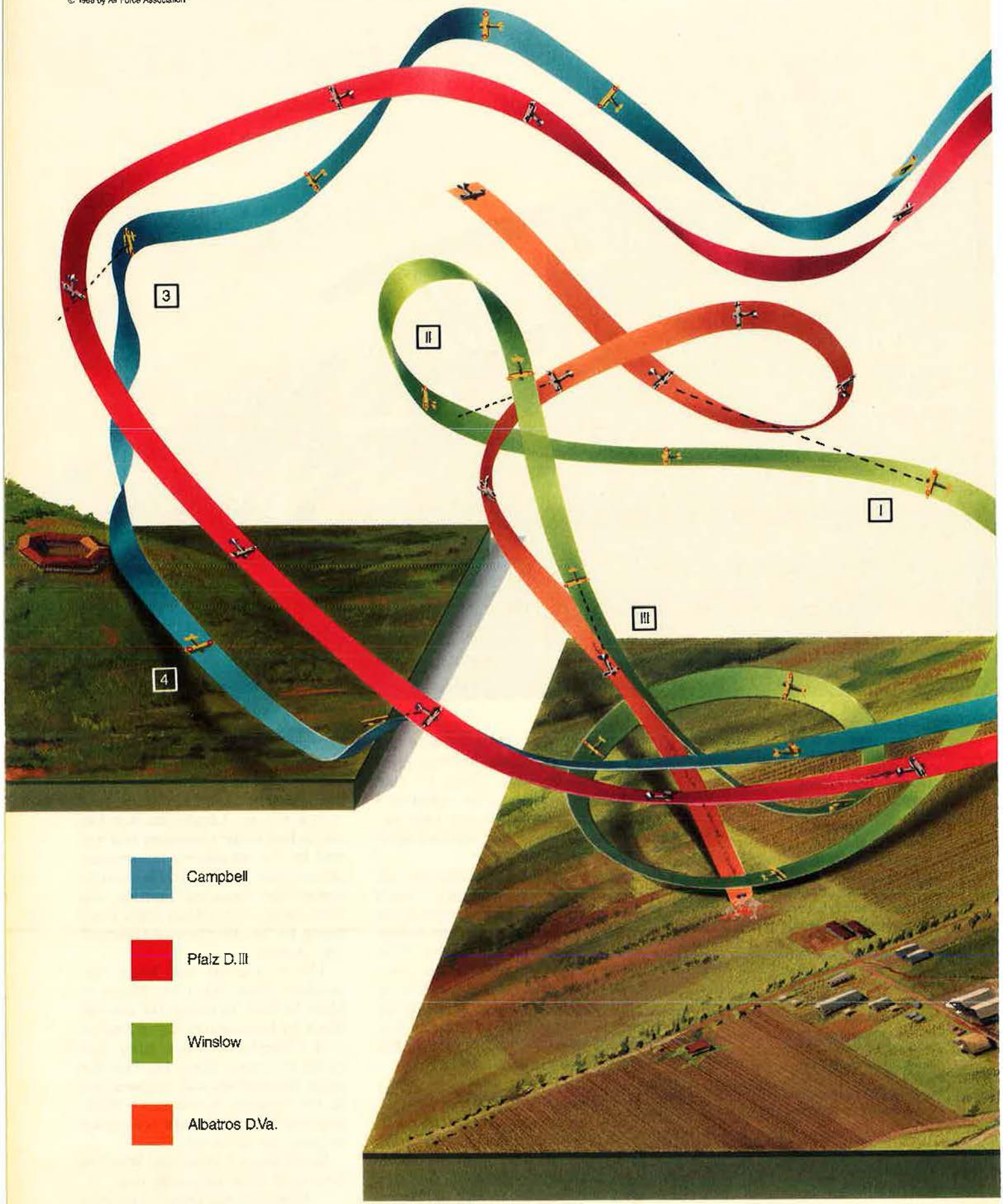
The operations center at Gengoult Aerodrome was linked by telephone to the observation post at nearby Mount St.-Michel. That forward station was, in turn, linked to antiaircraft sector control centers at Commercy, Lironville, and Delourd running west to east along the battlefront.

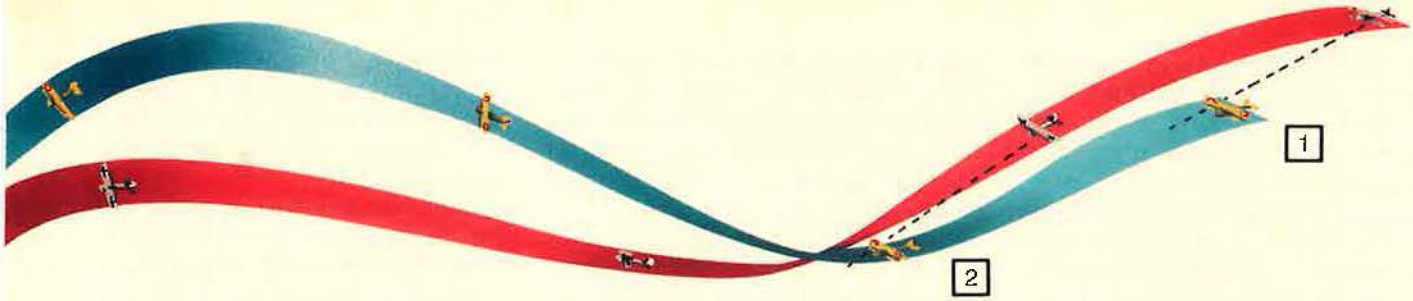
At 8:45 a.m., Lieutenant Winslow was called to the telephone and was told by the squadron's information officer that the Lironville control center had reported sighting two German aircraft fifteen miles away flying in the direction of Gengoult Aerodrome.

These aircraft had been dispatched from *Jasta* 64, based at Mars la Tour, to attack the aircraft flown by Lieutenants Rickenbacker and Chambers when they had crossed German lines. The German pilots themselves had become lost in the weather. Lieutenants Winslow and Campbell were scrambled to meet the intruders.

In his diary, Lieutenant Winslow described what happened next:

" 'Doug' started ahead of me, as I





America's first World War I air battle took place over the 94th Aero Squadron's aerodrome near Gengoult, France, on April 14, 1918. Lt. Douglas Campbell and Lt. Alan Winslow, flying in Nieuport 28 C.1s, downed two German planes in an engagement that lasted only ten minutes. Here's how the action progressed:

1. Lieutenant Campbell takes off first and waits for Lieutenant Winslow to take off and assume lead of the formation.
2. Campbell banks right (in order to see Winslow, who has taken off and has already begun his engagement), when he is fired on by the pilot of a Pfalz D.III.
3. Both pilots jockey for position, and Campbell gets his first shots at the German from below and to the left of the Pfalz.
4. Campbell's Nieuport stalls and drops to within 100 feet of the ground near the observation post atop Mount St.-Michel. With power restored, Campbell climbs at a steep angle and begins firing at the Pfalz. The German plane catches fire.
5. After Campbell fires about fifty rounds at the German, the Pfalz dives, and Campbell — now behind his foe — follows him down.
6. The Pfalz, now burning furiously, crashes 100 yards behind the 94th's hangars.

I. Meanwhile, Lieutenant Winslow's portion of the battle begins immediately after he takes off. He fires at an Albatros D.Va. The German pilot reverses and comes out firing at Winslow.

II. Winslow climbs, enters a right-hand spiral, and comes down behind the German. Winslow opens fire and disables the engine of the Albatros. The German fighter goes into an uncontrolled dive.

III. The Albatros pilot tries to regain control near the ground, but cannot. He crashes in a field across the road from the 94th's aerodrome. Winslow makes a victory pass and then climbs to see if Lieutenant Campbell needs any help.

was to meet him above a certain point at 500 meters, and then take the lead. . . . I was at about 200 meters, when straight above and ahead of me in the mist of the early morning, and not more than a hundred yards away, I saw a plane coming toward me with huge black crosses on its wings and tail. I was so furious to see a Hun directly over our aviation field, that I swore out loud and violently opened fire.

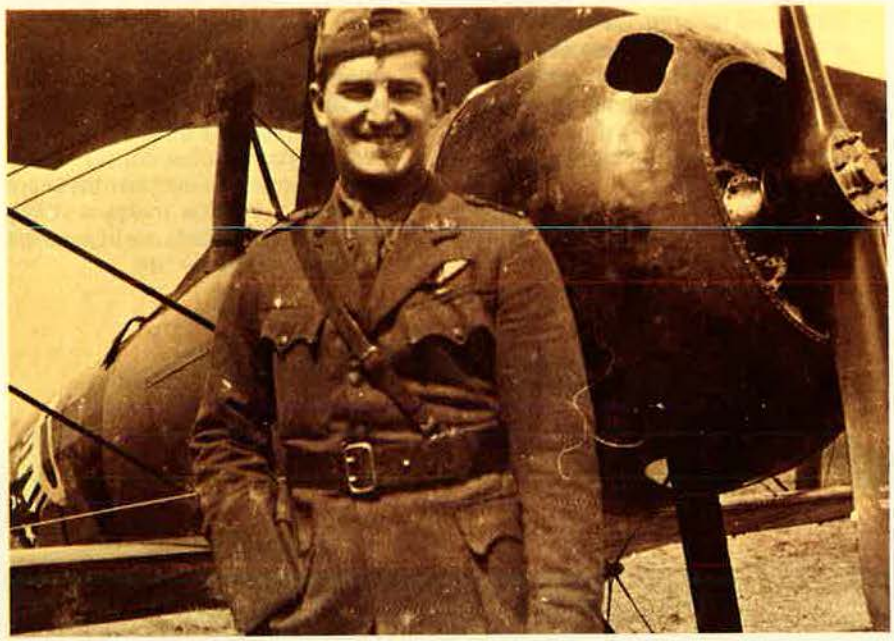
"At the same time, to avoid my bullets, he slipped into a left-hand reversement, and came down, firing on me. I climbed, however, in a right-hand spiral and slipped off, coming down directly behind him and on his tail. Again I violently opened fire. I had him at a rare advantage, which was due to the greater speed and maneuverability of our wonderful machines.

"I fired twenty to thirty rounds at him and could see my tracers entering his machine. Then, in another moment, his plane went straight down in an uncontrolled nose-dive—I had put his engine out of commission. I followed in a straight dive, firing all the way.

"At about six feet above the ground, he tried to regain control of his machine, but could not, and he crashed to earth.

"I darted down near him, made a sharp turn by the wreck, to make sure he was out of commission, then made a victorious sweep down over him, and climbed up again to see if 'Doug' needed any help with the other Hun—for I had caught a glimpse of their combat out of the corner of my eye."

Lieutenant Winslow's kill was an Albatros D.Va, a fairly new aircraft type to the war. The aircraft, flown by *Unteroffizier* Simon, had the red and black stripes of *Jasta* 64 on the horizontal tail surfaces.



—The National Archives

Lt. Douglas Campbell stands next to his Nieuport 28 C.1 at the 94th Aero Squadron's field near Gengoult, France. Lieutenant Campbell was the first American-trained pilot to score a victory, and he later became the first American-trained ace. Mr. Campbell is now ninety-one and lives in Connecticut. He still has a piece of the fabric covering from his first victim's aircraft.

Back in the Air

Lieutenant Campbell described his part in the air battle to his parents the next day in a letter, in which he wrote:

"Our squadron started regular patrols and alerts yesterday. Alan Winslow and I were on schedule to be on alert from 6:00 to 10:00 a.m. At 6:00, we had our planes wheeled out, and tested the motors to make sure they were running OK. The first two and a half hours were slow, but then things began to happen so quickly that we could hardly keep track of them.

"At 8:45, the telephone rang, and the message was that two Boche planes had been sighted some fifteen miles away, headed our way. At 8:50, I took off and had made a round of the field at 500 meters altitude when Winslow got into the air. He was to lead, and when he reached 200 meters, I was getting into position behind him. It was quite misty.

"All at once he turned, and I saw him chase a plane that wasn't more than 300 meters high. *It had black crosses on it!* I heard him shoot, and they both went out of sight under my wings. I banked up ninety degrees and turned, to get a view below so as to go help Winslow if necessary, and it was lucky I did, for just as I turned I heard the pop-pop-pop of a machine gun behind me, and there was another Boche shooting at me.

"For some reason I thought his tail was turned toward me as he shot, and the thought, 'Biplace [two-seater], keep under him,' flashed into my brain. He turned out afterward to be an Albatros [actually a Pfalz D.III] monoplace, but I had guessed wrong, and instead of getting above him, which would have been easier, I kept below him, maneuvering so as to try to get under his tail without letting him point toward me, [*i.e.*, a head-on pass] or get a shot at me from a broadside [*i.e.*, from the rear-seat gunner.]"

Near Disaster

At this point, Lieutenant Campbell was to the left of the German aircraft while the enemy plane was in a turn. The American pulled up sharply to fire. Immediately, Lieutenant Campbell's aircraft stalled and fell to what he described as "within 100 feet of the ground." Lieutenant Campbell had "forgotten about the ground" during the excitement of combat. As he recovered from the stall, he then found himself flying in the same direction as the German aircraft directly above him.

"It took over a minute to maneuver into a position behind and under his tail without exposing myself to his fire (I thought), but finally found myself right under him. Then I pulled my nose straight up into the air and let him have the bullets, and I think he got some in his motor, for I saw some tracers hitting his nose.

"The next thing I knew, he was diving at about forty-five degrees, and I was behind and above him but behind his tail. Then I got a good aim, pulled the trigger, and held on to it. Two or three tracers hit him,

—From the collection of H. L. Cavanagh

"That afternoon, my wrecked Hun plane and the charred result of 'Doug's' good work were exhibited in the public square of the town," notes Lt. Alan Winslow, who recorded the first aerial victory for America. This photo shows Lieutenant Winslow (center) with his prize, an Albatros D.Va, after the battle.

and after about fifty rounds had been fired, a streak of flame came shooting out of his fuselage near the motor. I ceased firing, and watched him land and crash in a plowed field, his plane a mass of flame and wreckage.

"The pilot had had sense enough to unfasten his belt, and was thrown clear of the machine, escaping with some bad burns and broken bones."

Mr. Campbell, who is ninety-one and living in Connecticut, still retains a portion of the silver-gray fabric of his first victory. The piece was recovered from the wreckage by fellow squadron member James Norman Hall and was presented to then-Lieutenant Campbell. The Pfalz D.III was flown by *Visefeldwebel* Wronieke.

After observing the crash of his adversary's aircraft, Lieutenant Campbell made one complete circuit of the field—he needed to calm down—and then landed.

Joy on the Ground

Both encounters had taken place within view of the other pilots and men of the aerodrome, including members of a French observation squadron that occupied the south side of the airfield. Many of the citizens of Toul had also witnessed the combat. Their reaction was immediate and unrestrained. In Winslow's words:

"The whole camp was pouring out, flying by on foot, bicycles, sidecars, automobiles, soldiers, women, children, majors, colonels, French, and American—all poured out of the city. In ten minutes, several thousand people must have gathered.

" 'Doug' and I congratulated each other and my mechanic (Sgt. Beerbower), no longer military, jumping up and down, waving his hat, pounded me on the back instead of saluting, and yelled, 'Damn it! That's the stuff, old kid.' . . . All had seen the fight. One woman, an innkeeper, told me she could sleep well from now on and held her baby up for me to kiss. I looked at the baby, then felt grateful to my major, who pulled me away in the nick of time. . . .

"That afternoon, my wrecked Hun plane and the charred results of 'Doug's' good work were exhibited in the public square of the town, surrounded by an armed guard, and overlooked by a French Military Band. It was also a great day for the townspeople and has had a good morale effect. You can imagine it, when you realize it took place above their roof tops . . . and that they were able to see the whole fight.

"The Americans were indeed welcome in the town now, and 'Doug' and I can buy almost anything half price. An amusing incident was this—the fight was so near to the earth that bullets were flying dangerously all about the ground. No one was hurt, save a French worker in the field, who received a hole through his ear from one of my bullets and is very proud of it."

It was a tribute to the skill of the American pilots, the effectiveness of the early warning system, and the nimble Nieuport 28 that the entire combat lasted only ten minutes—five minutes to get into the air once the alert had been received and another five minutes to send both of the enemy planes crashing to the ground.

Two days later, Lieutenants Campbell and Winslow were decorated by the French with the Croix de Guerre with Palm, and both were mentioned in the General Orders. Both would later receive the US Distinguished Service Cross for other actions.

The events of April 14, 1918, had great significance for the new arm of the American Expeditionary Force. Lt. Alan Winslow was credited with achieving the first victory for the 94th Aero Squadron, and Lt. Douglas Campbell was recognized as the first American-trained pilot to score a victory for what would soon become the Army Air Service (Lieutenant Winslow had been trained by the French). Lieutenant Campbell would later become the first American-trained ace.

These dramatic victories were only the first of many that were to follow for the Hat-in-the-Ring Squadron. The significant accomplishments of the 94th were soon recognized in a letter of commendation from First Army Corps Air Service Commander Col. William "Billy" Mitchell, who said the unit had "fulfilled every desire and laid a foundation for the future development of pursuit aviation which will be an example for all to follow."

The 94th Aero Squadron still exists today as the 94th Tactical Fighter Squadron, now based at Langley AFB, Va. The unit flies the Nieuport's far-distant descendant, the supersonic F-15 Eagle. ■

Theodore Hamady is a Washington, D. C., businessman whose company markets defense-related aviation and marine equipment internationally. Mr. Hamady has had a lifelong interest in US military and commercial aviation. He is a member of the American Aviation Historical Society, the Company of Military Historians, and the Confederate Air Force.

The computer model predicted that after thirty days on short supplies, the squadron would be almost down and out. It did not foresee the amazing results that top-notch people can wring out of superb machines.

Eagles 17, Bean Counters 4

BY JEFFREY P. RHODES, AERONAUTICS EDITOR

TAKE 530 maintenance troops and pilots, a less-than-complete war readiness spares kit (WRSK), twenty-four F-15 aircraft, then isolate them from the rest of the world for thirty days. Then, while keeping flyable as many jets as possible, go out and launch an incredible number of sorties to simulate the taskings a fighter squadron would face during the first month of a war.

That was the drill for Coronet Warrior, a Tactical Air Command-sponsored exercise designed to test the computer model used to build a WRSK. The exercise, conducted last summer at Langley AFB, Va., saw the 94th Tactical Fighter Squadron deploy to their runway, completely cut their lifelines to normal supply channels, and live out of their spares kit.

"If you had asked me the day before we started, I would have said that after the first seven-day period, we'd have half the jets airborne, and by the end of the month, we'd only have seven flyable aircraft," said Capt. Steve "Spike" Henderson, one of the pilots who flew in the exercise. "I figured pushing jobs and people like that, events would just catch up, and we'd come to a grinding halt."

Even the Dyna-metric computer model agreed with that dismal assessment. Given a WRSK that is only partially complete (as the 94th TFS's was), the model predicts that only four aircraft will be fully mission-capable (FMC) at the end of the month.

The actual exercise, however, beat the model all over the lot. Seventeen F-15s were fully able to carry out their missions at the end of the test—only one aircraft less than the model had predicted would have been flying if the unit had been furnished a full spares kit. The results also indicate that this unit could have met its tasked sortie level well into the second month with just minimal resupply.

"The exercise was a resounding success," said Maj. Gen. Henry Viccellio, Jr., the TAC Deputy Chief of Staff for Logistics. "We wanted to take a look at the modeling technique and validate it—which we did. The decision to give the unit a deployed repair capability is also ab-

The Coronet Warrior exercise tested the 94th Tactical Fighter Squadron's ability to live out of its suitcase—the war readiness spares kit—for a month. The unit set up shop on its ramp at Langley AFB, Va. (top), and the combat supply system (CSS) computer, jockeyed by a very hot SrA. John Monroe (above), kept track of the available spare parts.

solutely valid. What surprised us was the innovation and our people's ability to do the job."

The test of that repair capability, which came in the form of a deployable avionics intermediate shop (AIS), was an important facet of Coronet Warrior. Another area put under the microscope was the reliability and maintainability of the F-15's electronic warfare equipment. This first extensive logistics field test had other benefits as well.

The Great Experiment

"Dyna-metrics is a tool we use in readiness assessment," said General Viccellio. "We use it daily to help our commanders know more about their resources and how they will come to play in supporting a war. The more we used it, though, the clearer it became that if you ran the model backward, it could be used reasonably well to build a spares kit."

Unlike other models that take lump-sum factors and multiply them together to get a readiness assessment (called C-status), the Dyna-metric model takes a fighter unit and, knowing what is in the spares package, fights a war day by day. By having the model "fly" at some wartime level and by using up the spares at a known failure rate, an assessment of the unit's ability to fly the wartime tasking for the first thirty days of combat can be made and serves as the baseline for the WRSK.

"We had a lot of confidence in the potential use of the model to provide a fresh look at what our spares requirements might be. In proposing this idea [of using the computer model] to the senior logisticians on the Air Staff and at AFLC [Air Force Logistics Command], though, there was a difference of opinions on which way we ought to go. We felt that if we conducted a field test, we could validate the computer modeling technique as right or wrong," added General Viccellio. "If it was wrong, we could analyze it, fix it, and make it right."

The AIS facility had been deployed for several short-term exercises, but it had never before been tested for a full wartime work load over such an extended period. How

it performed for the thirty days would be an important benchmark for future spares planning.

The twenty-two air-conditioned trailers that make up the AIS can be collapsed and packed on pallets to be airlifted in C-141s or a C-5. The AIS is an important adjunct to the F-15 WRSK and is also an integral part of a unit's ability to conduct operations from a forward location. It gives the unit the capability to fix the avionics "black boxes" for such items as antennas, controls, indicators, or the onboard computer on site, rather than send them back for a depot repair.

Coronet Warrior checked on how well electronic warfare assets would stand up to the rigors of a month-long trial. "For a variety of reasons, we don't go around jamming all the time," said General Viccellio. "We really didn't have as much confidence in our assessment of EW equipment as we'd like. We wanted to generate the capability to evaluate the equipment in flight on as many sorties as possible to see how it is working. We also wanted to learn a little bit more about how to maintain it properly."

TAC set up an electronic countermeasures range on NASA's Wallops Flight Facility in the Chesapeake Bay, and every pilot had to go wavelength to wavelength with the emitters on every flight. "Electronic warfare is something we don't do an overabundance of," said 1st Lt. John "Moby" Dyck, the 94th TFS's flight safety officer. "We have [EW] training requirements, and we definitely exceeded those during Coronet Warrior."

As important as Coronet Warrior was to TAC planners, it was equally important to AFLC, because the logisticians are the ones who actually supply the parts to build the spares kit.

A team of sixty TAC and AFLC observers watched everything that went on during the month and took notes. The data team would watch the overall action, or they would follow one person for his whole shift just to find out what he did. "A lot of the data collectors didn't know what our jobs were," said SSgt. John M. Wilson, a jet engine manager for the exercise. "They weren't bugging us, but they were trying to get information and learn as much as they could. And they were always around."

The repair capability of the people manning the Avionics Intermediate Shop (AIS) was one of the major reasons Coronet Warrior was so successful. The AIS, housed in the white cubicles under the camouflage netting, would be airlifted to a forward location in time of war, but is not expected to be operational until Day 3 of a conflict.

As realistic as Coronet Warrior was set up to be, the exercise was not "real world." As the exercise was mainly a test of the WRSK and AIS capability, there were none of the other variables that a unit would face in an actual shooting war.

There were no simulated chemical attacks on the base, for instance, and there was no battle damage added to either the aircraft or the runway. Finally, there was no attrition factor. "Attrition rates are hard to assess," said Lt. Col. Ragin "Rags" Hause, the commander of the 94th TFS. "They are also not a part of the model, so 'no attrition' was a strategy we had to employ to verify the model."

The 94th TFS was deliberately denied a full spares kit. The C-2 spares kit, or one that has only seventy-one percent of the parts it is supposed to have, allows for some above/below average performances. "If we had used a full kit and flown all of the sorties, there would have been no way of telling how well the unit could have done or how many fewer spares they really needed," added General Viccellio.

Of Tents and Taskings

The 94th TFS set up its compound on the edge of the runway at Langley. The wooden boxes that contain the parts for the WRSK were arrayed under camouflage netting and a big white tent. The AIS facility was set up in advance, but technicians were not allowed to go there until 6:00 a.m. on Day 3, which is when the model says the facility would have arrived at the "forward" location.

The 500 or so technicians from the 94th Aircraft Maintenance Unit and the 1st TFW's equipment maintenance, component repair, supply, transportation, civil engineering, and several other squadrons then began thirty days of twelve-hours-on/twelve-hours-off work shifts and started launching airplanes.

The twenty-four F-15s were tasked to fly at a surge rate for the first few days of the exercise, and then the tasked sortie rate fell considerably before continuing at a steady pace. The model, though, predicts that by Day 30, significantly fewer sorties a day could be generated for lack of spare parts. The 94th TFS's ground troops, however, kept the actual sortie rate close to the predicted level (approximately thirty sorties a day) for almost the whole exercise. In fact, the 94th TFS bettered so many of the model's predictions that the key data inputs for the model are being revised.

Several factors contributed to this performance.

The F-15s performed better than the model predicted. Since the parts

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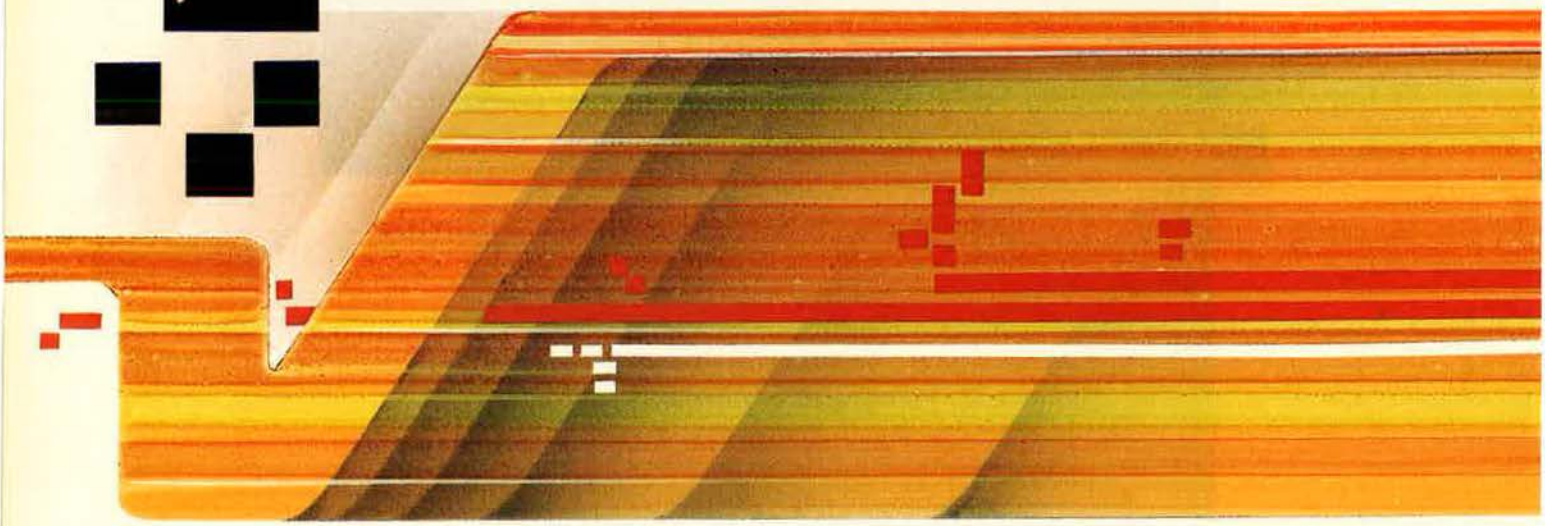

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on the C and D model F-15s are more reliable, there was less demand for replacement parts. Of the 2,187 repairable parts in this reduced spares kit, demand, based on worldwide data, was expected to be 2,162 parts and 1,690 issues (the parts actually in the kit that could be distributed).

