JANUARY 1988/$2

AIR FORCE MAGAZINE

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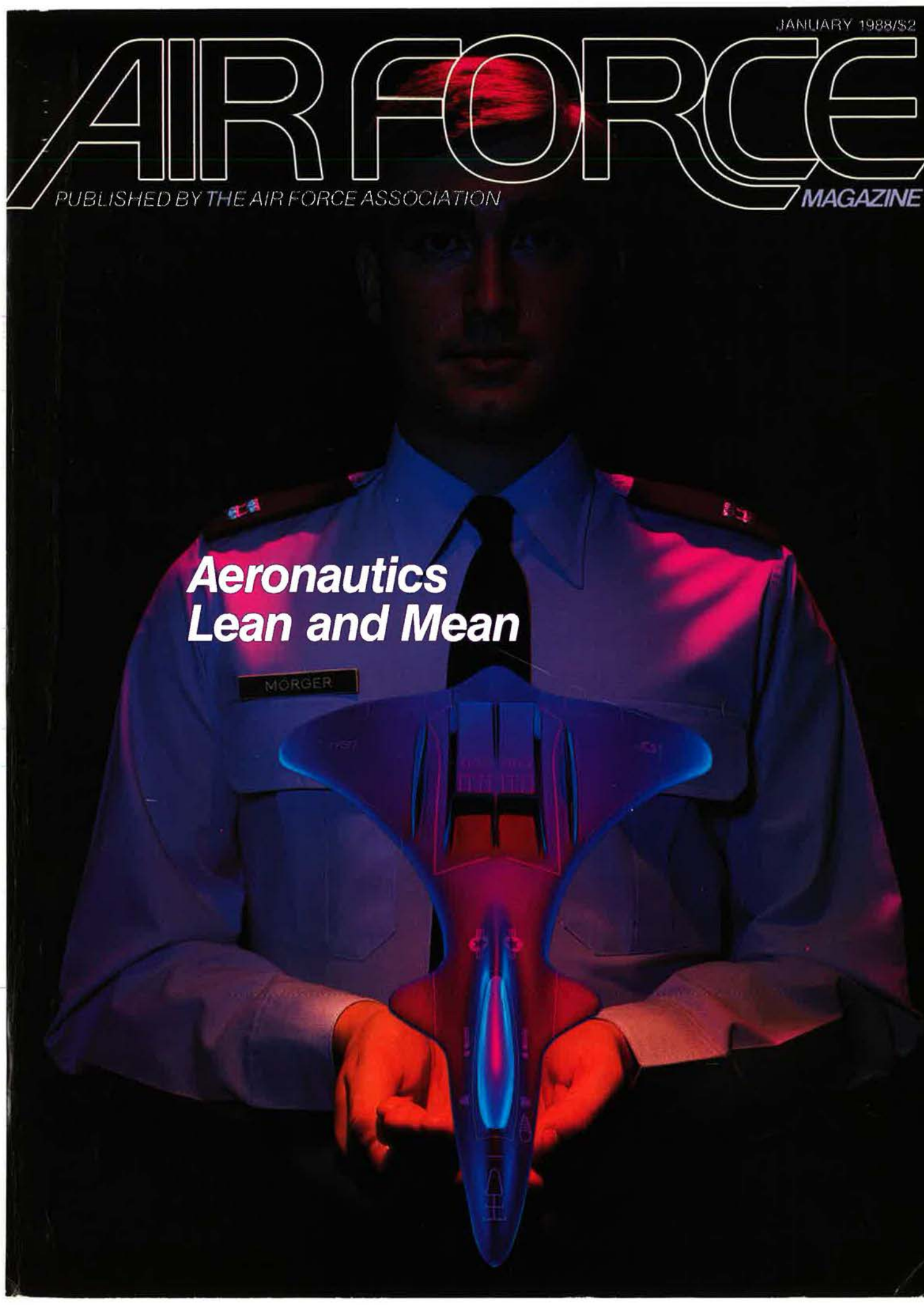

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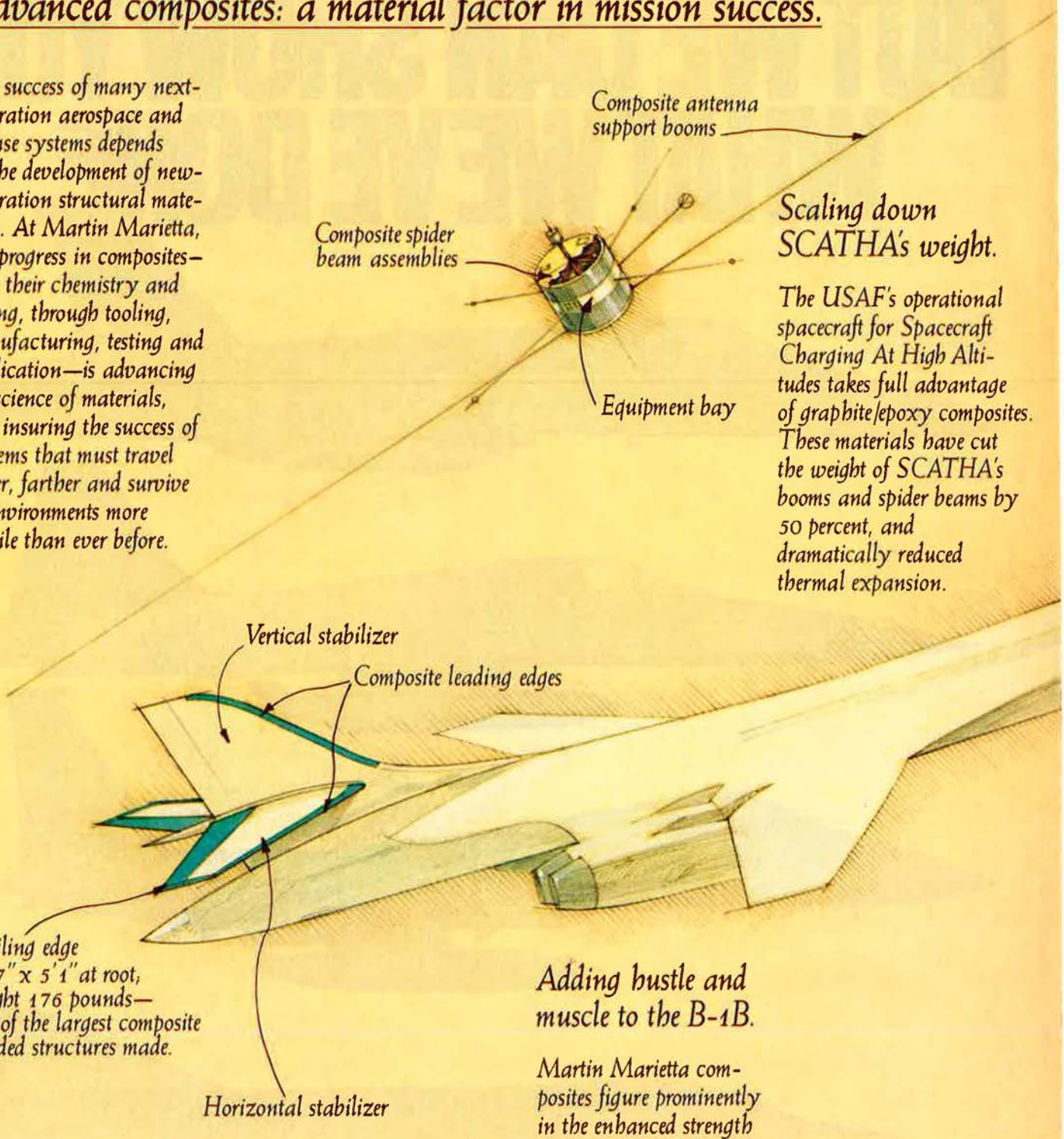

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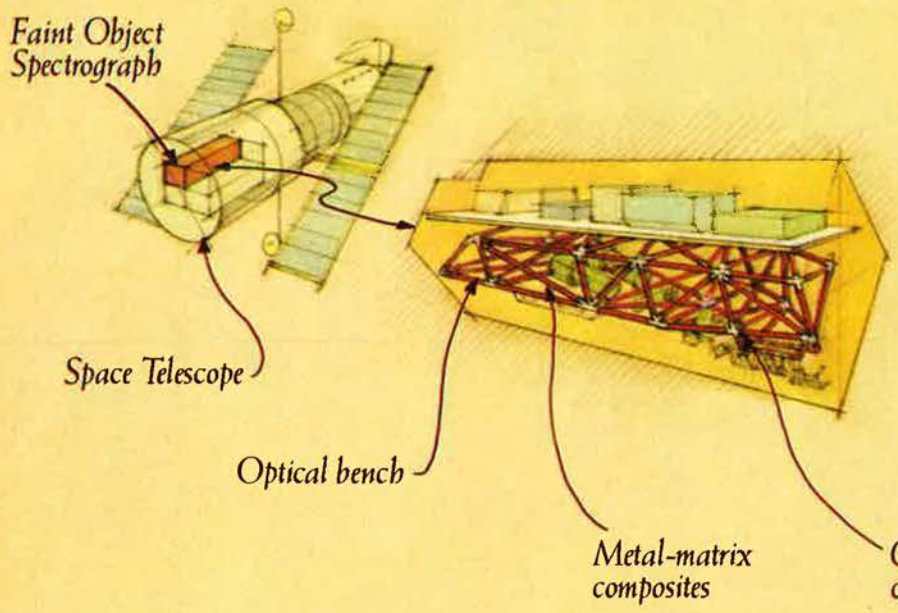

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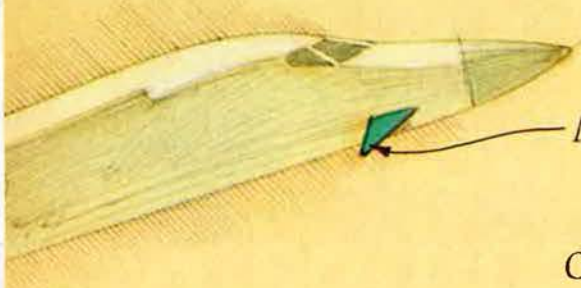

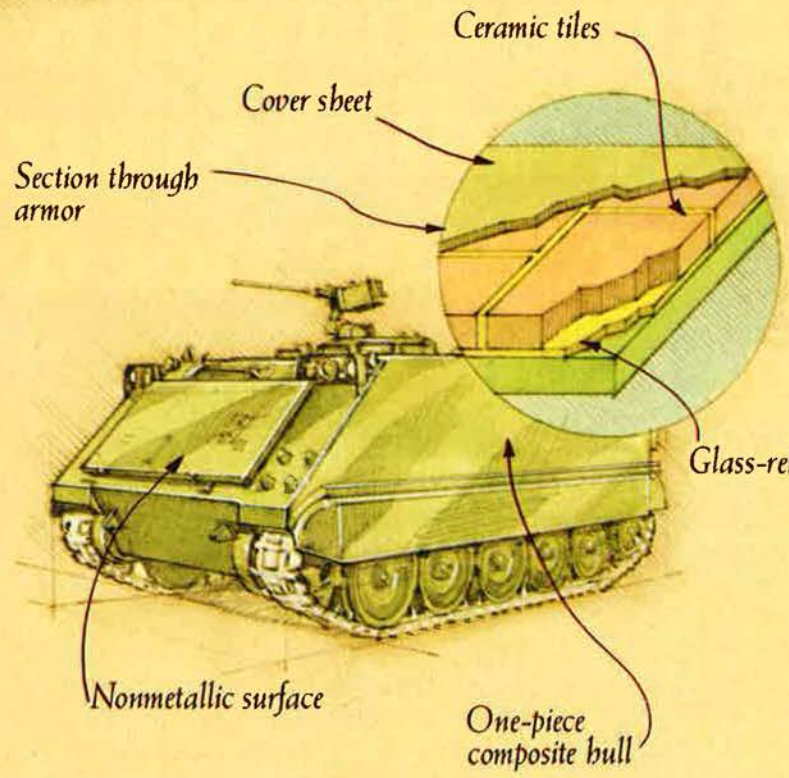

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JANUARY 1988
VOLUME 71, NUMBER 1

AIR FORCE MAGAZINE

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Page 88

About the cover: ASD is going all out to present the Air Force of the future with the best in high-technology combat capability at affordable costs. A special section covering the latest developments in "Aeronautics" begins on page 38 of this issue. (Cover photo © Larry Chapman, 1987)

Special Section: Aeronautics

Features

Departments

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An Editorial

The $65,671 Man

By John T. Correll, EDITOR IN CHIEF

MILITARY people were dumbfounded November 14 when they picked up the Washington *Post* and discovered how prosperous they were. According to a front-page story in that newspaper, a male college graduate in the armed forces earns $65,671 a year by age thirty-five. The source cited for this startling information was a General Accounting Office (GAO) report that says military compensation is twenty-seven percent better than that in the Civil Service and generous by almost any standard.

By sheer coincidence, an early copy of the GAO report found its way into the hands of the Project on Military Procurement *(see "The Reformers," p. 106)*, which leaked it to the *Post* at the peak of the federal budget furor—and at a time when axe-grinders all along the Potomac were trying to prove that defense costs had brought the nation to economic ruin. GAO did not openly release its report until November 20, the day the Administration and Congress announced they had struck a deal on the FY '88 budget.

The report uses the strange sort of methodology we have come to expect from GAO. It is built around four data tables that claim to array military personnel and civil servants by age, sex, cash compensation, and other benefits. The numbers do not match directly with anything on the actual pay charts.

Available clues, however, suggest that GAO's mythical $65,671 moneymaker is a major with fourteen years of service and whose base pay, quarters allowance, and subsistence allowance in reality came to $42,823.80 at the time of the study. The report further says that a thirty-five-year-old high school graduate earns $39,021 annually in service. Interpolation from clues here points to a master sergeant with seventeen years in uniform and whose payroll total is $26,309.25. GAO appears to have taken these military men the rest of the way to affluence on the strength of benefits it contends they are getting.

GAO devotes about a third of its report to itemizing and commenting on the range of military benefits and financial advantages. It does not specify which of these went into its calculations, but there was, to put it mildly, no discernible effort to hold down the score. While many employers routinely budget twenty to thirty percent of salary to cover benefits and payments to Social Security and retirement accounts, few people interpret the income a person "earns" per year as including those amounts.

This is one in a series of GAO reports that, taken together, paint the picture of an overpaid military. The conclusions attract considerable notice, the fine print almost none. In the latest report, for example, GAO had no idea how long the civil servants in its data base had worked for the government. The fourteen-year major may have been compared with an accountant who had been on the job for two weeks. A highlighted conclusion of a June 1986 GAO report on military compensation proclaimed that "pay differences may not affect military retention." The first sentence of the current study recalls an earlier analysis in which GAO found the military well ahead of "a national sample of employed workers" on total compensation.

Such statements arise from the depths of either ignorance or malice. Pay is not the only thing that motivates people to choose a military career, but the "hemorrhage of talent" in the 1970s was painful evidence that compensation has a profound effect on retention.

If GAO's thesis is correct, why isn't the world beating down the doors to military recruiting offices? What keeps the US labor force in those private sector occupations that pay so much less? Civil Service may or may not suffer by comparison with the military, but there are presently 650,000 job applicants registered with the Office of Personnel Management's nationwide Staffing Service Center in Macon, Ga. Thoughtful people must surely wonder what kind of numbers game GAO is playing.

It's true that military pay is better than it once was. When the nation decided in 1973 to meet its defense needs with an all-volunteer force, part of the arrangement was to take the troops off starvation wages. Income of $42,823 is not excessive for a middle manager who has been with an organization for fourteen years and who carries significant responsibility—to say nothing of the possibility of being shot at. The enlisted force would be a bargain at substantially higher salary levels.

GAO makes much of the fact that military allowances are untaxed and that transient military members are often able to avoid state income taxes by having some choice in where they establish their legal residences. What this leaves unsaid is that the government chooses to put $7,771 of our major's $42,823 into tax-free allowances so that it can save later by computing his retirement annuity on a base pay that is lower than his payroll income. People who complain about military residence options should experience the aggravation of changing car tags and driver's licenses every three years or splitting their tax returns between two states with different filing rules. The military member, whose dislocation allowance seldom covers the real cost of a move, may think the advantage lies with his civilian neighbor, who has built up equity in a home bought fifteen years ago at a third of today's prices.

Meanwhile, GAO's master, the Congress of the United States, had two pay raises in 1987, taking the legislators from $75,100 to $89,500 per head. A cost-of-living increase, still in the budget being debated at this writing, would put them at $92,000 in January. If it passes, that would be a 22.5 percent improvement over the span of a year and a day. This isn't to suggest that a member of Congress isn't worth that much, but it's a bigger jump than you're likely to find in one of those national samples of employed workers. ■

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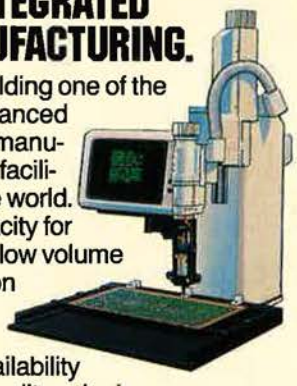

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Airmail

Maritime Strategy

I am writing to express my concern regarding the manner in which my views on "the maritime strategy" were presented in an article by the same name in the November 1987 issue of your magazine. By taking statements I have made out of context, Mr. Polmar and Dr. Truver have confused the issue of what constitutes American naval strategic thinking. . . . My position on the value of American seapower has been strong and unambiguous.

To talk of the Kola or Kamchatka peninsulas as a strategy is inaccurate. The maritime strategy is not a theater war plan. Our seapower projection, as a key element of our national strategy, will apply global pressure on all Soviet fronts in time of crisis. By controlling the seas in peacetime, we will force the Soviets to conclude that they will not be able to win quickly, having denied them the strategic initiative and their preferred one-theater war. The first goal is to defuse the crisis; our naval forces will be in position to strike effectively and decisively.

I would add that this strategy was not designed to be implemented in a vacuum. To be most effective, the Navy's projection of seapower works in cooperation with our sister services and our allies.

Our singular purpose is to control the seas and thus ensure the vitality of our maritime nation. This purpose has remained unchanged for two centuries, an observation that should stir little controversy in anyone who depends on the sea for their livelihood.

The Hon. James H. Webb, Jr.
Secretary of the Navy
Washington, D. C.

The Pacific Challenge

As always, your issues are most interesting and informative. I particularly appreciated the November 1987 article "Power Players on the Rim of Asia" by John T. Correll. You have an uncanny way of putting significant military situations in a timely and enlightened manner. You have assuredly stated PACOM's and PACAF's enormous responsibilities in a straightforward, realistic manner. The future is ominous.

It is uncommon knowledge that commanders in the Pacific have always been highly dedicated and motivated, going all the way back to 1941 days. Yesterday's and, I fear, today's lack of proper interest by Washington, D. C., has left and is now leaving the Pacific theater less than fully supported, with its vast and enormous area of responsibilities. It is certainly much less supported than the European theater, where we will soon be in the process of removing theater nuclear missiles.

I fear the future demand for conventional force posture in Europe will only tend to aggravate the Pacific force shortfall. I know, because I served two tours with the Air Force throughout the Pacific in World War II and during the Korean conflict.

My son is about to embark on an important assignment with Marine air in the Pacific. I want him and all the rest of PACOM to get timely and adequate support by Washington in order to be able to carry out their responsibilities.

I most sincerely hope that Gen. Jack Gregory of PACAF and all elements of PACOM get the maximum support and recognition so vital to the Pacific theater of operations, where the Communist threat is growing. Your article has gone a long way to enlighten all of us on the current situation.

Lt. Col. Wayne J. Guidry,
USAF (Ret.)
Sun City West, Ariz.

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 Corps Facts

Okay, that did it. On page 69 of the November 1987 issue of your fine magazine, for the second time in six months you again mention the F-16s at Misawa AB in Japan as the first fighters based on mainland Japan in fifteen years. Wrong answer. The US Marine Corps has had two air groups of "fighters" based at MCAS Iwakuni since the late 1950s.

These air groups, MAG-12 and MAG-15 (or by other numbers, but always two air groups), have operated out of Iwakuni continuously except for a couple of periods when they flew a little farther south—in such places as Chu Lai, Danang, the Rose Garden, or Bien Hoa. Though the squadrons are not permanently based at Iwakuni but rotate on a six-month basis, there are always at least four squadrons of "fighters" (by Air Force definition) plus two detachments and an eight-aircraft headquarters and maintenance squadron with OA-4M "Fast FAC" aircraft.

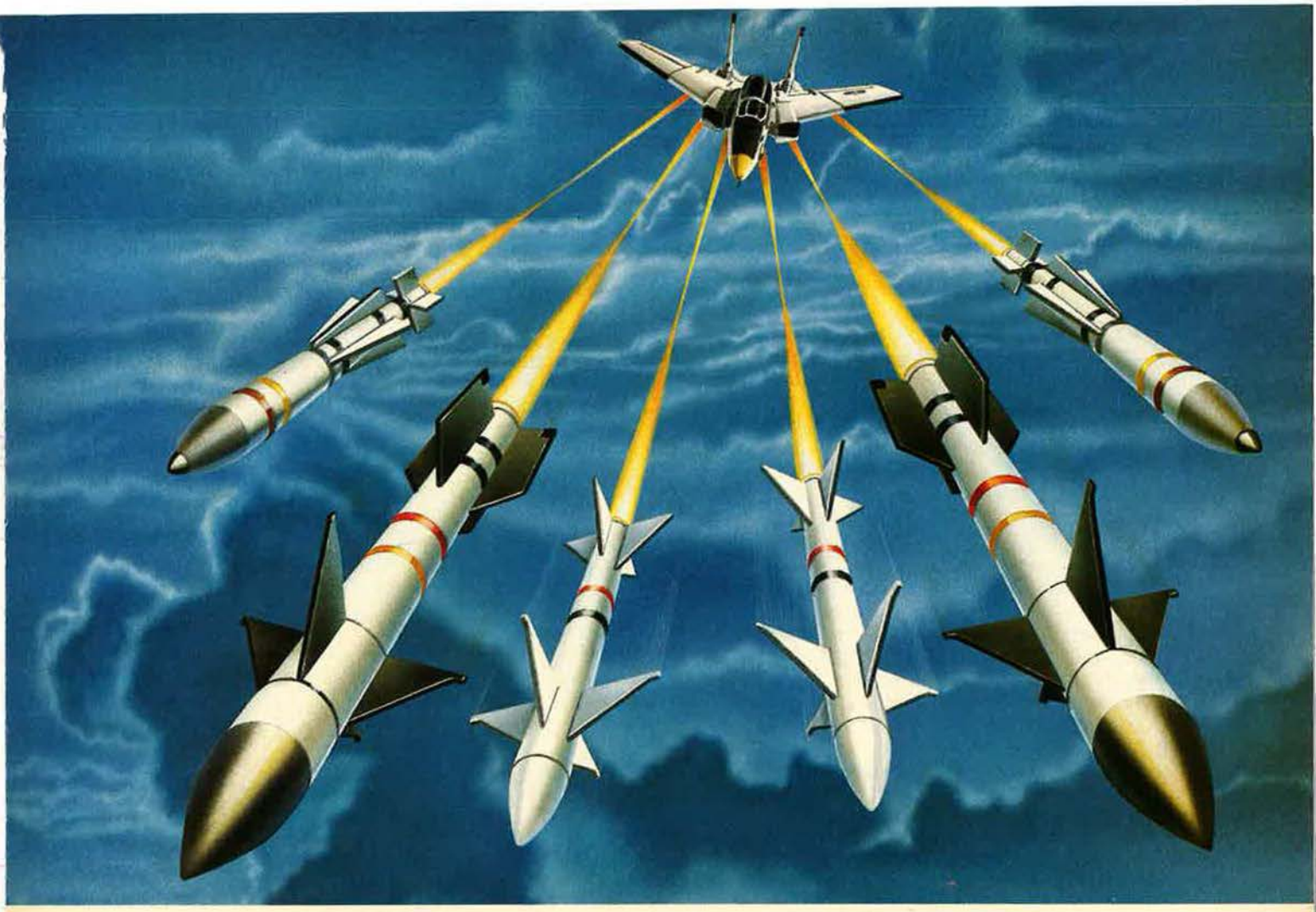
MAG-15 operates two squadrons of F/A-18s (up until September of this year, these aircraft were F-4Ss) and a four-aircraft detachment of RF-4Bs. MAG-12 usually has an A-6E squadron (not a fighter by our definition, but by yours) and an A-4M squadron (same comment). In 1984–86, MAG-12 was host to a Navy A-7E squadron.