The results weren't even close. Actual demand for repairable parts was 946 (or forty-three percent of the predicted total), and issues totaled only 772 parts. That left a balance of 1,415 parts in the kit that did not have to leave the supply tent during the exercise.

Tracking Parts

Keeping track of the WRSK parts was a ruggedized field computer known as the combat supply system (CSS). This computer consists of one main station and six minicomputer cluster work stations. Exactly what parts were available was loaded onto the computer before the exercise began.

"We used the computer to issue all the parts," said MSgt. Thom Knowling, one of the senior supply section technicians. "It ran full up for the whole thirty days. It kept track of what went out to the shops and which parts were repairable or serviceable."

The computer would also list the bins in which the parts were located and describe what substitutes could be used and where they could be found if certain parts weren't available. This method cut the time needed to get a part from the stockroom on its way to where it was to be used to about fifteen minutes, or roughly the same time it would have taken in the supply warehouse during peacetime.

Another area in which the actual results differed appreciably from the model's predictions was the amount of cannibalization. The model predicted 429 cases where one part that was supposed to be in a full WRSK that wasn't for this exercise would have to be removed, instead, from aircraft "A" and put in aircraft "B" to keep "B" flying. There were 414 actual cannibalizations, and 412 of them (99.5 percent) were successful. Of that 414 figure, only 174 involved parts that were in the WRSK. The remainder came from parts not in the kit and cannibalizations to move "holes," or where one cannibalization was less serious than another.

"We started isolating an aircraft that may not be fully mission-capable for a while and used it for parts to get the other aircraft ready so we could maximize the sorties," said Col. Richard Lombardi, the 1st TFW's chief of supply. "Because the computer knows how many parts are in the bin and how many are being fixed, it can tell whether I should cannibalize off another aircraft or wait for a repaired part."

The other major factor that allowed the squadron to better the predicted sortie rate was the productivity of the people working in the AIS. Parts to be fixed were repaired faster and more successfully than was predicted.

"We told the repair station folks that, except for safety, all restrictions were lifted," noted General Viccellio. "On several occasions, components would break, and there wouldn't be a spare. Those folks would take out their soldering irons and resistors and circuit diagrams and would fix the piece. That is something they wouldn't normally even attempt to do. They kept themselves in business."

The AIS processed 557 units during the exercise, and of that total, two-thirds were returned to service. The "snapshot" taken at the end of the thirty days showed that eight percent of the black boxes were awaiting maintenance and another eight percent were waiting for parts. Only nine percent of the units brought in could not be repaired.

The Real Key

The durability of the aircraft and the ability of the AIS to rework the parts were pleasant surprises, but the real key to why Coronet Warrior was so successful was the innovation and productivity of the people involved.

"After an initial learning period, the unit really got its act together," said General Viccellio, who is a past commander of the 1st TFW. "They became a well-honed team. Everybody knew what the priorities were. There was not much wasted effort at all."

Several times a day, the chief of maintenance, Maj. Gail Duke, would set her priorities on what needed to be fixed, and she made sure all of the technicians knew them. After that, all repair activities, cannibalizations, and regular maintenance were aimed at meeting those goals.

"It didn't take very long for the force to become integrated," said Colonel Lombardi. "Supply and maintenance started working together immediately, and we became the 94th TFS. The organizational patches quickly became blurred. I was amazed how quickly it all happened."

Innovation was the rule rather than the exception. Airplanes that were grounded because they were the source of cannibalization parts became test-beds for repaired "black boxes." Instead of performing a bench test, a technician would try the box on a real aircraft for quicker results. The pilots were more than willing to help with these tests.

"Holes" were also moved around to meet priorities. A cannibalized aircraft that needed, for example, five "black boxes" and would take three hours to fix would be made fully mission-capable at the expense of an F-15 that needed only three boxes but would take six hours to fix. The five-hole aircraft would be fixed first because it would fly sooner than the three-hole airplane and thus be of more help in meeting the sortie rate.

Added Colonel Hause, "The technicians came up with lots of new ways to fix things. People would come up to me and say, 'Here is the way we normally fix this, but it can be fixed this way, too. Can I try?' and I'd say, 'Sure.' We improvised, tried some new techniques, and combined some procedures, and they worked."

The unit also became quite proficient at fixing and working with the internal and external jamming pods during the exercise. All of the EW assets also performed quite well during Coronet Warrior.

Understanding and Teamwork

The pace of the exercise sped up the learning curve for the ground troops. They became more familiar with the avionics equipment and thus could pull off fixes much faster and with greater success. Rather than go through the whole failure

test program, the technician would logically deduce the most likely cause of the failure, test for it, and then fix it. This knack came from the added exposure of working with the equipment.

Morale, despite the 100-degree heat and twelve-hour days that often stretched to fourteen hours, was not a problem. What was a problem was getting people to go home and rest because they were so interested in the exercise. Extra duties and some bureaucratic procedures, as one participant noted, were "quasi-put-on-hold" for both the pilots and technicians. Lack of motivation was not a problem, either.

"Those people busted their butts out there," observed Captain Henderson, who also serves as the 94th TFS's plans officer. "They got to do for thirty days exactly what they got in the Air Force to do—turn the bolts, take the parts off, and get their hands on the aircraft. They really had a mission in front of them." Added Colonel Hause, "There were a lot of people grinning at 2:00 a.m."

There were a lot of grinning pilots, too. It is not often that the aviators get a chance to ply their trade for nearly two hours every day for a month. But instead of just "flying around the flagpole," each of the sorties involved stopping off for a fill-up at a tanker and running the electronic warfare course at Wallops Island. Most of the sorties also included dissimilar air combat training with Navy fighters from nearby NAS Oceana. "It really boosted our proficiency," said Lieutenant Dyck. "That wasn't the intent [of the exercise], but we definitely benefited."

A less tangible benefit to come from the exercise was understanding and teamwork. By working so closely for such an extended period, each of the specialists and technicians gained an understanding of what each area does to get the jets flying. "I always thought of support guys as 'boxologists,' " said Sergeant Wilson. "But I know now that it takes more than that. Working as a team, you learn to appreciate each other's job."

What's Next?

While Coronet Warrior was a strong success, it is just a very valuable data point. It is not the be-all and end-all for future WRSK evaluations. "This was one squadron, fighting one war, for one thirty-day period," General Viccellio said. "Their demand data and break data [for parts] may or may not be the average."

The mechanics of the Dyna-metric modeling technique worked well, though, and the modeling technique was proven conclusively by Coronet Warrior. The absolute need for accurate data to go into the model, however, was also clearly shown. Although the analysis of the data is not complete, the numbers generated from the exercise have already been fed into the computer to plan for a revised WRSK.

A revised spares kit could be beneficial in a number of ways. If the logistics numbers mavens determine that a spares kit can be equipped with fewer parts, that could mean that fewer than the five C-141s currently needed to airlift the WRSK could be employed. That would free up the StarLifters for other airlift assignments earlier in any future conflict.

Fewer parts in the kit would also lead to a less costly WRSK. During peacetime, the spares that make up the kit are basically protected in the squadron's supply warehouse. Although the kit is occasionally dipped into, those parts have to be replenished because the WRSK would have to go with the unit on the first day of a war. Any reductions in the number of parts needed would result in what could be a substantial savings.

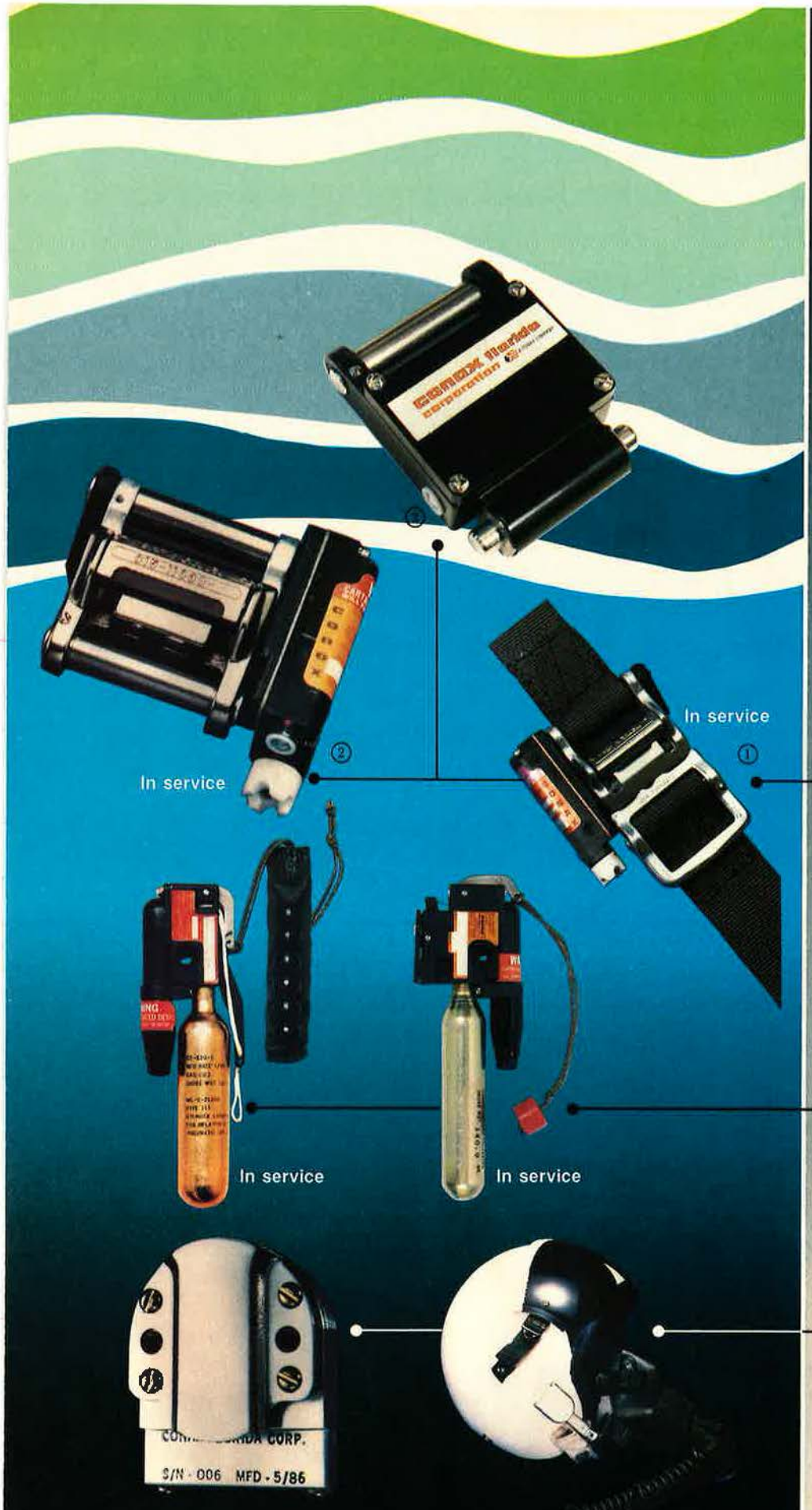
More important, any revised WRSK to come out of Coronet Warrior will have the parts that are most needed and are most usable—any "fat" that existed in the F-15 kit can now be trimmed.

The next step is to conduct a Coronet Warrior-style exercise for an F-16 unit, as the F-16 will be the heart of the Air Force's fighter fleet in the 1990s. The test, which is to take place at Shaw AFB, S. C., in late spring or early summer of this year, will provide a needed data base for revising the F-16 WRSK projections.

The F-16 is a newer-generation aircraft than the F-15 and is more reliable—so much more reliable, in fact, that the AIS, which proved invaluable to the 94th TFS, will not deploy immediately with the F-16 unit. The F-16 maintainers will have to do without AIS support until Day 30 in a war. That fact alone justifies the need for a full-up test.

"It is good to run exercises like Coronet Warrior," concluded General Viccellio. "We learn so much in related and unrelated areas. And any ability we have to get through a war and to get through this upcoming budget era is a step in the right direction." ■

By cannibalizing this F-15's engines, the maintenance troops were able to get two other aircraft flying. The computer model predicted that only four aircraft would be flyable by the end of the exercise, but innovation and hard work by the Coronet Warriors yielded seventeen flyable aircraft at the end of thirty days.



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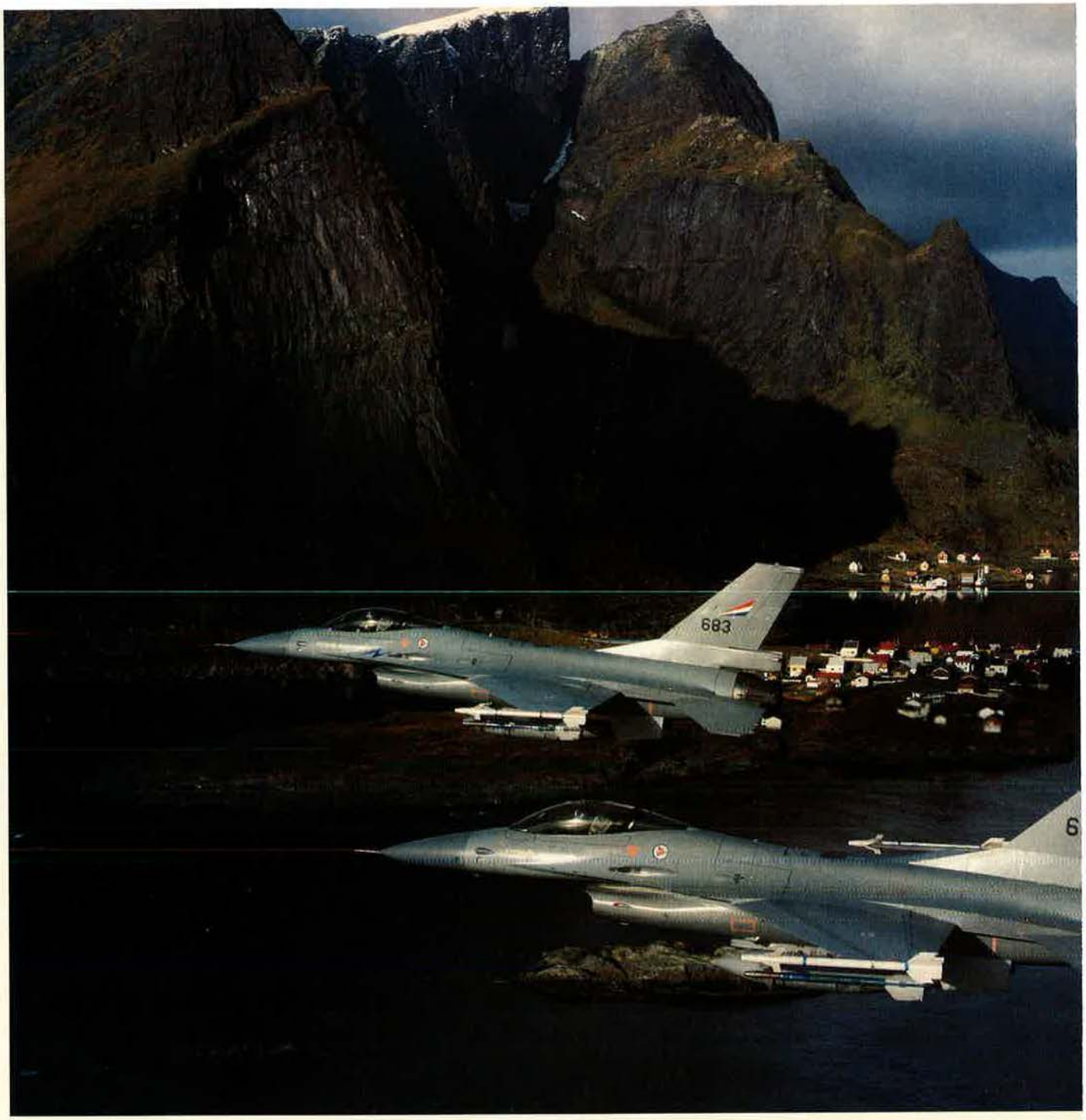


The most lightly defended stretch of NATO is also the key to Soviet maritime strategy.

The Northern

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

Norwegian F-16s cruise the fjords. If war should break out, the Soviets are expected to attempt to neutralize Allied airpower on the Northern Flank in order to protect their military forces operating from the Kola Peninsula. NATO, in turn, would try to bottle up Soviet forces and prevent them from breaking out into the Atlantic.

Flank

IN THE long-ago years of World War II, as we came off targets near the Baltic Sea, we would sometimes see a crippled B-17 heading for Sweden. Internment in that nearby land was a pleasant alternative to internment in a German Stalag. Of the Nordic countries, Sweden alone managed to remain aloof, militarily at least, from the war. With its products sought by both sides, Sweden also prospered.

The Allies had arrived too late to save Norway. German forces, aided by the notorious Norwegian fascist, Vidkun Quisling, conquered that country, after a two-month battle, in June of 1940, when German military power was at its zenith. That is not to say all Norwegians were subdued. A sizable number fled to Britain, where they served with distinction alongside the British forces, and King Haakon led a government in exile. The Norwegian RAF contingent, in particular, had a glittering record, returning in triumph at war's end to put on a memorable air show over Oslo. Many other undefeated Norwegians remained at home to continue the fight in the underground. When the war was over, Quisling was tried and shot, but his name lives on, a synonym for traitor.

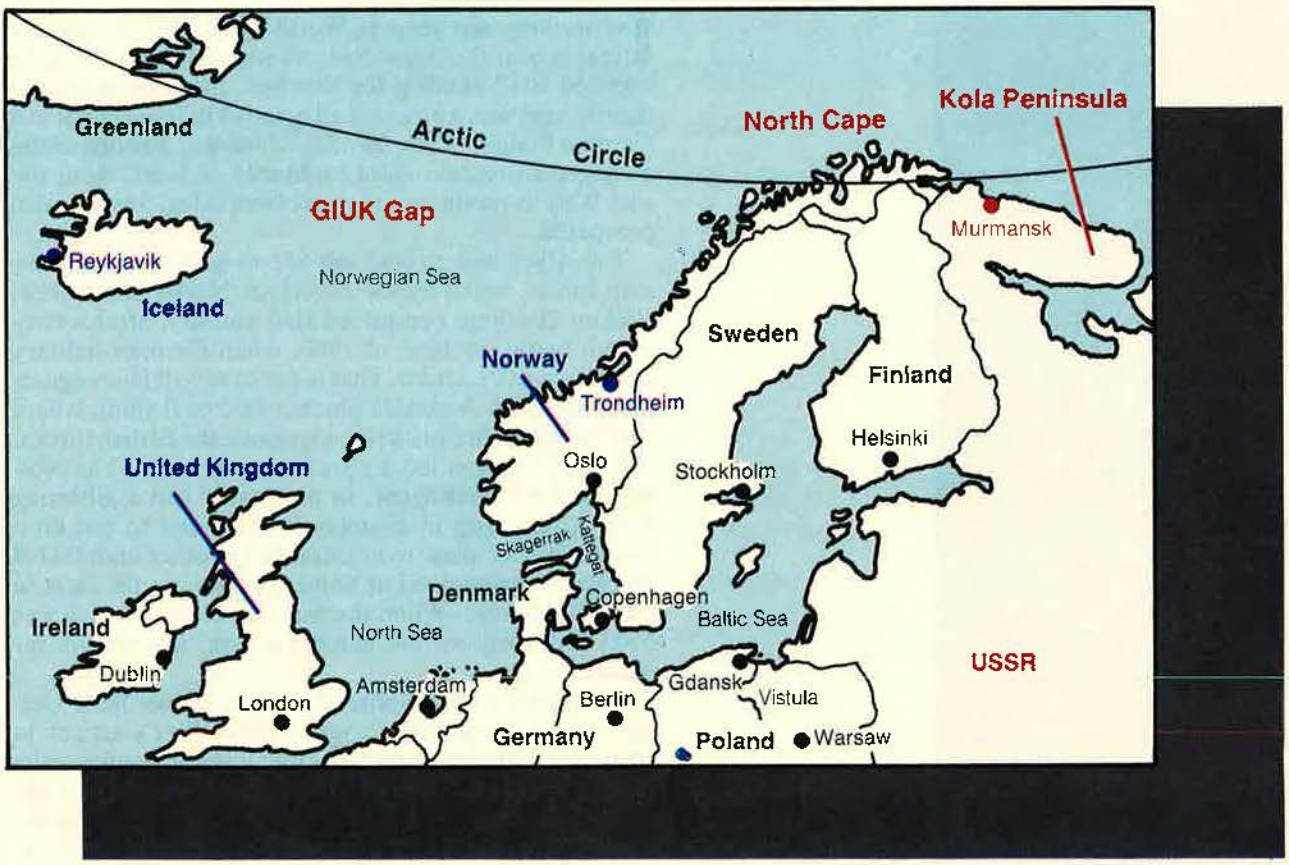
Denmark, a geographic extension of northern Germany, was more easily overrun by Hitler's armies in 1940. While there are many heroic tales of Danish resistance, Denmark was too close to Germany, and the Jutland Peninsula was too small and flat for even the kind of mischief the Norwegians were able to create in their fjords and northern mountains. Those Danes who joined the Frikorps Danmark and fought with Germany on the Eastern Front were treated as turncoats when they returned on home leave.

Finland had already had its war before 1940, in this case, a heroic struggle against the invading Russians. For a while, during the winter of 1939, the Finns seemed almost to have a chance, to the delight of much of the free world. But, vastly outnumbered, Finland at length surrendered to the USSR only to join Germany in 1941 when the Soviet-Nazi entente came to an end with Hitler's invasion of Russia. The final result was a loss of further territory to the USSR—about one-fifth of prewar Finland—and a requirement for neutrality and good relations with the Soviets. Finland has not only recovered from World War II's devastation but has become an economic showplace, the favorite shopping destination of privileged Communists from the drab land next door.

Iceland, the smallest of the Nordic countries, has, perhaps, the closest links to the Vikings. British and, later, American forces preemptively occupied Iceland and defended it during World War II, although there were no serious challenges from Germany. During that period, in 1944, Iceland declared its independence from Denmark and became a republic.

A Shared History

The Nordic countries have a long and intertwined history. Over the centuries, Norway, like Iceland, has been a part of the Danish kingdom. Finland was once a Swedish possession, as was Norway, for a time. And while there are some differences in vocabulary and distinctly different accents, Swedes, Danes, and Norwegians understand one another well enough. Icelandic



NATO's Northern Flank stretches roughly from the Kola Peninsula in the east to Greenland and Iceland in the west and from Germany in the south up to the Arctic Circle in the north. The Kola Peninsula in the Soviet Union hosts one of the world's largest concentrations of military power. Complicating NATO's defense against those Soviet forces is Scandinavian unwillingness to host foreign troops and bases and nuclear weapons except in case of conflict.

appears a bit more difficult—much of its vocabulary is based on Old Norse. Only Finland goes its own way linguistically, with a language that is incomprehensible to other Scandinavians. Curiously, according to a learned Turkish acquaintance, Finnish and Turkish share a few similar words. In order to deal with foreigners, all the Nordic countries have an easy familiarity with English, and Finns use English as the bridging language in dealing with their neighbors.

With all this closeness, we could suppose these northern countries would consider a common defense. They did, in fact, shortly after World War II when the Soviet menace began to emerge, but there were too many obstacles. Iceland was too remote, Finland's position with respect to the USSR too delicate, and while Norway and Denmark desired a westward tilt to a defense arrangement, Sweden insisted on neutrality. The alternative was continued neutrality for Sweden, a guarded sort of neutrality for Finland, and membership in NATO for Norway, Iceland, and Denmark. The traditional nonalignment of the Nordic bloc was thus ended. It was, in truth, no longer a bloc. The Scandinavian nations had gone their separate military ways, thanks, for the most part, to their separate experiences during the second World War.

Occasionally, one hears regret, even reproach, over Sweden's decision to stay out of the North Atlantic Treaty Organization. After all, it is one of the most prosperous nations, a stronghold of democracy and human rights and thus a natural ally of the other NATO partners. Besides, Sweden spends a respectable percentage of its GNP on national defense and has a highly developed armament industry. Even if the Soviets have chosen to make its coastal inlets a playground for their submarines, Sweden is a country that pays for its neutral stand with first-class forces.

It would be, on paper, a formidable addition to NATO, but there are other reasons why NATO might be better served by Swedish neutrality. The assumption supporting that statement is that Swedish neutrality tilts toward the West. A resolute and well-armed neutral Sweden could present a more persuasive deterrent than a NATO nation standing in the way, or so goes the rationale.

Be that as it may, the argument is academic. Sweden is determinedly neutral. NATO will have to make do with what it has for Nordic allies: Norway, Denmark, and Iceland. The latter's 240,000 inhabitants do not include any in military uniform.

The Northern Flank

Norway and Denmark, together with a bit of the north German plain, make up what is known as NATO's Northern Flank, or more formally, the Northern Command of Allied Command Europe. Iceland, in the military sense, belongs to the Atlantic Command, although the logic of this is doubtless more apparent to NATO functionaries than to the Soviets. Iceland, no matter in which command, is an integral part of any northern strategy. Northern Command, with headquarters in Oslo, is a British Army fiefdom, just as NATO's South-

ern Command is always awarded to an American admiral. Over the years, Northern Command has not been much in the news, although one rather contentious Commander in Chief, North, made a few headlines in 1970 with his views on the uselessness of nuclear weapons.