As a historical note: A-4 squadrons from MAG-12 were the last fixed-wing American units based in Vietnam. MAG-12 and Iwakuni also are home to rotating detachments of EA-6Bs. The Electric A-6s are the only electronic countermeasures aircraft permanently in the Far East (on our side).

I'm disappointed that your normally accurate publication made this mistake once, but to do so twice in one year is unforgivable, especially in these days of jointness. By the way, Marines from both groups operate with PACAF units in Cope Thunder, Team Spirit, and other exercises throughout the Far East.

It's a great place to fly. . . .

Lt. Col. L. A. Wood,
USMC
Newport, R. I.



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Picture Imperfect?

Re: "Getting the Picture Behind the Lines" by James W. Canan in the November 1987 issue.

In this article, I think it is Mr. Canan who didn't "get the picture." Tactical reconnaissance isn't now and never has been in the business of getting pictures to anyone. It provides intelligence information. Skilled photographic interpreters view the film with magnifying glasses or stereoscopic equipment and produce a written military report that must be on the teletype within one hour of landing.

If the report is on a land battle area, the user will receive information on troops, tanks, trucks, guns, etc., by type, number, and exact map coordinates. Providing the front lines with a TV tape of the battle zone will not provide the information necessary to assess the enemy's strength and intentions and will only take away valuable time from the troop commander. Ultimately, he will give up viewing the TV tape or have to detail someone else to do it for him—a photo-interpreter. Why don't we give the commanders the information they need in the form they can use it to begin with?

Should there be a need for even faster information, all reconnaissance pilots are trained to make visual reports that can be radioed to the front lines while in flight.

Use of high-resolution TV cameras in the airplanes could eliminate the ten minutes of time needed to develop film as well as the associated equipment and supplies, but saturating the front lines with unedited TV tapes would be a disservice. . . .

If reports are not on the teletype within one hour of the aircraft's landing, then the reconnaissance unit should be listed as "nonoperationally ready." And any commander who wants "pictures" instead of hard intelligence should be sent back to school. Or could it be that our staff schools don't understand that tactical reconnaissance is a method of gathering intelligence? It is not in the picture-making business.

Lt. Col. Richard T. White,
USAF (Ret.)
Grosse Ile, Mich.

• *The article made the point that Tactical Air Command decided to forgo cameras in its penetrating reconnaissance aircraft because it became convinced that intelligence gleaned from electro-optical imagery, transmitted from aircraft to ground stations, would get to combat commanders much faster.*—THE EDITORS

Shaky Philippines

In the November 1987 issue of AIR FORCE Magazine, Gen. T. R. Milton wrote an article titled "The Baguio Connection." I would like to comment on a number of the General's points.

First, the General identifies English as a semicommon language in the Philippines. This is quite true among the young and educated. The common farmer in the provinces does not speak, read, or write English. This becomes a serious problem when the government is transmitting speeches and addresses in English on radio and television to the nation. The solution to this problem is very difficult until the farmer can be directly influenced or educated to a common language.

Secondly, the General states that the Philippine armed forces had descended to a "low state" during Mr. Marcos's last years of running the government. The fact is that the armed forces have sunk even lower under President Aquino. Already on numerous occasions, her own officers have tried to kill her while staging coups against her government. Her inability to persuade loyalty and devotion to the nation among members of the military will continue to work against her. Officers are still riding around in their staff cars and other vehicles while the troops in the field continue to walk.

Finally, I agree that the Philippines is indeed having serious problems. The General identifies the elimination of the Communist insurgency as the "overriding priority." He states that the way to do this is to restore discipline and to supply equipment to the Philippine armed forces.

It is my personal belief that the continued involvement by the United States is simply fueling the Communist insurgency. The recent killings of American service members at Clark AB by members of the Communist Party of the Philippines provides evidence that further US involvement could project us right into another Vietnam-style conflict against Communist guerrilla forces. The situation is developing in a pattern similar to that of the Vietnam War. The Communists are being given a reason to target Americans, and the service member is once again restricted in terms of reacting.

Probably one of the reasons that President Aquino has not been successful in eliminating the insurgency stems from her inability to keep earlier promises to work with insurgent factions in establishing reforms. She

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Publisher
John O. Gray

Associate Publishers
Charles E. Cruze, Richard M. Skinner

Editor in Chief
John T. Correll

Senior Editors
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Advertising Director
Charles E. Cruze
1501 Lee Highway
Arlington, Va. 22209-1198
Tel: 703/247-5800
Telex: 44-0487 (Courtesy Associates)
Telefax: 703/247-5855

Director of Marketing Services
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realized this all too late and now finds her government and country in the midst of a guerrilla insurgency.

Menno A. Young, Jr.
Reinholds, Pa.

Second Carrier

In the "November Anniversaries" on page 33 of the November 1987 issue, you state that the USS *Saratoga* was the second Navy carrier. CV-1 was *Langley,* CV-2 was *Lexington,* and *Saratoga* was CV-3. All three were converted from hulls designed for a different purpose.

I realize the Navy is not worth getting it right, but in "There I Was . . ." on page 128, your cartoonist describes an incident involving a C-141—but draws a C-5 instead! That's disgraceful. It's like when you said the Grenada liberation occurred in 1985. Please get your act together.

W. B. Larew
Falls Church, Va.

• *While the* Saratoga *was indeed given the third hull number, it was launched on April 7, 1925, and commissioned on November 16, 1927. The* Lexington *was not launched until October 3, 1925, and was not commissioned until December 14, 1927. The* Saratoga *is, chronologically, the Navy's second aircraft carrier.*

As for the "There I Was . . ." cartoon: The aerial refueling receptacle, visible on the top fuselage of the cartoon version of the aircraft, would appear to type the bird as a C-141B, though others might conclude differently.—THE EDITORS

Bases and Stations

I refer to the item in "Aerospace World" on page 34 of your November 1987 issue. You state: "New Boston Field, Mass., has also been redesignated as an Air Force Station."

Last time I flew over it, New Boston was approximately halfway between Goffstown and Mont Vernon on Route 13 in New Hampshire. *Boston* is in Massachusetts; *New Boston* is in New Hampshire, chaps.

Reginald V. Maisey
Raymond, N. H.

Re: The item in "Aerospace World" on page 34 of the November 1987 issue.

You state that the Air Force has defined a base as an "installation that is a self-supporting center of operations for actions of importance to Air Force combat, combat support," etc.

Do you know if or when Hurlburt Field, Fla., will ever be redesignated as Hurlburt AFB? It definitely fits the description.

Capt. Kerry McCullough, USAF
Hurlburt Field, Fla.

• *New Boston is indeed in New Hampshire. We regret the error. Hurlburt Field is on the Eglin AFB reservation and, as such, is considered part of Eglin AFB. The Air Force may choose to review its designation in the future.*—THE EDITORS

October Issue

Congratulations on the cover for the October 1987 issue. I was delighted to see the B-17F in the background. It was from the old 381st Bombardment Group. The selection of the "Triangle L" and a unit from the 1st Combat Wing, 1st Air Division, honors all the airmen who served with the US Eighth Air Force during World War II.

Also, regarding the article "SAC's Sea Patrol" in the same issue: The concept behind SAC's sea patrol is an excellent one. However, the plan is flawed by the use of Loring AFB, Me., as a primary base for operations. The base was built to support B-36 operations and should have been declared obsolete with the end of that aircraft's removal from active service. . . .

Perhaps the decision to reduce Loring to a forward operating location will be made by the next Administration. Let us hope so. It continues to be a waste of human and material resources.

Thomas W. O'Brien, Jr.
Miami, Fla.

First to Balikpapan

In the "Valor" article "Top Gun" in the October 1987 issue, John L. Frisbee states that Maj. Dick Bong escorted the first bombers to hit the oil refineries at Balikpapan, Borneo, in early September 1944.

For Mr. Frisbee's information and to set the record straight, the first bombers to hit oil refineries at Balikpapan were B-24 aircraft from the 380th Bombardment Group (better known as "The Flying Circus"), Fifth Air Force, attached to the RAAF based in the Darwin area, Northern Territory, Australia.

The bombing of Balikpapan was accomplished thirteen months earlier than stated, and *no* fighters accompanied the missions, because we did not have a fighter that could stay in the air that long. The missions we flew averaged sixteen and one-half hours, with the longest being seventeen hours and twenty minutes.

Three missions were flown: August 13, 1943, August 15, 1943, and August 16, 1943. For this feat, the group was awarded a Distinguished Unit Citation.

Lt. Col. Forrest Thompson, USAF (Ret.)
President, 380th Bomb Group Association
Heber Springs, Ark.

Pilot Retention

I quote from an item in "Aerospace World" on page 25 of the October 1987 issue: "Pilot retention continues to be a problem for the Air Force." After reading the entire article, it appears to me that it will continue to be a problem.

Another quotation from the same item: "A recent survey of Air Force pilots indicated that their biggest concerns were length of the duty day and excessive amounts of nonflying duties." As an ex-Air Force pilot, I agree with that statement. One more quotation from the same item: "The main item on the Air Force's agenda, though, is increasing aviation career incentive pay (ACIP), commonly known as flight pay."

Is anybody listening? We are not getting out because we do not earn enough money. We are not *going* to the airlines. We are *leaving* the Air Force. Admit it, and you can begin to solve the problem.

Larry Wolf
Warren, Pa.

C-5 Galaxy

In your October 1987 issue, your pictures on pages 41 and 46 of a C-5 are pictures of a C-5A, not a C-5B as indicated in the captions.

In the picture on page 41, you can note the following:

• C-5Bs do not carry a full set of engine fan stops.

• The forward ramp actuator is an A-model type.

• The forward ramp shows no auto rail bridge, which all B models have.

On page 46, it's obviously a C-5A. The VHF #1 antenna is that of an A model. And, after all, no C-5B would be missing that amount of visor insulation.

James L. Singer
Travis AFB, Calif.

Southern Air Division

I look forward to reading your superior magazine each month and wanted to inform you that in your Photo Directory on the "USAF Secretariat and Command and Staff" in the September 1987 issue, two mistakes

SOON THERE WILL BE A WEAPON SO SMART IT WILL LEAVE AN ENEMY NO PLACE TO HIDE.

Deep in hostile territory an enemy surface-to-surface missile installation is poised to strike at troops miles away. Its equipment is cleverly camouflaged, highly mobile, and protected by an array of surface-to-air defenses.

It's the kind of target that's difficult to find and risky to hit with today's attack aircraft.

But future battlefield commanders will be able to locate and target it with pinpoint accuracy, while minimizing risk to their own forces. Lockheed is making it possible by developing advanced software for autonomous air vehicles and their intelligent munitions.

Operating on their own, far behind enemy lines, these vehicles will have the decision-making ability to identify and prioritize multiple target types, select targets and appropriate weapons, and attack while avoiding ground fire. They will accomplish tasks too hazardous for manned aircraft and their valuable crews.

The smart weapons Lockheed is researching now will be the intelligent answer for a variety of difficult missions on battlefields in years to come.

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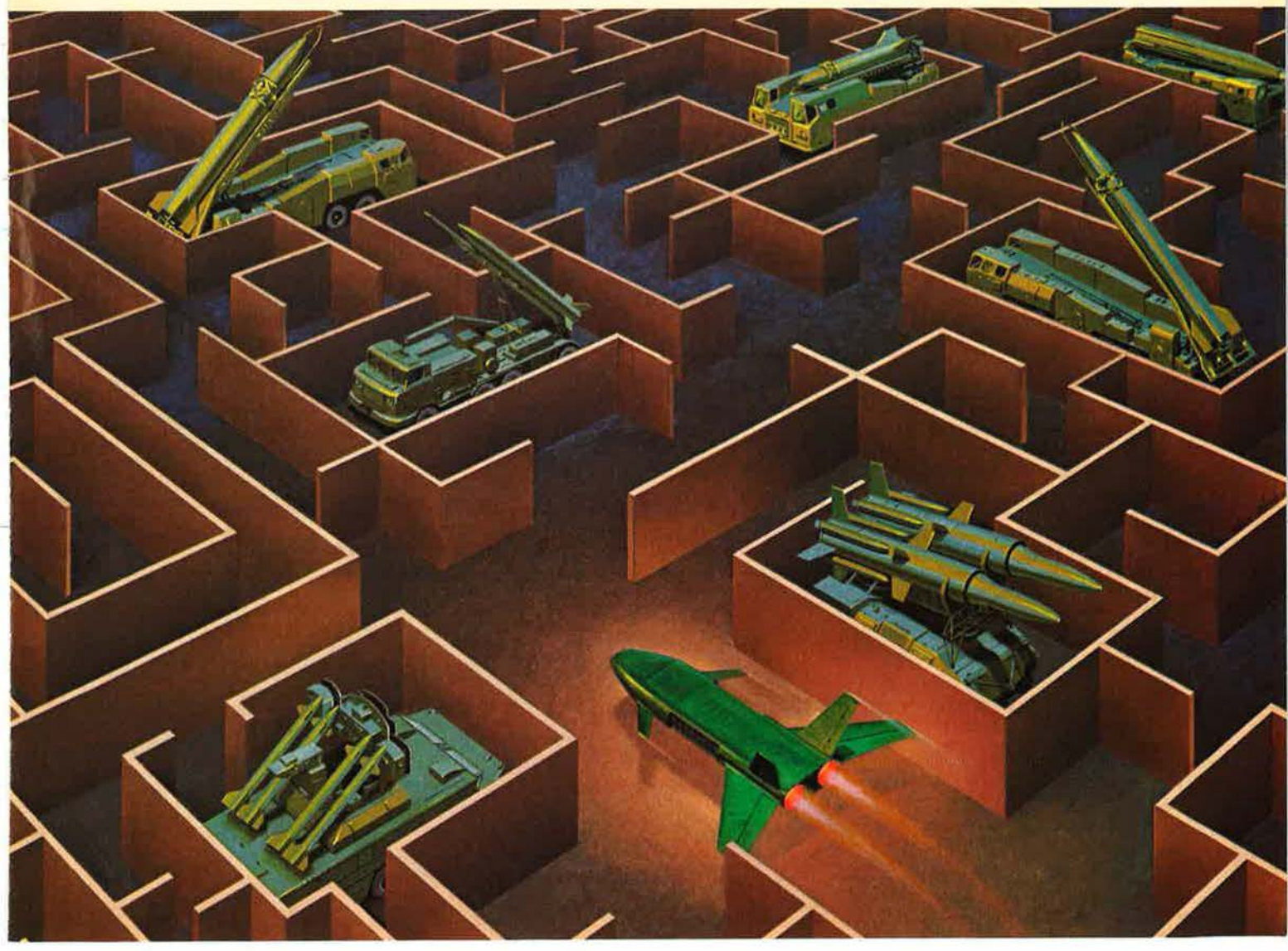
Giving shape to imagination.



CHEAP SHOT

LTV's Hypervelocity Missile: Fast, accurate and affordable.

The column of enemy tanks is still several miles away when the attacking aircraft swings onto its firing run. Its FLIR is already tracking their heat signatures. Less than three seconds later, with the aircraft still safely out of range, the missiles slam into their targets with uncanny accuracy.

Low Cost, High Firepower

One of the most awesomely effective weapons ever developed for Close Air Support/Battlefield Air Interdiction, the Hypervelocity Missile (HVM) weapon system was designed to deliver maximum firepower at a cost far below anything in our current inventory. A product of the Missiles Division of LTV Missiles and Electronics Group, HVM is a masterpiece of simplicity and ingenuity. It carries no warhead, relying instead on its blistering 5000-foot-per-second speed to blast a penetrator rod through heavy multi-plate armor, even at highly oblique angles at extreme range.

Its guidance system is a simple CO_2 laser, mounted on the aircraft. With only an aft-looking receiver on the missile, the amount of expensive "throwaway" hardware is held to an absolute minimum. And because HVM is a "wooden round" with no warhead, storage and handling are simpler, safer and cheaper.

Multiple Targets, Maximum Effect

The system can track and attack multiple targets simultaneously—any ground vehicle, fixed or mobile. In live fire tests an HVM was purposely aimed more than 100 feet off-target. Automatic guidance brought the missile to impact near the target center.

With no bulky on-board guidance system or warhead, the HVM is small enough to permit a large loadout—up to 24 per aircraft, at a low installed drag.

No other weapon system has ever given the CAS/BAI pilot the HVM's unique advantages in speed, accuracy and survivability—advantages matched only by its cost-efficiency and low susceptibility to countermeasures.

LTV Missiles and Electronics Group, Missiles Division, P.O. Box 650003, Mail Stop MC-49, Dallas, Texas 75265-0003.

LTV Missiles and Electronics Group
Missiles Division

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

were made that need correction.

On page 119 and page 126, you list Maj. Gen. Eugene H. Fischer as the Commander of the USAF Southern Air Division. The Commander of the USAF Southern Air Division is Col. Harold E. Watson, who has held that post since the departure of Maj. Gen. Henry D. Canterbury in the spring of 1987. General Fischer is the Deputy Commander, United States Southern Command, and is the highest-ranking Air Force person in Panama.

Maj. Malcolm D. Patterson, USAF
Howard AFB, Panama

Roll Call

I am trying to locate Cyril Shia Aroskin, who was born in Great Britain and who, following several years of service in the Royal Air Force, joined the United States Air Force on June 27, 1950. Although he was a flying officer (first lieutenant) in the RAF, I do not know what rank he held in USAF or how long he served.

I would appreciate any assistance in contacting Mr. Aroskin.

Gilbert S. Guinn
216 Janeway
Greenwood, S. C. 29646

I am trying to locate MSgt. John L. Gladden, USAF (Ret.). We were stationed together at Osan AB, Korea, in 1981, with the 554th Red Horse Squadron.

Anyone knowing his whereabouts is asked to contact me at the address below.

John F. Morgan
2161 Mills Ave.
Menlo Park, Calif.
94025-6545

Three major generals in the Ecuadoran Air Force—Marcelo Salvador, Carlos Jaramillo, and Raul Cousin—would like to make contact with former instructors and classmates from UPT Class 63-H at Craig AFB, Ala. They are especially interested in the possibility of a twenty-five-year reunion.

They may be contacted through the address below.

Col. Gary D. Lape, USAF
USDAO Quito
APO Miami 34039-0008

I am attempting to locate the ball-turret and right-waist gunners from our B-17 during World War II. We flew this B-17 from Station 6 with the 544th Bomb Squadron, 384th Bomb Group, Eighth Air Force, in England.

On November 8, 1944, our B-17 was shot down by flak near Frankfurt, Germany. All the crew cleared the plane by parachute. This was the last contact we had with the two gunners: Ralph W. Butler and Robert R. Owen.

Any information or help will be greatly appreciated.

Lt. Col. Leonard F. Dunning, USAR (Ret.)
P. O. Box 330
Spalding, Neb. 68665-0330

I am asking for help in locating the present address of Lt. Col. Richard E. Turner, USAF (Ret.). Colonel Turner served during World War II as a member of the 356th Fighter Squadron, 354th Fighter Group. This unit flew P-51 Mustangs.

Colonel Turner authored the book *Big Friend, Little Friend.* I am seeking his address to ask him if he will please autograph my copy of his book. Also, I would like to learn Chuck Yeager's address for a similar reason.

Dave Lusk
1710½ Market St.
Lewisburg, Pa. 17837
Phone: (717) 523-6281

Collectors' Corner

I am a collector of military aircraft photographs and am very interested in the XB-70 program. This program had quite a few milestones in aviation history. I need any information and photographs on this particular aircraft.

I do realize that the program was effectively canceled twenty years ago, which might mean that photos are scarce. I have not been able to see the remaining B-70 at the Air Force Museum at Wright-Patterson AFB, Ohio.

Any information on or photos of this remarkable and unforgettable aircraft would be greatly appreciated.

Russell Mackey
8425 8th Ave. W.
Everett, Wash. 98204
Phone: (206) 353-3880

I am attempting to put together a complete Air Transport Command (ATC) uniform and flying gear display. Any World War II-era uniforms, wings, flight suits, etc., would be greatly appreciated. I am also in need of the above items for a display depicting World War II enlisted pilots (liaison, service, glider) as well as flight instructors.

I may be contacted at the address below.

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

"Without the Osprey, the hostages might still have been with the hijackers."

"First word of the hijacking set a fast chain of events into motion . . .

"Although the airport was many miles away, the Air Force CV-22s slipped up on them quickly, quietly. In fact, we were on top of them before they could react. The Ospreys gave us clandestine precision and surgical accuracy. There was not one casualty among the hostages.

"Maybe, just maybe, this kind of response will send terrorists a message: Using innocent people for your purposes just won't work any more."