A principal reason for Northern Command's low profile is the Scandinavian attitude toward foreign troops and bases: They don't want any except under the threat of war. With the exception of a Northern Command headquarters contingent of allied officers and men, Norwegians can be essentially unaware of their membership in NATO, and the Danes even more so. It is a condition of Norwegian and Danish NATO membership that there be neither foreign troops nor nuclear weapons on their soil except in wartime.

That attitude may be understandable, but it does cause a planning problem. Reinforcement of NATO's Northern Flank must necessarily be from scratch. And this lightly defended stretch of NATO responsibility extending from the Elbe-Trave Canal in Germany to Norway's North Cape—a distance of more than 1,000 miles—holds the key to Soviet maritime strategy.

The Kola Peninsula is probably the most heavily armed area in the world. It is home base for the Northern Fleet, the largest of the four Soviet Navy fleets. A formidable surface complement includes two carriers equipped with V/STOL aircraft and helicopters, eleven cruisers, nineteen destroyers, and forty-seven frigates. There are also thirteen amphibious landing ships and a 1,000-man naval Spetsnaz brigade, troops highly trained in commando tactics. Sixteen airfields with blacktop runways and navigational aids, while not all in use, are available.

Clearly, the Kola Peninsula harbors considerably more than a defensive force. Among other objectives, it is a fair bet that seizure of Norwegian air bases is part of the Northern Fleet's war plan, stemming from bitter Soviet memories of damage done to Murmansk convoys during World War II and the havoc created by the Luftwaffe operating out of northern Norwegian bases. There are only, at most, about six of these, and while the Norwegian Air Force has put some maintenance and storage into tunnels blasted out of the rocky hillsides, it is hard to imagine a prolonged defense of these northern bases unless reinforcements arrive on the scene early.

NATO plans to do just that, mainly with US naval and Marine forces. The 4th Marine Expeditionary Brigade (MEB), its equipment prepositioned in Norway, will fly from Cherry Point, N. C., in Military Airlift Command transports. A Marine air wing, with F/A-18s and AV-8Bs, will make the trip nonstop in the hated survival, or poopy, suits, supported by USAF tankers and eight en route refuelings. The Marines do this exercise annually in the dead of Norwegian winter—or at least they have done so until now. The Norwegian government has recently decided annual exercises are too expensive, and so, presumably, they will be held less often in the future.

The Navy's Forward Strategy

Unfortunately, the Marines, like the rest of US forces, do not have designated Arctic troops. The learning curve, including getting around on skis and snowshoes, thus has its dips. Nevertheless, the 4th MEB would present a formidable obstacle to a Soviet assault on Norway's northern airfields, provided it can get there in time. For that to happen, NATO would have to take action on the basis of strategic warning or, at the very worst, tactical warning.

Sweden's proximity to the Soviet Union promotes a policy of well-defended neutrality. Some observers have argued that Sweden's tough neutrality deals Soviet war planners a wild card. Here, Swedish airmen service a JA-37 Viggen at a dispersed operating location.

To begin the complex NATO alerting process on warning of any kind is far easier talked about than done. First of all, there is always the worry that any considerable defensive preparations might appear provocative. Besides, increased NATO preparedness can come only after political wrangling. Getting the North ready would not be easy.

As a further complication, a Canadian brigade earmarked for Norwegian duty was withdrawn from that assignment this year and reassigned to the Central Front. Canadian authorities reasoned that Canada's small NATO contingent could function more effectively if it were consolidated. They are doubtless correct, but it does leave the northern Norway defense line even thinner than before.

Defense of the sparsely inhabited but militarily vital northern reaches of Europe is a complex affair. The task of the US Marines, to secure the airfields, is an important one, but it is at best a holding operation. Soviet power in the Kola Peninsula is too formidable to be neutralized by the forces NATO can provide on the ground. The US Navy, with its forward strategy, believes it has the answer. This concept, put forth vigorously by former Navy Secretary John Lehman and many senior admirals, would take the fleet directly against the Soviet forces based on the Kola Peninsula.

Of Resistance and Risk

Any sort of resistance to the Nazi occupation was both difficult and perilous. Resisters were not accorded the generally correct treatment that the Germans granted to prisoners of war, but were left to the mercies of the Gestapo.

One evening in Copenhagen, a friend and NATO colleague of mine took me to an apartment where the game had ended for him. He had concealed rifles and ammunition in the ceiling, in preparation for some serious resistance work. Instead, someone tipped off the Gestapo, and he was arrested. Fortunately, he was not shot, although there were days when he almost wished he had been.

His worst moments came during the Allied bombing of Hamburg, where he was working as a laborer. The fire storm and havoc remain fixed in his memory for all time.

Years later, in Brussels, it became my friend's distasteful chore to present to me Denmark's formal denunciation of our Christmas bombing of Hanoi. Having delivered his protest, he asked if he might sit down. Over a cup of coffee, the Dane, by this time a senior general, first apologized for his government's stand and then went on to say that he was perplexed. Why, he asked, didn't we silence critics like the Danish government by comparing the almost unbelievable precision of the Hanoi raids, and the minimal casualties even by Hanoi's own count, with the World War II bombing of Hamburg?

My Danish friend risked more, and was in harm's way to a greater extent, than most people in that war. Happily for us, there are a good many Danes such as he.

SACEUR's Northern Command is visible evidence of NATO's responsibility for its Northern Flank, but the US Navy is viewed by Norwegians as their principal ally. The Navy's bold forward strategy, considered foolhardy in some quarters, sees the US Second Fleet, with allied detachments, entering the Norwegian Sea north of the Greenland-Iceland-UK gap—or, in military jargon, the GIUK gap—before war breaks out. The plan calls for a powerful armada: probably a carrier strike force with three battle groups, the aforementioned 4th Marine Expeditionary Brigade, and a British antisubmarine contingent.

Unlike the Soviet Baltic ports, which freeze early in winter thanks to the freshwater flow from the Vistula and other rivers, the Norwegian fjords do not freeze—a happy fact of Nordic climatology for this maritime strategy. They also provide excellent hiding places for ships, and ships in these fjords are not only hard to find but are hard to hit from the air. Or at least they were in World War II.

Arctic operations, however, present a cruel environment for men and machinery. Temperatures in north Norway fall to minus forty degrees Fahrenheit, at which point everything moves more slowly, and tasks are infinitely more difficult to perform. The difficulty is the same for both sides, but the Soviets do have a big advantage in proximity to home and in numbers. They also have their 1939 Finnish experience to remember, when a small force of determined Finns made the mighty Soviet Army look foolish. They know, too, that the best time to attack is in the fall.

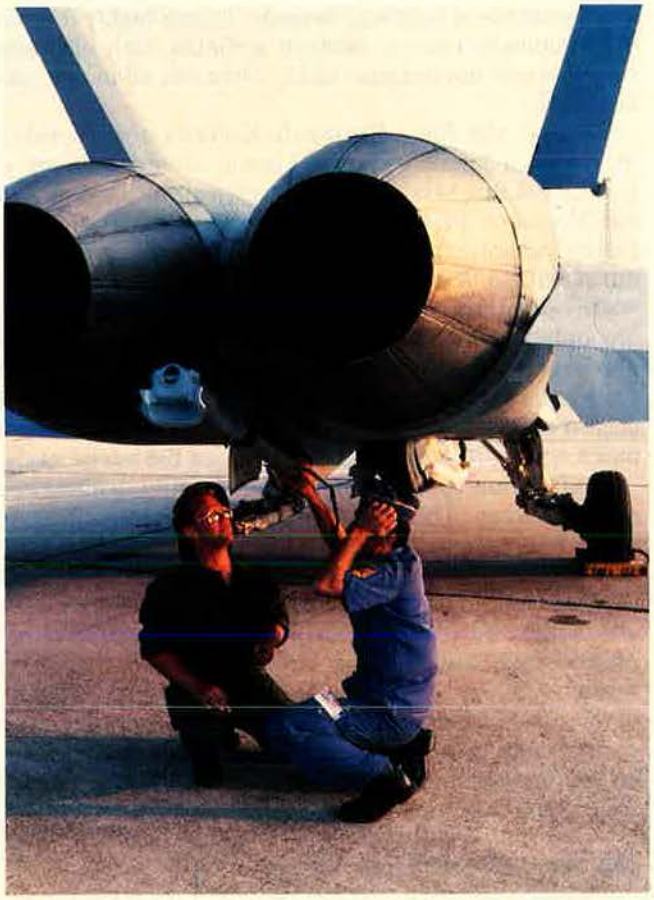
Scenarios for Conflict

The armchair strategist can conjure up a variety of scenarios for a war in the north, but the most plausible is patterned after the 1940 German invasion, with one notable variation—a determined attempt by the Soviets to capture Iceland. For while air superiority was important in World War II, it would be essential next time around. Whoever gains air superiority, whether attacker or defender, holds the key to military dominance of the sea approaches to Kola.

It follows, then, that defense of NATO's Northern Flank depends to an even greater degree than other NATO strategy on timely reaction to intelligence warning. Unless reinforcements are in place, a Soviet preemptive attack might well result in a *fait accompli*, much as the German venture did in 1940. An alternative to forces in place on the ground, albeit an expensive one, would be the constant presence of US naval forces off the coast of north Norway.

While north Norway and Iceland are surely the ultimate prizes in the eyes of the Soviet attacker, the Baltic and its approaches play an important role in northern strategy. At the very least, conquest of the Baltic should not come easily.

Denmark, contiguous with Germany and an easy land invasion route, shares its vulnerability with the north German plain. As in the north, air superiority is the essential element. Denmark's other contribution to the defense would lie in its ability to mine the Baltic passages to the North Sea—Kattegat and Skagerrak—thus



A Marine air wing of F/A-18s and AV-8Bs is slated to reinforce Norway in case of war. The Marines have deployed the wing to Norway in annual exercises, but because of the expense involved, those exercises will probably occur less frequently in the future.

Soviet Bear bombers routinely traverse the GIUK gap during flights into the Atlantic and to Cuba. The US Navy's forward strategy would send Allied forces into the Norwegian Sea to prevent such Soviet forces from menacing the US supply route to Europe.

bottling up, or at least slowing down, the Soviet Baltic Fleet. There is a discouraging likelihood, however, that the Soviets, on one pretext or another, would have sailed their combatants out of the Baltic before any crisis reached the point of Danish reaction.

Therein lies the difficulty in defending NATO's Northern Flank. The Scandinavian allies are edgy about stirring up their giant neighbor by readiness measures that might appear provocative. Even such stalwarts as the Norwegians require the US Marines to stockpile their war readiness gear well to the south in Trondheim rather than in the northern region where it will be needed.

This sensitivity to Soviet displeasure has not been without cause. The USSR has applied steady diplomatic pressure on the Scandinavian countries to remain defenseless and nonaligned. Norway has been a particular target of this Soviet effort to neutralize the Nordic lands. The fact that Norway has joined the Alliance and made only slight concessions to Soviet sensitivity says a lot for Norwegian courage.

In any case, a successful defense of the Northern Flank, and Norway in particular, will take some remarkable doing. A war between NATO and the Warsaw Pact or, for that matter, any war involving the United States and the USSR would almost certainly see a Soviet attack on Norway.

Soviet military literature reveals a great understanding of Hitler's successful gamble against Denmark and Norway. A key element in that gamble was the imaginative use of airpower against superior British naval forces. Then, there was the toll taken on convoys to Murmansk by the Luftwaffe based in north Norway. If Soviet planners have their way, that will not happen again.

Important and Vulnerable

How to hang on to the north is a most important question for NATO strategists. It will take imagination, early reaction to warning, and the combined resources of land, sea, and air. It will also require at least a holding action in southern Norway, for the Germans, remember, took the south first. After that, the north was no problem.

Occasionally, NATO's Scandinavian allies give some slight indication of a lessening will to resist. There is, for instance, the drive to declare all of Scandinavia a nuclear-free zone. Aside from the fact that such a declaration would have no more force in the real world than a similar one made in Berkeley or Boulder, it is divisive in an alliance that relies on nuclear weapons as part of its strategy.

A more serious shortcoming has been Denmark's long-term reluctance to spend much on defense. While the Danes now have a conservative government, Denmark has strong antidefense elements in its political structure. Some years ago, a Danish minister in one of the more liberal Danish governments suggested, not entirely in jest, that Denmark abandon defense in favor of a loudspeaker positioned on the border and programmed to blare, "We surrender." He was by no means typical, and there are in the Danish military ranks some of NATO's strongest supporters, but Denmark, with its two percent or so GNP defense budget, is a worry.

To be honest, we should not worry too much. The Danes don't do enough toward their own and the mutual defense, but happily, they are a part of that defense. The Danish Navy, along with the Navy of the Federal Republic of Germany, shows the flag in the Baltic in full view of the satellite navies of Poland and East Germany. Danish Air Force F-16s and German Tornados are also in evidence over the Baltic, and they must be taken seriously by the other side.

NATO's Northern Flank is both important and vulnerable, and it is no overstatement to say that that region holds the key to Soviet maritime and Arctic strategy. But the Northern Flank is only a part of the larger NATO whole, all of which is both important and vulnerable. The plain fact is that the Northern Flank, like the rest of the Alliance, is most of all a symbol of a unified front against Soviet aggression. Were they outside the Alliance, Norway and Denmark might long since have gone the way of Finland. ■

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It's a mistake to think of air defense, space defense, and ballistic missile defense as separate missions. They fit together naturally as parts of a single package.

The Strategic Defense Triad

BY DONALD C. LATHAM

THIS nation has long since entered an era in which active defense is a requirement for survival. Strategic defense should be viewed as a three-tiered concept—in effect a "triad" composed of defense against air-breathing and strategic air-to-ground missiles and aircraft, defense against ballistic missiles of all ranges launched from fixed or mobile facilities, and defense of space-based systems that support military operations.

A Strategic Defense Triad (SDT) architecture would consist of a variety of weapons, aircraft, spacecraft, and missiles and a survivable and enduring command control communications and intelligence (C^3I) system.

The concept of a Strategic Defense Triad is not entirely new. The Defense Department has studied integration of air, space, and ballistic missile defense in the Strategic Defense Architecture 2000 (SDA 2000) initiative. Focus on the Strategic Defense Initiative (SDI), however, has tended to obscure the two other vital legs of the defensive triad.

In particular, a "super" SDI system would be fatally flawed without a supporting "super" air and space defense, all integrated with a very capable C^3I system. Another major factor is that defensive systems all *must* eventually be embedded into and operate as components of the much larger global National Military Command System (NMCS). It is important to understand each component of SDT and assess how it could function in the overall strategic defense equation.

Too often, the term "C^3I" is used to describe or discuss communications or emitter location systems when they are, in fact, subcomponents of some larger C^3I capability. In the context of the SDT, supporting C^3I components and systems are woven into the entire fabric of the battle-management sensors, networks, weapons, and operations.

It is the intelligence, or "I," com-

ponent of C³I that must provide, from its globally deployed multiple sensor network, relevant indications and changes in potential enemy forces. This is usually known as "strategic warning," distinct from the so-called "tactical warning" we might receive that weapons have been launched against us.

In a time of heightened tensions, there would be ambiguous indicators, deception would be used, and the assessment function thus would become more difficult. But with sophisticated multiple sensor systems and our ability to process incredible volumes of data in near real time, along with greatly improved assessment techniques, we can reasonably expect to provide the President as well as the force commanders with adequate strategic warning of attack on the United States or on its allies.

Zero warning—the so-called "bolt out of the blue"—is a highly improbable but not impossible event. However, the actual timing of an attack would likely come as a surprise.

Tactical warning for an ICBM launched from the Soviet Union would be perhaps thirty minutes and less than that for an SLBM launch. In the future, when space-based assets attack each other, the tactical warning could shrink to seconds, or to the time it takes a pulse of laser energy to traverse a few thousand kilometers. Attacks from space on earth-based targets could also be carried out with extremely short tactical warning.

Other Critical Support

In addition to warning, C³I must provide the SDT with other critical support. This includes assessment centers for sifting, correlation, and merging of data; command centers where operational commanders allocate defensive resources; and weapons control centers from which weapons are employed.

In the case of air defense, such first-generation centers as the highly useful Airborne Warning and Control System already exist. For space defense, we are in the early stages of designing and constructing such a capability. For ballistic missile defense (BMD), no such centers exist in the United States. The Soviet Union, however, does have BMD command and control centers for the Moscow ABM system.

To link the sensors, weapons, and command and control centers into a coherent, interoperable whole, an "elaborate" communications network is required. "Elaborate" means a communications system with survivability against enemy electronic attacks, use of multimedia transmission for connectivity and redundancy, graceful degradation as it is destroyed or degraded, ability to be partially reconstituted rapidly, and survivability against and ability to operate in spite of certain nuclear effects. It must further be affordable and available in the time required. Such communications systems are either in place or are in full-scale engineering development and should be available to support the SDT—at least in its early stages.

As new technology matures and the architecture becomes better defined, one can predict the need for newer communications systems, netted and distributed command and control, and multisensor data fusion. The major technical challenges will continue to be the concept definition, design, and test of software to permit rapid and accurate decisions and the ability to manage large data bases and, in effect, to "run" the integrated defensive systems—all in near real time.

Zero warning—the so-called "bolt out of the blue"—is a highly improbable but not impossible event.

An effective continental air defense system that *must* also function *after* a massive homeland-to-homeland nuclear exchange is a very difficult requirement to meet technically and operationally. The Soviets continue to invest massively in air defense, deploying new fighters by the thousands, new airborne control platforms, and modern surface-to-air missile systems, radars, and internetted command control and communications. Some estimates place the Soviet air defense investment in excess of $100 billion. Their system requires tens of thousands of personnel to maintain and operate, and the annual operating costs are substantial.

Peacetime or prestrike air defense warning sensors and associated C³ and intelligence systems can be quite effective in providing high-quality warning of bomber and

tanker movements. Both the Soviet Union and the United States have elected to deploy a combination of fixed, large, over-the-horizon (OTH) radars; fixed, shorter-range microwave radars; and mobile airborne radar systems. The Soviets, however, have deployed thousands of fixed and mobile radar systems for detection, tracking, and eventual engagement, employing more than 10,000 surface-to-air missile launchers. In contrast, the US has few microwave radars capable of doing anything in an air defense sense and *zero* surface-to-air missiles or gun systems deployed in the United States.

The warning problem against submarine-deployed cruise missiles is more difficult. Space-based sensors can detect ballistic missiles while their engines are burning. In contrast, it is exceedingly difficult from space to detect cruise missiles in flight, let alone track them continuously. This, combined with manned bombers flying at extremely low altitudes for extended ranges, complicates the air defense problem.

Other factors complicating the defense against cruise missiles and bombers include electronic countermeasures to deceive and/or jam warning and tracking sensors, decoys to "fake out" the defensive systems, and techniques to deceive and/or degrade the performance of the command control and communications systems that would, in turn, degrade the ability of the defensive system to function as an integrated whole.

The Air Defense Initiative

We cannot ignore the bomber and cruise missile threats and focus exclusively on SDI—a situation that has prevailed too often in recent years. The US cannot adopt the "blanket the homeland" approach of the Soviet Union for reasons of cost, political reality, and, perhaps more important, technical futility.

This latter point is underscored by the broad threat of low-observable cruise missiles and the potential of an Advanced Technology Bomber (ATB). Such capabilities on the US side promise to return the Soviet air defense system to the Dark Ages, especially since bombers would follow a retaliatory missile strike that had degraded some portions of the defenses. The reverse situation would likely obtain for the US as well.

If a viable defense against ballistic missiles is developed and deployed, it will likely have vital space-based components.

What then should the United States do in air defense as the Soviets progress in the coming years to their potential versions of ATBs and advanced cruise missiles launched from both aircraft and sea forces?

- Do not attempt a *total* homeland defense. It's in the "too-hard" pile for several reasons.
- Plan to protect only those assets that would give great pause to Soviet war planners *if* deterrence should ever fail.
- Employ highly mobile warning, detection, and engagement defensive systems.
- Use a mix of airborne, ground-based, and sea-based systems, with heavy emphasis on ASW against cruise missile-carrying submarines.
- Develop means to detect and engage the sea and airborne cruise missile carriers *well before* they are able to launch their missiles.
- Employ preferential defense tactics to compound Soviet targeting difficulties.
- Be able to reconstitute some portions of the defense as elements are destroyed.

The newly constituted Air Defense Initiative (ADI) is a triservice joint program with the Air Force as executive agent. Initial funding will address both technology and concepts. It will likely be years before anything radically new emerges from ADI, but some SDI research could find use in ADI sooner than one might expect.

Space Defense

The United States, like the Soviet Union, is increasingly dependent on space-based sensors and communications.

More sophisticated satellite-based sensors are evolving to include those required for surveillance of space from space for the active defense of national space assets and other missions. Thus, space defense can be expected to take on an ever-increasing level of sophistication, and expenditures will rise as technology and operational doctrine mature.

If a viable defense against ballistic missiles is developed and deployed, it will likely have vital space-based components. This means that space defense of *these* components will be required. The same may soon be true in air defense. Space-based components, such as radar, could be required for defense of wide areas against threats coming from all directions.

Air, space, and ballistic missile defense must be interlocked so tightly and crafted so carefully that the triad of defensive systems functions as one. This further demands that the funding priorities for SDT must be viewed in totality and not allocated heavily to any one leg to the detriment of the others. So far, SDI has tended to dominate.

Operationally, this calls for near real-time command and control coordination, interoperable and networked communications, equally shared intelligence, and common, up-to-date knowledge of friendly forces.

Conventional BMD

A subset of the Strategic Defense Triad is defense of tactical forces

and allied territory against shorter-range ballistic missile systems, which might be either nuclear or conventional. (Air defense must be integrated with the tactical ballistic missile defense system as well.)

A spinoff from SDI research could be a system capable of defending against the shorter-range ballistic missile threats to such areas as Europe, the Middle East, Korea, and Japan. The Army is working on several concepts for what it calls Anti-Tactical Missile (ATM) Defense and has established a Joint Tactical Missile Defense (JTMD) Project Office at Army Missile Command. This joint project office will address a four-tier concept consisting of active defense, passive techniques, counterforce, and C^3 for battle management (C^3BM).

Some would argue that the short-range (up to several hundred miles) ballistic missile threat is not all that serious, especially if it is nonnuclear. Furthermore, the Intermediate-range Nuclear Forces (INFs) agreement seems to promise elimination of all except the longest-range ballistic missile threats.

Unfortunately, the Soviet short- to medium-range ballistic missile threat remains of great concern, especially in Central Europe and in the Middle East. The new Soviet array of mobile surface-to-surface missiles (SSMs) consists of at least three new systems that are extremely accurate and capable of carrying nonnuclear, chemical, or nuclear warheads. The mobile launchers can be rapidly reloaded. The nonnuclear warheads could consist of multiple warheads or submunitions that might contain independent terminal guidance for attack of specialized targets.

Given sufficient numbers of the missiles, a devastating conventional strike could be mounted with little or no warning and short launch-to-impact time. A handful of such missiles equipped with modern submunitions can close down an airfield quickly and keep it closed for hours or days. Add chemical munitions, and it gets worse. Those who contend that the Soviet forces in Europe and elsewhere are "defensive" in nature and that preparations for a large-scale attack could be detected "early" should reassess that contention.

Those who contend that the Soviet forces in Europe and elsewhere are "defensive" in nature should reassess that contention.

Observations and Recommendations

The foregoing boils down to a number of observations leading to some specific suggestions. First the observations.

- Strategic defense is a triad of systems. They should be technically and operationally integrated just as are the strategic offensive forces.
- Management and funding priorities for the air and space defensive legs of the triad should be more balanced and in phase with the SDI program.
- The technical and operational challenges facing SDI are not necessarily unique or that much more difficult than those found in air and space defense systems.
- More technical synergism is needed among the legs of the defensive triad because several sensor, C^3, intelligence, and weapon concepts could apply to all three legs, partially or in whole.
- The command control communications and intelligence (C^3I) and the associated so-called battle management mission, function, concepts, and designs *badly trail* the defensive weapon development initiatives in time, funding, and technical maturity.
- Tactical ballistic missile defense is also a serious requirement and deserves high-level attention and resource priority.

To better orchestrate the Strategic Defense Triad and move it along more rapidly, some initiatives are worth consideration:

- The JCS and US Space Command should undertake development of joint plans, doctrine, and operational concepts of employment for a Strategic Defense Triad.
- The research, development, and acquisition of the joint defensive systems should be coordinated and overseen by a single office within the Office of the Secretary of Defense. This implies the amalgamation of the SDIO into the existing acquisition structure as opposed to its present status as a stand-alone agency devoted only to defense against ballistic missiles.
- Delegate to USCINCSPACE the overall responsibility for the Strategic Defense Triad, to include the oversight of development and acquisition and the integration into the overall NMCS and force structure for day-to-day operations. This would move the Tactical Air Command (TAC) CONUS air defense mission as well as all ballistic missile and space defense activities under USCINCSPACE for Strategic Defense.
- Develop a master plan for strategic defense development that integrates the plans for SDI, ADI, and space defense and addresses resource priorities for each leg of the Strategic Defense Triad. ■

Donald C. Latham is the Systems Group Vice President of Computer Sciences Corp. in Falls Church, Va. From 1984–87, he served as Assistant Secretary of Defense for Command Control Communications and Intelligence. Notwithstanding his recent government service, the views expressed here are his own and should not be construed as reflecting those of the Department of Defense.

Airman's Bookshelf

"Why Not?"

Voyager, by Jeana Yeager and Dick Rutan, with Phil Patton. Alfred A. Knopf, New York, N. Y., 1987. 337 pages with photographs. $19.95.

On December 23, 1986, history was made. Nine days before, on December 14, an odd-looking aircraft took off from Edwards AFB, Calif., and subsequently circumnavigated the globe nonstop and without refueling. This aircraft, named *Voyager,* was piloted on its nine-day journey by Jeana Yeager and Dick Rutan. This book is their story.

Dick Rutan's obsession with flying and airplanes began when he was a child. His family traveled wherever there were planes, especially to Air Force bases. Rutan grew up in the 1950s during the height of the Cold War. In the book, he recalls an episode of the television series "Dragnet" that featured fighter pilots and the sound of sonic booms. "When you don't hear that sound anymore," Jack Webb said, "it will mean we are no longer free, because that is the sound of freedom." To Rutan, fighter pilots were like supermen. He had to be one.

He began flying lessons when he was fifteen and soloed after just five and a half hours of training. At sixteen, he got his private license. Then it was on to commercial, instrument, multiengine, seaplane, and instructor certificates. In 1958, he entered the Air Force as a navigator candidate.

It took almost eight years, but Rutan finally got his chance at pilot training. On graduation, his boyhood dream of flying an F-100 came true. He finished at the top of his class and picked one of two F-100 slots. In 1967, he was assigned to Vietnam, where he flew 105 missions over North Vietnam.

Jeana Yeager contends that her first spoken sentence was, "I want a horse." Although she grew up with horses, it was her fascination with dragonflies that attracted her to flying. She won her private pilot's license in 1978.

Aviation brought Dick and Jeana together. Jeana stopped by a booth that Rutan and his family had set up at an air show at Chino, Calif., in 1980. It was their first meeting, with many to follow.

They dated for a while. Yeager did not have a job, and Rutan was unhappy working at the Rutan Aircraft Factory. They decided to start their own company. They planned to take one of brother Burt Rutan's many aircraft designs, produce it, and pay him a royalty. Over lunch, Yeager and Rutan approached Burt with the idea. Burt casually asked them to do a round-the-world flight, without refueling, before starting the company. Yeager responded with, "Why not? Let's do it." No one could think of any reason why they should not. Burt outlined his plan on a napkin, and the *Voyager* story began.

Yeager and Rutan thought *Voyager* involved two challenges. One challenge was a public one—the challenge of innovation and leadership in design and technology. The other challenge was one of personal danger.

For the round-the-world flight, Burt Rutan planned an aircraft with a range of 28,000 statute miles. The first sketch was a flying wing. But when Burt ran the design through his computer, he found that it didn't provide enough fuel capacity.

Burt turned to a notion that he had been exploring: twin booms or outriggers. It looked like an oversized version of Kelly Johnson's classic World War II P-38, although the concept was very different. Because *Voyager* was to use the engines in stages, Burt put the engines front and back. The wings, booms, and fuselage were to be a series of fuel tanks. The graphite structure itself, partitioned with bulkheads and pierced by the light plastic tubing that, joined with safety wire, was to serve as fuel lines, would hold the fuel. There were to be no exterior tanks.

Voyager was, in essence, a large fuel tank. However, keeping the weight down became imperative. For every pound added to the 939 pounds of basic fuselage and wing, six more pounds of gasoline would be required.

With the design completed, the next hurdle was money. For eighteen months, Rutan and Yeager rode a roller coaster of hope and disappointment. They approached corporations for sponsorship, but failed to find any that were interested. They sold shirts and posters and did fly-ins at air shows, all to raise money. But there continued to be setbacks. They explored the possibility of a nonprofit organization, but encountered bureaucratic restrictions and time delays.

Yeager developed the idea of the Voyager Impressive People Club (VIPs). Its success depended on wide, grass-roots involvement. The VIPs finally became the primary sponsor Rutan and Yeager never found in the corporate world.

To help establish their credibility, Yeager and Rutan decided to attempt to set records with another aircraft. They thought that it would get favorable attention and help bring in funding for *Voyager.* They built an aircraft designed by Burt that was called a Long EZ.

In May 1981, they took their Long EZ to Alaska with plans to set a distance record in the international C1B category—the category for airplanes weighing less than 1,000 kg. Dick's goal was to exceed 5,000 miles by flying nonstop from Alaska to St. Thomas in the Virgin Islands. He landed short of his goal when, after thirty hours and eight minutes and 4,563 statute miles, he put down on Grand Turk Island, northeast of St. Thomas. However, he had broken the previous record long before, somewhere over Chicago.

Yeager and Rutan started to build *Voyager* in the spring of 1982. They knew very little about how to proceed and relied chiefly on the TLAR method—"that looks about right"—and the SWAG rule—"scientific wild-assed guess." By May two years later, the pieces were mostly assembled; the fuselage and wings and cowlings were all together and ready for paint.

They finally had something that looked like a whole airplane.

On June 22, 1984, more than three years after Jeana and Dick started a program that they thought might take a year, *Voyager* flew for the first time. Yet it would be three more years before the beginning of their triumphant nine-day flight.

Originally, they planned for a roomier, pressurized cabin and fewer days in the air. They settled for a cramped space and an oxygen system in an unpressurized cabin. Noise levels ranging up to 110 decibels forced them to wear earplugs. None could be found to meet their requirements. Special earplugs had to be made. Fecal-containment bags would serve for sanitation.

After sixty-seven flights and 354 hours in the airplane, Yeager and Rutan were ready. The airplane was ready. The mission began with good news and bad news. On takeoff, they set a record: the longest takeoff ever from Edwards AFB, Calif. To get off the ground, they had to use up all but a thousand feet of the longest runway in the world. The bad news was that the wingtips had dragged, causing damage to the winglets.

This was just the beginning of many problems. They encountered autopilot problems, harsh weather, fuel gauge problems, and much more. At different points in the trip, it looked as if they would have to give up. And when it was over and they were asked if they would do it again, Yeager and Rutan said, "No, no, once was enough. Not again."

But when asked if it was worth it, both simply said, "Yes."

—Reviewed by Maj. Miles C. Wiley III, USAF. Major Wiley is currently a student at Air Command and Staff College at Maxwell AFB, Ala.

Workhorse Wimpy

Wellington: Mainstay of Bomber Command, by Peter G. Cooksley. Patrick Stephens Ltd., Wellingborough, England, 1987. 176 pages with photos and index. $19.95.

In his latest book, Peter Cooksley memorializes one of the great airplanes of World War II. Designed by Dr. Barnes Wallis of "Dambusters" fame, the Wellington was an unglamorous workhorse that symbolized the might of RAF Bomber Command in the early years of the war. The long-range night bomber carried the war to German soil before the deployment of such bigger bombers as the Short Stirling, Handley Page Halifax, and Avro Lancaster.

Like the B-17 Flying Fortress, the Wellington could take great punishment. It could become riddled with holes or have one of its engines knocked out, but its crew still had a good chance of getting back to base in one piece. Credit went to Wallis, whose ingenious "geodetic structural concept" gave the plane such inherent strength and resilience.

It was not the easiest plane to fly, but its crews loved the Wellington. It was named in 1936 for the Duke of Wellington, the victor of Waterloo, but the RAF airmen and ground crews nicknamed it "Wimpy" after the cartoon character, J. Wellington Wimpy, in the *Popeye* newspaper comic strip.

Powered by two 1,050-horsepower Bristol Pegasus XVIII radial piston engines, the Wellington had a maximum speed of 235 miles an hour, a wing-

span of eighty-six feet, and a length of sixty feet. It carried up to 4,500 pounds of bombs, and its armament consisted of eight .303-inch machine guns—two in the nose, four in the tail turret, and two in beam positions. It had a crew of five to six men.

Peter Cooksley has assembled in this book a wealth of memories of Wellington operations, stretching from the earliest flight-test days in the late 1930s through the stern early years of the war when the Wellington was Bomber Command's mainstay in the night offensive and up to its service in the 1950s. There are many exciting accounts of both day and night raids, aerial battles with flak and night fighters, sea patrols, downings in hostile territory, battles with the elements, near-misses, and tragic losses.

More than 11,000 Wellingtons rolled off the assembly lines at Weybridge, Blackpool, and Chester for service with the RAF, Royal Australian Air Force, Royal Canadian Air Force, and Royal New Zealand Air Force in almost every theater of operations. Six squadrons of Bomber Command were equipped with Wellingtons at the outbreak of war. The number rose to twenty-one by the winter of 1941–42.

The Wimpy was in action from the start. On September 4, 1939, Wellingtons of Nos. 9 and 149 Squadrons—along with Bristol Blenheims—bombed German shipping at Brunsbüttel. Wellingtons flew in Bomber Command's first raid on Berlin on August 25–26, 1940, a Wellington dropped the first 4,000-pound "blockbuster" bomb during a raid on Emden on April 1, 1941, and 599 Wellingtons took part in the famous 1,000-bomber raid on Cologne on the night of May 30, 1942. Wellingtons dropped almost half a million tons of bombs on Axis targets in Europe.

Wing commanders rub shoulders with aircraftmen in this reliable, readable narrative. The book also provides all the necessary detail about Wellington equipment, characteristics, markings, variants, and such peacetime missions as famine-relief flights and training exercises.

Wellington preserves a vital chapter of aviation history and deserves a place in every World War II library. It is a most rewarding history that interweaves the stories of the Wellington and the men who flew it.

—Reviewed by Michael D. Hull. Mr. Hull, a veteran of the British Army, is a journalist with the Springfield Newspapers in Massachusetts.

The Business End

The Illustrated Encyclopedia of Aircraft Armament, by Bill Gunston. Orion Books, New York, N. Y., 1987. 208 pages with glossary and index. $24.95.

There are countless aviation books on the market that detail heights, weights, and engines fitted into aircraft types. However, almost to a volume, these books give little more than a cursory listing of what types of armament a certain species of airplane carries. There is a real gap between knowing that a B28 is a nuclear bomb and knowing what it looks like and how much it weighs. This work more than fills that gap.

This book is an enthusiast's and specialist's dream. There are hundreds of color pictures, cutaway drawings, and detailed descriptions (including user countries) of every major type of gun, bomb, rocket, and missile that falls between Argentine general-purpose bombs and the US-built Tround 12.7-mm (0.5-inch) machine gun now in test by the Navy.

The opening section of the book gives the history of aerial weapons development. Divided into four eras—World War I, 1920 to 1950, Korea and After, and Current Systems—this is the encyclopedia's only lengthy section of text. Each era's section is illustrated with archival photographs showing major developments, such as powered gun turrets.

While the text is interesting and filled with information, this section is no masterpiece. Author Gunston veers somewhat unevenly between extremes. His discussion of World War II German cannon reads like a laundry list, but the section dealing with the development of air-to-air missiles is a valuable historical review.

One thing that is most interesting, though, is the author's opinionated outlook expressed in this book. Long known as a straight-shooting, highly accurate documentarian, Bill Gunston doesn't mince his words here:

- The "Ju-87R was effective only against indifferent opposition."
- "These flying lighthouses [airborne warning and control aircraft] . . . would appear to have a life expectancy in warfare of precisely zero. . . . [T]here must be some unannounced 'gentlemen's agreement' that in wartime they would not be destroyed."

The reader really doesn't mind such opining because Mr. Gunston knows what he is talking about and has demonstrated that fact many times.

The last two-thirds of the book is a weapon-by-weapon listing organized by country of origin and broken down into unguided ordnance, air-to-surface missiles and torpedoes, air-to-air missiles, and machine guns, cannons, and pods.

The sections begin with an overview of each of the weapon types, and each individual entry lists the specifications and then goes into a brief text section on development or employment. Some entries include ribbon diagrams showing how to deliver such weapons as an AGM-65 Maverick missile from low level. Also helpful are the frequent explanations of such concepts as how semiactive missile radars work.

So far as negatives are concerned, this book has only a few minor ones, and those are mostly of the typo variety. Acronyms are used frequently, which is somewhat of a distraction while reading the text. The book's glossary, however, is always available and is helpful. The historical section could have been more detailed and expanded a little more, but that is just a personal observation.

Because it concisely fills a need that has existed for some time, *The Illustrated Encyclopedia of Aircraft Armament* makes for a wonderful addition to the reference shelf. It might not be for everyone, but for anybody who has to know (or who just wants to know) the differences between a Kormoran and a Sea Eagle or between a Hellfire and a TOW, this is a needed and welcome work.

—Reviewed by Jeffrey P. Rhodes, Aeronautics Editor.

New Books in Brief

Born to Fly, by Gen. Edwin W. Rawlings, USAF (Ret.), with Edwin B. Stone. This autobiography of the first Comptroller of the United States Air Force is, as former AFA Executive Director Russell E. Dougherty writes in the foreword, "a real-life American success story." The Minnesota native, inspired by Lindbergh's transatlantic solo flight, joined the Air Corps in the late 1920s. After graduating from Harvard Business School in 1939, he served at Wright Field during World War II. His postwar duty included stints as the first USAF Comptroller and as Commander of Air Materiel Command. In 1959, he left the service to begin a successful second career in industry, eventually becoming President of General Mills. General Rawlings remains active in retirement, raising funds for scholarships

to the Air Force Academy and promoting computer literacy among the young. His life story, told here with characteristic Rawlings zest, is one of exemplary vision. With photos. Great Way Publishing, Minneapolis, Minn., 1987. 189 pages. $17.95.

Igor Sikorsky: The Russian Years, by K. N. Finne, edited by Carl J. Bobrow and Von Hardesty. In 1918, a brilliant Russian aircraft designer named Igor Sikorsky immigrated to the West and embarked on a celebrated career as a builder of seaplanes and helicopters. Few Westerners, however, are well acquainted with Sikorsky's early career in Russia. Editors Bobrow and Hardesty, in a scholarly effort that involved more than a little detective work, bring to the public this memoir of those early years by K. N. Finne, a contemporary and friend of Sikorsky. Finne, a flight surgeon with a Russian squadron of huge, Sikorsky-designed *Il'ya Muromets* bombers, recognized the importance of Sikorsky's pioneering work and resolved to record it for posterity. While Finne's memoir on the building of the *Il'ya Muromets* is the heart of this book, the editors flesh out the story with a stage-setting introduction, an epilogue by Sikorsky's son Sergei, and a half dozen appendices. This painstakingly researched book plugs a significant gap in the history of early aviation. With photos, bibliography, and index. Smithsonian Institution Press, Washington, D. C., 1987. 223 pages. $22.50.

World Unmanned Aircraft, by Kenneth Munson. The increasing density of air defenses on modern battlefields and the need to maintain constant tactical surveillance and to manage the electromagnetic spectrum are occasioning a fresh look at the stepchild of aviation, the unmanned aircraft (UMA). Air tacticians East and West are now studying the early and largely successful use of drones in Vietnam and Israeli wizardry in their use and are reappraising the worth of these versatile platforms. In this nation-by-nation catalog of the burgeoning worldwide UMA inventory, Ken Munson, a longtime contributor to *Jane's All the World's Aircraft*, presents a complete description of each type, along with specifications, photographs, and line drawings. This encyclopedic reference is certain to draw a widening audience in the future. With appendices and index. Jane's Publishing Inc., New York, N. Y., 1988. 221 pages. $40.

—Reviewed by Hugh Winkler, Assistant Managing Editor.

Viewpoint

The Importance of Bases

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

The Navy is a splendid instrument for showing the flag and demonstrating resolve, but in wartime, aircraft operating from fixed locations would play a decisive role.

A curious sidelight to the recent eviction notice served on the 401st Tactical Fighter Wing at Torrejon AB, Spain, was the absence of any audible outcry from Brussels. The removal of seventy-two F-16 fighters from the Med should be considered a major setback to NATO's Southern Flank strategy, if, in fact, there is a viable strategy for that ancient cockpit. There are times, and this is one of them, when the Alliance seems more concerned with harmony than with the military facts of life.

Over the years, the NATO hierarchy has been singularly indifferent to airpower. Any slight diminution in naval strength in the Med, particularly any affecting the Sixth Fleet, will set off an alarm in Brussels. It is an understandable attitude of politicians in peacetime. The Navy is a matchless instrument for showing the flag and demonstrating resolve. But if the Mediterranean ever becomes a theater of war—or even a place of confrontation—then land-based air will almost certainly play a decisive role.

The British found that out the hard way in 1941. In the battle for Crete, the Luftwaffe, after systematically knocking out RAF bases, made the Aegean untenable for the Royal Navy. Of some 27,000 tons sent by sea to the besieged British forces on Crete, 21,000 tons were turned back under air assault, 3,400 tons were lost at sea, and fewer than 3,000 reached their destination. Air superiority from land bases in Greece and the Dodecanese were the key to the German successes in the eastern Mediterranean.

Air Chief Marshal Arthur Tedder—later Lord Tedder—wrote at the time: "Without bases, one cannot do much. I have been trying for the past three weeks to rub it in to Wavell [General, British Army] and Cunningham [Admiral, Royal Navy] that this war was one for air bases." Time, and later events, proved him right, to the Germans' eventual misfortune.

The Spanish decision to evict the 401st TFW from Torrejon was, of course, a political one—Premier Felipe Gonzalez's payoff to the dissident elements in his electorate in return for a favorable vote on the 1986 NATO referendum. That referendum allowed Spain to retain its somewhat tentative position in the Alliance.

While NATO's announced purpose is collective defense, it is also a club. And like other clubs, it occasionally admits a social member who does not have full privileges, but pays reduced dues. France and Spain enjoy that sort of NATO membership. It gives them a voice in policy and allows attendance at functions, but there is no participation in the military organization. It is far better to have them on those terms than not at all, although it does deny the Alliance, and especially the United States, highly desirable air bases. In all fairness, however, even though seventy-two F-16s must now seek a new home, it must be noted that we do retain certain rights at Zaragoza, Moron, and the naval base at Rota.

The uprooting of the 401st TFW is a reminder of another time, back in the 1960s, when President Charles de Gaulle ordered NATO out of France. The French air bases were mudholes, with leaky trailers for housing, but they were in the right place, even for the short-legged F-86s of that day. When USAF was forced to leave France, it had to deploy forward to bases in Germany—with far better facilities but also with more vulnerability to surprise attack and a variety of other threats.

Bases for our air units are becoming an increasing problem just at a time when, with the departure of the INF, air forces must take on a greater role. Andreas Papandreou, Prime Minister of Greece, is once again posturing on the bases issue. Our tenure in Greece has been uneasy for years and has been marked by occasional violence and the endless public hostility of the Papandreou crowd. Even the faithful Portuguese have been threatening to make trouble over US occupancy at Lajes in the Azores as a response to their disappointing share of the aid program.

It may be stretching a point to say that part of these base difficulties dates back to the 1950s and a preoccupation with nuclear war. Tied down to a role as minor-league affiliates of the Strategic Air Command, tactical air became a fixed-base operation with all the efficiences, such as centralized maintenance, that come with a fixed-base concept. Not surprisingly, these tactical units became less mobile as they acquired airplanes dependent on complex diagnostic support.

The F-15 Avionics Intermediate Shop (AIS) is an example, demanding three C-141s just to deploy it and 4,500 feet of precisely level, air-conditioned space when it gets there. It is a far cry from the days when P-47s and P-51s could hop to a new air patch with little effort.

Mobility of tactical forces today takes place, to a considerable extent, in the air. Airplane range and speed are far greater, and air refueling gives a further extension. There is no escaping the need for the fixed base with its support equipment, but given the capabilities of modern aircraft, do fixed bases need to be so vulnerable?

The United States has fought a number of wars without having to worry very much about enemy action against its air bases. Once in a while, as at Bien Hoa in the early 1960s, we were caught off guard, but for the most part, USAF bases have been safe havens.

While there isn't much to be done about it in the short run, politics and the budget being what they are, some long-range thinking ought to go into our NATO deployments. The main bases are so vulnerable to a variety of threats as to be of doubtful usefulness in time of war. ■

JANE'S

ALL THE WORLD'S AIRCRAFT SUPPLEMENT

APRIL 1988

An unfamiliar sight at Andrews AFB, Maryland, near Washington, D. C., this Ilyushin Il-76 landing on 7 December 1987 was part of the entourage of Mr Mikhail Gorbachev, arriving for his summit with President Reagan *(©1987 Douglas A. Zalud)*

ILYUSHIN

ILYUSHIN DESIGN BUREAU, Moscow Central Airport, Khodinka, Moscow, USSR

Soviet designers are skilled at adapting their aircraft for a variety of different military tasks. Although obsolescent as a transport, the turboprop Ilyushin Il-18 continues to give good service in electronic intelligence, reconnaissance, anti-submarine, maritime patrol, airborne command post, and meteorological roles. It was logical to expect the far more impressive Il-76 turbofan transport to be used for additional duties requiring high performance and a roomy cabin. An AEW&C version became operational last year, to support Soviet combat units based in the Kola Peninsula in the far northern Murmansk region of the USSR. Deployment of an in-flight refuelling tanker variant, which has been under development since the mid-1970s, is also thought to have started.

ILYUSHIN Il-76

NATO reporting name: Candid

To replace Antonov An-12BPs as standard paratroop and freight transports of the Soviet Military Transport Aviation force (VTA), the Ilyushin design bureau was made responsible for development of an aircraft able to haul 40 tonnes of freight for a distance of 2,700 nm (5,000 km; 3,100 miles) in less than six hours. It had to be capable of operation from short, unprepared airstrips, in the most difficult weather conditions experienced in Siberia, the north of the Soviet Union, and the Far East, while being much simpler to service and able to fly much faster than the An-12BP. Equally important was to avoid the limitations imposed on the usefulness of the Antonov aircraft by lack of an integral rear loading ramp/door.

The prototype of the new transport, known as the Il-76 (SSSR-86712), flew for the first time on 25 March 1971 and made its public debut at the 29th Salon de l'Aéronautique et de l'Espace in Paris in May 1971. It was seen to be similar in size and general configuration to USAF's well-established Lockheed C-141A StarLifters, and in 1974 an official film depicted Il-76s with twin-gun rear turrets in use as vehicles for Soviet airborne troops, presumably with a development squadron.

The Il-76 entered series production in 1975. Subsequent operation in the most difficult weather and ground conditions of Central and Eastern Siberia revealed operating costs at least 25 per cent lower per tonne/km than for the An-12. Since that time, development of the Il-76 has continued, and the following major production versions can now be identified:

Il-76 (Candid-A). Initial basic production version.

Il-76T (Candid-A). Developed version, with additional fuel tankage in wing centre-section, above fuselage, and heavier payload. No armament.

Il-76M (Candid-B). As Il-76T, but for military use, with rear gun turret containing two 23 mm NR-23 guns, and small ECM fairings between centre windows at front of navigator's compartment, on each side of front fuselage, and on each side of rear fuselage. Turret and ECM not always fitted to export Il-76Ms. Up to 140 troops or 125 paratroops can be carried as an alternative to freight.

Il-76TD (Candid-A). Unarmed version, generally similar to Il-76T. First identified in November 1982, when an example registered SSSR-76467 passed through Shannon Airport in Ireland. Fully operational from July 1983, this version has Soloviev D-30KP-1 engines, which maintain full power up to ISA + 23°C against ISA + 15°C for earlier models. Max T-O weight and payload are increased. An increase of 10,000 kg (22,046 lb) in max fuel capacity provides an increase of 648 nm (1,200 km; 745 miles) in range with max fuel.

Il-76MD (Candid-B). Military version, generally similar to Il-76M, but with same improvements as Il-76TD.

More than 350 military Il-76s and Il-76M/MDs have been delivered to first-line squadrons of the Soviet VTA, as An-12BP replacements, from the assembly line at Tashkent, with production continuing at the rate of about 30 a year. Other customers for the military versions include the air forces of India, Iraq, Czechoslovakia, and Poland. India is reported to be considering conversion of some of its standard Il-76s for AEW duties.

Aeroflot has more than 120 Il-76s, including Il-76Ts and Il-76Ms, which form an immediately available military reserve. Iraqi Airways has received at least 29 Il-76Ts and Il-76Ms (one has been shot down), which are operated on behalf of the military services; Jamahiriyan Air Transport of Libya has 19 Il-76Ts; Syrianair has two Il-76Ms and two Il-76Ts. The guns are removed from the rear turret of Il-76Ms in airline service, and the first of two Il-76MDs delivered to Cubana, in November 1984, had no turret.

In July 1975, the Il-76 set a total of 25 officially recognised records for speed and height with payload. Some of them, for speed with payload over 1,000 km, 2,000 km, and 5,000 km, have been beaten by an Il-86 and a B-1B; that for the greatest payload lifted to a height of 2,000 m is now held by an Antonov An-124. Details of the old records can be found in the 1981–82 *Jane's;* those still held by the Il-76 are for a height of 11,875 m (38,960 ft) with payloads of 60,000 kg, 65,000 kg, and 70,000 kg, and for a speed of 440.305 knots (815.968 km/h; 507.019 mph) around a 5,000 km circuit, with payloads of 35,000 kg and 40,000 kg.

In specialised roles, Il-76s have served as testbeds for the power plant of the Il-86 and an experimental propfan, and as aircraft in which Soviet cosmonauts have been able to experience several tens of seconds of weightlessness during training.

The following description of the Il-76T is generally applicable to all versions, except as indicated under the individual model listings:

TYPE: Four-turbofan medium/long-range freight transport.

WINGS: Cantilever monoplane, mounted above fuselage to leave interior unobstructed, and with constant anhedral from junction with centre-section on each side. Sweepback 25° at quarter-chord. All-metal five-piece structure, comprising centre-section, two inner panels carrying engines, and two outer panels. Leading-edge sweepback constant. Trailing-edge sweep increases outboard of joint between each inner and outer panel. Multi-spar fail-safe construction. Centre-section integral with fuselage. Mass-balanced ailerons, with balance/trim tabs. Two-section triple-slotted flaps over approx 75 per cent of each semi-span, from wingroot to inboard edge of aileron. Upper surface spoilers forward of flaps in 16 segments, four on each inner and outer wing panel. Ten-segment leading-edge slats over almost entire span, two on each inner panel, three on each outer panel.

FUSELAGE: All-metal semi-monocoque fail-safe structure of basically circular section. Underside of upswept rear fuselage made up of two outward hinged clamshell doors, upward hinged panel between these doors, and downward hinged loading ramp.

TAIL UNIT: Cantilever all-metal structure, with variable incidence T tailplane. All surfaces sweptback. All control surfaces aerodynamically balanced. Tabs in rudder and each elevator.

LANDING GEAR: Hydraulically retractable tricycle type, designed for operation from prepared and unprepared runways. Nose unit made up of two pairs of wheels, side by side, with central oleo. Main gear on each side is made up of two units in tandem, each unit with four wheels on a single axle. Low-pressure tyres size 1,300 × 480 on mainwheels, 1,100 × 330 on nosewheels. Nosewheels retract forward. Main units retract inward into two large ventral fairings under fuselage, with an additional large fairing on each side of lower fuselage over actuating gear. During retraction mainwheel axles rotate around leg, so that wheels stow with axles parallel to fuselage axis (*i.e.*, wheels remain vertical but at 90° to direction of flight). All doors on wheel wells close when gear is down, to prevent fouling of legs by snow, ice, mud, etc. Oleo-pneumatic shock absorbers. Tyre pressure can be varied in flight from 2.5 to 5 bars (36–73 lb/sq in) to suit different landing strip conditions. Hydraulic brakes on mainwheels.

POWER PLANT: Four Soloviev D-30KP turbofans, each rated at 117.7 kN (26,455 lb st), in individual underwing pods. Each pod is carried on a large forward-inclined pylon and is fitted with a clamshell thrust reverser. Integral fuel tanks between spars of inner and outer wing panels. Total fuel capacity reported to be 81,830 litres (21,617 US gallons; 18,000 Imp gallons).