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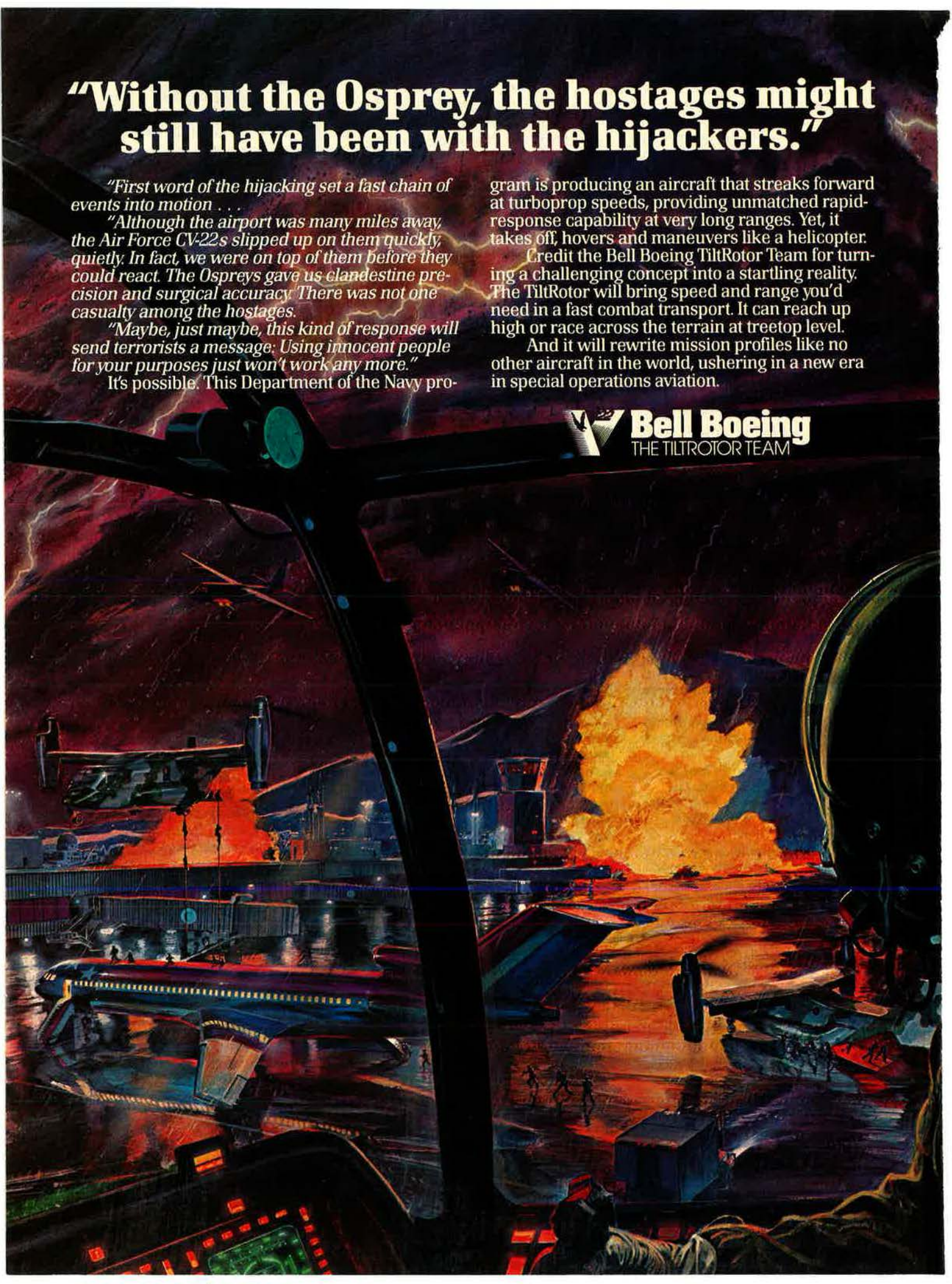
Credit the Bell Boeing TiltRotor Team for turning a challenging concept into a startling reality. The TiltRotor will bring speed and range you'd need in a fast combat transport. It can reach up high or race across the terrain at treetop level.

And it will rewrite mission profiles like no other aircraft in the world, ushering in a new era in special operations aviation.

Bell Boeing
THE TILTROTOR TEAM



The Measure of Carlucci

By Robert S. Dudney, SENIOR EDITOR

Predictions about his "flexibility" may be excessive. The new Pentagon boss is a tough operator in bureaucratic combat, and time will tell what his "consultation" pledge means.

Washington, D. C. Those attempting to predict the course of Frank C. Carlucci's term as Defense Secretary in 1988 should ponder some preliminary events. Consider, for example, a scene from a confirmation hearing. It is in an atmosphere of grave concern about defense spending that members of the Senate Armed Services Committee meet the man newly chosen to be Pentagon chief. Hawks and doves alike quickly get to the point. The point is money.

The conservative chairman worries aloud that the nominee's selection "signals some change in the defense policy" of Ronald Reagan. Another hawkish Senator expresses doubt that the new man really wants "substantial increases" in spending for arms. A leading dove, saying the Pentagon "throws money at problems," takes heart knowing that the new Secretary will be "very tight-fisted" when it comes to funding the armed services.

This scene did not take place at Mr. Carlucci's confirmation. The day, rather, was January 6, 1981. The nominee was Caspar Weinberger—he of the $2 trillion arms buildup. The rest, as they say, is history.

It is instructive history. Today, as the Reagan Pentagon enters its final lap, Washington again rings with facile predictions about the new leader at the Defense Department. Mr. Carlucci will be "more flexible," it is said, than Mr. Weinberger was. He will not be as "hard-line." He is willing to "consult" with lawmakers.

Just as Mr. Weinberger's questioners (they were Sens. John Tower, Henry Jackson, and Alan Cranston, in that order) misjudged the godfather of the Reagan rearmament, experts may now be taking the wrong measure of Mr. Carlucci.

True, he is unlikely to bombard Congress, as did his predecessor, with unrealistic demands for ever-higher budgets. When Mr. Weinberger left office, the gap between the arms he sought and the money he was to get, over five years, came to $300 billion. Under Mr. Carlucci, such wishful thinking is certain to recede.

But on most issues, Mr. Carlucci is steering a course consistent with that set by Mr. Weinberger. What's more, in the few areas where Mr. Carlucci parts company with his predecessor, his avowed willingness to "consult" seems unlikely to offer the lawmakers much comfort.

Why? Where, in fact, does Mr. Carlucci differ from Mr. Weinberger in his stance on national defense? Mr. Carlucci's own November 12 confirmation hearing in the Senate suggests three principal areas.

- *Force Structure.* Mr. Carlucci says continuing reductions in military spending are likely to lead to a smaller force. "As I look at the budget figures that are being debated, it is becoming very clear to me that we may well be talking about a different kind of military force. . . .

"We may well be talking about a smaller force. I would rather have a smaller force that is effective and that has necessary equipment, the necessary ammunition, the necessary personnel, than to have a larger structure that is not effective." Mr. Weinberger thought size itself was at least as important as the other factors.

- *Weapons Programs.* Whereas Mr. Weinberger preferred to keep production lines open by stretching out purchases, Mr. Carlucci shows every inclination to bite the bullet and scrap programs altogether.

The present budget crunch, he says, "does mean terminating some programs in order to fund others more fully. It does mean delaying some new starts. I think we have to look at everything. I don't think anything can be sacrosanct."

- *Use of Military Power.* In a departure from the Weinberger philosophy, Mr. Carlucci suggests that Washington may sometimes have to commit US forces to combat even though a domestic political consensus supporting the move is absent.

Mr. Weinberger's reluctance to use force in such ambiguous circumstances was a key feature of his stewardship—enshrined in the public dictum that there should be a political consensus in advance. The Carlucci view: "I don't know that it's always feasible to have full consensus. . . . There are times when the President needs to move forces in advance of total agreement of the body politic."

Even as lawmakers were endorsing Mr. Carlucci, praising him as a man who would consult them, a big question became obvious.

Does Congress, in an election year, really desire to take a leading role in (1) dismantling the US military, (2) canceling a number of billion-dollar programs (and the jobs they create), and (3) acquiescing in a possible military operation that may be necessary but unpopular?

In pledging to "consult," what Mr. Carlucci is holding out to Congress looks less like an olive branch than it does a noose. An often-overlooked fact about Mr. Carlucci is that he is a tough operator—in bureaucratic combat, far tougher than Mr. Weinberger. For many in Congress, "consultation" is a euphemism for political cover for unwise decisions. In this, Mr. Carlucci could prove to be most unhelpful.

In 1960, as a foreign service officer posted to what was then known as the Congo (now Zaire), Mr. Carlucci was involved in a traffic accident. An angry mob surrounded him. One thing led to another. It was only afterward, when informed by a horrified colleague, that Mr. Carlucci learned that someone had driven a knife between his shoulder blades.

The incident led a wit at the *Sunday Times* of London to observe that

"Frank Carlucci must be the only American to have been stabbed in the back *before* exposure to high office." Now that knives are out again in Washington for defense spending, the fact that the Pentagon is being led by a man who knows a little bit about knife fights may be no bad thing at all.

The Cloud Over the Army

If, as Mr. Carlucci suggests, reductions in force structure do indeed become the order of the day for the American military, there is one service that may view it with something like relief. It is the United States Army.

The Army is finding it difficult in the extreme to live with a Weinberger decree that there be no shrinkage of the 780,000-strong, eighteen-division American land force. Only by scaling back can the Army hope to maintain combat readiness with modern arms at a time of austerity.

That, at least, is the message from Army Under Secretary James Ambrose, the man with day-to-day responsibility for managing the force. The Ambrose view of the Army's situation, delivered recently to a few military writers, comes across as remarkably bleak.

"Inevitably, we'll reraise the question about [maintaining] the force structure itself, even though decisions have been made or [are] thought to [have been] made," says Mr. Ambrose. "The arithmetic may not be there to support them."

The Under Secretary volunteered no specifics about cuts contemplated by the service. Nor, he notes, is the Army "racing after force structure with an axe." It's just that "simple logic" leads one to the conclusion that force structure is vulnerable.

The reason stems from a number of interrelated factors.

- First is the fact that the Army is the most labor-intensive of the services. Personnel costs—pay, training, and the like—consume sixty percent of the Army budget, far more than in the Air Force or Navy.

That means the Army has less money, as a percentage of budget, for weapons to begin with.

- Second, with the personnel accounts deemed to be off-limits, there is no way to spread the budget cuts broadly. Thus 100 percent of the reductions are imposed on only forty percent of the Army budget.

That is the forty percent that funds weapons procurement, research and development, and all the other items the Army needs to equip and sustain its forces.

- Finally, because such budget-cutting mechanisms as the Gramm-Rudman-Hollings Act focus on reducing current outlays, it takes relatively big reductions in long-term procurement accounts to achieve small savings in the year immediately at hand.

It may already be too late for the Army to head off severe retrenchment in its modernization program. That is because reductions of force, even if they were implemented today, would not produce large savings rapidly.

In this circumstance, what is the prospect that the Army will suffer cancellations of planned arms programs? "Oh, it's very high," asserts Mr. Ambrose. "The easiest thing in the world to do at the moment is to start nothing new. There may be regrets about that decision later. But it's much easier to keep on producing what's running rather than move ahead with new starts."

It is not only its own programs that the Army worries about. There is conviction—from the controversial Army Under Secretary, at least—that the crunch will erode future Air Force willingness to pursue a program of critical importance to the land forces—specifically, development of a new close air support aircraft to assist the Army in European battles.

While the solution will not come for years, if then, the problem is critical today. As Mr. Ambrose tells it, there's been an obvious need for years to replace the Air Force's A-10 close air support plane.

The A-10 is aging, and even when it was new, it did not possess enough combat power. This, he says, is particularly true in the realm of night fighting. There is near universal doubt, too, that the slow-flying A-10 could survive the current Soviet weaponry it would face in battle.

The earliest that the Air Force could deliver a new, improved version of such an airplane, assuming ideal conditions, would be the mid-1990s, and even that looks like a bad bet to the Army. "So, from my perspective," the Under Secretary states, "which is the parochial one of the Army, we are not getting the fixed-wing close air support that we need."

The current Air Force position is that the service believes the close air support mission is important and must get a significant degree of future support. USAF is considering several options along these lines *(see "Making Warplanes Lean and Mean," p. 38).* The Air Force is in the throes of a major study—its second in recent years—aimed at determining the best way to proceed. It is due in March of this year.

Mr. Ambrose, who has no difficulty telling the difference between studies and funded programs, is skeptical.

"I don't know what the next Air Force study will show," he says, "but I think I'm correct in saying that there is not, in the present or future [USAF] funding lines, enough money to get either an old, reworked airplane or a new one. That's an expensive proposition. It's just not there."

The Army official makes plain that the responsibility for this situation lies not so much with the Air Force as it does with officials at the highest reaches of the Pentagon. The question, in his view, should be dealt with by the Chairman of the Joint Chiefs of Staff and the Secretary of Defense.

Does the failure of either office to promote the project indicate a lack of concern about providing air support for the Army?

Says Mr. Ambrose: "I don't think there's any other conclusion that you can draw."

Close Air Support: Round II

One does not have to strain very hard to hear the gnashing of teeth around Washington in the wake of the Army Under Secretary's words about the close air support situation. Few issues are more sensitive.

The Pentagon, the JCS, the Air Force, and even the uniformed Army are not only irritated but mystified by his remarks.

The mystification part comes through loud and clear in the statements of Gen. Bernard Randolph, new Commander of Air Force Systems Command. At a private breakfast with a group of defense writers, the General made plain that he was at a loss for an explanation.

"I just can't comment on the Army Under Secretary's statement to you," says the General. "I can only tell you the part that I know. The part that I see is a good solid working [Army-Air Force] relationship" on this and other matters.

As evidence, General Randolph points to a public hearing, held the day following the Ambrose remarks, in which Army and Air Force generals assured Congress that the two services were on track with respect to close air support issues.

General Randolph's words: "The testimony of the Army representative was that the United States Air Force was dedicated to supporting the Army, was dedicated to working the problem of close air support. That

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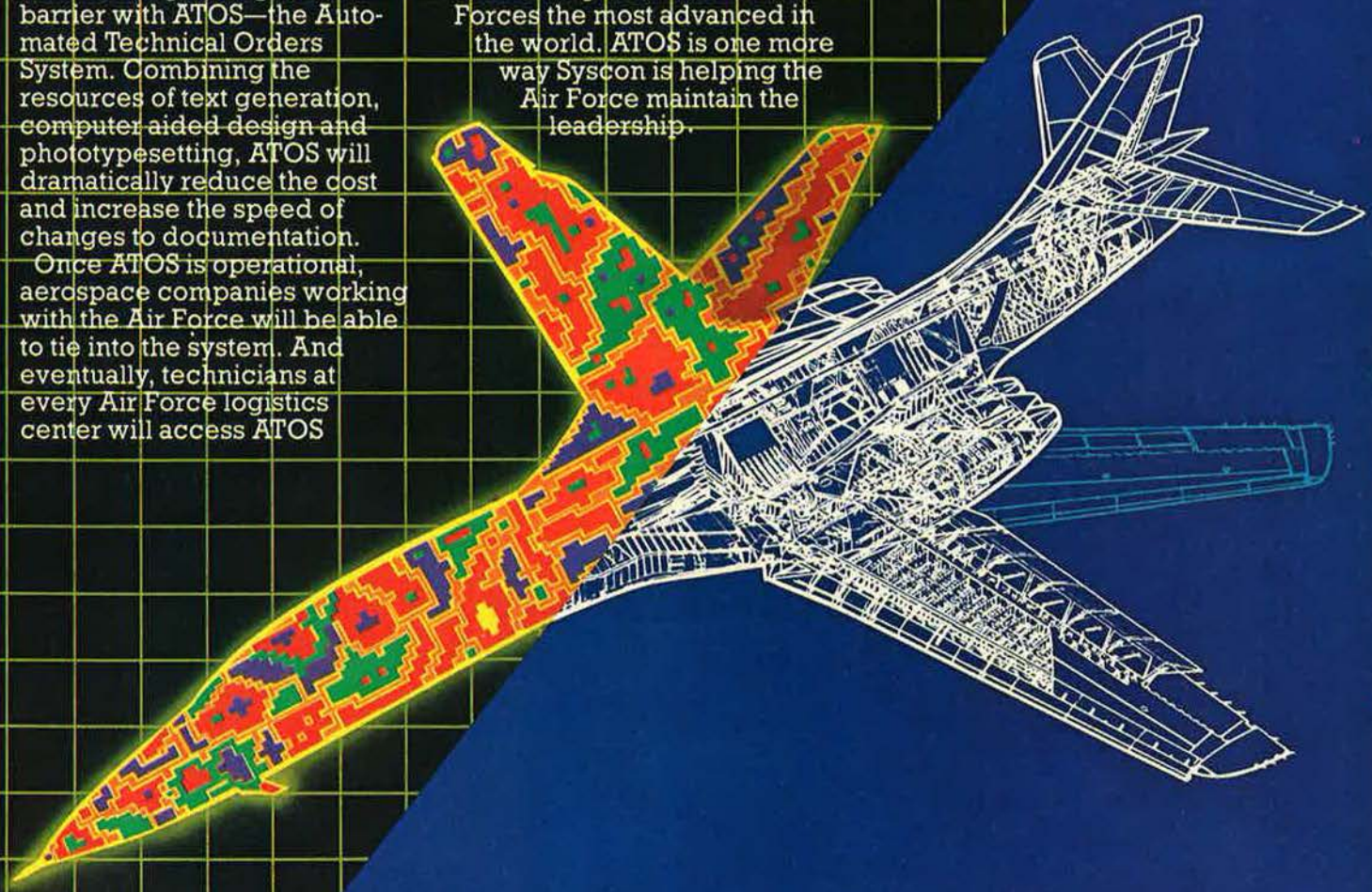

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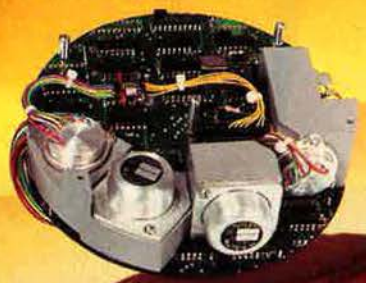


Delco Systems Operations

IT TAKES INERTIAL KNOW-HOW TO KEEP TACTICAL WEAPONS ON TARGET.

DELCO'S GOT IT.

was official testimony to the United States Congress by a general officer of the United States Army.

"Believe me, we don't go over and say things to Congress without approval of the leadership."

What, actually, is happening with respect to this aircraft?

Defense Department officials have approved the Air Force's broad mission requirements package. Added was a caveat that the service will look at a broader range of candidate airplanes than has been studied to date. Approval of that package makes it possible to award study contracts to aerospace companies.

In a somewhat surprising turn of events, the General seemed to leave open the possibility that the Air Force might eventually develop a brand-new, next-generation airplane for the mission rather than modify one or more existing aircraft for support of the infantry. "We're talking about a whole range of candidates," says he. "If the requirement is more stressing than we could handle by modifying an existing design, then we'll have to go to something new."

This appears to contradict an earlier statement by James McGovern, the Air Force Under Secretary. Mr. McGovern had indicated that the service is not interested in developing a new airplane "in this budget environment." His view is that the proper course is to modify an existing plane for the task.

Hovering over all the debate, of course, is the contraction of defense funding, which is forcing harsh trade-offs of weapons programs. It is a reality that is certain to persist for the next few years at least. A large number of good intentions—the desire to build a new CAS plane among them—may go glimmering as a result.

The issue was put squarely in this fashion by General Randolph:

"We buy, within the dollars that are available, the things that we think are important. Some things you have to give up. If the belief is that [the CAS aircraft] is an important thing, we'll have to give something up in order to fund it. We're not going to get any more money [above current budget levels]. I think that message is loud and clear. That means something else has to go."

The critical question of the next several years will be what, if anything, is that "something else" going to be?

The German Question, 1988

Now that the Intermediate-range Nuclear Forces (INF) treaty has been signed and delivered into the hands of Senate ratifiers, one might have hope that Washington can take a breather from NATO nuclear cares for a spell. Yes? No.

When it comes to nuclear weapons in Europe, US officials were appearing to grow increasingly edgy about West Germany on two scores.

The first worry is whether or not Bonn will fully discharge its commitment to help modernize aging short-range NATO nuclear weapons on its soil.

The second, perhaps more important, issue is the question of whether or not the political system of the West Germans will be able to resist a Soviet call for further nuclear talks in the wake of the INF accord.

These were the two major issues on the minds of NATO defense ministers and other Western officials who gathered not long ago in Monterey, Calif., at the most recent Nuclear Planning Group session. They are certain to emerge again in months ahead, because they go to the heart of NATO's strategy of deterrence.

One of the participants in the Monterey session was Alton G. Keel, Jr., the US ambassador to NATO based in Brussels. Mr. Keel, an astute observer of Alliance politics, stopped off in Washington to visit with Pentagon correspondents, where he was asked about the new German question.

Mr. Keel drew attention to the need for the Alliance to follow through with NATO agreements, concluded in October 1983 at Montebello, Canada, for modernization of nuclear systems on the Continent.

His view is that this requirement is made more important now that the longer-range systems will be withdrawn. His point is that the remnant must be sound and modern.

Mr. Keel is frank in noting that there could be trouble on this score. "Obviously, it's a concern that there might be some tendency to backslide on Montebello," says he, though it would be most unwarranted.

Most of the nuclear modernization would take place on West German soil, but Mr. Keel says he "wouldn't try to single out the Germans" as recalcitrant parties. Then, however, he came close to doing so: "Clearly, in Germany, some have indicated that they're not going to be enthusiastic about modernizing the remaining forces."

The problem stems from the fact that the INF accord, while eliminating much of the nuclear threat for most West European nations, leaves West Germany as the prime target and repository of the remaining short-range weapons, of which there are about 4,600 in NATO. The Germans refer to this as "singularization."

The reality, says Mr. Keel, does not support the charge of singularization. Thousands of nuclear weapons exist in European sites outside West Germany. Not to be overlooked are the thousands of nuclear weapons based on American soil.

"I'm not trying to underestimate that concern," he explains. "It is a particularly real concern in Germany. It's one we have to be sensitive to. It's a product of geography. What has to be done is to continue to have European political leaders voice support for moving ahead with decisions that were endorsed and are no less necessary."

The sense of singularization has also increased divisions between West Germany and the rest of the allies on the question of arms talks.

As Mr. Keel puts it, there is near unanimity among the allies that there should now be a "pause" in Soviet-American talks on nuclear weapons. That is necessary to blunt Gorbachev's plan to negotiate US nuclear weapons completely out of Europe.

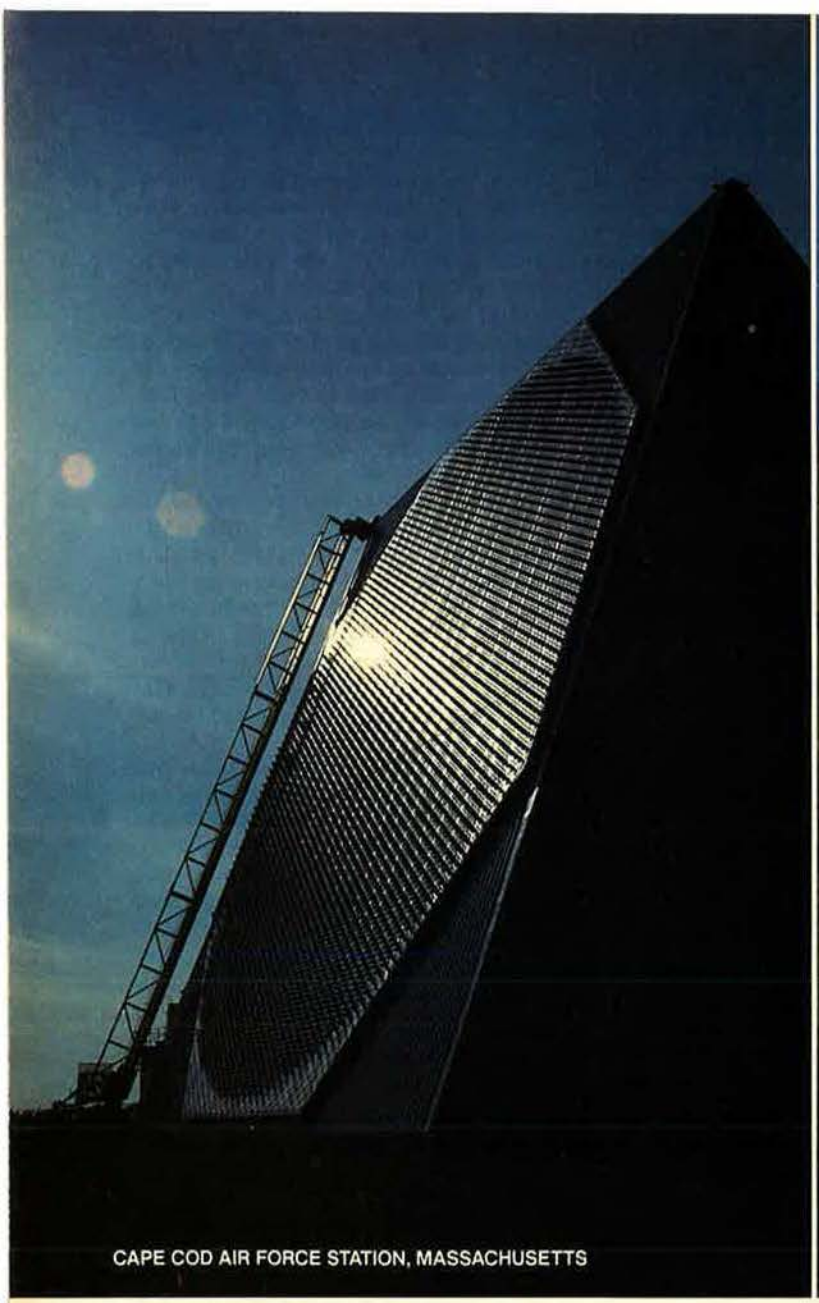
The Bonn government, itself, agrees that the elimination of the remaining US weapons would be bad, says Mr. Keel. But it still wants to have negotiations, mostly for domestic political reasons.

"The Germans," Mr. Keel notes, "are not of the same view as the rest of the allies on this question. The dilemma, one even the Germans recognize, is how do you get back to the negotiating table and yet say 'no' to Gorbachev's trump card?"

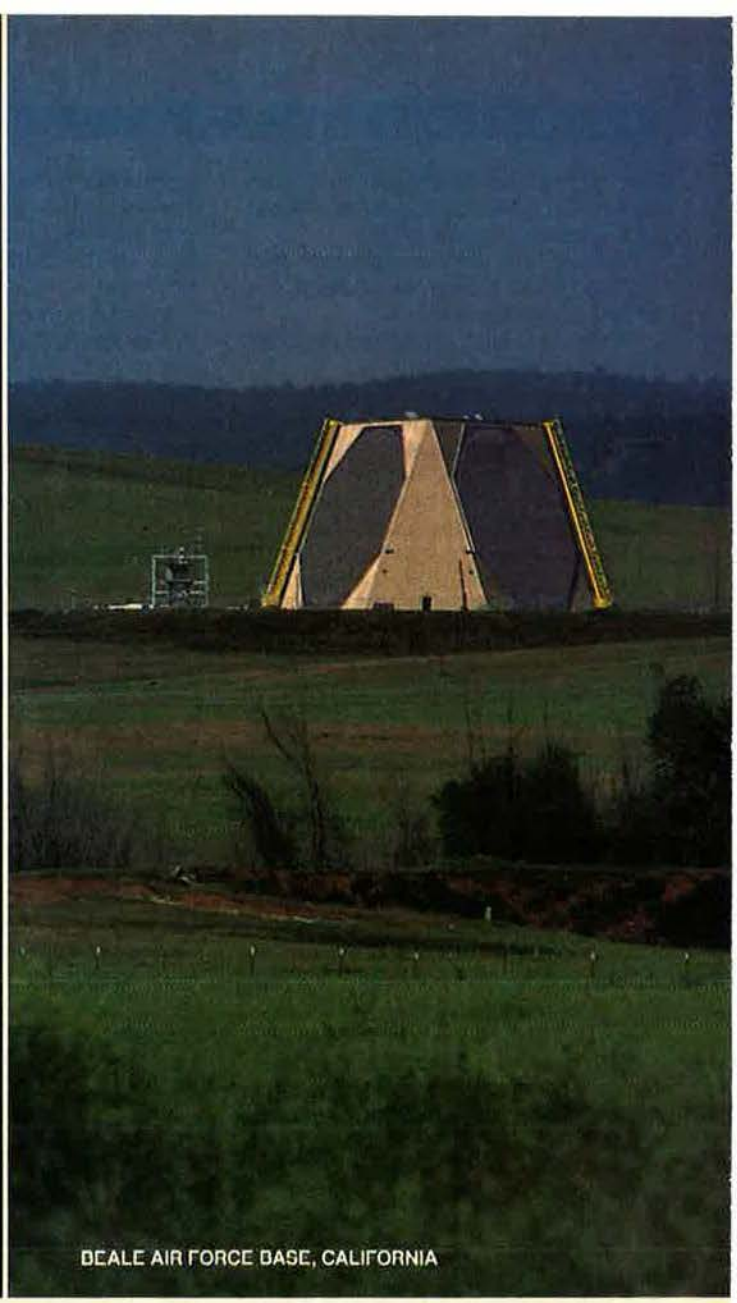
That trump card, says the NATO ambassador, is a call for removal of the remaining, battlefield-range nuclear weapons in Europe and with them the vigor of NATO's deterrent.

Are there official concerns about the danger? "I would say, yes, there are concerns," Mr. Keel states. "I would characterize the European mood in very simple terms. They are seeing it as a cause for celebration and a cause for a pause. They see it as being in our security interests. They are not concerned about where *INF* leaves us. They are concerned about where Gorbachev's [next] initiatives may lead us.

"It's not so much denuclearizing Europe, but forcing *US* nuclear weapons from Europe. They are concerned about where we go from here. We are, too." ■



CAPE COD AIR FORCE STATION, MASSACHUSETTS



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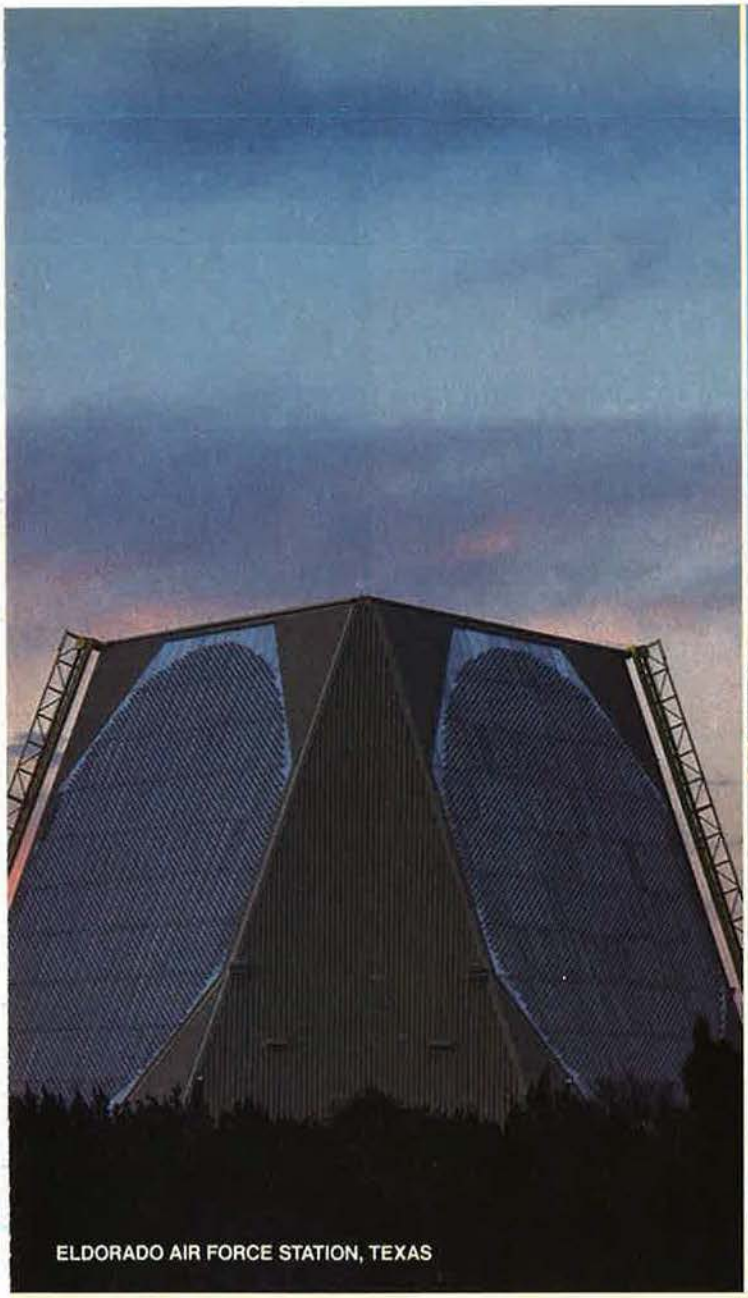

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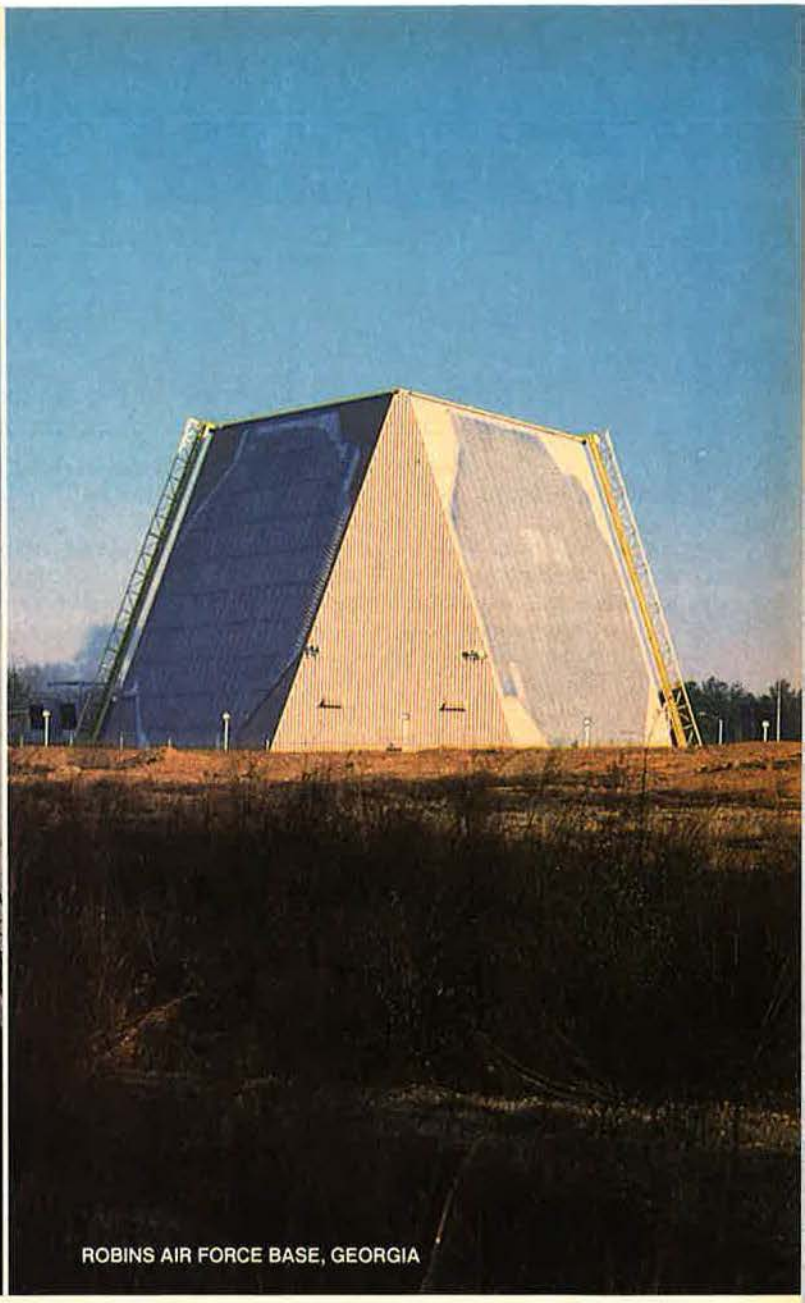

ROBINS AIR FORCE BASE, GEORGIA

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Capitol Hill

By Brian Green, ASSISTANT TO THE EXECUTIVE DIRECTOR FOR POLICY AND LEGISLATION

Washington, D. C.

Budget Summit

Administration and congressional negotiators reached agreement on a compromise FY '88 budget package to reduce the deficit that includes increased revenues of about $11 billion and defense funding of $292 billion in budget authority (BA) and $285.4 billion in outlays. (Budget authority is the total amount DoD and other defense agencies are authorized in a given year and is spent over a period of years; outlays are actual expenditures in a given fiscal year.) That figure represents a real (inflation-adjusted) decline in BA of about three percent compared to FY '87 and falls short of the $296 billion slated for defense by the authorization bill *(see below)*.

The outlay figure was key to the negotiators, since FY '88 outlays affect the size of the FY '88 deficit. The concern among some on Capitol Hill is that the budget summit has produced a compromise that contains a mismatch between outlays and budget authority. The House Appropriations Committee, in comparison, approved a defense appropriations bill that includes $284.3 billion in outlays (compared to $285.4 billion in outlays proposed at the budget summit) but only $282.4 billion in new budget authority.

In this view, the only way for an appropriations bill to reflect the $285 billion outlay figure with the $292 billion BA figure is to protect procurement and R&D accounts (which have a high BA figure associated with given outlays) while deeply cutting operations and maintenance and personnel accounts (which, because they are mostly spent in the year they are authorized, have a low BA figure associated with given outlays).

Authorization Bill Compromise

Congress finally approved without amendment the long-delayed compromise defense authorization bill with provisions that limit US strategic programs close to SALT II levels and restrict SDI testing to the "narrow" interpretation of the Antiballistic Missile (ABM) Treaty. The House of Representatives passed the bill by a vote of 264–158 and the Senate by a vote of 86–9.

The SALT II limits were enforced by denying funding—"for budgetary reasons"—for the overhaul of a ballistic missile submarine. The multiwarhead missiles on that submarine would have been in excess of the SALT II limits. The "narrow" reading of the ABM Treaty was imposed by requiring "funds to be spent consistent with the SDI plan as presented to Congress during the FY '88 budget hearings" and prohibiting acquisition of long-lead items required for tests under the broad treaty interpretation.

The bill provides two budget authority levels: a high tier of $296 billion in BA if $19 billion in new taxes are approved and a low tier of $289 billion if not. Procurement accounts were cut by nearly ten percent compared to FY '87. The funding requests for R&D, personnel, and O&M accounts were all cut, though each grew slightly compared to FY '87.

Key provisions include:

- A one-year stretchout of the six percent officer cut mandated by last year's DoD reorganization bill. The legislation mandated a one percent cut in officer strength in FY '87, two percent in FY '88, and three percent in FY '89. The services all opposed these reductions. The FY '88 authorization bill changes the reductions to one percent in FY '88 and two percent in both FY '89 and FY '90.
- A three percent pay raise at the low tier and a three percent raise in BAS and a six percent increase in BAQ at the high tier.
- $3.9 billion for SDI out of $5.7 billion requested.
- $300 million for R&D on garrison rail-mobile basing for the MX at the high tier and $100 million at the low tier. The Administration requested $591 million.
- $1.5 billion for the Small ICBM at the high tier and $700 million at the low tier. $2.2 billion was requested.
- A ten percent funding cut for the Advanced Technology Bomber at the high tier and a seventeen percent cut at the low tier.
- $536 million at the high tier and $508 million at the low tier out of $537 million requested for the Advanced Tactical Fighter and funding for the forty-two F-15Es and 180 F-16s requested.
- $736 million for 500 Advanced Medium-Range Air-to-Air Missiles (AMRAAMs); 630 missiles and $837 million were requested.
- The full $618 million requested for procurement of the first two C-17 airlifters at the high tier and $600 million at the low tier. $1.17 billion of the $1.2 billion requested for R&D was approved at the high tier and $880 million at the low tier.

HAC Defense Appropriations

The House Appropriations Committee (HAC) approved a defense appropriations bill that includes $266.7 billion in new budget authority for the Department of Defense. When tallied with other spending bills, defense funding would be $282.4 billion in new budget authority and $284.3 billion in outlays. The committee also rescinded nearly $4 billion in prior-year budget authority, resulting in an effective BA level of about $279 billion. The committee stated in its report, however, that it is "unable to provide all the funds it feels are necessary for defense programs" because of pressure to reduce the deficit.

The committee gave priority to operations and maintenance funding, "since these accounts are vital to the readiness of our nation's armed forces." The HAC bill reduces the FY '88 budget request for Air Force aircraft and missile procurement by nearly twenty percent. The Air Force R&D request was chopped by more than thirteen percent.

The HAC bill includes:

- $250 million for R&D on rail-mobile basing for the MX Peacekeeper.
- $1.6 billion of $2.2 billion requested for the Small ICBM.
- $480 million for the Advanced Tactical Fighter out of $537 million requested and funding for thirty-six of forty-two F-15Es requested and all 180 F-16s.
- $1.1 billion for C-17 R&D and

$550 million for procurement of the first two C-17s.

- The go-ahead for 500 AMRAAMs funded at $680 million.
- $2.5 billion for SDI, against a DoD SDI request of $5.2 billion.
- Forty percent of the four percent pay raise requested, to be funded with "available resources."

Carlucci Hearings

The Senate confirmed Frank Carlucci to be Secretary of Defense by a vote of 91–1.

At his confirmation hearing before the Senate Armed Services Committee, Mr. Carlucci said that in view of budget constraints, force structure might have to be reduced. "It is becoming very clear to me that we may well be talking about a different kind of military force [or] at least a different size military force. . . . [W]e need to . . . avoid getting back to a hollow [military]," he said. "I would rather have a smaller force that is effective . . . than . . . a larger structure that is not effective."

On other key issues, Mr. Carlucci:

- Argued that the Under Secretary of Defense for Acquisition is "paramount" in acquisition matters.
- Favored as a "high priority" conventional force reduction negotiations with the Soviet Union.
- Favored a "militarily effective" SDI program.
- Noted that the ABM Treaty is "ambiguous." Therefore, "we really do have to look at the national security interests."

Costello Hearings

Dr. Robert Costello, at a hearing on his nomination to be the next Under Secretary of Defense for Acquisition (USDA), maintained that the USDA has the authority to "demand, direct, and control" acquisition policies and introduced a menu of ten goals and strategies designed to streamline the acquisition process. These goals and strategies include a fifty percent reduction in the time taken to introduce new technology into weapon systems and a "could cost" approach to reducing costs of sole-source programs.

Dr. Costello, under questioning by members of the Senate Armed Services Committee, maintained that the USDA has the authority to "decide" or "recommend" acquisition matters, while the services have the right to appeal those decisions to the Secretary of Defense. He noted his belief that the USDA has a strong voice in considering "what" in addition to "how" to buy. "The Under Secretary utilizes the Defense Advisory Board's advice to make his recommendation to the Secretary of Defense . . . as to whether a program should be authorized . . . or be . . . terminated. To me, that's a big voice in determining what we buy," Dr. Costello said.

His approach to reducing the lead time for introducing new technologies focused on concurrency in development and production. He noted that for this to succeed, "reasonable risk must become acceptable again." Dr. Costello said he will seek to utilize an approach he called "could cost" to reduce costs on the forty percent of DoD procurement for which no competition is conducted. He described "could cost" as a "major cultural change" aimed at minimizing the "nonvalue-added work done by a contractor." He noted multiyear purchasing and possible reductions in auditing, overhead, marketing forces, and documentation as means that could substantially reduce costs on such programs. ■

Aerospace World

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C.

★ President Reagan, in somewhat of a surprise move, announced on November 10 that he supports the creation of a Cabinet-level Department of Veterans Affairs. The President's action was sharply criticized by both the Washington *Post* and the New York *Times,* but was applauded by the Air Force Association and other veterans' groups that contend it will increase the visibility and voice of veterans as well as give them direct access to the executive branch of the government.

Another group that approved of the President's initiative was the House of Representatives. On November 17, the House approved H. R. 3471, which called for a Cabinet-level Department of Veterans Affairs, by a margin of 399–17. Senate deliberations, which were to have taken place in February, have been moved up and were to be held in December. The Senate is expected to pass the measure, and it will then go to the President, who has already said he would sign the legislation.

The House bill was introduced by Reps. G. V. (Sonny) Montgomery (D-Miss.), Gerald B. H. Solomon (R-N. Y.), Frank Horton, Jr. (R-N. Y.), and Jack Brooks (D-Tex.). Representative Brooks, the bill's floor manager, said that a similar measure has been introduced in every Congress since he was first elected in 1952. Identical legislation was introduced in the Senate by Sen. Strom Thurmond (R-S. C.) and thirty cosponsors.

The bill calls for the Department of Veterans Affairs to be run by a Secretary appointed by the President and approved by the Senate. Other DVA officials will include a Deputy Secretary, a Chief Medical Director, a Chief Benefits Director, and eight Assistant Secretaries, one of whom will be responsible for functions regarding national cemeteries.

The Veterans Administration has estimated the cost of turning itself into a separate department at only about $30,000, mainly for covering pay raises for top department officials.

The VA has the fifth-largest budget (after Defense, Health and Human Services, Agriculture, and Transportation) among federal departments and agencies, and the agency's expenditures ($26.5 billion in FY '86) were larger than those of the Departments of Energy, Interior, Justice, State, and Commerce combined. It is second only to the Department of Defense in terms of employees (240,000). One out of every ten employees of the federal government's full-time permanent work force works at the VA.

The VA also operates 172 medical facilities and 111 national cemeteries. Disability compensation and pension payments totaling almost $15 billion go out each year to almost 4,000,000 veterans and eligible dependents.

★ After months of wrangling and controversy, the Japanese Defense Agency (JDA) announced on October 21 that it had decided on a modified General Dynamics F-16 to fill that country's requirement for a close support/sea patrol aircraft. The Japanese National Security Council formally endorsed the choice a few days later.

Before deciding that the modified F-16 met the specifications of its FSX (Fighter Support Experimental) program to replace the Mitsubishi F-1 and F-4EJ, Japan had first considered building an indigenous aircraft design. Buying foreign aircraft (such as the F-16, McDonnell Douglas F/A-18 Hornet, or Panavia Tornado) and building them under license was also considered, as was a modification effort on one of those airplanes or to the McDonnell Douglas F-15. Japan already produces the F-15J under license.

Bowing in part to the need to ease the huge US-Japanese trade deficit, the JDA took the middle road and will build 170 of the greatly modified F-16s in a deal worth approximately $5.5 billion. The F-16 was finally chosen over the F-15 because the projected development and production costs for the F-16 would be less expensive.

The Japanese F-16s, to be designated SX-3, will have a number of external differences from their American counterparts. The planes will have a larger wing made of composite materials, a twenty-four-inch fuselage plug forward of the vertical tail, a

The latest addition to the Hawk family of aircraft—the Hawk 100 Series with a new aerodynamic front fuselage shape—flew for the first time in October at British Aerospace's Flight Development Center at Dunsfold, south of London. The aircraft, which is powered by the Rolls-Royce Adour -871 turbofan engine, is now undergoing flight-testing.

modified nose shape, vertical canards under the intake, and a drag chute. The aircraft will also have a strengthened canopy and a wing leading edge made with radar absorbent material (RAM).