ACCOMMODATION: Crew of seven, including two freight handlers. Conventional side by side seating for pilot and co-pilot on spacious flight deck. Station for navigator below flight deck in glazed nose. Forward hinged door on each side of fuselage forward of wing. Two windows on each side of hold serve as emergency exits. Hold has reinforced floor of titanium alloys, with folding roller conveyors, and is loaded via rear ramp. Entire accommodation is pressurised, and advanced mechanical handling systems are provided for containerised and other freight, which can include standard ISO containers, each 12 m (39 ft 4½ in) long, building machinery, heavy crawlers, and mobile cranes. Typical loads include six containers measuring either 2.99 × 2.44 × 2.44 m (9 ft 9¾ in × 8 ft × 8 ft) or 2.99 × 2.44 × 1.90 m (9 ft 9¾ in × 8 ft × 6 ft 2¾ in) and with loaded weights of 5,670 kg (12,500 lb) or 5,000 kg (11,025 lb) respectively; or twelve containers measuring 1.46 × 2.44 × 1.90 m (4 ft 9¼ in × 8 ft × 6 ft 2¾ in) and each weighing 2,500 kg (5,511 lb) loaded; or six pallets measuring 2.99 × 2.44 m (9 ft 9¾ in × 8 ft) and each weighing 5,670 kg (12,500 lb); or twelve pallets measuring 1.46 × 2.44 m (4 ft 9¼ in × 8 ft) and each weighing 2,500 kg (5,511 lb). Quick configuration changes can be made by the use of modules, each able to accommodate 30 passengers in four-abreast seating, litter patients and medical attendants, or cargo. Three such modules can be carried, each approx 6.10 m (20 ft) long, 2.44 m (8 ft) wide, and 2.44 m (8 ft) high. They are loaded through the rear doors by means of two overhead travelling cranes, and are secured to the cabin floor with cargo restraints. Cranes can utilise two hoists, each with capacity of 3,000 kg (6,615 lb), or four hoists, each with capacity of 2,500 kg (5,511 lb). Ramp can be used as additional hoist, with capacity of up to 30,000 kg (66,140 lb) to facilitate loading of large vehicles

A military Ilyushin Il-76, with tail turret, in Iraqi Airways insignia *(Austin J. Brown)*

Ilyushin Il-76MD (NATO 'Candid-B') in Aeroflot insignia *(Austin J. Brown)*

One of the first photographs of the Il-76 AEW&C variant (NATO 'Mainstay'), taken from a P-3B of No. 333 Squadron, Royal Norwegian Air Force

and those with caterpillar tracks. Pilot's and co-pilot's windscreens can each be fitted with two wipers, top and bottom.

SYSTEMS: Hydraulic system includes servo motors and motors to drive the flaps, slats, landing gear and its doors, ramp, rear fuselage clamshell doors, and load hoists. Flying control boosters are supplied by electric pumps and are independent of the central hydraulic supply. Manual control is possible after booster failure. Electrical system includes engine driven generators, auxiliary generators driven by an APU, DC converters, and batteries. It powers the pumps for the flying control system boosters, radio and avionics, and lighting systems.

AVIONICS AND EQUIPMENT: Full equipment for all-weather operation by day and night, including a computer for automatic flight control and automatic landing approach. Large meteorological and ground mapping radar in undernose radome. APU in port side landing gear fairing for engine starting and to supply all aircraft systems on ground, making aircraft independent of ground facilities.

DIMENSIONS, EXTERNAL:

Wing span	50.50 m (165 ft 8 in)
Wing aspect ratio	8.5
Length overall	46.59 m (152 ft 10¼ in)
Height overall	14.76 m (48 ft 5 in)
Rear loading aperture:	
Width	3.40 m (11 ft 1¾ in)
Height	3.45 m (11 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length: excl ramp	20.00 m (65 ft 7½ in)
incl ramp	24.50 m (80 ft 4½ in)
Width	3.40 m (11 ft 1¾ in)
Height	3.46 m (11 ft 4¼ in)
Volume	235.3 m³ (8,310 cu ft)

AREA:

Wings, gross	300.0 m² (3,229.2 sq ft)

WEIGHTS AND LOADINGS (A: Il-76T, B: Il-76TD):

Max payload: A	40,000 kg (88,185 lb)
B	48,000 kg (105,820 lb)
Max T-O weight: A	170,000 kg (374,785 lb)
B	190,000 kg (418,875 lb)
Permissible axle load (vehicles):	
A	7,500–11,000 kg (16,535–24,250 lb)
Permissible floor loading:	
A	1,450–3,100 kg/m² (297–635 lb/sq ft)
Max wing loading:	
A	566.7 kg/m² (116.05 lb/sq ft)
B	633.3 kg/m² (129.72 lb/sq ft)
Max power loading:	
A	361.1 kg/kN (3.54 lb/lb st)
B	403.6 kg/kN (3.95 lb/lb st)

PERFORMANCE (Il-76T):

Max level speed 459 knots (850 km/h; 528 mph)
Cruising speed
405–432 knots (750–800 km/h; 466–497 mph)
T-O speed 114 knots (210 km/h; 131 mph)
Approach and landing speed
119–130 knots (220–240 km/h; 137–149 mph)
Normal cruising height
9,000–12,000 m (29,500–39,370 ft)
Absolute ceiling approx 15,500 m (50,850 ft)
T-O run 850 m (2,790 ft)
Landing run 450 m (1,475 ft)
Nominal range with 40,000 kg (88,185 lb) payload
2,700 nm (5,000 km; 3,100 miles)
Max range, with reserves
3,617 nm (6,700 km; 4,163 miles)

ILYUSHIN Il-76 (AEW&C)

NATO reporting name: Mainstay

Development of this AEW&C version of the Il-76 began in the 1970s, to provide a replacement for the ineffective Tu-126s operated by the Soviet Voyska PVO home defence force and tactical air forces. Known to NATO as 'Mainstay', it is said by DoD to provide Soviet forces with the capability to detect aircraft and cruise missiles flying at low altitude over land and water, to help direct fighter operations over potential European and Asian battlefields, and to enhance air surveillance and defence of the USSR.

The first examples became operational in 1987. The accompanying illustration shows one of those based in the Kola Peninsula, where 'Mainstays' operate in conjunction with the new Sukhoi Su-27 (NATO 'Flanker-B') counterair fighters. It can be seen to have a conventionally located rotating 'saucer' radome, lengthened fuselage forward of the wings, and flight refuelling probe on the nose. The nose glazing around the navigator's station of the Il-76 transport and the tail gun turret are deleted. There is an air intake at the front of the dorsal fin. Avionics include a new IFF, comprehensive ECM, and equipment under a large dielectric blister fairing forward of the wing centre-section. Of interest are flat plates, attached to the upper landing gear fairing on each side, which appear to mask in a vertical plane the portions of the rotodome that are not already masked by the aircraft's wings and fuselage.

It can be assumed that the basic airframe and power plant of 'Mainstay' are similar to those of the Il-76 transport. A production rate of at least five 'Mainstays' a year is to be expected.

ILYUSHIN Il-76 TANKER VARIANT

NATO reporting name: Midas

This probe-and-drogue in-flight refuelling version of the Il-76, known to NATO as 'Midas', was expected to be operational by now, but no photographs have yet become available. It will replace the modified Myasishchev M-4 (NATO 'Bison') aircraft, which have served in this role for many years, in support of both strategic and tactical combat aircraft.

BRITISH AEROSPACE

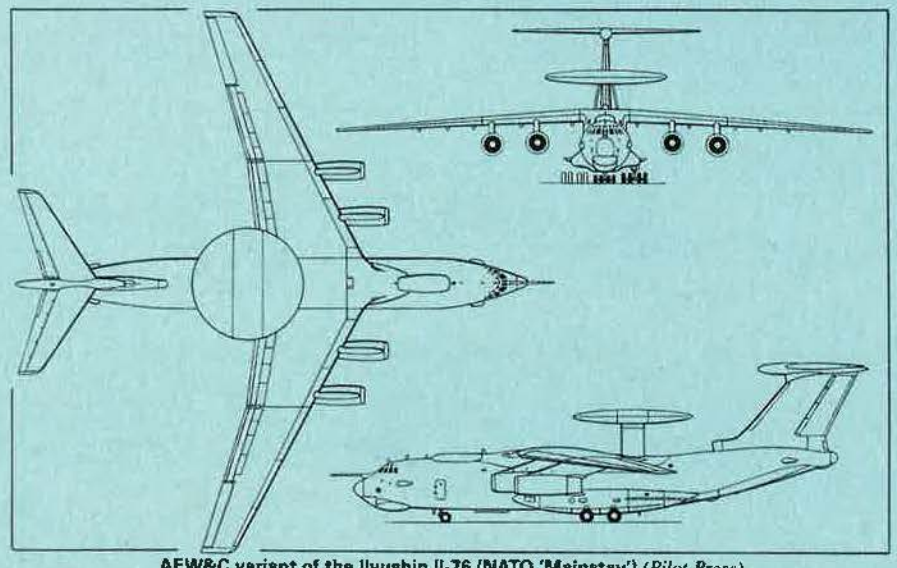
BRITISH AEROSPACE PLC (Military Aircraft Division), Richmond Road, Kingston upon Thames, Surrey KT2 5QS, England

BAe SABA

BAe's Military Aircraft Division released details in November 1987 of a highly manoeuvrable subsonic combat aircraft project on which it has been working since 1985. Known as SABA (Small Agile Battlefield Aircraft), it was conceived as a potential counter to the growing threat posed by the combat helicopters, tilt-rotor aircraft, and cruise missiles that are likely to be met on battlefields of the 1990s. BAe believes that an aircraft such as SABA, combining relatively light weight with excellent STOL performance, heavy firepower, and the agility to combat low-flying high-performance interceptors, can fulfil this need.

Design parameters included a soft-field take-off run of 305 m (1,000 ft); a rate of turn of 180° in five seconds at Mach 0.4, with a minimum turn radius of 152 m (500 ft) at combat speeds; a transit speed of at least 400 knots (741 km/h; 460 mph); a four-hour minimum loiter capability at low level; and a weapons load comprising a 25 or 30 mm gun and at least six air-to-air missiles.

The primary role of such an aircraft would be to intercept and destroy enemy helicopters crossing the forward line of own troops (FLOT) on either close air support or airmobile operations. A combination of low wing loading and advanced aerodynamic wing design would provide an unbeatable advantage in combat manoeuvrability over even the most agile battlefield helicopters fielded today and



AEW&C variant of the Ilyushin Il-76 (NATO 'Mainstay') *(Pilot Press)*

Left: Artist's impression of BAe P1233-1 SABA single-seat agile battlefield aircraft in an anti-helicopter role. Right: Escort of tilt-rotor assault forces is another planned SABA mission

in the foreseeable future, at both long and short range. Such agility would also be a decisive advantage in close air combat against fixed-wing aircraft, and initial computer simulations of one-to-one combat against both rotating- and fixed-wing adversaries have demonstrated convincingly the value of the SABA concept. The aircraft is designed to maintain its high agility throughout the flight envelope, yet would subject the pilot to the maximum airframe g limit of +8 for no longer than three seconds at a time.

During the first two years of design study, various airframe configurations were evaluated by BAe, as were alternative propfan, unducted fan, and turbofan power plants. Designs examined included a project numbered **P1238** for a pod-and-twin-boom, high-tailed aircraft powered by a Textron Lycoming T55 turboprop driving a single 'pusher' propeller; two tail-less deltas (**P1234-1** and **-3**), each with an Adour turbofan; and the **P1234-2**, a straight-wing, twin-fin design powered by a 33.36 kN (7,500 lb st) ALF 502 turbofan with lateral intakes. The version currently favoured for further development is the canard configuration **P1233-1**, which has a T55 engine mounted aft of the wings, with a dorsal intake and shaft drive to UDF type contra-rotating propellers behind the tail unit. BAe is now embarking on a company funded R&D programme in order to validate further the promising results of the work carried out so far. Future programme objectives include wind tunnel testing; maximising survivability, repairability, and structural efficiency; and the integration of advanced systems for this aircraft and its role in a high intensity threat environment. The funding required has been assessed up to the stage of a demonstrator aircraft, which could make its first flight in 1992 or 1993. Presentations of SABA have been made to the British Ministry of Defence, NATO, and (as a potential A-10 replacement) to the US Air Force. China is also envisaged as a possible customer and/or production partner.

The following description applies to the P1233-1:

TYPE: Single-seat agile battlefield aircraft.

WINGS: Cantilever low-wing monoplane. Wing design incorporates experience from BAe/RAE national high-lift wing programme. Construction would be of composites and improved metals, including a one-piece central torsion box of carbonfibre. Leading-edges are untapered outboard, and sweptback between root and inboard missile station; trailing-edges are tapered. Variable camber achieved by combination of slats on outer leading-edges and automatic flaps on inboard trailing-edges.

FOREPLANES: All-moving canard surfaces, each approx half the span of main wing, for pitch control. Mid-mounted on fuselage sides just aft of pilot's seat, they have compound sweepback on leading-edges and untapered trailing-edges.

FUSELAGE: Conventional structure, with carbonfibre reinforcement, roughly elliptical in cross-section except for flattened undersurface. Dorsal air intake for rear-mounted engine.

TAIL UNIT: Main fin, with dorsal fin, plus smaller ventral fin under rear fuselage. Small ventral rudder, beneath nose, for yaw control.

LANDING GEAR: Retractable, long-stroke tricycle type, with single wheel and low pressure tyre on each unit. Mainwheels (tyre diameter 0.91 m; 2 ft, pressure 5.52 bars; 80 lb/sq in) retract inward into extended wingroots; nosewheel retracts rearward into fuselage.

POWER PLANT: One 3,355 kW (4,500 shp) Textron Lycoming T55 turboprop, with shaft drive via reduction gear to a pair of low tip-speed contra-rotating reversible-thrust propellers at rear of fuselage. Six to nine metal or plastics blades on each propeller. A derivative of the General Electric GE38 is a possible alternative engine.

ACCOMMODATION: Pilot only, on upward ejecting zero/zero seat. Framed canopy, with flat-plate low glint armoured glass front and side panels, offers good views forward, rearward, and sideways/downward. Armour protection (metal or composites) for pilot and flight control system.

SYSTEMS: Fly by wire flight control system.

AVIONICS: Will incorporate terrain profile matching (Terprom) and track-while-scan technology.

ARMAMENT AND OPERATIONAL EQUIPMENT: One 25 mm cannon, with 150 rds, in lower front fuselage on port side. Six underwing stations for AIM-9L Sidewinder or AIM-132 ASRAAM air-to-air missiles. Infra-red target seeker and laser/radar designator/rangefinder in extreme nose.

DIMENSIONS, EXTERNAL:

Wing span	10.97 m (36 ft 0 in)
Wing aspect ratio	5.9
Foreplane span	approx 5.79 m (19 ft 0 in)
Length overall	9.50 m (31 ft 2 in)
Wheel track	approx 3.35 m (11 ft 0 in)
Wheelbase	approx 3.20 m (10 ft 6 in)
Propeller diameter	approx 2.29 m (7 ft 6 in)

AREA:

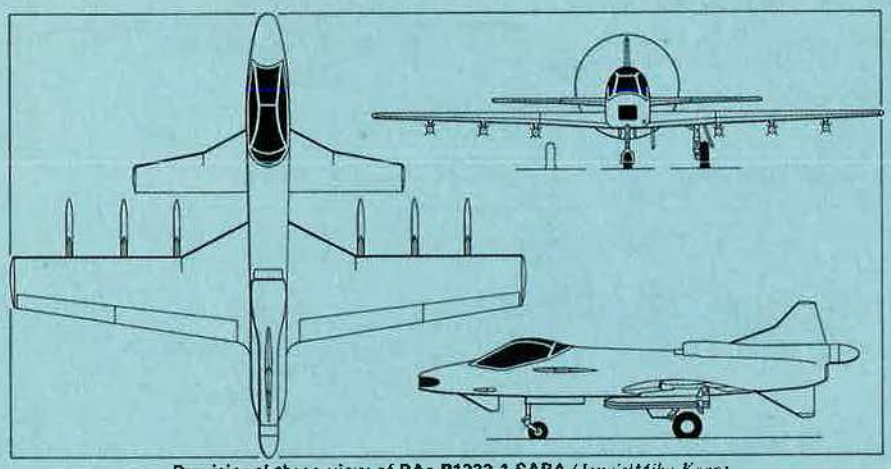
Wings, gross	20.39 m² (219.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	3,535 kg (7,793 lb)
Max external stores load	1,844 kg (4,000 lb)
Combat T-O weight (50% fuel and full external stores)	4,536 kg (10,000 lb)
Max T-O weight	4,989 kg (11,000 lb)
Combat wing loading	222.3 kg/m² (45.56 lb/sq ft)
Combat power loading	1.35 kg/kW (2.22 lb/shp)

PERFORMANCE:

Transit speed	more than 400 knots (741 km/h; 460 mph)
Approach speed	80 knots (148 km/h; 92 mph)
T-O time (brake release to unstick)	less than 10 s
g limit (for 3 s)	+8



Provisional three-view of BAe P1233-1 SABA *(Jane's/Mike Keep)*

AYRES

AYRES CORPORATION, PO Box 3090, Albany, Georgia 31708-5201, USA

AYRES TURBO-THRUSH NEDS

Ayres has developed a special version of its Turbo-Thrush S2R agricultural aircraft, known as the Narcotics Eradication Delivery System (NEDS), for the US State Department, to which nine aircraft were delivered during 1983–85.

The Turbo-Thrush NEDS is powered by a 1,026 kW (1,376 shp) Pratt & Whitney PT6A-65R turboprop, driving a five-blade propeller of 2.82 m (9 ft 3 in) diameter, and features a two-seat armoured

Ayres Turbo-Thrush NEDS of the US State Department's International Narcotics Matters Bureau on a drug-eradication mission. This aircraft is actually spraying herbicide on real marijuana *(Jon Lake)*

cockpit, armour protection around the engine compartment, and a 75.7 litre (20 US gallon; 16.7 Imp gallon) self-sealing auxiliary fuel tank mounted in a bulletproof structure, in addition to standard Turbo-Thrush wing fuel tanks. The aircraft are operated by the State Department's International Narcotics Matters Bureau and have been used on 'Operation Roundup' drug eradication missions in such countries as Burma, Colombia, and Thailand against poppy crops, in Mexico against marijuana and poppies, and in Belize and Guatemala against marijuana. A chemical herbicide known as 'Roundup' is carried in a 1,514 litre (400 US gallon; 333 Imp gallon) tank and is sprayed on the plants to make them overfertilise, grow rapidly, then wilt and die. Delivery rate, at a working speed of 104–113 knots (193–209 km/h; 120–130 mph), is some 265 litres (70 US gallons; 60 Imp gallons) per acre, a typical marijuana field being about 0.7 acres. Underwing hardpoints are fitted for 7.62 mm miniguns, but the Turbo-Thrush NEDS operates unarmed in places like Belize, under an annual agreement at government level, with escort by an armed Pilatus Britten-Norman Defender which could provide fire support in an emergency, such as a forced landing. The Turbo-Thrush NEDS is usually operated by two crew in case of injury from groundfire, and is equipped with King VLF Omega 660, ADF, VOR, HF, and VHF avionics.

TELEDYNE RYAN

TELEDYNE RYAN AERONAUTICAL, 2701 Harbor Drive, San Diego, California 92138, USA

TELEDYNE RYAN MODEL 324 SCARAB

The Model 324 Scarab is a medium-range tactical reconnaissance RPV developed under a 1984 contract from the Egyptian government to provide an aerial reconnaissance capability for the Egyptian Air Force. Designed for operations in unprepared forward areas, the system includes both the jet powered air vehicle and a mobile launch/recovery vehicle, so providing all necessary requirements for fully autonomous transportation, launch, command and control during air operations, and recovery and retrieval functions. It can be deployed to an operational location by air or surface transport.

Flight testing took place in 1987, prior to the first public showing of the RPV at the Cairo International Military Equipment Exhibition in November 1987. Deliveries were due to begin in early 1988 of 29 air vehicles, including four prototypes, plus three sets of ground support equipment and launch recovery vehicles and operational spares to support 120 missions. Operational crew and maintenance training assistance in Egypt is being provided by Teledyne Ryan.

The Scarab air vehicle has a configuration reminiscent of Teledyne Ryan's AQM-91A Compass Arrow and YQM-98A Compass Cope RPVs of the 1970s and has an all-composites airframe produced for TRA by Scaled Composites Inc of Mojave, California. It is powered by a growth version of the TCAE J402 turbojet used in the AGM-84 Harpoon missile, and is booster launched by a modified Harpoon rocket motor that is jettisoned once the RPV is airborne.

TYPE: Recoverable tactical photographic reconnaissance RPV.

AIRFRAME: Low-wing monoplane, with flat-bottomed fuselage, sweptback wings and tailplane, and sweptback twin fins at mid-tailplane span. Aerodynamic control surfaces comprise tail-mounted elevons and rudders. Airframe, built by SCI, consists of four major subassemblies: nose module (containing mission guidance and flight control systems); modular payload compartment; fuel tank (in centre-fuselage) and wings; and rear fuselage (including detachable tail unit). Construction is of moulded composites materials (Kevlar and glassfibre) for load-bearing structures, with foam sandwich stiffening for skin panels and metal fittings in concentrated load areas. No landing gear.

POWER PLANT: One 4.31 kN (970 lb st) Teledyne CAE 373-8C turbojet, submerged in rear fuselage and fed by dorsal air intake. Fuel capacity (fuselage tank) 568 litres (150 US gallons; 125 Imp gallons).

LAUNCH AND RECOVERY: Ground launched, by ventrally mounted Morton Thiokol jettisonable rocket booster (burn time 4 s) adapted from that of Harpoon missile, from truck mounted zero-length launcher, to rail of which RPV is attached at three points. On completion of mission, RPV returns to a pre-determined recovery area, and engine is shut down. Two-stage recovery parachute system is then deployed automatically or on command for descent, during which barometric altimeters activate inflatable airbag for soft landing. RPV is then retrieved by launch recovery vehicle (LRV) and returned to a maintenance area for refurbishment and re-use. The LRV comprises a Standard Manufacturing Co eight-wheel all-drive prime mover and six-wheel self-drive launcher trailer, with special all-terrain tyres for on- or off-road transportation. Capable of a max speed of 84 km/h (52 mph) and endurance of up to 6 hours, the LRV integrates all mission support functions and can be operated by a crew of three.

GUIDANCE AND CONTROL: Normally pre-programmed, with onboard flight control and guidance providing automatic attitude and flight path control under authority of a Teledyne Ryan designed mission logic control unit that uses digital microprocessor based logic to control speed, payload, guidance and navigation, propulsion, fuel, and electrical and recovery systems. Avionics also permit switching from automatic to manual control, or vice versa, to control air vehicle during launch, flight, and recovery. Position data are obtained through use of an onboard Litton LN-81 (modified) strapdown inertial navigation system, updated by a Rockwell Collins Navcore I C/A code Navstar GPS receiver. Control of

Booster-assisted launch of a Teledyne Ryan Model 324 Scarab RPV

the mission loading, launch, and re-acquisition of the air vehicle for recovery and commanded flight are exercised from the command control ground station housed in the LRV. A Vega Precision Laboratories C band flight command, tracking, and telemetry system is incorporated for remote control functions within line of sight.

MISSION EQUIPMENT: Camera payload (CAI/Recon Optical KS-153A) is suspended from isolation mounts in sides of payload compartment.

DIMENSIONS, EXTERNAL:

Wing span	3.66 m (12 ft 0 in)
Wing aspect ratio	6.0
Length overall	6.10 m (20 ft 0 in)

AREAS:

Wings, gross	2.23 m² (24.0 sq ft)
Fins (total)	0.74 m² (7.92 sq ft)
Tailplane	1.02 m² (10.95 sq ft)

WEIGHTS:

Weight empty	619.5 kg (1,366 lb)
Max payload	113.5 kg (250 lb)
Max launching weight	1,134 kg (2,500 lb)

PERFORMANCE:

Max level speed at high altitude
Mach 0.8 (460 knots; 853 km/h; 530 mph)
Service ceiling 13,720 m (45,000 ft)
Range with max fuel
1,700 nm (3,150 km; 1,957 miles)

The Shorts Tucano T. Mk 1 is replacing the Jet Provost as the Royal Air Force's standard basic trainer

SHORTS

SHORT BROTHERS PLC, PO Box 241, Airport Road, Belfast BT3 9DZ, Northern Ireland

The Newsletter sent in January by Air Commodore David Leppard, Commandant of the Royal Air Force's Central Flying School, to members of the CFS Association states: "We look forward to seeing a new shape on the flight line at Scampton in the form of the Shorts Tucano, the RAF's first high-performance turboprop basic trainer. Although its selection was seen by some as a retrograde step, the fact that it outperforms the Jet Provost 5A in all respects except top speed belies this view. Whilst we do not envisage any significant changes to the traditional general handling syllabus, the sprightly performance will make for some tight aerobatic sequences. Tucano's range and comprehensive navigation fit—Tacan, VOR, and ILS—will enable us to teach the basics of procedural flying and thus satisfy a request from Strike Command. The well-proven low level navigation techniques will remain unchanged but the high level techniques have been rationalised, using the navigation aids, to match more closely the methods of the front line. Tucano's tandem configuration, electric trimmers, and its responsive and powerful engine combine to make it an excellent formation aircraft; we intend to utilise this capability by extending the present formation syllabus to develop the students' appreciation of lead/flag, use of the vertical, and overall confidence in close formation flying. Described as 'an aircraft that puts the fun back into flying', Tucano's arrival at Scampton (expected in March 1988) is eagerly awaited."