Internally, the planes, which will cost approximately $35 million each (or more than twice the cost of an F-16C), will have a new phased-array radar, a new mission computer, an inertial navigation system (INS), and an integrated electronic warfare system. Underwing provisions for four antiship missiles or four medium-range air-to-air missiles will be added. The internal 20-mm cannon and two wingtip-mounted infrared air-to-air missile launch rails of the F-16 will be retained.

A competition between the General Electric F110-GE-129 and the Pratt & Whitney F100-PW-220 improved performance engines seems likely.

The SX-3 will have a top speed of Mach 2, a payload of 22,000 pounds, and a range of 516 statute miles with four Mitsubishi Type 80 antiship missiles. First flight is scheduled for 1993, and the planes are expected to enter service in 1997.

A dummy's life is not an easy one. In this time-lapse photo, a test figure seated in a half-scale model of the new Crew Escape Technology (CREST) ejection seat is shown in various orientations in one of the wind tunnels at Arnold Engineering Development Center, Arnold AFB, Tenn., where the seat has been undergoing tests.

★ Air Force Systems Command's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, awarded a $1.2 million firm, fixed-price contract to McDonnell Douglas on November 4 for technology transfer leading to a second-source capability for the AGM-129 Advanced Cruise Missile (ACM) being developed by General Dynamics Corp.

This action—seen as "something to get the contractor's attention" according to testimony by Gen. Bernard P. Randolph, the AFSC Commander—was recently made public by the House Appropriations Committee's Defense Subcommittee. The missile's development has been greatly slowed by what General Randolph said were quality control problems and GD's poor subcontractor management.

General Dynamics reports that it is taking "strong measures" to eliminate the quality control problems at the subcontractor level. AFSC is also working closely with the contractor to correct deficiencies in parts and components of the missile, and hardware quality audits are currently being performed on forty-four major components of the AGM-129.

Under terms of the contract to the McDonnell Douglas Astronautics Co. in St. Louis, Mo., the company will receive technology related to building the ACM from the Convair Division of General Dynamics in San Diego, Calif. The contract funds will allow McDonnell Douglas to validate an ACM technical data package and begin planning for fabrication and qualification of the missile.

ASD will oversee the technology transfer effort. If the effort is successful and a follow-on qualification program is approved, the Air Force will award subsequent production contracts on a competitive basis.

Development efforts toward the AGM-129 began in 1983. K. I. Sawyer AFB, Mich., will be the first base to receive production ACMs. Approximately 1,500 AGM-129s will be built. The stealthy ACM will have greater range, accuracy, and flexibility than the AGM-86B air-launched cruise missiles that are currently in operation.

★ Bailing out of the Air Force's Advanced Tactical Fighter may be a little easier because of tests recently completed in the two sixteen-foot wind tunnels at the Arnold Engineering Development Center at Arnold AFB, Tenn.

A one-half-scale model of a prototype ejection seat being developed under the Crew Escape Technology (CREST) program was tested for two weeks at transonic and supersonic speeds (up to Mach 3) to measure aerodynamic loads on the seat.

The seat, developed by the Boeing Military Airplane Co., includes a computerized control system that determines altitude, attitude, and airspeed when the crew member ejects. The control system also automatically directs the firing of a series of solid-fuel rocket motors through thrust-vectoring nozzles to position the seat away from the aircraft after ejection.

An additional feature of the CREST prototype is a Kevlar fabric "flow fence" that surrounds the crew member on both sides and the top to prevent the head and arms of the occupant from flailing after "punching out" and also to provide protection from the windblast experienced in a high-speed ejection.

Data and results from the wind-tunnel tests will be used to refine the design requirements and performance predictions of the CREST seat, which will undergo rocket sled testing at Holloman AFB, N. M., in 1989.

★ A world record was set in early fall at the air combat maneuvering instrumentation (ACMI) range at Decimomannu AB, Sardinia, as 11,926 sorties were flown there in Fiscal Year 1987. The previous record was 11,185 sorties. Lt. Col. Thomas S. "Foot" Milner, director of operations at the range, flew the mission that broke the record.

The ACMI system, built and run by Cubic Defense Systems of San Diego, Calif., trains fighter pilots in air-to-air tactics. The aircraft involved in the dogfights carry pods that relay real-

time information to a central point where the battle can later be replayed and studied. The system is called Tactical Aircrew Combat Training System (TACTS) in Navy parlance.

The Decimomannu range is one of twelve ACMI ranges operated worldwide. The range on Sardinia is jointly owned by the US, Italy, West Germany, and the United Kingdom. The range had an operational readiness rate of ninety-nine percent for the year.

Naval Air Systems Command recently awarded Cubic a $74 million contract for four new TACTS/ACMI ranges at MCAS Cherry Point, N. C., MCAS Beaufort, S. C., Homestead AFB, Fla., and the Air National Guard Field Training site near Gulfport-Biloxi Regional Airport, Miss.

In a related note, the new Grand Bay Weapons Range east of Moody AFB, Ga., opened for business on October 26. The range is situated on 5,900 acres of land transferred to the Air Force from the US Forest Service. The air-to-ground training range has conventional bombing and strafing targets. The range was constructed at a cost of approximately $627,300 with money from the Air Force's Productivity Investment Fund. Those costs will be recovered in a year because the F-16s of the 347th Tactical Fighter Wing will not have to travel to train on other ranges.

★ There was a flurry of activity in the world of missiles during late October and early November. Two launches were conducted in the continuing Minuteman test program, a sea-launched cruise missile attacked several land targets with conventional munitions, AMRAAM racked up another success, and an important test in the development program for the Small ICBM was carried out.

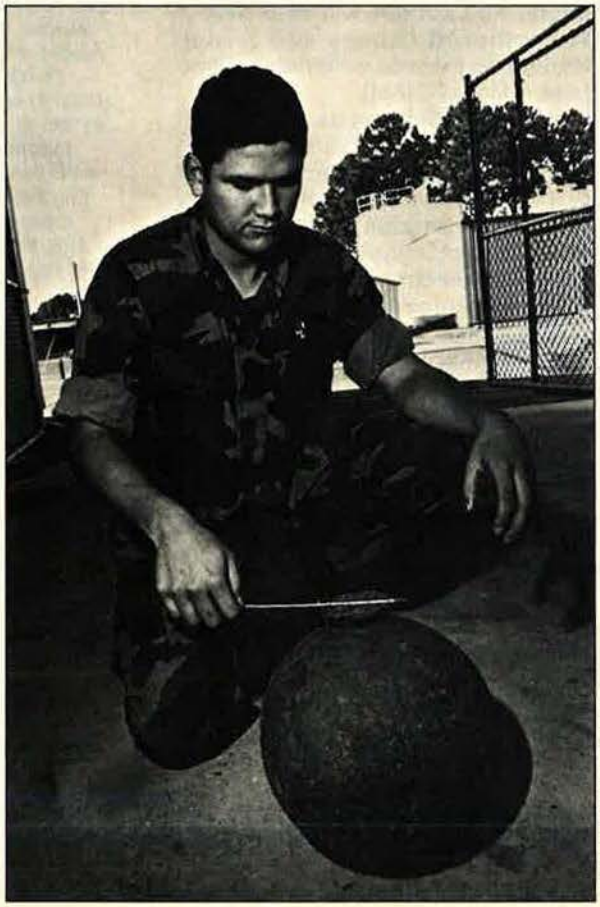
On October 22, Air Force Systems Command's Ballistic Missile Office (BMO) carried out the first successful cold launch of a simulated Small Intercontinental Ballistic Missile (SICBM) at Vandenberg AFB, Calif. A cold launch is one in which the missile is ejected from its canister before the engines ignite. All sea-launched ballistic missiles and the Air Force's LGM-118A Peacekeeper are launched in this manner.

This Canister Assembly Launch Test Program (CALTP) test, the first of three planned trials, was designed to evaluate the SICBM cold launch system, to test launcher subsystems, and to examine how the missile interfaces with the test launcher's subsystems. A total of 143 measurements of such parameters as ejection dynamics, temperatures, and acoustics was taken during the test.

The missile simulator, which is the same size (fifty-three feet tall and forty-six inches in diameter) and weight (roughly 37,000 pounds) as the actual SICBM, traveled more than 300 feet into the air during the test and then impacted in a predesignated area within 100 feet of the launchpad.

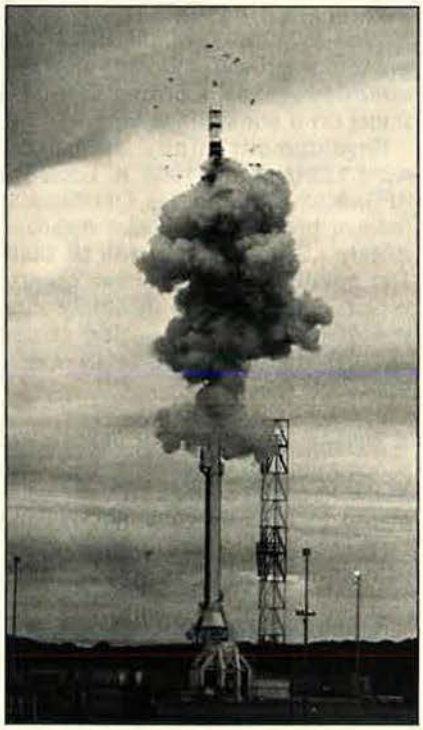
The BMO, based at Norton AFB, Calif., is developing the SICBM, and it will conduct twenty-two flight tests of the missile. The SICBM will be based in hardened mobile launchers, and initial operational capability (IOC) with the missile is expected to be reached in 1992 at Malmstrom AFB, Mont.

That same day, an AIM-120A Advanced Medium-Range Air-to-Air Missile (AMRAAM) passed within lethal range of its target, a QF-100 drone, over the Gulf Test Range at Eglin AFB, Fla. The 335-pound missile was rail-launched from an F-15. This test demonstrated AMRAAM's performance against a single target in an electronic countermeasures environment. As the result of an editing error, it was erroneously reported in this space last month that the AMRAAM



The Explosive Ordnance Disposal team at Hurlburt Field, Fla., recently got an emergency call to deal with a 200-year-old dud cannonball unearthed by workers laying cable in a Pensacola neighborhood. The cannonball was probably a British mortar round dating back to their defense of Pensacola during the 1781 Spanish siege. Here it's admired by the team's Sgt. Rafael Armenta.

—USAF photo by SrA. Jeff Trojahn



The Small ICBM development program recently passed an important milestone as a simulated SICBM was successfully cold-launched at Vandenberg AFB, Calif., in the first of three trials of its Canister Assembly Launch Test Program.

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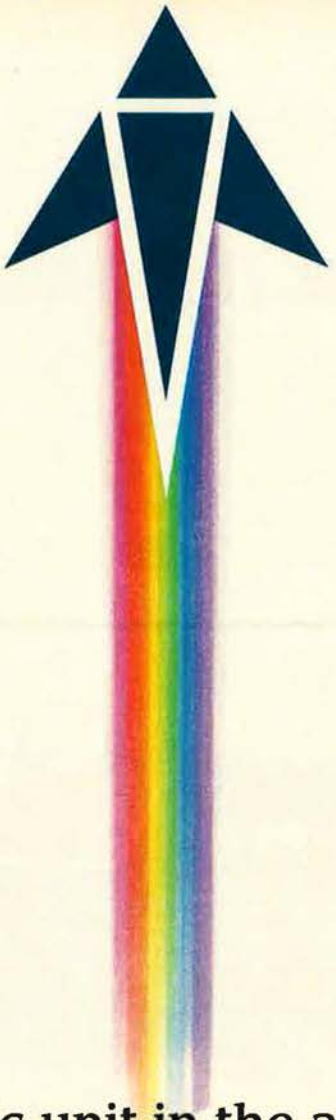

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test record was then thirty-eight successes in forty-six attempts. That eighty-three percent success ratio is the mark after this latest test.

The Navy successfully attacked four land targets with a BGM-109 Tomahawk sea-launched cruise missile on November 3. The missile was launched from a submerged submarine off the coast of southern California and flew a fully guided flight of about 500 miles over and around San Clemente Island.

The missile dispensed twenty-four packages containing a total of 166 BLU-97 combined effects munitions on an aircraft in a revetment, a simulated missile site, and a simulated "defense site." The missile then performed a pop-up terminal dive and attacked the fourth target.

This was the first test in which live BLU-97s were used and the sixth overall to qualify a Tomahawk that can dispense submunitions. This version of the weapon is expected to reach IOC next September.

And finally, an LGM-30F Minuteman II and an LGM-30G Minuteman III missile were successfully launched from Vandenberg on October 28 and November 3. The launches marked the 126th operational test launch of the Minuteman II and the 129th operational test firing of the Minuteman III. Both missiles traveled the 4,200 miles to the Western Missile Test Range near Kwajalein in the Pacific Ocean in about thirty minutes. The launch crews were from Whiteman AFB, Mo., and F. E. Warren AFB, Wyo.

★ **REAPPOINTED—Dr. Jacquelyn K. Davis,** executive vice president of the Institute for Foreign Policy Analysis in Boston, Mass., **has been reappointed** by the Department of Defense **for an additional one-year term as chair of the Defense Advisory Committee on Women in the Services** (DACOWITS) beginning January 1. Dr. Davis, who has written several articles for this magazine, was appointed to DACOWITS in 1984 and was appointed chair in 1986. DACOWITS was established in 1951 by Secretary of Defense George C. Marshall. Its thirty-two civilian members advise the Secretary of Defense on policies and matters relating to women in the services.

★ **AWARDED—Capt. James A. Trinka,** a flight commander and F-16 instructor pilot with the 311th Tactical Fighter Training Squadron at Luke AFB, Ariz., **has been named the 1987 winner of the Jabara Award for Airmanship.** The native of Lidgerwood, N. D., a 1978 Air Force Academy graduate, won the award for his actions in saving his flamed-out F-16 after a birdstrike and for his continual professionalism in all aspects of his military endeavors.

On April 17, 1986, Captain Trinka's airplane ingested a bird just after takeoff at 750 feet above the ground and at a speed of 250 knots. He was able to turn, land, and catch the arresting cable all within the space of thirty seconds. Among his accomplishments on the ground, Captain Trinka, who also won the Aviators' Valor Award for 1986, was cited for his work in scheduling his unit's 5,700 sorties so that all training requirements were met. The Jabara Award is named in honor of Maj. James Jabara, the second-highest-scoring Air Force ace in the Korean War.

★ **MILESTONES**—The **first part for the McDonnell Douglas C-17 airlifter was machined** on November 3 at the Douglas Aircraft Co. facility in Torrance, Calif. The lower frame support corner, a part that supports the edge of the cargo floor where it joins the fuselage, was machined from 2.5-inch-thick aluminum plates fifteen inches wide and forty-four inches long. The 170-pound block weighed 9.61 pounds when machining was

Weinberger Steps Down, Carlucci Steps Up

After serving as the Secretary of Defense for nearly seven years, Caspar W. Weinberger resigned for personal reasons on November 5, 1987. Praised by President Reagan as "the finest Secretary of Defense in the history of our nation," he will be remembered for his steadfast support for America's defense strength. Under his leadership, the badly eroded defense forces of the 1970s were rebuilt and strengthened.

On November 23, former National Security Advisor Frank Carlucci was sworn in as the new Defense Secretary. A former Deputy Secretary of Defense, he authored the "Thirty-two Carlucci Initiatives" for reforming the defense acquisition process. Taking over at the National Security Council is Army Lt. Gen. Colin Powell, Mr. Reagan's sixth National Security Advisor.

For more on Mr. Carlucci, see "Washington Watch" on p. 17 of this issue.

A high-speed milling machine at the Douglas Aircraft Co.'s Torrance, Calif., facility cuts the outline of the first part to be machined for the new C-17 airlifter. The lower frame support corner, which supports the edge of the cargo floor, weighed just under ten pounds when machining was complete.

completed. First flight of the part (and the rest of the C-17) is scheduled for 1990.

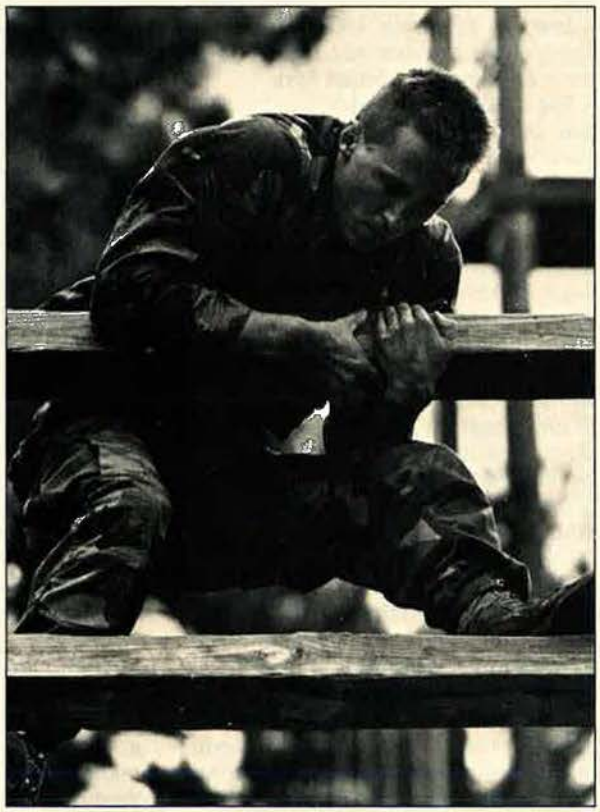
The **first AGM-65G Maverick missile launch was successful** in early November, with the infrared-guided missile destroying a tank after launch from an F-16 at Eglin AFB, Fla. The low-altitude launch was the first of five planned developmental launches for the new G-model Maverick. The AGM-65G employs a guidance system similar to that of the Air Force's AGM-65D infrared-guided Maverick, but its armament system and 300-pound warhead are the same as those used in the Marine Corps's AGM-65E and the Navy's AGM-65F. With a selectable fuze delay, the warhead can penetrate hard structures, such as bunkers and ships, before detonating. The Air Force plans initially to acquire 600 G models.

After checking its records and working backwards, Naval Air Systems Command recently pinpointed when **the Navy's fleet of Grumman F-14A Tomcats passed the 1,000,000-flight-hour milestone.** Last March 26, twenty-six Tomcats were airborne at the time of the 1,000,000th hour, and by landing first, Lt. Bing Stickney (pilot) and Cmdr. Ed James (radar intercept officer) of VF-111 (The Sundowners) claimed the record. The honored aircraft was F-14 Bureau Number (BuNo) 160666. Tomcats have been operational for fourteen years.

On November 1, 29 Squadron, **the first Royal Air Force unit to be equipped with the Panavia Tornado F. Mk 3, was declared operational.** The squadron, based at RAF Coningsby, also recently completed two successful firings of the Skyflash air-to-air missile using the new Foxhunter pulse-Doppler radar. The look-down/shoot-down shots were made from an altitude of 10,000 feet at targets flying at 250 feet above ground level. The RAF has ordered 165 Tornado F.3s, and the aircraft will be assigned to RAF Leeming and RAF Leuchars in addition to RAF Coningsby.

According to the Strategic Air Command's Inspector General Team, **for the first time** in the forty-year history of the Air Force, **a wing has passed its first operational readiness inspection (ORI) after transitioning to a new aircraft.** The 96th Bomb Wing at Dyess AFB, Tex., the first B-1B unit, earned superior ratings from the sixty-seven-member SAC inspection team during a nine-day inspection that ended October 29. The 96th Bomb Wing began operations with

SrA. Dennis Hoebee, Det. 3, 602d Tactical Air Control Wing, Fort Carson, Colo., reaches the top of the "inverted ladder" on the obstacle course at Hurlburt Field, Fla., during the fifth annual 275XO (Tactical Air Command and Control Specialist) competition. More than 100 TACCSs from the US, Panama, Korea, and Germany took part in the competition. Events included a two-mile combat run with a thirty-five-pound rucksack, the obstacle course, job knowledge tests, constructing field antennas from basic materials, marksmanship, and various field skill events.



—USAF photo by SrA. Jeff Trojahn

January Anniversaries

- *January 13, 1908:* Henri Farman wins the 50,000-Franc Deutsch-Archdeacon Prize for the first officially observed one-kilometer circular flight in Europe.
- *January 19, 1918:* The US School of Aviation Medicine begins operations at Hazelhurst Field, Mineola, N. Y., under the command of Signal Corps Maj. William H. Wilmer.
- *January 23, 1918:* The first ascent by an American Expeditionary Force balloon is made at the Balloon School in Cuperly, France.
- *January 27, 1928:* The Navy airship *Los Angeles* (ZR-3) lands on the aircraft carrier USS *Saratoga* (CV-3) during a fleet exercise near Newport, R. I., and resumes its patrol after replenishment.
- *January 5, 1943:* Army Air Forces Maj. Gen. Carl A. "Tooey" Spaatz is appointed commander in chief of the Allied Air Forces in North Africa. The Lockheed C-69 transport (a military version of the Model 49 Constellation) makes its first flight at Burbank, Calif., four days later.
- *January 27, 1943:* The first American air raid on Germany is made by Eighth Air Force B-17 crews against Wilhelmshaven and other targets in the northwestern part of the country.
- *January 30, 1948:* Orville Wright dies in his hometown of Dayton, Ohio, at age seventy-six. Famed German aircraft designer Ernst Heinkel would pass away at age seventy on the same date ten years later.
- *January 2, 1953:* Cessna Aircraft is declared the winner of the Air Force's primary jet trainer competition. The Cessna design, later designated T-37, beat out fourteen other entries.
- *January 26, 1953:* Chance Vought Aircraft completes the last F4U Corsair. In production for thirteen years (and built by two other manufacturers during World War II), almost 12,700 Corsairs were built in a number of versions, marking one of the longest production runs in history.
- *January 31, 1958:* Explorer I, the first US satellite, is launched by the Army at Cape Canaveral, Fla. The satellite, launched on a Jupiter-C rocket, later played a key role in the discovery of the Van Allen Radiation Belt.
- *January 17, 1963:* NASA pilot Joe Walker qualifies for astronaut wings by flying the North American X-15 to a height of 271,700 feet, or a little over fifty-one miles. He is the eleventh man to pass the fifty-mile mark.
- *January 27, 1973:* Cease-fire agreements ending the Vietnam War are signed in Paris. Secretary of Defense Melvin Laird also announces that the draft in the United States has ended.

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The first of two LTV A-7D attack aircraft to be modified to the "A-7 Plus," or as it is officially called now, YA-7F, configuration is being stripped down by workers in the company's Dallas, Tex., facility. The two aircraft will be lengthened, reengined, and equipped with improved avionics as part of a $133.6 million effort.

the Rockwell B-1B in July 1985 and achieved initial operational capability in September 1986.

★ **NEWS NOTES**—In a "shocking" development, a **Rockwell B-1B** arrived at Kirtland AFB, N. M., on October 23 **to begin the first phase of a system-level electromagnetic pulse (EMP) test program** at the Air Force Weapons Laboratory. The aircraft, based at Ellsworth AFB, S. D., will undergo six weeks of tests during which the bomber will be "zapped" with high energy pulses to determine what effects the simulated EMP will have on its systems. The data gathered in these "aircraft as delivered" tests will be compared with data from future tests to detect any degradations of the plane's systems.

The Air Force notified LTV Aircraft in early November that the **two A-7D aircraft being modified to the "A-7 Plus" configuration will be officially designated YA-7F.** The aircraft are in the first phases of the modification program, which will see the venerable A-7s lengthened, reengined, and equipped with improved avionics. The A-7 Plus program is seen as an interim solution to the Air Force's close air support/battlefield air interdiction (CAS/BAI) requirements.

On November 10, **the British Ministry of Defence exercised an option for one of two Boeing E-3A Sentry** airborne warning and control system (AWACS) aircraft. The RAF will now get seven E-3A aircraft, and this latest action concludes all the options the British have on the aircraft. The additional Sentry will cost approximately $120 million and brings the total value of the deal to $1.42 billion. Boeing has an offset agreement with the British MoD worth 130 percent of the purchase price. All seven E-3A aircraft will have been delivered by 1991.

The organization at Air Force Systems Command's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, that is **responsible for developing the second-generation Short-Range Attack Missile (SRAM II) has been elevated to deputate status.** The SRAM II System Program Office (SPO), which had been assigned to ASD's Deputy for Strategic Systems, will now report directly to Lt. Gen. William E. Thurman, the ASD Commander. Boeing is the prime contractor to develop SRAM II, which will replace the twelve- to fifteen-year-old AGM-69A SRAMs. Plans call for 1,633 SRAM IIs to be built at a cost of $2.5

Senior Staff Changes

RETIREMENT: B/G Robert A. **Norman.**

CHANGES: Col. (B/G selectee) Billy A. Barrett, from Dir., Maintenance, Sacramento ALC, AFLC, McClellan AFB, Calif., to Dir., Maintenance and Supply, DCS/L&E, Hq. USAF, Washington, D. C., replacing B/G Philip L. Metzler, Jr. . . . **M/G Harold N. Campbell,** from DCS/Log., Hq. USAFE, Ramstein AB, Germany, to Dep. Dir., DLA, Cameron Station, Va., replacing M/G Stanton R. Musser . . . **B/G John S. Fairfield,** from Dep. Dir. for Resources, Dir. for P&E, DCS/P&R, Hq. USAF, Washington, D. C., to Ass't Deputy Under Secretary of Defense, Strategic and Theater Nuclear Forces, OSD, Washington, D. C. . . . **B/G (M/G selectee) Ronald R. Fogleman,** from Dep. Dir., P&E, DCS/P&R, and Chairman, PRC, Hq. USAF, Washington, D. C., to Dir., P&E, DCS/P&R, and Chairman, ASB, Hq. USAF, Washington, D. C., replacing retiring M/G Clarence R. Autery.

B/G Albert A. Gagliardi, Jr., from Dep. US Mil. Rep., NATO Mil. Committee, Brussels, Belgium, to IG, Hq. ATC, Randolph AFB, Tex., replacing Col. (B/G selectee) James P. Ulm . . . **B/G Eugene E. Habiger,** from IG, Hq. SAC, Offutt AFB, Neb., to Dep. Dir., P&E, DCS/P&R, and Chairman, PRC, Hq. USAF, Washington, D. C., replacing B/G (M/G selectee) Ronald R. Fogleman . . . **B/G Donald G. Hard,** from Dep. Cmdr., Launch and Control Sys., SD, AFSC, Los Angeles AFB, Calif., to Dir., Office of Space Sys., OSAF, Washington, D. C., replacing B/G (M/G selectee) Thomas S. Moorman, Jr. . . . **B/G Philip L. Metzler, Jr.,** from Dir., Maintenance and Supply, DCS/L&E, Hq. USAF, Washington, D. C., to DCS/Log., Hq. USAFE, Ramstein AB, Germany, replacing M/G Harold N. Campbell.

B/G (M/G selectee) Thomas S. Moorman, Jr., from Dir., Office of Space Sys., OSAF, Washington, D. C., to Dir., Space and SDI Prgms., Ass't Sec. of the Air Force (Acquisition), OSAF, Washington, D. C., replacing M/G Robert R. Rankine, Jr. . . . **M/G Robert R. Rankine, Jr.,** from Dir., Space and SDI Prgms., Ass't Sec. of the Air Force (Acquisition), OSAF, Washington, D. C., to Vice Cmdr., SD, AFSC, Los Angeles AFB, Calif., replacing M/G (L/G selectee) Donald J. Kutyna . . . **Col. (B/G selectee) James P. Ulm,** from IG, Hq. ATC, Randolph AFB, Tex., to Command Dir., NORAD Combat Ops. Staff (J-31), Cheyenne Mountain Complex, Colo., replacing B/G William T. Williams IV . . . **B/G William T. Williams IV,** from Command Dir., NORAD Combat Ops. Staff (J-31), Cheyenne Mountain Complex, Colo., to Spec. Ass't, Joint Strategic Defense Planning Staff, Hq. USSPACECOM, Peterson AFB, Colo. ■

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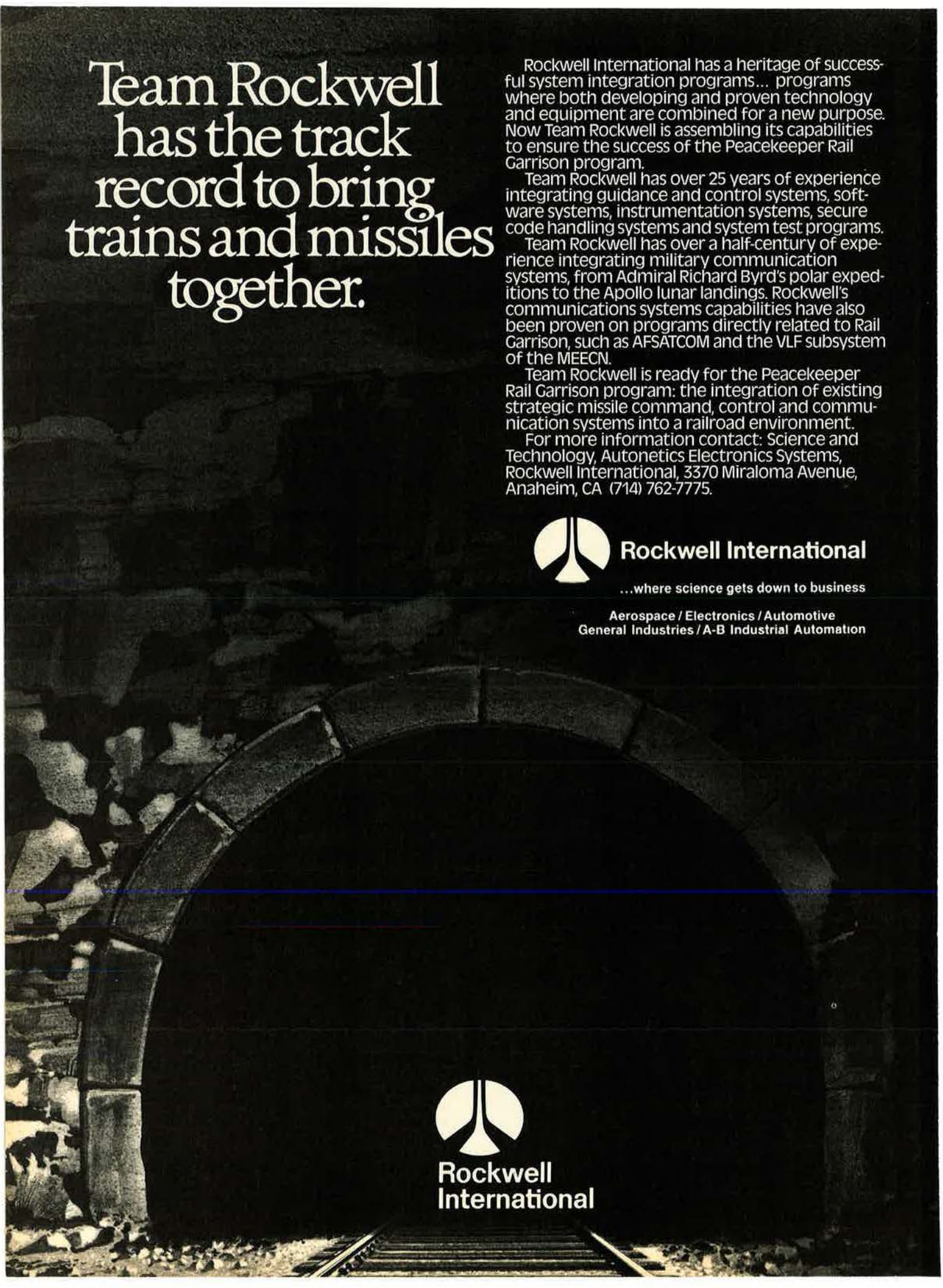

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billion. IOC with the new missiles is expected to be reached in 1993.

ASD's Flight Dynamics Laboratory dedicated its new Philip P. Antonatos Subsonic Aerodynamic Research Laboratory on November 6. The facility, named for a former Air Force career civilian scientist who pioneered work in advanced airfoil and maneuvering devices, is a low-turbulence wind tunnel, and it will allow engineers to investigate aerodynamic phenomena, such as high-angle-of-attack flight and other techniques for improved airframe/propulsion integration. The lab is the only one of its kind in the Air Force. Another aerodynamicist, Walter S. Diehl, who from 1918 to 1951 directed the Navy's work in aerodynamics and hydrodynamics, was honored on October 10 when **the *Walter S. Diehl* (T-AO-193), a fleet oiler, was launched** at the Avondale Industries Shipyard in New Orleans, La.

The **Air Force Recruiting Service achieved 100 percent or better in all of its recruiting goals for FY '87.** Of the almost 60,000 people recruited in the last fiscal year, 55,000 enlisted with no prior service, approximately 1,000 enlisted with prior service, Officer Training School (OTS) attracted some 1,600 applicants, and more than 950 health-care professionals received direct commissions. Recruiting Service even met its goal of attracting 114 physicians. The average OTS candidate had a college grade point average of 3.15, and ninety-six percent of the nonprior enlistees were high school graduates.

Thomas G. Lanphier, Jr., served as AFA's first elected President in 1947–48.

★ **DIED—Thomas G. Lanphier, Jr.,** World War II fighter pilot who later served as the first elected National President of AFA, on November 26, 1987, one day before his seventy-second birthday, after a year-long battle with cancer.

Born in Panama City, Panama, to a military family, Mr. Lanphier earned his AAF wings one month before Pearl Harbor and was in the Pacific theater as a front-line fighter pilot two months later. On April 18, 1943, in one of the most celebrated engagements of the war, he was one of the P-38 pilots who took part in the mission over the Solomon Islands that downed Japanese Adm. Isoruku Yamamoto, planner of the surprise attack on Pearl Harbor.

Mr. Lanphier flew a total of 112 combat missions and is credited with 5½ aerial victories. Among his decorations were the Navy Cross and the Silver Star.

After his 1947–48 term as AFA President, he continued to serve AFA as a National Director and member of the Executive Committee. He held a series of posts in the federal government, including a position on the National Security Resources Board, before moving to private industry. He became a vice president of the Convair Division of General Dynamics and in 1963 began his own consulting business. ■

Index to Advertisers

ASD is under pressure to eliminate the bells and whistles and to design systems that are both affordable and combat-capable.

Making Warplanes Lean and Mean

BY ROBERT S. DUDNEY
SENIOR EDITOR

THE American warplane-maker—traditional provider of dazzling but expensive tactical aircraft—is under pressure to tighten up his act.

Even the most ardent proponents of building sophisticated new planes and equipment to bolster the US Air Force are turning their guns on overenthusiastic weaponeering that brings needless expense.

They warn that USAF's need to produce a top-rank 1990s force during the coming years of budgetary retrenchment will greatly increase the capacity of undisciplined programs to create utter havoc.

The magnitude of the requirement, as 1988 dawns, for a lean-and-mean approach to arms-making becomes apparent from looking at the long list of ambitious Air Force programs on tap, including plans to:

- Build a new fighter—on paper, a technological jewel—at what is viewed as a bargain-basement price.
- Expand USAF ground-attack power without, it now seems, adequate funding to build a new-generation, close air support airplane.
- Magnify the wizardry of the USAF electronic combat forces even while staying within the confines of existing aircraft.

These are openers. Overall, the task will be to produce airpower more marvelous than that brought out in years gone by but in a climate of austerity that will afford little, if any, margin for error.

This problem is hardly a military secret.

Today, signs are evident that a new ball game is under way at Air Force Systems Command's Aeronautical Systems Division at Wright-Patterson AFB, Ohio—proving ground for the future tactical airplanes and assorted hardware.

There, key officials—preparing to absorb major funding cuts imposed by Congress—are taking direct aim at unnecessary expense. And they are surprisingly blunt about the need for tight discipline.

Listen to Lt. Gen. William Thurman, ASD's Commander: "We've had programs here where for thirty percent of the money we could have ninety percent of the capability. Should we always try to get the last ten percent? Should we always strive for that final, few percentage points of capability that adds the majority of the cost?"

The theme is being taken up by pilots who, in most circumstances, hanker for the latest and best in all matters that involve aircraft.

"The technologist always has got a lot of technology in the laboratory," says Maj. Gen. J. M. Loh, ASD's Vice Commander, formerly a requirements official at Hq. USAF and a combat veteran. "The tenden-


MORGER

cy is to try to shove everything into the next system because the one after that won't come for twenty years. But if you're going to be smart, you have to put limits on what you try to do."

The Stakes Are Huge

Whatever the ultimate course that ASD takes, Air Force leaders acknowledge that the stakes—for USAF and the nation—are huge. In the 1990s, its aircraft will have to be up to the test of battle against new, improved Soviet forces, and that means more capability—much more.

Even so, in the wake of painful budget cuts—and in light of the reality that more will come—these weapons must be affordable. If not, say officials, they are destined to remain paper airplanes forever.

For a close look at the progress and problems of the nation's program to build the tactical fighting force for the 1990s, AIR FORCE Magazine spoke with top ASD officials, civilian aerospace experts, and Pentagon figures. From this, one can begin to get a feel for how the Air Force is planning to cope with harsh financial pressures.

The consensus of these experts—backed by evidence on display at ASD—is that there is cause for optimism that USAF will be able to hack the demanding task it faces. The quest for high performance is there, but it is blended with a new sense of discipline.

Nowhere are pressures to change the traditional way of aircraft-making more evident than in development of a sophisticated fighter for air superiority—the Advanced Tactical Fighter.

The ATF, the first new USAF fighter program in a generation, now shapes up as the ultimate test case for airplane builders.

USAF is not budging on its plan to field a wonder of an airplane for the mid-1990s—stealthy, nimble, far-seeing, lethal, and with a surfeit of power and ability to fight around the clock without pause.

The goal, in fact, remains development of an aircraft that will be twice as good by every measure as USAF's F-15, the world's top gun.

The catch is that the allowable cost barely exceeds that of the F-15. The ATF is now being pegged at a unit flyaway price (in 1985 dollars) of no more than $35 million based on production of seventy-two ATFs per year up to a run of 750 aircraft. Each F-15 costs about $30 million.

The result: ASD is now working feverishly to prove its claim that its highly touted technologies of digital avionics, propulsion, and materials can be combined with fiscal discipline to build and operate a red-hot plane more efficiently, more reliably, and more inexpensively than ever.

How is the highly secretive, top-priority program progressing?

From Col. James Fain, manager of the ATF program, comes this assessment: "The $35 million is going to be tough, but technology will help us get there. Now, please don't go out and print that Fain thinks that it's a piece of cake, because I damn sure didn't say that. What I did say is the technology's out there and if we are able to harness it, we'll make the $35 million [goal]."

One cause for optimism is competition. ASD is prodding two pairs of aerospace contractors to develop, respectively, flying aircraft and engines. The expectation is that the process will drive down costs.

Flying Prototypes by 1989

Highest hopes for efficiencies rest on the two contractor teams who are to produce flying prototypes by 1989, plus avionics. Northrop (paired with McDonnell Douglas) and Lockheed (teamed with General Dynamics and Boeing) were chosen in October 1986 to hammer together two ATF prototype aircraft each, with both teams working from $691 million contracts. Lockheed's plane is the YF-22A; Northrop's is the YF-23A.

Each is producing not only planes but ground-based prototypes of the ATF's avionics system. Signs point to progress on both fronts.

- *Airframe Prototypes.* Northrop and Lockheed are responsible for integration of their respective aircraft and have sole power to decide which combinations and permutations promise greatest efficiencies.

USAF's demands are high. The service expects the plane to boast low observability, high maneuverability, high reliability, and ease of maintenance and repair. Gross takeoff weight of the ATF cannot exceed 50,000 pounds—far less than the 68,000 pounds of the F-15.

Explains Colonel Fain: "We have said: 'OK, Mr. Contractor. We have given you a very tough job. You've got to go off and do a lot of work to come back and convince us what the right requirements should be.'"

They are doing so. Each is producing studies of the kinds of harsh tradeoffs in capabilities that will be required on their airplanes.

Use is being made of weight-saving composite materials, reliable fiber optics, and digital computing in the flight controls and advanced low-observables (LO) technologies.

Even at this stage, the shape of the airplane has firmed up. "The aerodynamics of the plane are pretty well set," says Colonel Fain.

One reason for that, say officials, may be that ATF contractors have been helping themselves to the valuable results of prior laboratory programs conducted by ASD's Wright Aeronautical Laboratories.

Among these may be the AFTI/F-111 Mission Adaptive Wing program, which for several years has been testing a variable camber wing that may well have application to the ATF. The program has proven that smooth-skin, variable-camber wings—which change shape by means of internal devices in order to sustain peak aerodynamic efficiency—have the potential to make major improvements in range and maneuverability.

In Phase II of the program, running through this summer, the Flight Dynamics Lab is at the point of testing the test-bed F-111 in a fully automated manner. Ron DeCamp, FDL's point man for the program, says it is proceeding with no slips, hitches, or surprises.

Whether one or both ATF contractors is using the new wing design is unknown. "The *concept* of the mission adaptive wing . . . is something that may or may not be in the airplane," says an ATF program official. "But clearly, both contractors are looking at the benefits."

All USAF planes—the ATF included—are benefiting from ASD's AFTI/F-16 program on experimental flight controls. It is possible that ATF will incorporate one or more of its technologies, such as digital, fly-by-wire control technologies.

ASD claims it has resolved what

had appeared to be conflicting goals—a stealthy airplane, on the one hand, and a hot one on the other. It was initially believed that the properties that led to the first canceled out the second. Now they are seen as complementary. "We think," maintains General Thurman, "that we can build a highly maneuverable, stealthy airplane. . . . We're finding we can have both. That's pretty exciting stuff."

Revolutionary Leaps

• *Avionics Prototypes.* Even more important in terms of both the cost and capability of the ATF is the promise of revolutionary leaps in avionics sophistication.

The fighter's avionics will be highly integrated within the framework of the Pave Pillar architecture developed in recent years in ASD's Avionics Laboratory. At its core is the common signal processor for such elements as the radar and communications systems. The whole affair will make extensive use of common modules to tie signals into a single, easily digested whole.

"We like to say that the avionics is *one* subsystem," says Lt. Col. Mike Borky of the ATF office, "not a collection of subsystems."

Hopes run high that the new avionics will help control ATF costs and size. For example, the system's heavy use of very-high-speed integrated circuit (VHSIC) technology means lighter weight, less bulk, and more reliability. "By using the VHSIC," says Colonel Fain, "I can—on one of those chips—have ten times the computer capacity of the F-15's total computer. On one little chip!" Less weight usually means less cost.

In addition, common modules promise to come in at prices far below those of individual "black boxes" of the type now in use.

The prototype effort is drawing heavily on work that has been under way in ASD labs for years—including the Integrated Navigation and Electronic Warfare System and the Integrated Communications, Navigation, and Identification Avionics system.

Of particular interest to ATF contractors, it seems clear, will be another program known as ICAAS—for Integrated Control and Avionics for Air Superiority—now being pursued by the Flight Dynamics Lab with assistance from the Avionics Lab. Its ambitious goal is to blend the avionics and flight controls of aircraft in ways that will provide high numerical leverage during combat.

Program manager James Kocher believes that it is possible to provide a system that permits US fighters, though outnumbered four to one, to shoot down enemy planes at a favorable rate of ten to one. The program, for which contracts were let last September, is independent of but obviously germane to ATF development.

ATF contractors are working to have their ground-based avionics prototypes ready in the 1990 time frame, early enough to deal with any problems and to provide confidence that the whole system can, in the real world, be put together.

Still, avionics is the biggest worry. "In the ATF program in general, the long pole in the tent is avionics," asserts Colonel Fain. "Avionics has been the long pole in the tent of every airplane that has ever been built."

The Competing Powerplants

In the development of the ATF's engines, too, competitive pressures are being stoked in hopes of reducing the cost and ensuring high reliability of the warplane's powerplants. Both Pratt & Whitney, with its YF119 engine, and General Electric, with the YF120, are at work on what they hope will be a winning design worth billions.

Those ATF engines will greatly surpass those of the F-15 and the F-16 in terms of their thrust-to-weight ratios measured at supersonic speed. They will enable the ATF to cruise supersonically over long distances without using afterburners. An impossibility in the current generation of fighters, this supersonic persistence will provide ATF with great range and will drastically reduce infrared signatures.

The prototype engine program is now going full blast, with both engines having run successfully, and will continue to 1991. Each contractor will build three engines, and each type will fly in both prototypes.

The engines, which may be made capable of reversing thrust, would then enhance the ATF's short-landing capability and certain maneuvering capability. Vectoring the engine's thrust would give the aircraft short-takeoff capability and greatly enhance its maneuverability in all combat regimes.

There are problems. Colonel Fain acknowledges that, to include the thrust-reversing and thrust-vectoring properties, "there is a tremendous weight penalty on that airplane. Also a cost penalty." The problem, at this writing, was being reviewed at high levels. It is certain that the nozzles will be two-dimensional, but the vectoring/reversing aspect is less so.

To try to solve the problem, engine contractors will be able to draw on the fruits of yet another ASD experimental program, the Short Takeoff and Landing (STOL) demonstrator plane. This is an F-15B plane modified, among other ways, with a P&W engine equipped with the thrust-vectoring and -reversing nozzles.

The demonstrator is moving closer to tests. First flight of the basic airplane, with standard nozzles, is set for early summer. Then, in the fall of 1988, the exotic nozzles will be mated to the test-bed aircraft and taken aloft for a tryout.

Lt. Col. Bill Neely, head of the STOL demonstrator program, notes that the nozzle is "by far the most challenging" aspect of the program. There have been fabrication problems. In addition, engineers are still struggling to reduce the weight of the engine.

"Those nozzles are the key to the whole program," says Colonel Neely. "There's a weight penalty for building a 2-D vectoring and reversing nozzle. But if you get the performance, it's worth it."

ATF contractors are getting some breaks. For one thing, it appears that some of the stringent demands on the ATF design might be eased. Such changes are expected to occur in years ahead as the Air Force gains a clearer idea of the nature of Soviet aircraft designs that will be developed for the 1990s.

At present, the program still appears on schedule. The current demonstration and validation phase will run into 1990, when prototype ATFs and their engines will undergo flight tests. The aircraft and engine

winners will then be picked to start producing operational airplanes by the mid-1990s.