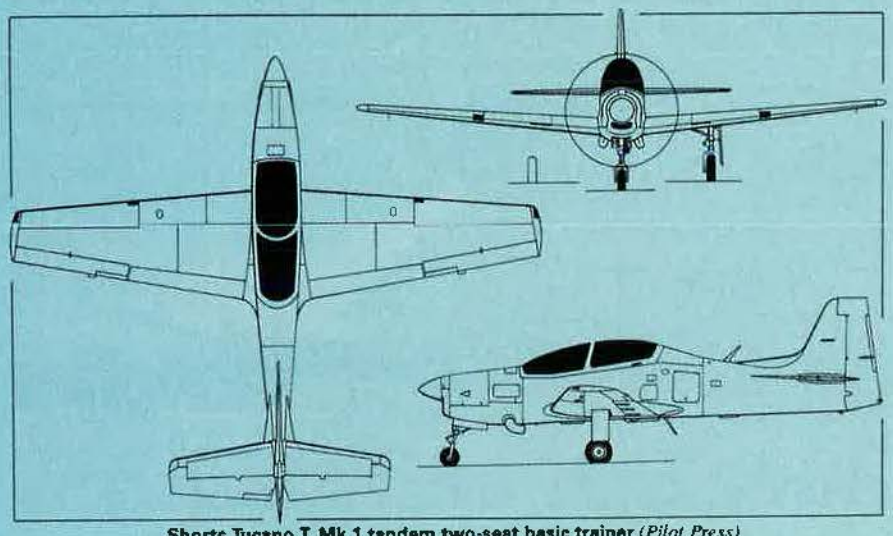
SHORTS S312 TUCANO

RAF designation: Tucano T. Mk 1

Under the terms of a co-operation agreement between Shorts and Embraer of Brazil, announced in May 1984, Shorts undertook to develop from the basic EMB-312 Tucano a new version of the turboprop trainer that would meet or exceed all requirements of the UK Ministry of Defence Air Staff Target 412 for a Jet Provost replacement.

The UK government announced on 21 March 1985 that the Shorts Tucano had been selected for this role. The decision ended a competition that had lasted two years and led to an initial order for 130 Tucanos for the Royal Air Force.

To exceed Air Staff Target 412, the Shorts Tucano embodies significant modifications compared with the EMB-312. These include a changed power plant to improve speed, particularly at low altitude, and provide an increased rate of climb; a ventral airbrake to control speed during descent; structural strengthening for increased manoeuvre loads and fatigue life; a new cockpit layout to meet RAF requirements; and wide use of UK equipment. For export sales purposes, the design incorporates wing hardpoints to provide armament and strike capability. Safe design fatigue life is 12,000 hours.



Shorts Tucano T. Mk 1 tandem two-seat basic trainer *(Pilot Press)*

The first flight of a Tucano with a Garrett engine (PP-ZTC), as chosen for the RAF version, took place in Brazil on 14 February 1986. After completing 14.35 hours of test flying there, it was airfreighted to the UK, reassembled in Belfast, and made its first flight with a British test flight serial (G-14-007) on 11 April 1986. During that flight it demonstrated its ability to fly at a sea level speed of 268 knots (496 km/h; 308 mph), as required by the RAF. The first Shorts-built production Tucano T. Mk 1 (ZF135) flew for the first time on 30 December 1986. Together with the second production aircraft, it was used for certification trials at the Ministry of Defence's experimental establishment at Boscombe Down.

TYPE: Tandem two-seat basic trainer.

WINGS: Cantilever low-wing monoplane. Wing section NACA 63_2A-415 at root, NACA 63A-212 at tip. Dihedral 5° 30' at 30% chord. Incidence 1° 13'. Sweepback 0° 43' 26" at quarter-chord. Aluminium alloy two-spar torsion box structure of 7075-T73511 and 7075-T76 and 2024-T3 sheet. Leading-edge strengthened for bird strike protection. Single-slotted electrically actuated trailing-edge flaps of 2024-T3, supported on 4130 steel tracks. Frise constant chord balanced ailerons. Electrically actuated trim tab in, and small ground adjustable tab on, each aileron.

FUSELAGE: Conventional semi-monocoque structure of 2024-T3 aluminium alloy. Hydraulically actuated ventral airbrake.

TAIL UNIT: Cantilever all-metal structure, of similar construction to wings. Non-swept fin, with dorsal fin, and horn balanced rudder. Non-swept fixed incidence tailplane and balanced elevators. Small fillet forward of tailplane root on each side. Electromechanically actuated spring trim in rudder and port elevator.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit. Accumulator for emergency extension in the event of hydraulic system failure. Nose unit retracts rearward, main units inward into wings. Piper oleo-pneumatic shock absorber in each main leg. Fairey Hydraulics steerable nosewheel unit. Dunlop wheels and tyres, size 22 × 6.75-10 on mainwheels, 5.00-5 on nosewheel. Dunlop hydraulic single-disc brakes on mainwheels.

POWER PLANT: One 820 kW (1,100 shp) Garrett TPE331-12B turboprop, driving a Hartzell four-blade constant-speed fully-feathering reversible-pitch propeller with spinner. Two integral fuel tanks in wings, total capacity 724 litres (191 US gallons; 159 Imp gallons). Gravity refuelling point in each wing upper surface. Oil capacity 4.25 litres (1.13 US gallons; 0.94 Imp gallon).

ACCOMMODATION: Instructor and pupil in tandem, on Martin-Baker Mk 8LCP lightweight ejection seats. Rear seat elevated. One-piece canopy, with

central frame, opening sideways to starboard. Dual controls standard. Baggage compartment in rear fuselage, with door on port side. Cockpit heating and canopy demisting by engine bleed air.

SYSTEMS: Cockpit air-conditioning by engine bleed air plus recirculated cockpit air through a regenerative turbofan system. Single hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear retraction and extension, and airbrake. Accumulator to lower landing gear in emergency. DC electrical power provided by a 28V 200A starter/generator and two 24Ah alkaline batteries. Static inverter for 115V and 26V AC power at 400Hz. Normalair-Garrett oxygen system supplied from a single bottle, capacity 2,250 litres (80 cu ft). Emergency oxygen bottle, capacity 70 litres (2.5 cu ft), mounted on each ejection seat. Engine air intake de-iced by engine bleed air; propeller, pitot head, static vents, and stall warning system de-iced electrically.

AVIONICS AND EQUIPMENT: Standard avionics include VHF/UHF/andio by Marconi, Plessey, and Dowty; gyro-magnetic compass, VOR/ILS/marker beacon receiver, GEC Avionics AD2780 Tacan, and Narco transponder.

DIMENSIONS, EXTERNAL:

Wing span	11.28 m (37 ft 0 in)
Wing chord: at root	2.30 m (7 ft 6½ in)
at tip	1.07 m (3 ft 6¼ in)
Wing aspect ratio	6.58
Length overall	9.86 m (32 ft 4¼ in)
Length of fuselage (excl rudder)	8.53 m (28 ft 0 in)
Fuselage: Max width	1.00 m (3 ft 3¼ in)
Max depth	1.55 m (5 ft 1 in)
Height overall (static)	3.40 m (11 ft 1¼ in)
Tailplane span	4.66 m (15 ft 3½ in)
Wheel track	3.76 m (12 ft 4 in)
Wheelbase	3.16 m (10 ft 4½ in)
Propeller diameter	2.39 m (7 ft 10 in)
Propeller ground clearance	0.32 m (12.6 in)
Baggage compartment door:	
Height	0.60 m (1 ft 11¾ in)
Width	0.54 m (1 ft 9¼ in)

AREAS:

Wings, gross	19.33 m² (208.08 sq ft)
Ailerons (total)	1.97 m² (21.20 sq ft)
Trailing-edge flaps (total)	2.58 m² (27.77 sq ft)
Fin, excl dorsal fin	2.08 m² (22.40 sq ft)
Rudder, incl tab	1.46 m² (15.70 sq ft)
Tailplane, incl fillets	4.57 m² (49.20 sq ft)
Elevators, incl tab	2.00 m² (21.53 sq ft)

WEIGHTS AND LOADINGS (A, aerobatic configuration; B, full weapons configuration):

Basic weight empty: A	2,017 kg (4,447 lb)
Max internal fuel: A, B	555 kg (1,223 lb)
Max ramp weight: A	2,670 kg (5,886 lb)
B	3,295 kg (7,264 lb)
Max T-O weight: A	2,650 kg (5,842 lb)
B	3,275 kg (7,220 lb)
Max landing weight: A	2,650 kg (5,842 lb)
B	2,900 kg (6,393 lb)
Max zero-fuel weight: A	2,028 kg (4,471 lb)
Max wing loading: A	137.1 kg/m² (28.07 lb/sq ft)
Max power loading: A	3.23 kg/kW (5.31 lb/shp)

PERFORMANCE (at max T-O weight of 2,650 kg; 5,842 lb):

Never-exceed speed
280 knots (518 km/h; 322 mph) EAS

Max level and cruising speed at 3,050–4,575 m (10,000–15,000 ft)
274 knots (507 km/h; 315 mph)

Econ cruising speed at 6,100 m (20,000 ft)
220 knots (407 km/h; 253 mph)

Stalling speed, power off:
flaps and landing gear down
69 knots (128 km/h; 80 mph) EAS
flaps and landing gear up
75 knots (139 km/h; 87 mph) EAS

Max rate of climb at S/L
1,070 m (3,510 ft)/min

Service ceiling	10,365 m (34,000 ft)
T-O run	283 m (930 ft)
T-O to 15 m (50 ft)	497 m (1,630 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Landing run	275 m (900 ft)

Range at 7,620 m (25,000 ft) with max fuel, 30 min reserves
900 nm (1,665 km; 1,035 miles)

Endurance at econ cruising speed at 7,620 m (25,000 ft), 30 min reserves
5 h 12 min

g limits
+7/−3.6 aerobatic
+4.4/−2.2 full weapons

EGRETT

E-SYSTEMS INC, PO Box 660248, 6250 LBJ Freeway, Dallas, Texas 75266-0248, USA

EGRETT-1

Described as being "adaptable to a broad spectrum of market requirements", the Egrett-1 surveillance and electronic relay aircraft derives its name from those of the three companies collaborating in its development. The first announcement of its existence, in April 1987, revealed that overall design of the aircraft had been formulated by the Greenville Division of E-Systems Inc, the project's programme leader. Detail airframe design, and prototype construction, were undertaken by Grob TFE of Mindelheim, West Germany; Garrett Turbine Engine Company of Phoenix, Arizona, provided the aircraft's turboprop engine. Systems integration, related to individual customers' mission requirements, is the responsibility of E-Systems.

detection and reporting, search and rescue, scientific missions such as geophysical survey, and public service or entertainment broadcasting. The aircraft's high-altitude capability facilitates the relay of radio transmissions over considerable distances, including transmission into mountainous areas. Additional on-station endurance can be provided by installing optional auxiliary internal fuel tanks. Equipped with a microwave relay payload (*e.g.*, two computer-pointed antennae, a receiver, and a power amplifier, transmitting broadband signals over long distances), the Egrett-1 could provide quick response in emergency situations where other long-term communications facilities might become overloaded. Public service and other broadcasts could be relayed in real time to provide, for example, quick-reaction support for law enforcement agencies or instantaneous direct news coverage of international events. In another application, one or more Egrett-1s could be deployed carrying payload packages to establish a radio based data communications network over a very large area.

The very few official announcements about the Egrett-1 programme have referred only to civil applications, but the partner companies' continuing reluctance (up to early 1988) to disclose even such elementary data as basic overall dimensions has served only to reinforce belief that the aircraft is foreseen as at least equally suitable for covert military roles such as tactical reconnaissance or surveillance and sigint/elint collection, and it is widely believed that both the West German Luftwaffe and USAF have expressed interest in its military potential. The Luftwaffe, whose Erprobungsstelle 61 test centre is located at Manching, already has substantial funding for a programme known as Luftgestütztes Erfassungs- und Auswertesystem (airborne data gathering and evaluation system) and is reported to be considering the possibility of acquiring up to 20 of these aircraft.

Prototype of the Egrett-1 're-usable communications satellite' *(W. Greppmeir)*

The prototype Egrett-1 (D-FGEI) made its first flight on 24 June 1987 at Manching in West Germany, in the hands of NASA test pilot Einar Enevoldson. At the end of the following month the flight test programme was described as yielding "very positive results" and was scheduled to continue for several more months. Assistance in this area is being provided by Messerschmitt-Bölkow-Blohm (MBB).

E-Systems, describing the Egrett-1 as "essentially a re-usable communications satellite" able to offer "the near-continuous coverage of high-altitude, geosynchronous orbits", claims that it could provide outstanding opportunities for radio communication spanning vast areas of the Earth's surface, such a capability having been the basic objective behind its design and creation. Its capacious fuselage—very large for a single-seater—and long-span, high aspect ratio wings, clearly place it in the HALE (high altitude, long endurance) category, and extensive use of radio- and radar-transparent materials in its construction contribute considerably to its ability to act as a platform for data communications equipment, or for systems transmitting and receiving radio waves from different frequency bands. The lower part of the fuselage, which is designed specifically so that it is not involved in the structural integrity of the aircraft, can accept a variety of payloads according to individual customer requirements. These can be mounted in removable canoe- or bathtub-shaped ventral panniers to facilitate straightforward installation, servicing, and removal; large doors provide easy access to all installed equipment.

Civil communications roles envisaged for the Egrett-1 include—but are not limited to—airborne communications relay, pollution and other disaster

Pending the release of official data, the dimensions, weight, and performance figures that follow should be regarded as provisional:

TYPE: Multi-purpose high-altitude surveillance and relay aircraft.

AIRFRAME: Cantilever mid-wing monoplane, constructed largely of glassfibre, carbonfibre, and Kevlar composites. Split flaps on wing inboard trailing-edges. Large, deep fuselage, underside of which is upswept at rear. Very tall, angular fin and rudder, latter with inset trim tab. Low-set tailplane and elevators.

LANDING GEAR: Tricycle type, with single wheel on each unit. Nose unit retracts rearward; main units on prototype are fixed in the down position, but on production aircraft are intended to retract rearward into underwing pods.

POWER PLANT: One Garrett TPE331-14 turboprop, flat rated at 731 kW (980 shp), driving a four-blade propeller with spinner.

ACCOMMODATION: Prototype has accommodation for pilot only, but large fairing aft of present pressurised cockpit appears to offer ample space for a second crew member such as a systems operator.

DIMENSIONS, EXTERNAL (estimated):

Wing span	28.80 m (94 ft 6 in)
Wing aspect ratio	19.8

First of the US Navy's new fleet of Boeing E-6A Tacamo communications relay aircraft

Length overall	10.36 m (34 ft 0 in)
Height overall	5.64 m (18 ft 6 in)
Wheel track	4.80 m (15 ft 9 in)
Wheelbase	3.66 m (12 ft 0 in)
Propeller diameter	2.74 m (9 ft 0 in)
AREA (estimated):	
Wings, gross	41.8 m² (450 sq ft)
WEIGHT (estimated):	
Max T-O weight	5,670 kg (12,500 lb)
PERFORMANCE (estimated):	
Max level speed	
280–310 knots (519–574 km/h; 322–357 mph)	
Econ cruising speed	
155–185 knots (287–343 km/h; 178–213 mph)	
Normal operating altitude	
14,935–17,985 m (49,000–59,000 ft)	
Endurance at 17,070 m (56,000 ft)	10–12 h

BOEING

BOEING AEROSPACE COMPANY, Box 3999, Seattle, Washington 98124, USA

BOEING E-6A TACAMO

On 29 April 1983, Boeing Aerospace Company received a contract to develop a survivable airborne communications system to provide an on-station/all-ocean link between the US National Command Authorities and the US Navy's Trident ballistic nuclear submarine (SSBN) fleet and to provide an emergency back-up communications network for fleet commanders.

Designated E-6A, the new aircraft will replace the EC-130Q version of the Lockheed Hercules that currently fulfils this mission, known as Tacamo (TAke Charge And Move Out), and is fitted with the EC-130Q's existing AVLF avionics. The airframe of the E-6A is almost identical with that of the E-3 Sentry AWACS aircraft and is assembled on the same production line. The prototype E-6A (62782) was rolled out on 18 December 1986 and made its first short flight from the Renton plant to Boeing Field, Seattle, on 19 February 1987. After installation of the aircraft's avionics, full flight testing was scheduled to have begun in mid-1987. Initial operating capability is planned for early 1989, by which time the Trident force will have increased to ten SSBNs, whilst the US Navy's EC-130 Tacamo fleet will have been reduced to 12 aircraft from the 17 currently operating with Fleet Air Reconnaissance Squadrons VQ-3 at NAS Atsugi, Guam, and VQ-4 at NAS Patuxent River, Maryland. During 1989–90 it is intended to deliver seven E-6As, and the full Tacamo complement of 15 E-6As (including the refurbished prototype) and ten EC-130Qs is planned to be achieved by 1993, when all 14 Trident SSBNs will be in service.

Eight of the E-6As will be allocated to the Pacific Fleet and the remainder to the Atlantic/Mediterranean. In each of these areas one E-6A will be required to be on station, in the air, at any given time, ready and able to relay emergency action messages to a high percentage of submarines, with an equally high chance of successful first-time reception. Another E-6A will be on standby alert, one on ready alert, and the remainder at dispersed bases or on maintenance or training.

The following details apply to the E-6A prototype:

TYPE: Long-endurance communications relay aircraft, to carry the US Navy's airborne very low frequency (AVLF) communications systems.

AIRFRAME: Retains more than 75 per cent commonality with that of the E-3A, main differences being deletion of the dorsal radome and its support structure, the addition of wingtip ESM/Satcom pods and HF antenna fairings, and increased corrosion protection. Also retained is the nuclear/EMP (electromagnetic pulse) 'hardening' of the E-3A airframe. Additions include incorporation of the large forward freight door of the commercial Boeing 707-320C. Landing gear is identical to that of the E-3A.

POWER PLANT: Four 97.86 kN (22,000 lb st) CFM International F108-CF-100 (CFM56-2A-2) turbofans in individual underwing pods, as on E/KE-3As for Saudi Arabia. Fuel contained in integral tanks in wings, with single-point refuelling. In-flight refuelling via boom receptacle above flight deck.

ACCOMMODATION: Basic militarised interior sidewalls, ceilings, and lighting are same as in E-3A. Interior divided into three main functional areas: forward of wings (flight deck and crew rest area), overwing (six-man mission crew), and aft of wings (equipment). Forward crew area, 50 per cent common with that of E-3A, accommodates a four-man flight crew on flight deck. Compartment immediately aft of this contains food storage, galley, dining area, toilets, and an eight-bunk rest area for spare crew carried on extended or remote deployment missions. Crew enter by ladder and hatch in floor of this compartment. Then follows the C³ overwing compartment with central and other consoles, their operators, and an airborne control officer (ACO). Through this is reached, to the rear, the compartment containing the avionics racks, transmitters, trailing wire antennae and their winches, parachutes, equipment spares, and a baggage storage area. There is a bail-out door at the rear of this compartment on the starboard side.

SYSTEMS: Some 75 per cent of the E-6A's systems are the same as those in the E-3A. Among those retained are the liquid cooling system for the transmitters, the 'draw-through' cooling system for other avionics, the 600kVA electrical power generation system, the APU, the liquid oxygen system, and MIL specification hydraulic oil.

AVIONICS AND OPERATIONAL SYSTEMS: Three Collins AN/ARC-182 VHF/UHF com transceivers, all with secure voice capability; two Collins AN/ARC-190 HF com (one transceiver, one receiver only); and Hughes Aircraft AIC-29 crew intercom with secure voice capability. External aerials for Satcom UHF reception in each wingtip pod; fairings beneath each pod house antennae for standard HF reception. Navigation by triplex Litton LTN-90 ring laser gyro-based inertial reference system integrated with Litton LTN-211 VLF/Omega system and duplex Smiths Industries SFM 102 digital/analog flight management computer system (FMCS). Bendix APS-133 colour weather radar, in nosecone, with capability for short range terrain mapping, tanker beacon homing, and waypoint display. Honeywell APN-222 high/low-range (0–15,240 m; 0–50,000 ft) radio altimeter, and Collins low-range (0–762 m; 0–2,500 ft) radio altimeter, with ILS and GPWS. General Instruments ALR-66(V)4 electronic support measures (ESM), in starboard wingtip pod, provide information on threat detection, identification, bearing, and approximate range. In overwing compartment, overseen by ACO, are two banks of three consoles and a new communications central console, which incorporates ERCS (emergency rocket communications system) receivers, Satcom cryptographic equipment, new teletypes, tape recorders, and other C³ equipment, all hardened against electromagnetic interference. In each operational area the E-6A links 'upward' with the airborne command posts and the Presidential E-4, to satellites, and to the ERCS; and 'downward' to VLF ground stations and the SSBN fleet. The main VLF antenna is a 7,925 m (26,000 ft) long trailing wire aerial (LTWA), with a 41 kg (90 lb) drogue at the end, which is winched out from the middle part of the rear cabin compartment through an opening in the cabin floor. The LTWA, with its drogue, weighs about 495 kg (1,090 lb) and creates some 907 kg (2,000 lb) of drag when fully deployed. Acting as a dipole is a much shorter (1,220 m; 4,000 ft) trailing wire (STWA), winched out from beneath the rear fuselage just forward of the tailplane. At patrol altitude, with the LTWA deployed, the aircraft enters a tight orbit, and the drogue stalls, causing the wire to be almost vertical (70 per cent verticality is required for effective sub-sea communications), and the aircraft/wire combination acts like a lasso being whirled above the head, only in reverse, *i.e.*, the path of the drogue is that of the hand holding the rope, while the orbit of the aircraft is the lasso. Signals transmitted through the trailing wire antennae use 200kW of power, and can be received by submerged SSBNs via a towed buoyant wire antenna. Mean time between failures of complete mission avionics is approximately 20 hours, but the E-6 is able to carry spares, and a spare crew, to permit extended missions of up to 72 hours with in-flight refuelling, and/or deployment to remote bases.

ARMAMENT: None.

DIMENSIONS, EXTERNAL:	
Wing span	45.16 m (148 ft 2 in)
Length overall	46.61 m (152 ft 11 in)
Height overall	12.93 m (42 ft 5 in)
Wheel track	6.73 m (22 ft 1 in)
Wheelbase	17.98 m (59 ft 0 in)
Forward cargo door:	
Height	2.34 m (7 ft 8 in)
Width	3.40 m (11 ft 2 in)
Height to sill	3.20 m (10 ft 6 in)
AREA:	
Wings, gross	283.4 m² (3,050.0 sq ft)
WEIGHTS:	
Operating weight empty	78,378 kg (172,795 lb)
Max fuel	70,305 kg (155,000 lb)
Max T-O weight	155,128 kg (342,000 lb)
PERFORMANCE (S/L, ISA, estimated):	
Dash speed	530 knots (981 km/h; 610 mph)
Cruising speed at 12,200 m (40,000 ft)	455 knots (842 km/h; 523 mph)
Patrol altitude	7,620–9,150 m (25,000–30,000 ft)
Ceiling	12,800 m (42,000 ft)
Critical field length	2,042 m (6,700 ft)
Max effort T-O run	1,646 m (5,400 ft)
Max effort T-O run with fuel for 2,500 nm (4,630 km; 2,875 miles)	732 m (2,400 ft)
Landing run at max landing weight	793 m (2,600 ft)
Mission range, unrefuelled	6,350 nm (11,760 km; 7,307 miles)
Endurance: unrefuelled	15 h 24 min
on station 1,000 nm (1,850 km; 1,150 miles) from T-O	10 h 30 min
with one refuelling	28.9 h
with multiple refuelling	72 h

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■ Hell Over Korea

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China Bomber

What were the odds against a single B-24 surviving repeated attacks on an enemy naval force? Maj. "Stump" Carswell didn't ask.

BY JOHN L. FRISBEE
CONTRIBUTING EDITOR

SAY "Fourteenth Air Force," and for most of us that conjures up visions of Maj. Gen. Claire Chennault's shark-nosed fighters battling vastly superior numbers of Japanese aircraft in the skies over China. Often forgotten is Chennault's small force of bombers, mostly B-25s with a single group of heavies, the 308th Bombardment Group.

The 308th brought its B-24 Liberators to China during the spring of 1943, flying its first mission on May 4. Chennault used his few heavies to support Chinese ground forces, bomb harbors, knock down bridges, and attack shipping in the enemy-dominated South China Sea—the latter often single-plane missions. Lacking accurate weather forecasts, adequate maps and navigational aids, fighter escort on their longer missions, and the mutually supporting firepower of large formations, losses were heavy. According to one source, ninety-three B-24s served in China, and sixty-two were lost in combat or to other causes. When not flying combat, the Liberators hauled supplies over the Hump to China—the terminus of the war's longest and most difficult supply route.

A year after the 308th became operational, Maj. Horace S. "Stump" Carswell reported at Kunming for duty with the Group. In the three years since completing pilot training, Carswell had served as an instructor, operations officer, and group commander with three B-24 operational training groups in the States. All he needed to fill the squares on his chart was combat experience, which he began acquiring immediately. After a short time at Group headquarters, he was named operations officer of the 374th Squadron.

On October 15, 1944, five months after joining the Group, Carswell won his first major distinction. Late that afternoon, he took off from an advance base at Liuchow on a solo sweep over the South China Sea. About 150 miles east of Hong Kong, he found a formation of six naval vessels. In a first attack through the concentrated fire of those heavily armed warships, Carswell's crew got two direct hits on a cruiser, blowing it up. Using his remaining bombs, Major Carswell made three runs on a destroyer, scoring one direct hit and two near misses that put the ship out of action.

Eleven days later, Carswell and his crew flew a night mission against a Japanese convoy of twelve armed cargo ships escorted by at least two destroyers. Taking the enemy by surprise, he made a run at 600 feet on one of the destroyers, damaging it with a near miss and drawing no fire from the convoy. He then set up for a second low-level attack, knowing that the element of surprise was gone. The crew got two direct hits on a large tanker, but their B-24 was raked repeatedly by antiaircraft fire. Two engines were knocked out, a third and the hydraulic system damaged, and the copilot wounded.

The only member of the wartime Fourteenth Air Force to win the Medal of Honor was Maj. Horace "Stump" Carswell.

Carswell regained control of the stricken bomber a few feet above the water and began a slow climb toward the China coast, hoping the damaged engine would hold out until they reached dry land where the crew could bail out, albeit over enemy territory. Then the bombardier discovered that his parachute had been shredded by flak. Carswell would have to nurse the bomber, with one good and one damaged engine, over the mountains to the west of the coast, perhaps to one of the Fourteenth Air Force fields in eastern China, but at least to an area where a successful crash landing might be made.

The crew knew that if anyone could coax a few more feet of altitude out of the struggling B-24, it was Stump Carswell. With every passing minute, the odds on making it improved. Then, before they had crossed the mountains, the third engine quit. Carswell ordered the crew to bail out. Eight men followed each other into the darkness, but Major Carswell chose to stay with the wounded copilot and his bombardier and attempt a crash landing.

It was not to be. The bomber hit a mountainside and exploded.