Whatever the schedule, this much is clear: ATF will come in at no more than $35 million per copy and at no more than 50,000 pounds, or it may not come in at all. As Colonel Fain puts it: "The Air Force is very serious about that."

Ground-Attack Capabilities

It is not only the air-superiority aircraft that is feeling the budgetary pinch. Less apparent, but equally serious, are cost pressures affecting USAF ability to upgrade its ground-attack capabilities.

Though it has a readily evident need to develop the next-generation close air support/battlefield air interdiction aircraft to replace A-10 planes that will start retiring in the 1990s, the start of a new development program at ASD apparently is not in the cards.

Money—or the lack of it—is the problem. The Air Force in recent years was forced to shelve a late-blooming proposal for a new CAS/BAI craft, the better to protect higher-priority programs threatened by the incipient budget crunch. Now the issue has been revived in the form of an ASD study, due in March, of alternatives to replace the A-10.

If the words of senior officials at ASD are any indication, however, the proposal will fare no better this time around. "You don't want to develop a new close air support aircraft if you can do it in a cheaper way just as effectively," says General Loh. "That is the approach we're taking. There is just no money for a new start." General Loh's opinion is echoed by Air Force Under Secretary James McGovern, among other senior civilian leaders.

Inasmuch as there is agreement that the A-10 will not survive interdiction flights over the European battlefield of the 1990s, the obvious question becomes how to replace it.

The most likely answer is that the Air Force will pursue a less expensive, two-track solution based on two existing warplanes.

One is the A-7 aircraft, 336 of which are maintained in the Air National Guard inventory. At present, ASD is overseeing a modest prototyping effort aimed at upgrading the A-7 into an "A-7 Plus" with improved aerodynamics, avionics, and engines. The goals are to increase the plane's survivability and extend its useful life by twenty years.

Congress provided $35 million in 1987 to start the modification with an eye toward possible modernization of the entire A-7 fleet, if the idea pans out in tests. Approval is not certain, even though TAC has expressed a keen desire to press ahead. The main concern is to reduce the inherent vulnerability of such a single-engine aircraft.

In any event, the A-7 is not the final answer. "As I see it, the A-7 is a placeholder," says Col. Don Ruths, program manager, meaning that the updated A-7 Plus would serve to bridge to something better.

Something better, in all likelihood, will be some variant, or variants, of the ever-popular F-16 multirole aircraft.

Already, some of the burden falls on F-16Cs. Moreover, Block 40 of the F-16C production run, slated to be introduced into the force starting next December, will be even better suited for the mission. Equipment will include gear for attacking at night and in bad weather as well as digital flight controls and automatic terrain-following devices. It will be able to carry the HARM and Shrike antiradar missiles for use in defense suppression. Plans call for building 450 of these aircraft.

What Air Force officials prefer, and what ASD officials say is eminently feasible, is to transform the F-16 into a dedicated CAS/BAI aircraft—an "A-16"—with tailored systems for ground attack. The F-16's manufacturer, General Dynamics, is pressing for this.

The Case for Agile Falcon

Making the idea even more attractive, in the view of key ASD officials, is GD's blueprint for the so-called "Agile Falcon."

In essence, this is a scheme to give the F-16 a twenty-five percent larger wing, minor aerodynamic changes, and a hotter engine. In the process, the F-16 would be able to hold on to the punch it has acquired through years of modification yet be able to reclaim the agility of its earlier, lighter versions.

The point, say ASD officials, is that the Agile Falcon configuration—speedy, nimble, and muscular—might well turn out to be an ideal aircraft design to handle the A-16 type of mission and may be proposed as such.

"I think it's fair to say that those prospects are good," remarks Maj. Gen. Robert D. Eaglet, head of the F-16 Deputate at Wright-Patterson. The first potential application of the Agile Falcon that USAF reviewed was for close air support and battlefield air interdiction. ASD officials add that USAF might also want to procure Agile Falcon-type aircraft for the swing air-to-air role to complement the ATF. All such matters are the province of TAC.

What will such a plane cost to develop? GD itself estimates $600 million, while General Eaglet puts it at "several hundred million." Even so, this pales in comparison with the billions that could be spent on a new airplane-development program.

The F-15, more than a decade in service and still the best air-superiority fighter in the world, is rapidly coming to the fore in the area of ground attack as well. The most recent variant, the F-15E dual-role fighter newly in production, is slated to perform both the air-to-ground and air-to-air missions deep behind enemy lines better than any US fighter ever.

Long in the making, the F-15E is now in hand. The first version of this aircraft rolled out little more than a year ago. Now, two are undergoing testing at Edwards AFB, Calif., and, at this writing, have logged more than 100 successful flights.

Thus far, says program head Col. Mel Hiyashi, the testing has turned up only minor glitches, one of them being gremlins in the area of weapons separation at transonic speeds.

The Air Force plans to buy 392 F-15Es over the next decade. Put together for the demanding deep-interdiction mission, they are expected to be superior in many ways to the F-111s that they will replace over the next several years. The most obvious improvement is the F-15E's ability to fight its way into and out of enemy territory in the face of hostile aircraft.

The F-15E is the heavyweight of its line. This model boasts a range increase of some forty percent on missions requiring heavy payloads.

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Powered by either the P&W F100-220 or -229 engines or the GE F110-100 or -129 engines, the F-15Es will be built for carriage of conformal fuel tanks to give them the range they need for deep flights.

"It's taking advantage of an investment we've already made in the F-15 program," says one officer. "The F-15E will show up in interdiction for a long time to come—until we have to replace the F-111."

Advantages of LANTIRN

The F-15Es and the F-16s both will have an advantage in years ahead. For the ground-attack mission, they will be bootstrapped up to higher performance levels by the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system.

Against long odds, ASD has brought the LANTIRN system out of a technological thicket of not too many years ago. Consisting of extremely complex navigation and targeting pods and a head-up display in the cockpit, it makes possible the tactical pilot's dream of being able to attack targets at night and under poor weather conditions.

The navigation pod provides infrared imagery of the darkest terrain, permitting the pilot to fly securely to a target area. The targeting pod, in turn, magnifies a particular portion of the darkened landscape to make possible precision attack.

The LANTIRN navigation pod was approved in November 1986 for high-rate production. The decision was based on successful testing of the system to maximum specifications. Production of 143 of these navigation pods began in 1986 and continued through 1987. A request to produce eighty-one targeting pods was approved by senior Air Force leadership this past fall.

The F-15Es will go operational with LANTIRN about one year before it starts to appear on F-16s. But not all F-16s will sport the system. Only about 350 of the planes will have LANTIRN capability.

The Air Force, at present, projects that it will spend $3.2 billion for a full complement of 700 LANTIRN sets, plus twenty-nine sets of support equipment and a complete depot, by the mid-1990s.

Also on tap for the F-16 and the F-15 is another dramatic but cost-reducing improvement known as the Increased Performance Engine. This program, now under way at ASD, is to produce uprated Pratt & Whitney F100-220 and General Electric F110-100 powerplants for installation into these two aircraft in the early 1990s.

Plans call for improvement of thrust from about 24,000 pounds today to 29,000 pounds while staying at nearly the same weight. "There's going to be a lot of extra power," says Mike Cassidy, manager of the Pratt & Whitney version of the IPE. In use are advanced materials and new internal designs for the engines.

As with the fighter and ground-attack forces, there's no excess of money in the electronic combat area, either.

Rarely have these types of aircraft been more important or under greater pressure than they are today. "The [TAC] users," says Col. Ralph Graham, chief of electronic warfare and strike systems at ASD, "very definitely have big problems out there today. The electromagnetic spectrum that we're dealing with these days is exponentially more complex than it was just ten years ago. Out of that exponentially more complex spectrum, we've got to be able to pick out single pulses, and they're coming out at millions of pulses per second."

Two Promising Upgrades

At present, the Air Force is proposing to counter this threat with two principal programs, both of which are upgrades to existing aircraft.

The first would modernize the EF-111A Raven aircraft, the prime source of standoff jamming, close-in electronic support, and penetration escort for US warplanes. There are only forty-two such aircraft in the entire inventory.

Plans call for a three-phase approach to the upgrade. ASD is now engaged in the first phase—updating the ALQ-99E processor that is considered the heart of the system. The processor handles signals from the risk environment, processing all the information. At the same time, ASD is doing a modification to the exciter, which generates the types of waveforms that are transmitted back at the enemy.

Due in part to a gloomy budget climate, ASD decided to stretch out the three-phase project. The first phase is expected to cost $300 million, and the second two phases haven't yet been approved. Should they be, it would be close to the year 2000 before the fully upgraded weapon systems came into the inventory. That's a span of sixteen years since the program began in 1984.

The second major program is the F-4G Wild Weasel Performance Update Program, or "PUP."

The idea is to modernize the electronic guts of the Wild Weasel, whose mission it is to detect, identify, locate, and destroy hostile radar emitters by use of antiradiation missiles, standoff munitions, or conventional bombs. There are about 100 F-4Gs in the inventory.

Once again, the system has been slowly overmatched by the multiplying electronic threat it faces. "It's a proven capability, and you have to update it for the same reason as [you do] the EF-111A," says an ASD officer at work on the program.

The program is two-phased. The first phase is to upgrade the computer, the most critical part. The second phase is to go after a better receiver. Officials maintain that the $900 million project could add at least thirteen years of life to the F-4G Wild Weasels.

The Air Force is moving slowly toward the replacement of the aging F-4G, eventually, with a newer aircraft. The service is moving with great caution on this project. At the current pace, the first replacement plane might not become available until the late 1990s, if then.

No matter how severe the budget crunch in years ahead, this much is clear: There will be no letup in the service's demand for aircraft of high—even overpowering—quality. There can be little doubt that ASD knows it is on its mettle to come up with all that power but at bargain prices.

As General Thurman puts it: "We are under pressure to produce." ■

Soviet aircraft designs still bear the personal touches of real people. Too often in the West, design responsibility is a corporate abstraction, dominated by the comptrollers and the computers.

JANE'S Aerospace Survey 1988

BY JOHN W. R. TAYLOR
EDITOR IN CHIEF, *JANE'S ALL THE WORLD'S AIRCRAFT*

AMONG Soviet aircraft illustrated for the first time in the 1987–88 *Jane's* is one known to NATO as Madcap. The photograph is not the kind that wins prizes in an Aircraft Portrait of the Year competition. Taken during a visit by Mikhail Gorbachev and his wife to the Antonov design bureau (OKB) at Kiev, it shows them being led past a row of assorted An-72s and An-74s by Pyotr Balabuyev, the bureau's design chief, and his colleagues. In the background is the tail end of an An-74 like no aircraft of this type seen previously. It has a large, slightly swept-forward fin and rudder with a rotodome mounted on top. This is Madcap.

Never has there been clearer evidence to support the suggestion, made repeatedly in *Jane's*, that if the Soviets perceive a gap in their air cover, they will lose no time in plugging it with the right aircraft in adequate numbers. Britain's Royal Navy learned to its cost during the Falklands campaign in 1982 that a surface fleet without airborne early warning (AEW) cover is highly vulnerable to air attack. Availability of E-2C Hawkeye AEW aircraft to the Israeli Air Force enabled it to ambush and destroy more than ninety Arab aircraft over the Bekaa Valley in Lebanon during a brief period, without loss to its own squadrons. These were warnings not to be ignored.

The Warsaw Pact air forces have, at present, only a handful of rather ineffective Tu-126 Moss AEW aircraft, plus the first new-generation Ilyushin Mainstays, which should prove considerably better but are likely to be too expensive to distribute among Warsaw Pact allies and friendly nations that rely on Soviet combat equipment. Madcap, in the class of the Hawkeye, will be more affordable if it is able to do the job.

The Soviet mini-AWACS, known to NATO as Madcap, was first seen in the background of this photograph of Mikhail Gorbachev's visit to the Antonov OKB.

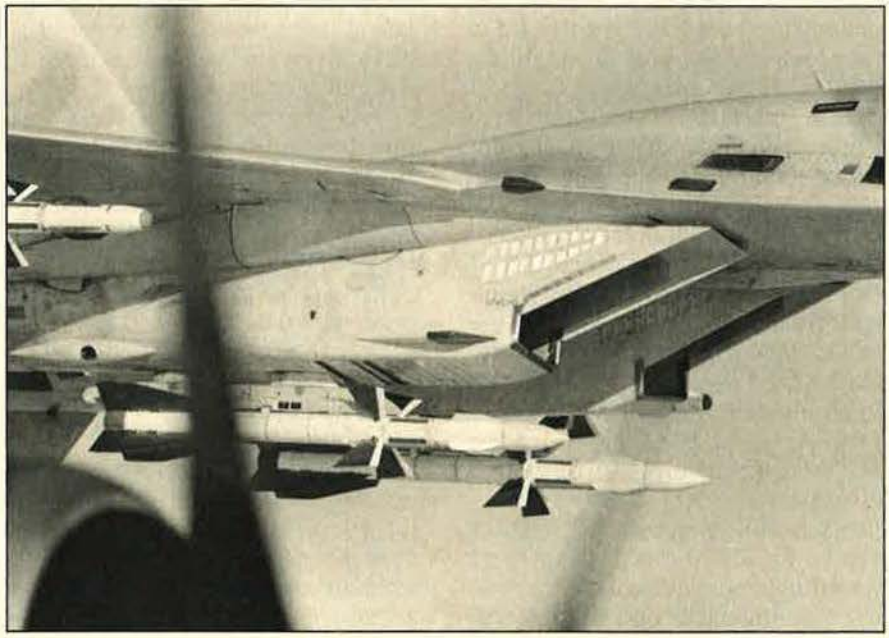
Close Encounters

NATO reporting names like Moss and Madcap often seem strange and inappropriate. The Oxford English Dictionary defines "madcap" as "a rash or impulsive person." Nobody would consider the development of this An-74 derivative to be rash, but one particular Soviet military pilot encountered by NATO airmen during recent months more than qualifies for such a description.

In the November 1987 AIR FORCE Magazine, Jeffrey Rhodes told the story of what happened when the pilot of a Sukhoi Su-27 Flanker-B from a unit based in the Kola Peninsula decided to take a close look at a P-3B Orion of the Royal Norwegian Air Force that was engaged in a wholly legitimate surveillance mission over the Barents Sea.

According to 1st Lt. Jan Salvesen, the Norwegian pilot, the Soviet fighter first approached to within two meters of his aircraft, then disappeared. Suddenly, it reappeared beneath the starboard wing of the P-3B and, accelerating clear, clipped the propeller of the outer turboprop with the tip of one of its tail fins. Both aircraft involved in the incident returned safely to their bases, and what could have ended as a nasty international controversy was averted. But the event was unique only because it resulted in actual physical impact.

On other occasions, MiG-31 Foxhounds have flown closely enough to NATO maritime aircraft to allow identification on photographs of those portions of the MiG airframe that are of riveted light alloy, compared with about eighty percent of the original welded steel airframe of the MiG-25 Foxbat that appears to have been retained in the newer fighter. Nor should it be assumed that such flying is exclusive to the Warsaw Pact. NATO fighter pilots fly close enough to Bears engaged in elint or simulated attack missions to be almost deafened by the noise of the big bombers' turboprops as they take detailed photographs of the



One of the P-3B's propellers in the foreground indicates how close Su-27 No. 36 came to the Norwegian aircraft on September 13, 1987. The Soviet fighter clipped the propeller of the outer starboard turboprop with the tip of one of its tail fins.

This Sukhoi Su-27 is shown on the runway at its base on the Kola Peninsula. Everything about the IRST-equipped Su-27 is impressive. It is generally similar to the MiG-29, and the two aircraft probably resulted from parallel development.

myriad and constantly changing external pylons, antennae, and equipment.

Photographs of the aggressive Flanker-B No. 36 taken by Lieutenant Salvesen's crew have enabled many features to be added to the descriptive text and three-view drawing in this year's *Jane's*. They include the large, door-type airbrake above the fuselage, very like that of the F-15; the patterns of still-unexplained louvers beneath and to each side of the engine air intake ducts; radar warning receiver (RWR) antennae on the ducts; the 30-mm gun installation in the starboard wing-root extension; the six AA-10 Alamo air-to-air missiles of three different models; pylons for four additional close-range AA-11 Archers; and the transparent hemispherical housing, forward of the windscreen, for the infrared search/track (IRST) sensor.

When discussing the IRST on Flanker's smaller partner, the MiG-29 Fulcrum, in last year's "Aerospace Survey," the writer expressed doubts about this fighter's ability to destroy an F-15 without revealing its presence to the victim, by avoiding radar and radio transmissions and using the IRST for both navigation and target search/track. This provoked an enlightening response from a retired USAF lieutenant colonel, who wrote:

"I don't know what kind of IRST system the MiG-29 has, but I do know what IRST systems of twenty-five years ago could do. The F-101B interceptor, which I flew for well over 1,000 hours beginning in 1964, had an IRST system that basically provided only azimuth and elevation to heat sources. [The F-102 and F-106 had similar IRST systems.] Using this system, it was not at all difficult to intercept an aircraft without alerting its crew.

"The ground control [GCI] station transmitted via data link the basic navigation and positioning information. The IRST system could detect an aircraft at several miles' range and more than fifty degrees either side of the nose. Interceptor crews could determine from the target's azimuth and rate of azimuth change their position in relation to the target's tail and the approximate target heading. By flying 2,000 or 3,000 feet above the target (or the ground, in the case of low-altitude intercepts) and noting the IRST seeker's elevation angle, they could estimate range and rate of closure accurately enough for an effective IR missile launch.

"The F-101B's IRST system also estimated range based on the increase in IR signal as range closed. Perhaps more importantly, the radar antenna slaved to the IR seeker when in IR tracking mode, which helped counter chaff and ECM. This primitive IRST system greatly enhanced interceptor capabilities and would still do so today. If US interceptors of twenty-five years ago could kill airplanes without first revealing their presence to their victims, it certainly seems logical to assume that the MiG-29 can also."

Soviet Designers

Point taken! It emphasizes that everything about the IRST-equipped Su-27 is impressive. Its configuration is generally so similar to that of the MiG-29 that it was probably conceived by a national research authority, such as the Central Aerodynamics and Hydrodynamics Institute (TsAGI), and passed to the Sukhoi and Mikoyan OKBs for parallel development, which eventually yielded aircraft in the class of USAF's F-15 Eagle and F-16 Fighting Falcon. Inevitable suggestions in the Western press that this configuration was copied from the F-15 indicate how much we still have to learn about the ability of Soviet designers even after years of meeting them on the friendliest terms and studying their products in minute detail at places like the Paris and Farnborough Air Shows.

Back in the early 1940s, when the writer worked in the Hawker Aircraft design office, responsibility for the quality of the company's fighters was taken by one man, the late Sir Sydney Camm. In more than forty years as Chief Designer responsible for the Royal Air Force's first aircraft able to fly at more than 200 mph, 300 mph, and 400 mph and ultimately for the pioneering V/STOL Harrier, he encountered structural failure in flight on only one type. That was the Typhoon, the first British production aircraft to be subjected to transonic airflow over its thick-section wings during a terminal velocity dive.

Today, in the Soviet Union, General Designer Alexei Tupolev bears similar final responsibility for aircraft that he designs for the Tupolev OKB. Pyotr Balabuyev is his counterpart at the Antonov OKB, as are Rostislav Belyakov at Mikoyan, Marat Tishchenko at Mil, S. V.

Mikheyev at Kamov, and E. A. Ivanov at Sukhoi. Their names may be less familiar than those of the earlier generation of designers after whom their bureaus are named, but they are real people—empirical designers like Camm—with whom one can discuss the aircraft for which they are responsible. Too often in the West, responsibility for a design is divided among a gaggle of vice presidents or directors, subject to the people who control company and national finances and who are prepared to leave vital structural decisions to a computer.

The Soviet system does not prevent all mistakes or ensure only trouble-free progress from drawing board to first-line use. This is apparent from the fact that it took ten years to get the Su-27 from a Flanker-A prototype to an operational Flanker-B of very different form. Nor is success achieved without the use of every available research tool. Designer Balabuyev told the writer at the 1987 Paris Air Show that development of his An-124 required building 3,500 individual subassemblies for testing in laboratories throughout the USSR and 18,000 hours of wind-tunnel testing.

In the past, shortage of test facilities led to development of design by flight testing, which is why the production versions of Soviet aircraft often looked entirely different from the prototypes. Balabuyev claimed that no significant changes had to be made when progressing from prototype to production An-124s, adding (with a mischievous smile) that *his* big four-turbofan freighter did not need a new wing and that it is approved for 8,000 operating cycles—rather more than other people's large freighters!

This is the first photograph of the new Backfire-C version of the Soviet Air Force's variable-geometry supersonic bomber. The aircraft, which has wedge air intakes and a peculiar upturned nose, is already operational in large numbers.

New Records

The An-124 arrived at the 1987 Paris Air Show with a new record to its credit. Two years earlier it had demonstrated its capability when it exceeded by fifty-three percent the C-5 Galaxy's record for maximum payload lifted to a height of 2,000 meters (6,562 feet). Such an increase was startling, even for the largest airplane currently flying in terms of wingspan, but many experts doubted that even those giant wings (about two meters or six feet, six and three-quarters inches thick at the root) could contain sufficient fuel to provide the range of 8,900 nautical miles (16,500 kilometers; 10,250 miles) claimed by the Antonov OKB.

The proof could be found this year inside the cavernous hold of the An-124 at Le Bourget. A large chart illustrated the route followed by an An-124 that had set an FAI-approved record by covering a closed circuit of 10,880.7 nautical miles (20,151 kilometers; 12,521.25 miles), without in-flight refueling or intermediate landing, around the perimeter of the Soviet Union on May 6–7, 1987. Earlier, an Su-27 Flanker had beaten four time-to-height records set by an F-15, with a final climb to 12,000 meters (39,370 feet) in 55.542 seconds.

Whatever the operational signifi-

—Photo by M. J. Hooks

The An-124 proved its range capability in May 1987 by setting a closed-circuit distance record around the perimeter of the Soviet Union of more than 12,500 miles. Earlier, the An-124 had eclipsed a C-5 Galaxy record for maximum payload to height.

sented a tremendous achievement for a small industry. Without the Lavi, Israel Aircraft Industries (IAI) might well lose its spirit, as did Avro Canada when its Arrow interceptor was canceled in 1959. Canada, which had earlier flown North America's first civil jet transport, never again attempted to take its place in the big league of aircraft-manufacturing nations.

An advanced version of the F-15 or F-16 may serve the Israeli Air Force well and give IAI work on which to keep its employees occupied, but small countries need pride as well as work. When their politicians follow controversial policies, they need to know that their security will never be impaired by delay or refusal of attrition replacements and spares from an overseas supplier whose government does not agree with them.

Like Israel, Japan has been persuaded to abandon its own projected next-generation combat aircraft, the FS-X, in favor of coproduction of an advanced F-16, possibly with larger wings and canards. India and Yugoslavia persist in efforts to develop indigenous fighters, although both will call on foreign suppliers for assistance with the more technologically advanced components.

Only the French, as always, seem determined to go it alone with the impressive Dassault-Breguet Rafale. There are suggestions that even they might be compelled to bury their intense nationalism and join the four-nation Eurofighter EFA program because of the likely price of 250 million French francs (about $44 million) for each of an initial series of 100 Rafales. This would be as unwise as it is unlikely.