Two posthumous awards went to Maj. Horace Carswell: the Distinguished Service Cross for his October 15 mission and the Medal of Honor for self-sacrifice on that last flight. He was the only member of Fourteenth Air Force to be so honored. Today, Carswell AFB at Fort Worth, Tex., stands as a memorial to this man who valued duty and honor above life itself—a heroic airman who became part of the Air Force tradition of valor. ■

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By Robin Whittle, AFA DIRECTOR OF COMMUNICATIONS

Central Florida Gala

It wasn't simply the $10,000 raised for AFA's Aerospace Education Foundation that made this year's Tactical Air Forces Gala one for the books. AFA's Central Florida Chapter had now sponsored four of them in conjunction with AFA's Tactical Air Warfare Symposium in Orlando, each one bigger and better than the Gala of the previous year.

For the first time, AFA's Foundation cosponsored the Gala, which honored twelve American fighter aces living in the central Florida area, nine of whom attended the event. They were invested as Gen. Ira C. Eaker Fellows of the Foundation, which represented a $9,000 contribution. Also honored was Gala Chairman Norman J. Abramson, who was invested as a Gen. Jimmy Doolittle Fellow of AEF, adding another $1,000 contribution for Foundation projects. Mr. Abramson has served as Gala Chairman without interruption.

More than 500 applauded when Chapter President Tommy Harrison, who emceed the event, presented the Chapter's Distinguished Service Award to the Tactical Air Warfare Center at Eglin AFB, represented by its Commander, Maj. Gen. John E. Jaquish. The award honors an Air Force unit in the state for exceptional support of AFA.

Comedian Jim Teter and the musical group "The Spurrlows" capped a well-executed event that honored fighter aces Col. Bruce W. Carr, USAF (Ret.); Brig. Gen. John F. Dobbin, USMC (Ret.); Rear Adm. Richard E. Fowler, Jr., USN (Ret.); Maj. Harry T. Hanna, USAF (Ret.); Fred R. Haviland, Jr., USAAF; Gen. Bruce K. Holloway, USAF (Ret.); Lt. Cmdr. William J. Kingston, USN (Ret.); Col. Robert L. Liles, USAF (Ret.); Maj. James F. Low, USAF (Ret.); Col. Heyward A. Paxton, Jr., USAF (Ret.); Cmdr. Joseph E. Reulet, USN (Ret.); and Brig. Gen. Donald K. Yost, USMC (Ret.). The nine aces who were able to attend are shown in the photo immediately below.

Flanked by Martin H. Harris, AFA Chairman of the Board, far left, and AFA Central Florida Chapter President Tommy G. Harrison, far right, are AFA President Sam E. Keith, fifth from left, and nine of the twelve American fighter aces currently living in central Florida who were honored with Gen. Ira C. Eaker Fellowships at the Central Florida Chapter's Tactical Air Forces Gala. From left: Mr. Harris, Robert Liles, William Kingston, Donald Yost, Mr. Keith, Fred Haviland, Heyward Paxton, Joseph Reulet, Richard Fowler, Bruce Holloway, Bruce Carr, and Mr. Harrison. Also honored but not pictured were John Dobbin, Harry Hanna, and James Low.

The Chairman of the extraordinarily successful Tactical Air Forces Gala, Norm Abramson, second from left, displays the Gen. Jimmy Doolittle Fellowship he received from AEF President James Keck, second from right. Looking on are AEF Board Chairman George Hardy, left, and Central Florida Chapter Chairman Tommy Harrison, right.

A perennial favorite with AFA audiences, retired Brig. Gen. Chuck Yeager, right, addressed a capacity crowd at a recent Sacramento Chapter luncheon meeting. Shown here talking with General Yeager are, from left, Chapter Vice President Sue Crites, Chapter President Roger Stiles, and Chapter Secretary and Communications Vice President Douglas Baldwin.

AFA Salutes Hospitalized Veterans

A World War II amputee who was recovering from his 106th operation was all smiles and handshakes when three AFA National Directors surprised him with a visit at the Veterans Administration Hospital in Pittsburgh, reports former AFA National President and Board Chairman Judge John G. Brosky. Carl Long and Bob Carr joined the Judge on a tour that began on the top floor. They visited every ward, chatting and swapping stories with the men as they worked their way down to the main entrance.

The longtime AFA leaders were joined on the tour by Dr. Ernest Urban, Chief of Staff of the Hospital; Thomas A. Gigliotti, Medical Center Director; Edward Politylo, Commander, Disabled American Veterans Chapter Eight, and World War II Medal of Honor recipient Leonard Funk.

"To a man, they were cheerful despite their medical problems," Judge Brosky said. "They were from every war, all branches of the services, and from the east, south, midwest, and as far away as Colorado."

The AFA leaders agreed that the visit lifted their spirits as much as it did those of the veterans. "I believe we even enjoyed it more," said the Judge.

The visit occurred on February 12 in conjunction with the official "Salute to Hospitalized Veterans."

Fort Worth Chapter Cohosts Dinner

More than 600 AFA members, active-duty personnel, and community leaders and residents turned out for a formal dinner party cohosted by Fort Worth Chapter President Wayne Calhoun and Col. George P. Cole, Jr., 7th Bomb Wing Commander at Carswell AFB, Tex. The event was held at the Worthington Hotel in downtown Fort Worth, described by Mr. Calhoun as providing a beautifully elegant setting for the festivities, which included an appropriate serenade from the Air Force Strolling Strings and an "extremely motivating and challenging address by former CINCMAC Gen. Robert E. 'Dutch' Huyser," Mr. Calhoun said.

AFA National President Sam Keith, Jr., presented AFA Exceptional Service Awards to retired Maj. Gen. H. E. Humfeld and David J. Brown and Fort Worth Chapter Awards for outstanding service to Robert Copley and Thomas Kemp.

Sizing up the success of the Fort Worth bash, President Calhoun said that the Chapter was especially pleased with the audience the event attracted. "We came very close to a fifty-fifty split between active-duty personnel and residents of Fort Worth," he said. Further, select companies were invited to sponsor corporate tables, and twenty-one did so, allowing the Chapter to reduce the per-ticket cost for active-duty personnel.

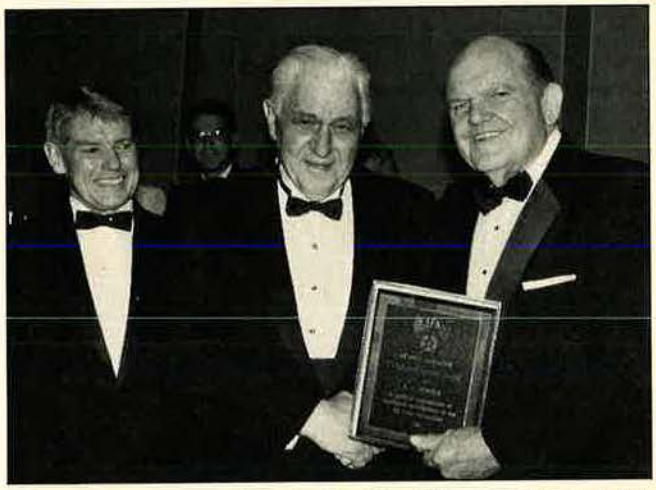
Chapter officials are planning to sponsor a formal dinner party each quarter at convention facilities that can accommodate 600-plus people. If the first one is any guide, they are off to a running start.

Kelly Chapter Cosponsors Luncheon

AFA's Colin P. Kelly Chapter and the Griffiss Military Affairs Committee cosponsored a luncheon featuring Col. Alfred G. Snelgrove, Commander, 10th Mountain Division Combat Avia-

New York AFA President Gerald V. Hasler, center, presents a Medal of Merit to New York State Vice President Michael Salerno, right, at the joint Colin P. Kelly Chapter/Griffiss Military Affairs Committee luncheon. Army Col. Alfred Snelgrove, left, Commander of the 10th Mountain Division Combat Aviation Brigade, was the featured speaker at the luncheon.

Hospitalized veteran Richard Thompson received a surprise visit from AFA during the Salute to Hospitalized Veterans last February. Pictured are, from left, Mr. Thompson, AFA National Directors Carl Long and John Brosky, Pittsburgh VA Hospital Chief of Staff Dr. Ernest Urban, MOH recipient Leonard Funk, and AFA National Director Bob Carr.



A beaming Fort Worth Chapter President Wayne Calhoun (left) watches as AFA National President Sam Keith, Jr. (right), presents an Exceptional Service Award to retired Maj. Gen. H. E. "Buzz" Humfeld at a formal dinner cohosted by the Fort Worth Chapter and the 7th Bomb Wing at Carswell AFB, Tex. A crowd of 600 attended the event.

tion Brigade, who said the upshot of the 10th's arrival at Griffiss AFB in Rome, N. Y., would be "more jobs, more money fueling the local economy, more children filling schools, and more participation in church and civic activities," reports New York AFA President Gerald Hasler, who attended the luncheon sponsored by an AFA chapter he helped to establish.

Some 120 community and base leaders joined Mr. Hasler for Colonel Snelgrove's introduction to the brigade, its functions, and its projected local impact. Nearly 700 soldiers are expected to be in place by June, creating an estimated 261 jobs in the civilian community and some 100 jobs on base over several years, Mr. Hasler reported.

"The aviation brigade is a new iteration of the light division, a concept that grew out of the Army's 1983 study on how to deal with low-intensity conflict," Mr. Hasler said. It is charged with deploying troops to strategic worldwide locations to conduct reconnaissance, provide battlefield mobility, and destroy enemy forces. The 10th will remain at Griffiss AFB until 1992, when facilities will be completed at the relocation site at Fort Drum, near Watertown.

During the luncheon, Mr. Hasler presented an AFA Medal of Merit to Mike Salerno, New York AFA Vice President/Central Region and former New York AFA Secretary. Colonel Snelgrove was introduced by Robert Morris, past Chairman and member of the Griffiss Military Affairs steering committee and current President of the Rome Industrial Development Corp.

In related New York AFA news, Mr. Hasler reports that an active Brooklyn "Key" Chapter helped raise $5,000 for the local VA hospital and, prior to Thanksgiving, gave out more than 100 food baskets while also donating funds to the Thanksgiving dinner at the hospital. Since December, the Chapter has given more than 100 baskets of food to the poor each month and is working with area clothing stores to find clothing for the needy.

On Christmas Eve, Chapter members put up a Christmas tree at the VA hospital and laid out a banquet table full of food that, according to Chapter President Gene Festa, stunned the hospital staff and volunteers. AFA has become known as the biggest contributor of time and services. This renewed activity by the Brooklyn "Key" Chapter in support of the community "is certainly following the spirit of headquarters's recommendations," Mr. Hasler said.

Tacoma Chapter Activities

Tacoma Chapter Communications Vice President Jack Gamble reports that nearly 200 people turned out for the Tacoma Chapter Christmas party on December 12 at the McChord AFB Officers' Club. The event honored Capt. Mark Peterson and the Air Force Band of the Pacific Northwest and Cadets Diane Choy and Roberto Acosta, who received $750 each as winners of the Chapter's "Big John Anderson" Scholarships. Both cadets are members of the AFROTC unit at the University of Puget Sound. Cadet Choy is in her third year at the University working toward a degree in computer sciences and business, while Cadet Acosta is working on a degree in business administration at St. Martins College.

During the party, Tacoma President Rene A. LeVitre presented a check in the amount of $2,000 for the McChord Youth Activities Program. Accepting the check on behalf of the program was John West, chief of the Morale, Welfare, and Recreation Division.

During the event, President LeVitre gave a "State of the Chapter" address that emphasized the success of the Chapter's awards and scholarship programs, which also include a $300 scholarship award to an outstanding AFJROTC cadet at Washington High School and $300 to the top Civil Air Patrol cadet at the area squadron. Another $300 is donated to the 62d Military Airlift Wing Rodeo team, $800 to the McChord Military Recognition Program, and $300 to the McChord Air Museum. The Chapter donates $250 to the Young Astronaut program and $100 to the annual model-airplane contest sponsored by the base.

The highlight of the Christmas party was the award to Captain Peterson and the Air Force Band of the Pacific Northwest, which has supported Tacoma Chapter activities for years. A special ensemble from the Band performed its Air Force fortieth anniversary show for the crowd.

Special guests included AFA National Director Sherm Wilkins and his wife Naomi; Washington AFA President Al Lloyd; Brig. Gen. John Davey, Commander, 25th Air Division, and his wife Barbara; and Col. Edwin Tenoso, Commander, 62d Military Airlift Wing, and his wife Kathy.

The evening was capped with dancing to the "Big Band" sound provided by "The Touch of Blue."

Mobile Chapter Activities

AFA National Director and Mobile Chapter Communications Vice President Dr. Frank Lugo says members of the Mobile Chapter in Alabama have been quite active at local, state, and national events. Chapter President H. R. "Bobby" Case and his wife Kay joined the Lugos to attend AFA's national symposium on the Air Force, held last October in Los Angeles, Calif.

Fourteen Mobile Chapter members sit on the Bay Area Veterans Day Commission and were instrumental in planning an air show to commemorate Veterans Day. Three other major events that the AFA members helped to coordinate were the Freedom Foundation ceremonies at the USS *Alabama* Battleship Rose Garden

Tacoma Chapter President Rene A. LeVitre, left, presents a $2,000 check from the Chapter to Greg Thomas, Youth Activities Program Director at McChord AFB, Wash., as some of the happy beneficiaries express their delight. At right is program staffer Joyce Collins.

AFA State Contacts

Following each state name are the names of the communities in which AFA chapters are located. Information regarding these chapters or any of AFA's activities within the state may be obtained from the appropriate contact.

ALABAMA (Birmingham, Gadsden, Huntsville, Mobile, Montgomery, Selma): **Robie Hackworth,** 206 Dublin Circle, Madison, Ala. 35758 (phone 205-532-4920).

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COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo): **Jack G. Powell,** 1750 S. Ironton, Aurora, Colo. 80012 (phone 303-370-4787).

CONNECTICUT (Brookfield, East Hartford, Middletown, Storrs, Stratford, Torrington, Waterbury, Westport, Windsor Locks): **Joseph Zaranka,** 9 S. Barn Hill Rd., Bloomfield, Conn. 06002 (phone 203-242-2072).

DELAWARE (Dover, Milford, Newark, Rehoboth Beach, Wilmington): **Horace W. Cook,** 112 Foxhall Dr., Dover, Del. 19901 (phone 302-674-1051).

DISTRICT OF COLUMBIA (Washington, D. C.): **Denny Sharon,** 1501 Lee Highway, Arlington, Va. 22209-1198 (phone 703-247-5820).

FLORIDA (Avon Park, Broward County, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Jacksonville, Leesburg, Miami, New Port Richey, Orlando, Palm Harbor, Panama City, Patrick AFB, Port Charlotte, Redington Beach, Sarasota, Tallahassee, Tampa, West Palm Beach, Winter Haven): **Roy P. Whitton,** P. O. Box 1706, Lake Placid, Fla. 33852 (phone 813-465-7048).

GEORGIA (Athens, Atlanta, Columbus, Dobbins AFB, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **Robert W. Marsh, Jr.,** P. O. Box 542, Springfield, Ga. 31329 (phone 912-964-1941, ext. 206).

GUAM (Agana): **Michael C. Wilkins,** Box CV, Agana, Guam 96910 (phone 671-646-5259).

HAWAII (Honolulu, Puunene): **Don J. Daley,** P. O. Box 3200, Honolulu, Hawaii 96847 (phone 808-525-6296).

IDAHO (Boise, Mountain Home, Twin Falls): **Chester A. Walborn,** P. O. Box 729, Mountain Home, Idaho 83647 (phone 208-587-7185).

ILLINOIS (Belleville, Champaign, Chicago, Elmhurst, Moline, Peoria, Springfield-Decatur): **Glen W. Wensch,** R. R. #1, Box 54, Champaign, Ill. 61821 (phone 217-352-2777).

INDIANA (Bloomfield, Fort Wayne, Grissom AFB, Indianapolis, Lafayette, Marion, Mentone, South Bend, Terre Haute): **Don McKellar,** 2324 Pinehurst Lane, Kokomo, Ind. 46902 (phone 317-455-0933).

IOWA (Des Moines, Sioux City): **Carl B. Zimmerman,** 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

KANSAS (Garden City, Topeka, Wichita): **Cletus J. Pottebaum,** 6503 E. Murdock, Wichita, Kan. 67206 (phone 316-683-3963).

KENTUCKY (Lexington, Louisville): **Bryan J. Sifford,** Rte. 4, Box 431, Cynthiana, Ky. 41031 (phone 606-234-1642).

LOUISIANA (Alexandria, Baton Rouge, New Orleans, Shreveport): **Paul J. Johnston,** 1703 W. Medalist Dr., Pineville, La. 71360 (phone 318-640-3135).

MAINE (Bangor, Loring AFB, North Berwick): **Alban E. Cyr, Sr.,** P. O. Box 160, Caribou, Me. 04736 (phone 207-496-3331).

MARYLAND (Andrews AFB area, Baltimore, Rockville): **William T. Reynolds,** 11903 Chesterton Dr., Upper Marlboro, Md. 20772 (phone 301-249-5438).

MASSACHUSETTS (Bedford, Boston, East Longmeadow, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **Leo O'Halloran,** 420 Bedford St., Suite 290, Lexington, Mass. 02173 (phone 617-264-4603).

MICHIGAN (Alpena, Battle Creek, Calumet, Detroit, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): **William Stone,** 7357 Lakewood Dr., Oscoda, Mich. 48750 (phone 517-724-6266).

MINNESOTA (Duluth, Minneapolis-St. Paul): **Earl M. Rogers, Jr.,** 325 Lake Ave. S., Duluth, Minn. 55802 (phone 218-727-8711).

MISSISSIPPI (Biloxi, Columbus, Jackson): **Henry W. Boardman,** 10 Bayou Pl., Gulfport, Miss. 39503 (phone 601-896-8836).

MISSOURI (Kansas City, Richards-Gebaur AFB, Springfield, St. Louis, Whiteman AFB): **Raymond W. Peterman,** P. O. Box 9605, Kansas City, Mo. 64134 (phone 816-761-7453).

MONTANA (Bozeman, Great Falls): **Ed White,** 2333 6th Ave., South Great Falls, Mont. 59405 (phone 406-453-2054).

NEBRASKA (Lincoln, Omaha): **Ralph Bradley,** 3902 Davenport, Omaha, Neb. 68131 (phone 402-554-6220).

NEVADA (Las Vegas, Reno): **Emery S. Wetzel, Jr.,** 2938 S. Duneville St., Las Vegas, Nev. 89102 (phone 702-362-1767).

NEW HAMPSHIRE (Manchester, Pease AFB): **Robert N. McChesney,** Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-664-5090).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Middlesex County, Newark, Old Bridge, Trenton, Wallington, West Orange, Whitehouse Station): **Robert Gregory,** R. D. #2, Box 216, Wrightstown, N. J. 08562 (phone 609-758-2973).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): **Louie T. Evers,** P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

NEW YORK (Albany, Bethpage, Brooklyn, Buffalo, Chautauqua, Griffiss AFB, Hudson Valley, Nassau County, New York City, Niagara Falls, Patchogue, Plattsburgh, Queens, Rochester, Rome/Utica, Suffolk County, Syosset, Syracuse, Westchester, Westhampton Beach, White Plains): **Gerald V. Hasler,** P. O. Box 5254, Albany, N. Y. 12205 (phone 518-785-5020).

NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh): **Robert C. Newman, Jr.,** 3037 Truitt Dr., Burlington, N. C. 27215 (phone 919-584-7069).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): **Ralph Ehlers,** 1207 Glacial Dr., Minot, N. D. 58701 (phone 701-852-3221).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield, Newark, Youngstown): **Cecil H. Hopper,** 537 Granville St., Newark, Ohio 43055 (phone 614-344-7694).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **Terry Little,** 4150 Timerlane, Enid, Okla. 73703 (phone 405-234-9624).

OREGON (Eugene, Klamath Falls, Portland): **Hal Langerud,** 10515 S. W. Clydesdale Terrace, Beaverton, Ore. 97005 (phone 503-644-0645).

PENNSYLVANIA (Allentown, Altoona, Beaver Falls, Bensalem, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Indiana, Johnstown, Lewistown, Mon Valley, Philadelphia, Pittsburgh, Scranton, Shiremanstown, State College, Willow Grove, York): **David L. Jannetta,** P. O. Box 643, Altoona, Pa. 16603 (phone 814-943-8023).

PUERTO RICO (San Juan): **Fred Brown,** 1991 Jose F. Diaz, Rio Piedras, P. R. 00928 (phone 809-790-5288).

RHODE ISLAND (Warwick): **Thomas R. Portesi,** 102d Tactical Control Squadron, North Smithfield ANG Station, Slatersville, R. I. 02889 (phone 401-762-9100).

SOUTH CAROLINA (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **Wesley H. Davis,** 7916 Bay Springs Rd., Columbia, S. C. 29233 (phone 803-788-5267).

SOUTH DAKOTA (Rapid City, Sioux Falls): **John Kittelson,** 141 N. Main, Suite 308, Sioux Falls, S. D. 57102 (phone 605-336-2498).

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): **Everett E. Stevenson,** 4792 Cole Rd., Memphis, Tenn. 38117 (phone 901-767-1315).

TEXAS (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **John P. Russell,** 118 Broadway, Suite 234, San Antonio, Tex. 78205 (phone 915-698-8586).

UTAH (Bountiful, Clearfield, Ogden, Salt Lake City): **Marcus C. Williams,** 4286 South 2300 West, Roy, Utah 84067 (phone 801-627-4490).

VERMONT (Burlington): **Ralph R. Goss,** 8 Summit Circle, Shelburn, Vt. 05482 (phone 802-985-2257).

VIRGINIA (Alexandria, Charlottesville, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **Don Anderson,** Box 54, 2101 Executive Dr., Hampton, Va. 23666 (phone 804-868-8756).

WASHINGTON (Seattle, Spokane, Tacoma, Yakima): **Alwyn T. Lloyd,** P. O. Box 24271, M/S 6A-30, Seattle, Wash. 98124 (phone 206-251-2055).

WEST VIRGINIA (Huntington): **Ron Harmon,** 1933 Ohio Ave., Parkersburg, W. Va. 26101 (phone 304-485-2088).

WISCONSIN (Madison, Milwaukee, Mitchell Field): **Gilbert Kwiatkowski,** 8260 W. Sheridan Ave., Milwaukee, Wis. 53218 (phone 414-463-1849).

WYOMING (Cheyenne): **Irene G. Johnigan,** 503 Notre Dame Court, Cheyenne, Wyo. 82009 (phone 307-775-3641).

During a celebration held at the Smithsonian Institution's National Air and Space Museum, AFA National Director Dr. Frank Lugo paused to chat with Jeana Yeager, who along with Dick Rutan piloted the Voyager aircraft on its epic journey. The event marking the one-year anniversary of the pair's historic, unrefueled, globe-girdling flight honored the two aviators.

Park officiated by Air Force Chief of Chaplains Maj. Gen. Stuart Barstad, the awards luncheon, which honored featured speaker Rep. Bill Nichols (D-Ala.) as "Patriot of the Year," and a parade through downtown Mobile that attracted the crowds.

In early December, the Chapter sponsored its annual "Salute to Community Partners," which featured Aerospace Education Foundation Board Chairman George D. Hardy as speaker. A special certificate of appreciation from AFA President Sam Keith, Jr., was presented to each Partner, and all thirty-three renewed their affiliation, according to Dr. Lugo.

Jim LeBlanc, AFA National Vice President/South Central Region, and his wife Teddy joined Mobile Chapter members at the Alabama Aviation Hall of Fame induction ceremony/banquet in Birmingham in support of fellow Chapter member Donald Bigler, one of three inducted for outstanding contributions to aviation. According to Dr. Lugo, who is on the Board of Directors for the Alabama Aviation Hall of Fame, Mr. Bigler's induction brings the number of Mobile Chapter members in the Hall of Fame to three. The others are retired Air Force Brig. Gen. John Dyas (1984) and Carl Lund (1985).

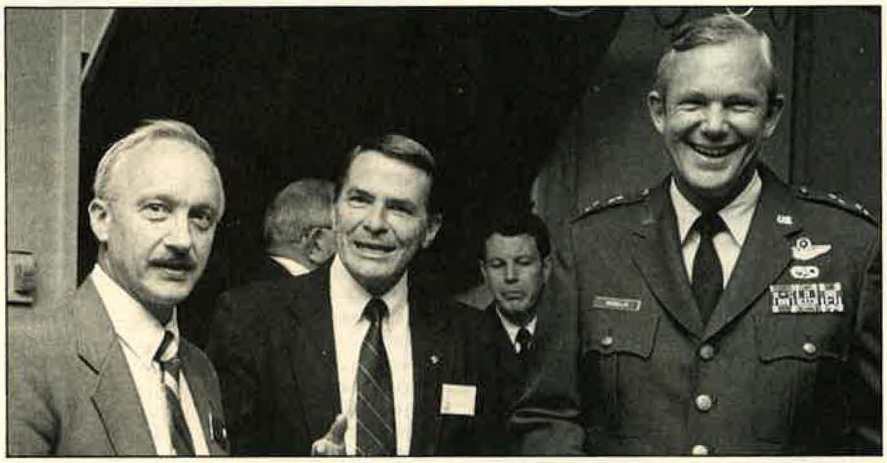
Finally, in December, Dr. and Mrs. Lugo were invited to attend the first anniversary celebration of the *Voyager* flight that honored pilots Dick Rutan and Jeana Yeager in the Flight Gallery at the National Air and Space Museum in Washington, D. C., where *Voyager* is on display.

Virginia AFA Spotlights TAC

Hopewell, Va., Mayor Clinton Strong and Martinsville, Va., Mayor L. D. Oakes were among the crowd of dignitaries from government, business, and community organizations from throughout the Commonwealth who enjoyed a firsthand look at the operation of the 1st Tactical Fighter Wing and the mission of Tactical Air Command at Langley AFB. The joint TAC/Virginia AFA event included briefings by senior TAC leaders and a tour of a tactical fighter squadron, where selected pilots and crew chiefs briefed the visitors on aircraft maintenance and operation.

Also on the busy schedule was a flight-line tour that featured an F-15

Donald Bigler, center, President of Teledyne Continental Motors, Inc., recently joined fellow Mobile Chapter members retired Brig. Gen. John Dyas, left, and former test pilot Carl Lund as members of the Alabama Aviation Hall of Fame. Members are inducted for their outstanding achievements in and contributions to aviation.



Hopewell, Va., Mayor Clinton Strong, left, chats with Virginia AFA President Don Anderson and Maj. Gen. Henry Viccellio, TAC's Deputy Chief of Staff for Logistics, during a tour of TAC operations at Langley AFB. The tour for civic leaders was sponsored by TAC and Virginia AFA.

Eagle on static display and an aerial demonstration of the Eagle's capabilities. The group lunched with some of the airmen assigned to Langley AFB, and a reception/dinner capped a tour of the base. The evening function featured entertainment by the "Flight of Six" TAC Band. Virginia AFA President Don Anderson and 1st Lt. Keith Tackett, TAC/PA, coordinated the event, which was very well received by the participants.

On the Scene

AFA National Director **Bill Ryon** related a bit of Air Force trivia he spotted recently in the Washington Cathedral *Age*. When longtime friend of the Cathedral **Col. Alan Harding** was deputy director of Air Force Maintenance Engineering back in the 1960s, he wanted to place in the Cathedral a memorial to the thousands of Air Force maintenance men and women who have given their lives to their country. At that time, the nave of the Cathedral was still under construction.

The result, high above the nave floor, is a twenty-six-inch stone falcon with outstretched wings, perched atop maintenance tools that are crossed beneath its talons. Further inspection shows that the bird is injured; its right leg is splinted. The memorial was sculpted by **Carl Bushn** and carved by **Rick Hart**, who created the statue of the three servicemen at the Vietnam Veterans Memorial in Washington.

The falcon has been in place since 1970, and now the Air Force has rediscovered it. The wounded falcon has been incorporated into the design adopted for use on the Aircraft and Munitions Maintenance badge that Air Force maintenance personnel wear on their uniforms. Further, a plaster model of the nave memorial adorns the office of the director of Maintenance and Supply for the Air Force. "We all carry a bit of the 'Cathedral' memorial with us each day," a maintenance officer was quoted as saying. ■

Coming Events

April 22–23, **Alabama State Convention,** Birmingham . . . April 22–23, **South Carolina State Convention,** Columbia . . . April 23, **Montana State Convention,** Bozeman . . . April 30, **Connecticut State Convention,** Vernon . . . June 3–4, **Louisiana State Convention,** New Orleans . . . June 10–11, **Oklahoma State Convention,** Tinker AFB . . . June 10–11, **Washington State Convention,** Seattle . . . June 17–19, **Georgia State Convention,** Athens . . . June 17–19, **New Jersey State Convention,** Cape May . . . June 17–19, **Ohio State Convention,** Columbus . . . July 8–9, **Missouri State Convention,** Springfield . . . July 15–16, **Mississippi State Convention,** Columbus . . . July 15–17, **Pennsylvania State Convention,** Pittsburgh . . . July 22–24, **Texas State Convention,** Kerrville . . . July 23–24, **North Carolina State Convention,** Raleigh . . . July 29–30, **Colorado State Convention,** Lowry AFB . . . July 29–31, **Florida State Convention,** Fort Lauderdale . . . August 4–6, **California State Convention,** San Diego . . . September 19–22, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.

Unit Reunions

Bradley Field
Veterans of World War II who served at Bradley Field, Conn., will hold a reunion on May 21, 1988, at Hq. 103d Tactical Fighter Group at Bradley IAP, Conn. **Contact:** Helen Snyder, 1463 Boulevard, West Hartford, Conn. 06119. Phone: (203) 561-3096.

Caterpillar Ass'n
The Caterpillar Association will hold its reunion on June 17–18, 1988, at the Wyndham Hotel in San Antonio, Tex. **Contact:** Johnny Brown, P. O. Box 1321, Kenosha, Wis. 53141. Phone: (414) 658-1559. Dr. Paul W. Pifer, 81 Zinnia Dr., Covington, La. 70433.

Spectre Ass'n
Members of the AC-130 Spectre Association will hold a reunion on May 14, 1988, at the Hurlburt Field NCO Club at Hurlburt Field, Fla. **Contact:** Spectre Association, P. O. Box 707, Mary Esther, Fla. 32569. Phone: (904) 884-7511. AUTOVON: 579-7511 (Jack Hollyfield or Gary Thompson).

USAF Honor Guard
The USAF Honor Guard is hosting a fortieth anniversary reunion ball on May 28, 1988, at the Bolling AFB, D. C., Officers' Club. **Contact:** 1st Lt. Mark A. Hobson, USAF, USAF Honor Guard, Building P-11, Bolling AFB, D. C. 20332-5000. Phone: (202) 767-4793. AUTOVON: 297-4793.

Reunion Notices

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

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Unit Reunions

4th Ferrying Group
Air Transport Command's 4th Ferrying Group (World War II) will hold a reunion on May 11–14, 1988, at the Airport Hilton Hotel in Nashville, Tenn. **Contact:** Daniel Donato Peters, Rte. 3, #136, Dagsboro Rd., Delmar, Del. 19940. Phone: (601) 453-6255 (Mike H. Carter).

4th Fighter Group
The 4th Fighter Group stationed at Debden, England, during World War II will hold a reunion on June 16–24, 1988. **Contact:** Col. Bob Beeson, USAF (Ret.), 7414 Abington Way, Brooksville, Fla. 34613. Phone: (904) 596-0420 or (800) 228-9690.

7th Bomb Group Ass'n
The 7th Bomb Group (including the 9th, 11th, 22d, 436th, 492d, and 493d Bomb Squadrons, the 88th Reconnaissance Squadron, the 5th Air Base Group, and associated units) will hold a reunion on June 22–25, 1988, in Salt Lake City, Utah. **Contact:** Sidney C. Birdsley, 1372 S. Main St., Salt Lake City, Utah 84115-5336. Phone: (801) 582-9772. Dick Young, 12301 218th Pl. S. E., Snohomish, Wash. 98290-7834. Phone: (206) 668-6642.

7th Photo Reconnaissance Sqdn.
The 7th Photo Reconnaissance Squadron (Oxford, England) will hold a reunion on August 11–19, 1988. **Contact:** George Lawson, 4390 14th St. N. E., St. Petersburg, Fla. 33703. Phone: (813) 526-8480 or (800) 228-9690.

12th Fighter Squadron
Members of the 12th Fighter Squadron, Thirteenth Air Force, will hold a reunion on April 15–17, 1988, in Fredricksburg, Tex. **Contact:** Paul S. Bechtel, 155 Carrigan Blvd., Merritt Island, Fla. 32952. Phone: (305) 453-4252.

34th Air Depot Group
The 34th Air Depot Group will hold a reunion on August 18–20, 1988, at the Harbor Inn in Duluth, Minn. **Contact:** Mike Sullivan, 3730 Casco Ave., Wayzata, Minn. 55391. Phone: (612) 471-9406. Joe Myers, 2729 Ostrom Ave., Long Beach, Calif. 90815. Phone: (213) 421-2166.

Class 38-B
Members of Flying Class 38-B (Randolph and Kelly Fields) will hold a fiftieth-year anniversary reunion on May 27–29, 1988, at Randolph AFB, Tex. **Contact:** Lt. Gen. J. H. Moore, USAF (Ret.), 6127 Shady Creek, San Antonio, Tex. 78239. Phone: (512) 653-1089.

Class 43-E
Pilot Class 43-E, Western Flying Training Command, will hold a reunion on May 19–22, 1988, in Scottsdale, Ariz. **Contact:** Paul Murphy, 7013 Bellrose N. E., Albuquerque, N. M. 87110.

50th Fighter-Bomber Wing
Officers who served with the 50th Fighter-Bomber Wing from 1952 to 1958 will hold a reunion on June 17–19, 1988, at the Sheraton Inn in Colorado Springs, Colo. **Contact:** Col. Robert P. Pasqualicchio, USAF (Ret.), 78 Cedar Lane, Briarcliffe Acres, Myrtle Beach, S. C. 29577.

72d Troop Carrier Squadron
Members of the 72d Troop Carrier Squadron will hold a reunion on August 11–14, 1988, in Buffalo, N. Y. **Contact:** Edward F. Ginal, 246 DuPont Ave., Tonawanda, N. Y. 14150. Phone: (716) 877-6199.

94th Bomb Group
The 94th Bomb Group (Rougham, England) will hold a reunion on June 2–10, 1988. **Contact:** Bob Voss, 26 Fawn Meadows Dr., Belleville, Ill. 62221. Phone: (800) 228-9690.

100th Bomb Group
The 100th Bomb Group (Thorpe Abbotts, England) will hold a reunion on August 4–12, 1988. **Contact:** Ray Miller, 1519 E. Siebenthaler Ave., Dayton, Ohio 54314.

305th Bomb Group
The 305th Bomb Group (Chelveston, England) will hold reunions on August 24–28, 1988, in Washington, D. C., and on August 29–September 6, 1988, in England. **Contact:** Abram A. Millar, P. O. Box 757, Sanger, Tex. 76266. Phone: (817) 458-3516. Ridge Kemp, 572 Fairway Dr., Novato, Calif. 94947. Phone: (415) 883-5792 or (800) 228-9690.

314th Composite Wing
Members of the 314th Composite Wing, Fifth Air Force, will hold a reunion on June 22–26, 1988, at the Knights Inn in Dayton, Ohio. **Contact:** Bob Kindell or Mel Hiller, Box 35372, Louisville, Ky. 40232. Phone: (502) 459-1121.

325th Fighter Group
The 325th Fighter Group "Checkertails" will hold a reunion on June 16–19, 1988, in Colorado Springs, Colo. **Contact:** Dan Penrod, 69 Keswick Ave., Pittsburgh, Pa. 15202. Phone: (412) 766-6190. George W. Liston, 13655 N. E. 10th Ave., #201, North Miami, Fla. 33161. Phone: (305) 891-6917.

357th Fighter Group
Veterans of the 357th Fighter Group (Leiston, England) will hold a reunion on August 18–26, 1988. **Contact:** Joseph DeShay, 465 N. E. 43d St., Boca Raton, Fla. 33431. Phone: (305) 392-4864 or (800) 228-9690.

363d Fighter Group
Members of the 363d Fighter Group will hold a reunion on May 19–22, 1988, at the Embassy Suites-Biltmore in Phoenix, Ariz. **Contact:** Col. Felix Kozaczka, USAF (Ret.), 21815 W. Ulmus Dr., Woodland Hills, Calif. 91364. Phone: (818) 888-1964.

366th Fighter Group
The 366th Fighter Group, Ninth Air Force, will hold a reunion on May 27–29, 1988, at the Marriott Copley Hotel in Boston, Mass. **Contact:** John F. Peterson, P. O. Box 392, Harrodsburg, Ky. 40330. Phone: (606) 734-7912. Larry Keating, 1365 York Ave., Apt. 8-C, New York, N. Y. 10021.

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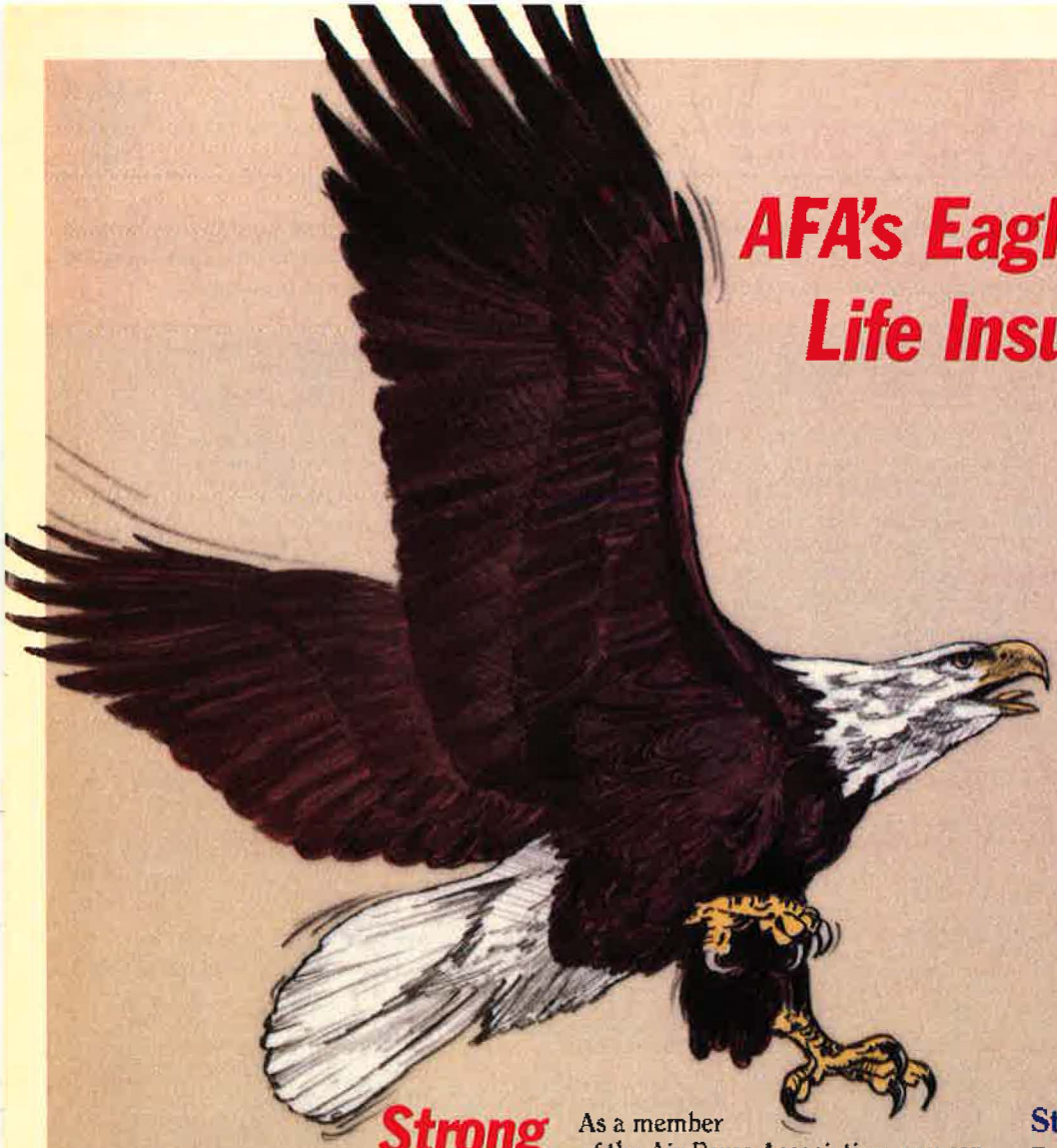

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Listed below are the Industrial Associates of the Air Force Association. Through this affiliation, these companies support the objectives of AFA as they relate to the responsible use of aerospace technology for the betterment of society and the maintenance of adequate aerospace power as a requisite of national security and international amity.

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AT&T Technologies, Federal Systems Div.
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Fairchild Communications & Electronics Co.
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Gates Learjet Corp.
GEC Avionics, Inc.
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General Dynamics, Electronics Div.
General Dynamics, Fort Worth Div.
General Electric Co.
General Electric Co., AEBG
Genisco Peripheral Systems
Geodynamics Corp.
GMC, Allison Gas Turbine Div.
GMC, Delco Systems Operations
Gould Inc., Defense Systems Group
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Grumman Corp.
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GTE Government Systems Corp.
GTE Government Systems Corp., Communications Systems Div.
GTE Government Systems Corp., Strategic Systems Div.
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Harris Government Communication Systems Div.
Harris Government Support Systems Div.
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Northrop Corp.
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Vitro Corp.
Walter Kidde Aerospace Operations
Watkins-Johnson Co.
Western Gear Corp.
Westinghouse Electric Corp., Baltimore Div.
Williams International
Wyle Laboratories

Unit Reunions

388th Bomb Group Ass'n
The 388th Bomb Group and attached units will hold a reunion during the week of August 21, 1988, at the Marriott City Center in Minneapolis, Minn. **Contact:** Edward J. Huntzinger, 1925 S. E. 37th St., Cape Coral, Fla. 33904-5035.

390th Bomb Squadron
Members of the 390th Bomb Squadron, 42d Bomb Group, Thirteenth Air Force, will hold a reunion on June 23–26, 1988, in New Braunfels, Tex. **Contact:** Hubert Hall, Rte. 1, Box 465, New Braunfels, Tex. 78130. Phone: (512) 625-6627.

447th Bomb Group
Veterans of the 447th Bomb Group (Rattlesden, England) will hold a reunion on July 21–29, 1988. **Contact:** Pete Petrillo, 955 N. Pasadena Ave., Elyria, Ohio 44035. Phone: (216) 365-2561 or (800) 228-9690.

454th Bomb Squadron
Members of the 454th Bomb Squadron, 323d Bomb Group, will hold a reunion on August 31–September 4, 1988, in Dayton, Ohio. **Contact:** Joseph R. Havrilla, 1208 Margaret St., Munhall, Pa. 15120. Phone: (412) 461-6373.

482d Bomb Group
The 482d Bomb Group (Alconbury, England) will hold a reunion on July 28–August 5, 1988. **Contact:** Pete Ardizzi, 835 Saint Davids Ave., Warminster, Pa. 18974. Phone: (215) 675-9194 or (800) 228-9690.

487th Bomb Group
Members of the 487th Bomb Group will hold a reunion on July 28–31, 1988, in Tulsa, Okla. **Contact:** Olen Huff, 18020 E. Brady, Catoosa, Okla. 74015.

913th ARS
Members of the 913th Aerial Refueling Squadron will hold a reunion on April 29–May 1, 1988. **Contact:** Reginald W. Adams, Jr., 710 Benton Rd., Bossier City, La. 71111. Phone: (318) 746-0252.

The Hunters
Pilots who appeared in the movie *The Hunters* are planning a reunion set tentatively for October 22, 1988, and need to locate some of the key performers. They are William N. Anderson, M. G. Armstrong, Dave Brown, Charley Joseph, Wendy Lawrence, Archie Lorenzen, George Mardison, Bob Saffel, "Snake" Simpson, Vernon Wright, and Ed Youst.
Please contact the address below.
Joe Turner
2705 Ross St.
Clovis, N. M. 88101

26th Tactical Dispensary
I am trying to locate members of the 26th Tactical Dispensary who served at Ramstein AB, Germany (1970–72). I would like to organize a reunion.
Please contact the address below.
Bruce Schatz
1932 Walnut Lane
Evansville, Ind. 47715

Class 43-H
I would like to hear from members of Class 43-H (George Field, Ill.) for the purpose of establishing a current directory and possibly organizing a reunion.
Please contact the address below.
Joseph W. Cathcart
933 Plateau Parkway
Nashville, Tenn. 37205
Phone: (615) 352-9540

62d AAFFTD
We would like to hear from former employees and students of the 62d AAFFTD school at Jackson, Miss., for purposes of planning a reunion next fall.
Please contact the addresses below.
Lt. Col. William T. "Bill" Dotson, USAF (Ret.)
3736 Mamaroneck
Louisville, Ky. 40218
or
William H. "Shorty" Holsclaw
9008 Trentham Lane
Louisville, Ky. 40222

312th Depot Repair Squadron
A reunion is in the planning stages for members of the 312th Depot Repair Squadron. This unit was stationed at Gioia del Colle, Italy.
Please contact the address below.
Joseph Monzella
765 Belwood Circle
Fairfield, Ala. 35064
Phone: (205) 923-1790

Bob Stevens'

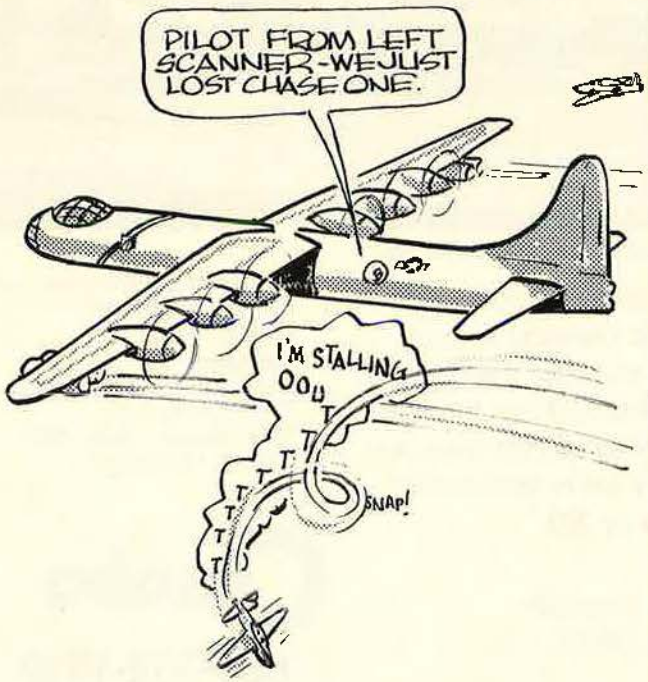
"There I was..."

THIS ISSUE WE FEATURE THE B-36. ITS 230-FT. WINGSPAN QUALIFIED IT AS THE BIGGEST BIRD TO SEE SERVICE IN THE USAF UNTIL SAC RETIRED THE LAST ONE IN FEB. 1959. THIS ALUMINUM OVERCAST HAD SIX PUSHER PROP ENGINES and FOUR TURBOJETS ON WING PODS. PILOTS OFTEN REPORTED, "SIX TURNIN' and FOUR BURNIN'".

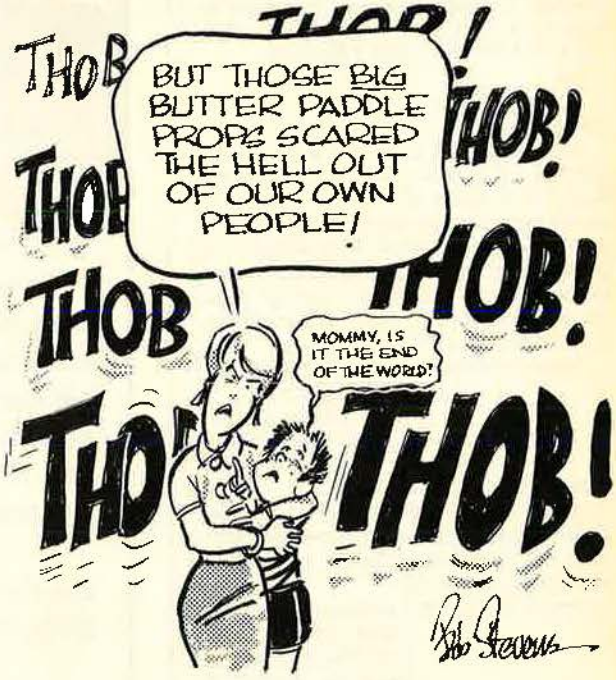
IT WAS A **BIG** MOTHER (SHIP)! OFTEN USED AS AN "OVERDRIVER" IN SECRET DRONE, TRAPEZE, and DROP TESTS—

THERE WAS AN 85-FOOT, PRESSURIZED CREW TUNNEL THRU THE BOMB BAY. (IT SEEMED A MILE LONG & ONE RODE A LITTLE PULL-ALONG SLED)

AND WHAT A WAKE THOSE BRUTES LEFT AT 40,000'+ IN SUPER-THIN AIR!



THIS BEHEMOTH NEVER DROPPED A BOMB IN ANGER... and AFTER ALL, THAT'S THE REASON WE HAD 'EM!



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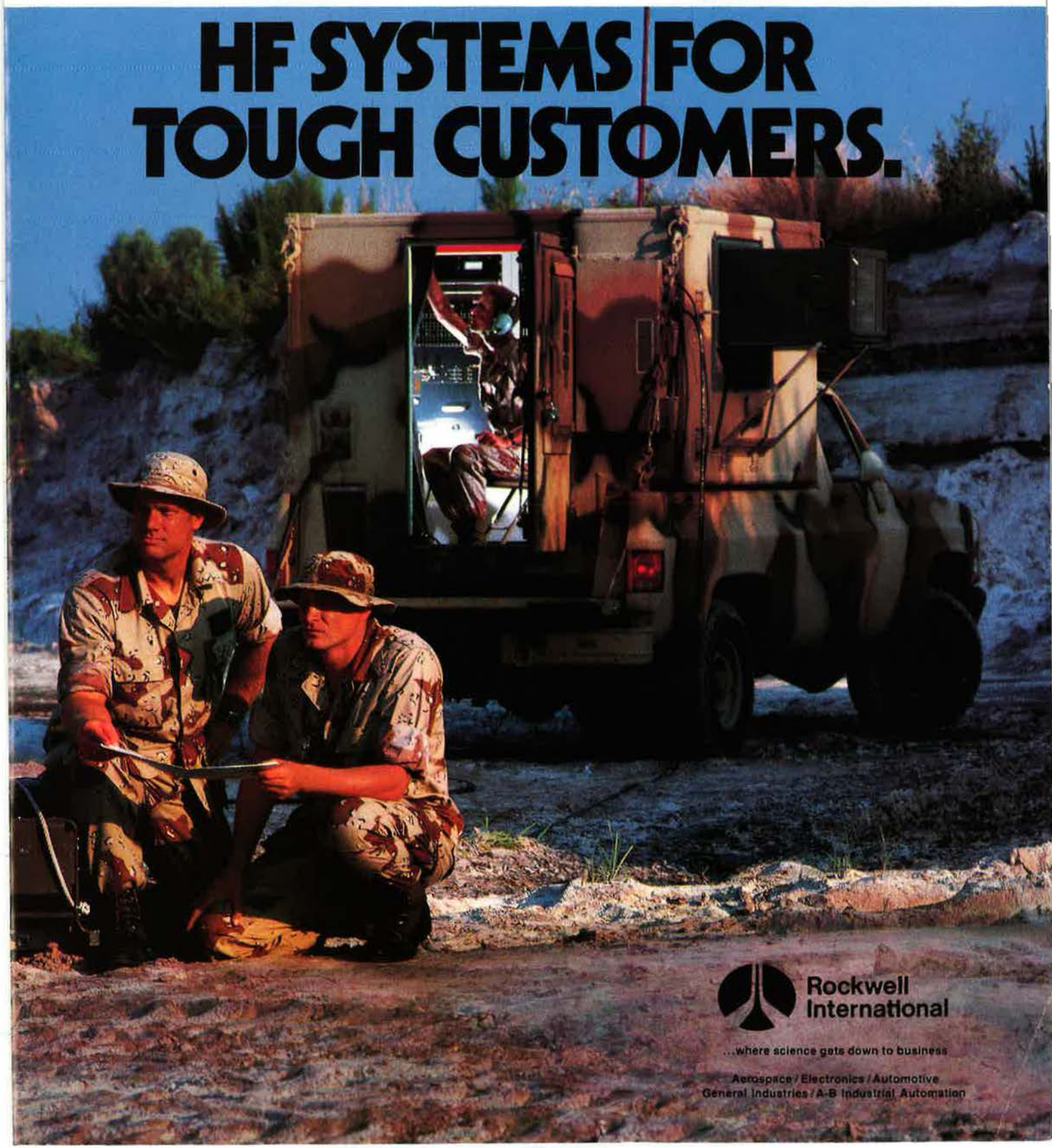

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