Reinventing the F-16

There is nothing wrong with the EFA by the standards of the late 1980s. It might be better than the Rafale, but a new decade—still more a new century—requires new concepts. An Agile F-16, of the kind in which four other European NATO nations and Japan are interested, represents the end of the line for conventional fighter development. The EFA reinvents the F-16, with refinements. The Lavi was much the same, except that it was intended to be small enough to get

The impressive Dassault-Breguet Rafale is France's "go-it-alone" fighter for the 1990s. There are suggestions that France might join the four-nation Eurofighter EFA program because of Rafale's cost.

off the ground in a shorter distance than any of its contemporaries. The Israelis knew from experience the vulnerability of airfields to preemptive strikes.

Sweden's Saab JAS 39 Gripen, despite its conventional appearance, conforms with that nation's policy of not relying on the continued availability of easily targeted airfields. It is designed to operate from short lengths of national highway that are almost impossible to detect from the air, and its roadside refueling/rearming bays are concealed by mobile plastic trees, perfectly fitting into the environment. To watch fighters as large as the JA 37 Viggen operating from such road bases, as the writer did last April, is to understand why the neighboring and mighty Soviet Union regards

—Photo by Michael J. Gething

Viggen taxiing into a roadside refueling and rearming bay after landing on a highway strip. The successor Swedish aircraft, the JAS 39 Gripen, conforms with that nation's policy of not relying entirely on easily targeted airfields.

the Swedish Air Force with respect, in spite of Sweden's nonnuclear defense policy.

Bearing all of these things in mind, it is a worthwhile exercise to consider what kind of airpower could be created within the NATO alliance if all current aircraft were scheduled for retirement by the mid-1990s and if there were by then no commitments for their replacements.

The West would begin with the clear advantage of being able to standardize without dispensing with the diverse talents and skills of peoples on both sides of the Atlantic. Ideas and experience as well as manufacturing facilities could be shared without the need for all NATO air forces to operate precisely similar equipment.

A spearhead for the attack force already exists in the shape of the B-1B, once it has attained its full capability. It is said to present a radar signature much smaller than that of Mathias Rust's Cessna 172, which the young German used for his wholly irresponsible penetration of Soviet airspace and for landing in Red Square on last May 28. Does USAF then need to progress to Northrop's ATB (B-2) Stealth bomber?

If rumor is to be believed, the ATB will be a flying wing, relying entirely on thrust vectoring for control in flight. Such a gamble on advanced technology may reap rich rewards now that it is possible to embody advanced composites, fly-by-wire, relaxed stability, and other concepts that had not been thought of when an earlier generation of Northrop XB-35/YB-49 Flying Wing bombers was test-flown in the second half of the 1940s. However, with the apparent loss on October 14, 1987, of another of the Lockheed "RF-19" stealth aircraft that are supposed not to exist, it may be asked if America is prepared to pay too high a price for any advantages derived from extreme low observability. There is little evidence that the Soviet Union is according prime importance to stealth concepts in its latest combat aircraft, while Europe's EFA, Rafale, and other designs appear to be only modestly stealthy.

The "little and large" fighter team represented in the West by the F-16 and F-15 and in the East by the MiG-29 and Su-27 seems likely to persist. USAF has decided, uncompromisingly, on the ATF to meet its future fighter needs. If this aircraft can be made less dependent on lengthy runways, it should be every bit as effective in its time as the F-15 is now. It will be interesting to see if USAF still considers it worthwhile to fit complex and heavy two-dimensional vectoring nozzles to the afterburning turbofans of the Lockheed YF-22A and Northrop YF-23A ATF prototypes after flight trials of the F-15 STOL maneuvering technology demonstrator.

The Eurofighter EFA. Is it the F-16 reinvented with refinements? The EFA, the author says, has "nothing wrong with it by the standards of the late 1980s," but "a new century requires new concepts."

V/STOL and Agile

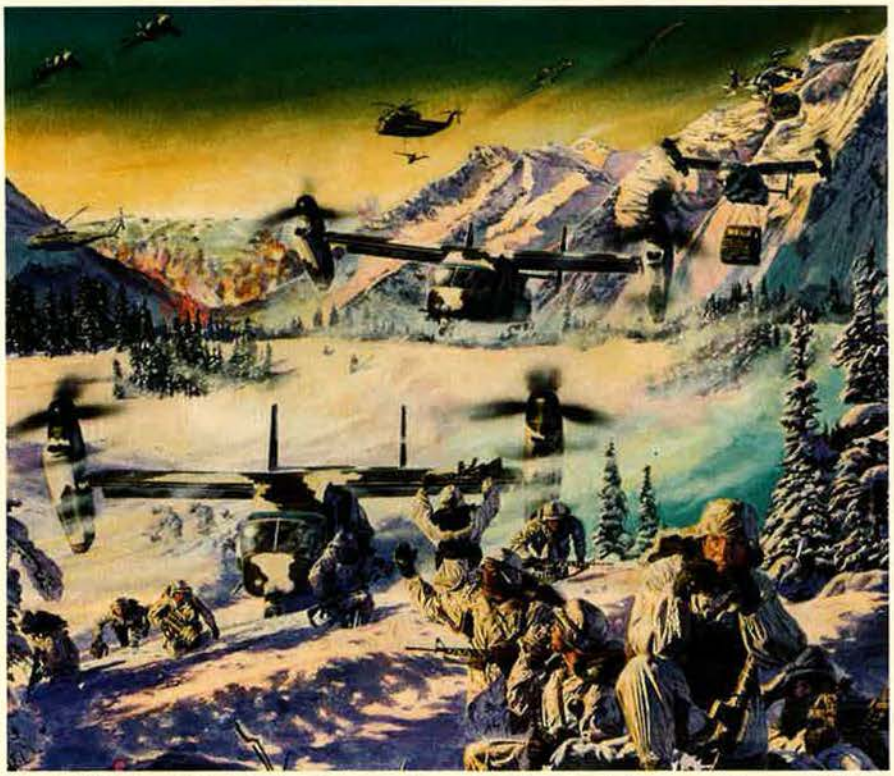
For a backup to the ATF, the Western industry should set out to produce a true fighter for the twenty-first century by drawing on its unique experience of V/STOL operations with the Harrier family and the experience it is soon to gain from the Rockwell/MBB X-31A enhanced maneuverability research aircraft.

By the use of control configured vehicle (CCV) flying surfaces and thrust vectoring under the command of a sophisticated computer, the X-31A is expected to offer the ability to perform beyond the stall and outside the conventional flight envelope without loss of control. Such superagility will increase survivability in close combat and provide an off-boresight weapon-aiming capability. In simple terms, the aircraft will be able to point in one direction to fire its weapons while moving in another direction.

Such concepts should be relatively easy to combine with Harrier-type V/STOL. That this is essential is explained by the fact that any Warsaw Pact commander who did not have a missile aligned permanently on every NATO runway or potential runway in his assigned sector of the potential battle area would deserve removal from his appointment. After the missiles had done their job, a skillful and courageous pilot might succeed in taking off between craters. His chances of picking a safe path among them when landing back at his base after a mission would be minimal.

Ability to operate from almost anywhere that a helicopter can fly has other advantages. Chatting to the press after a typically memorable display at the 1987 Paris Air Show, BAe test pilot Heinz Frick commented that his Harrier had burned only 500 liters (132 US gallons) of fuel during its entire performance. Two-engine fighters at Le Bourget had used more than that to start up, taxi out, and take off. He added that there seemed to be little point in having a stealth aircraft if everyone knew where you parked it.

Dual-role, even multirole, capability is becoming increasingly important as a means of limiting inventories and expenditure. There is no reason why any future fighter



The Bell/Boeing V-22 tilt-rotor Osprey, shown here in an artist's conception, could be "one of the most significant developments in flying history," the author suggests. First deliveries will go to the US Marine Corps.

should be unable to perform both interceptor and attack missions. Nor is there likely to be much future for aircraft as vulnerable as USAF's A-10 or the Soviet Su-25 Frogfoot over the battlefield now that missiles like Stinger can be made available by the thousand.

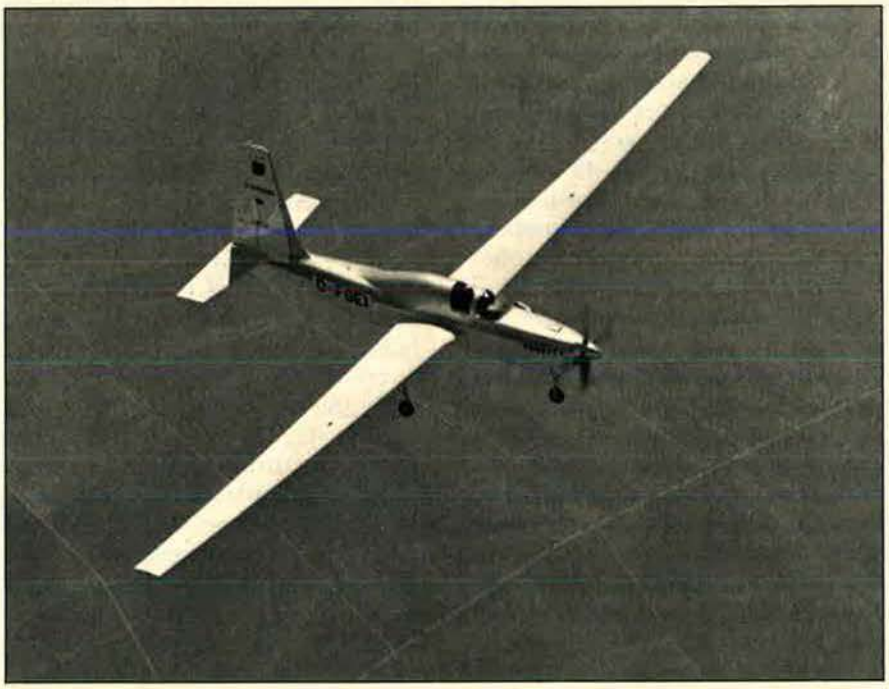
For all-important AWACS support, there is no current alternative to the E-3, but for how long will a 150-ton, slowly orbiting chunk of metal remain survivable, especially when it is of use only while emitting signals that show where it is? There are already suggestions that it would have to operate so far back from a potential combat area that its usefulness would be limited.

An answer to this need may be suggested by the Egrett-1 prototype first flown in Germany on June 24, 1987. A joint project by E-Systems and Garrett Turbine Engine Co. of the US and Burkhart Grob, a German manufacturer of composites sailplanes, it is said to conform to a Luftwaffe requirement for a high-altitude over-the-border sigint/elint aircraft. Its thirty-meter (ninety-eight feet, five inches) wingspan, inherent low observability, and long endurance on the power of a single 1,227 kW (1,645 shp) Garrett TPE331-4 turboprop would seem to point to other possibilities for the future. It is inconceivable that the AWACS mission will always require a 9.14-meter (thirty-foot) rotodome now that avionics miniaturization is becoming more impressive daily.

Tilt-Rotor Promise

To provide multirole support for the operational aircraft described so far, there is no need to look further than the tilt-rotor configuration that will begin its flight-proving when the Bell/Boeing V-22 Osprey takes off in mid-1988. This could be one of the most significant developments in flying history, combining VTOL capability with the performance of a fixed-wing turboprop aircraft. Its likely versatility has already led to stated production requirements for a total of 682 V-22s for the US Marine Corps, Navy, and Air Force for assault transport, search and rescue, and special operations missions. The US Navy has expressed an interest in up to 300 more for antisubmarine warfare, and the US Army plans to acquire 231 for transport, utility, and medevac operations—an overall total of up to 1,213 aircraft for all four US services before the prototype has been put together.

Rarely has such confidence been shown in any new program, particularly one that pioneers a completely new kind of production aircraft. Little wonder that Bell and Boeing have been encouraged to look beyond the present family of variants to derivatives of the Osprey for everything from business flying to short-haul passenger transport, air-



Built in secrecy as a joint US/Federal German program, the Egrett-1 could point to a future survivable AWACS as well as a low-observable elint/sigint aircraft.

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— Francis Bellamy, 1892

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There is no shortage of good strategic and tactical transport aircraft already available to airlift men and freight to places from which they could be ferried to forward positions by STOL transports, tilt-rotor aircraft, and helicopters. Equally, it is surprising to find USAF so entangled in problems concerning its future training program when there are plenty of excellent basic and advanced trainers waiting on the shelf.

After evaluating all alternatives, the Swiss announced their choice of a new advanced trainer in January 1987, adding that "the factors tipping the balance in favor of the Hawk were its clearly lower price [than the Alpha Jet], its strong airframe designed for a long service life, and its cockpit providing better visibility." Yet USAF shows no enthusiasm to follow the lead of the US Navy by ordering these British-designed trainers, even though it could take delivery of them in California as McDonnell Douglas T-45A Goshawks. It could then resolve its basic training requirement speedily and economically by purchasing Tucanos of the kind selected by the Royal Air Force, designed originally in Brazil but manufactured in Northern Ireland.

Aircraft of the Year

For this year, there was only one possible choice for the color frontispiece of the 1987–88 *Jane's*—the globe-girdling *Voyager*—as aircraft of the year. *Voyager's* spindly and cramped airframe was very different from the kind of airplane in which most of us would wish to fly 40,212 kilometers (24,986 miles) in nine days, without landing en route. By doing just that, it set new world absolute records for both distance in a straight line and distance in a closed circuit, but is unlikely to have pioneered any commercially viable future operation of the same kind. It simply demonstrated that modern technology in terms of structures made possible something that had previously been impracticable, and it proved the reliability of one of the new generation of engines for light aircraft. More than that, it left no doubt about the engineering talents of Burt Rutan, its designer, and the courage and endurance of its pilots, Dick Rutan and Jeana Yeager.

Nations that buy the Hawk advanced trainer can cut costs and acquire a highly effective combat aircraft by equipping also with the generally similar single-seat Hawk 200.

Equally profitless in commercial terms but almost at ultimate cost to the lives of those involved was the flight across the Atlantic by Richard Branson and Per Lindstrand in the hot-air balloon *Virgin Atlantic Flyer.* It set records, but could not be counted as a genuine transatlantic journey because it ended in the sea after only brief contact with the ground, without the crew's disembarking, in Ireland. Even so, it is an exploit that adds to the history of the oldest form of human flight.

Another exciting news item for lighter-than-air enthusiasts was the US Navy's decision to order a prototype airship for evaluation in an independent airborne early warning role. When the Sentinel 5000 flies in late 1990, it will be the largest nonrigid ever constructed. It will combine the lighter-than-air expertise of Airship Industries of the UK with the avionics leadership of Westinghouse of the USA to provide a vehicle able to remain on station for thirty days with the support of refueling and replenishing by surface craft.

It is too early to suggest that this prototype will be followed by up to fifty production Sentinels for operational use, and the postwar history of smaller nonrigids in extreme weather is not reassuring. But airship protagonists have waited a long time for this opportunity to demonstrate the practicality of airships for anything but public-relations exercises, and one can only wish success to the transatlantic partnership.

Glancing back in November 1987, when this "Survey" was written, the past year has clearly been packed with progress and promise in *almost* every sector of human flight. With the US Space Shuttle being prepared to resume business, the mighty launcher for its Soviet counterpart already tested, and the Soviet orbiter scheduled to begin its gliding trials in the atmosphere, the picture could look complete again by this time next year. ■

John W. R. Taylor is in his twenty-eighth year as Editor in Chief of the world-renowned Jane's All the World's Aircraft, *and his "Jane's Supplements" have appeared in* Air Force *Magazine since 1971. Mr. Taylor, who is a Fellow of the Royal Aeronautical Society and the Royal Historical Society, also compiles or edits the galleries of aerospace weapons for both the USAF Almanac and Soviet Aerospace Almanac issues of this magazine.*

The ground attack team from Hill went to Gunsmoke and won bragging rights for the next two years.

On Target

BY JEFFREY P. RHODES
AERONAUTICS EDITOR

THE pilots of the 169th Tactical Fighter Group arrived at Gunsmoke '87 a little early. Not a couple of weeks or even a few hours ahead of schedule, mind you, but .0736 seconds before their designated arrival time.

The 169th TFG, an Air National Guard F-16 unit from McEntire ANGB, S. C., won the arrival event. But it was a close call. The first five places were decided by less than one second.

The closeness of the times indicates just how good the crews are and just how competitive Gunsmoke, Tactical Air Command's biennial air-to-ground gunnery meet, has become.

This year's event saw eighteen of the top active-duty, Air National Guard, and Air Force Reserve F-4, A-7, A-10, and F-16 units battle it out for two weeks in October on the ranges and ramp of Nellis AFB, Nev., to decide just who indeed is the best.

The result: The 388th TFW from Hill AFB, Utah, wins bragging rights for the next two years. It can call itself overall champ—at least until the next Gunsmoke competition in 1989.

Apart from the competition trophy, there were other prizes of a more enduring type to come from Gunsmoke '87. These include better pilot proficiency, ground crew experience, pilot-crew cooperation, and operational lessons—in short, real additions to the battleworthiness of USAF forces.

Simply stated, Gunsmoke tests the ability of aircrews to put bombs on a target. The crews fly three progressively harder bombing missions (called profiles) and try to put their bombs closer to the target than competing crews.

—Staff photo by Jeffrey P. Rhodes

Preparation is half the battle at Gunsmoke. In the photo above, SSgt. Mark Parsley of the 121st Tactical Fighter Wing at Rickenbacker ANGB, Ohio, readies "his" plane for the day's action. The practice bombs (right) may look insignificant, but those are how the pilots rack up the all-important points on the range.

The competition is not just about fighter sorties, though. It is also about fighter operations. The talents of maintenance and weapons loading crews are important factors, as four healthy jets are needed for each mission, and a hung bomb loses points for the individual and the team. Maintenance and weapons loading are also counted as separate events.

Unlike competitions in past years, the emphasis at Gunsmoke '87 was short on the "show" aspects of the meet, focusing instead on the demonstration of combat capability. There was no trophy, for example, for the most garishly decorated toolbox as in years past.

For the events themselves, two important changes were made. First, an integrated combat turn (ICT) was added. This is a wartime maneuver where an aircraft is serviced and rearmed as quickly as possible so it can get back into the fight. The second change was the use of inert Mk 82 air-retarded 500-pound bombs on the Profile III, or most difficult, mission. These bombs, which use a balloon-like parachute, or "ballute," to slow their fall, are among the most prevalent munitions found at forward locations.

Bombs in the Desert

"The three profiles at Gunsmoke are the basic building blocks we use," said Lt. Col. Michael Brake, chief operations judge at the competition. "All of the skills shown here are the primary skills every fighter pilot has."

- The first mission, Profile I, is called a "box" pattern. The flight showcases the pilot's basic skills in a benign, or no threat, environment. The four fighters from each team enter the range on the crosswind leg downrange from the target, fly the downwind leg, and then bank around to the target (a tank that has seen better days) for the bomb runs.

Two passes are made at 450 knots at three different angles—at thirty degrees for dive bombing, at twenty degrees with a low-angle, low-drag release, and finally at ten degrees with a low-angle, high-drag release. Once the bombs are dropped, the planes make three strafing runs.

The strafing targets are twenty-five- by twenty-five-foot cloth panels strung between two poles. Each pilot can only fire a total of 100 rounds on the three passes at his individual target. This profile is the only mission where the crews get to use their internal 20-mm or 30-mm cannon. The older F-4Ds used by two Air National Guard units at Gunsmoke carried external gun pods.

- Profile II, or the "tactical" pattern, is a pop-up attack on a tactical target where, in combat, exposure to ground fire would have to be minimized. The planes enter the range on the downwind leg at low altitude and high speed, pop up after turning off the base leg, and roll in to bomb the target.

Two passes are made at twenty degrees, at ten degrees, and in a level run. The pop-up maneuver can begin no higher than 300 feet, and the pilot can expose his aircraft for no more than five seconds beyond a specified time or he gets zero points for the bomb. Two judges, who are rated, monitor the pop-up maneuver with binoculars and stopwatches. In both Profile I and II, twenty-five-pound BDU-33 training bombs equipped with a spotting charge are used.

- In Profile III, pilots put it all together in a realistic "navigation/attack" scenario. The pilots have to use flares, there is a simulated surface-to-air missile threat, and time on target and accuracy are paramount.

"The box pattern shows an awful lot of aircraft capability, and Profile II shows how good the pilot's skills are," says Maj. Mike Marshall, one of the pilots for the 121st Tactical Fighter Wing, an Air National Guard A-7 unit from Rickenbacker ANGB, Ohio. "But navigation/attack is the bottom line."

The pilots do not know the route the nav/attack mission will take, but they are provided with map coordinates outlining designated checkpoints. Aircraft are flown in two-ship formations at low altitude, and each team member flies two different 150-mile routes, once as lead and once as wingman.

To score maximum points, one of the two aircraft in each flight must pass between two ten- by twenty-foot orange panels on the ground that mark the turn points of the route. The turn must be made within five seconds of a predetermined time, and once on the range, the planes have only one chance to hit the target with their inert Mk 82 airs, and they must dispense flares, or again points are lost. "Smokey SAMs," or small unguided rockets, are used to simulate the ground threat.

Testing the ability of the teams to meet time on target, as in the arrival competition or in Profile III, is important for a number of reasons.

"The best time to catch an enemy not paying attention is early in the morning or late at night, so you can

Gunsmoke '87 Final Team Results

Team	Aircraft	Base	Total Points (10,000 Possible)
1. 388th TFW	F-16A	Hill AFB, Utah	9,165.5
2. 419th TFW (AFRES)	F-16A	Hill AFB, Utah	9,048
3. 401st TFW	F-16A	Torrejon AB, Spain	9,013.5
4. 121st TFW (ANG)	A-7D	Rickenbacker ANGB, Ohio	8,862
5. 31st TFW	F-16A	Homestead AFB, Fla.	8,845
6. 140th TFW (ANG)	A-7D	Buckley ANGB, Colo.	8,771
7. 8th TFW	F-16A	Kunsan AB, Korea	8,741
8. 169th TFG (ANG)	F-16A	McEntire ANGB, S. C.	8,702.5
9. 81st TFW	A-10A	RAF Bentwaters, UK	8,612.5
10. 51st TFW	A-10A	Suwon AB, Korea	8,514
11. 103d TFG (ANG)	A-10A	Bradley ANGB, Conn.	8,297.5
12. 354th TFW	A-10A	Myrtle Beach AFB, S. C.	8,259.5
13. 926th TFG (AFRES)	A-10A	NAS New Orleans, La.	8,158
14. 37th TFW	F-4E	George AFB, Calif.	8,056
15. 343d TFW	A-10A	Eielson AFB, Alaska	7,818
16. 4th TFW	F-4E	Seymour Johnson AFB, N. C.	7,722.5
17. 924th TFG (AFRES)	F-4D	Bergstrom AFB, Tex.	6,478.5
18. 187th TFG (ANG)	F-4D	Dannelly Field, Ala.	5,618

use time to your advantage," explains Colonel Brake. "If you are massing firepower for a mission and you only have a small amount of time, you have to get rolling to meet that time. Otherwise, everybody gets in everybody else's way."

Accuracy in timing is also critical for such things as making a scheduled rendezvous with a tanker.

Most units agreed that their normal training sorties were much more involved and contained more events in them than the ones flown in the competition.

"We do much more on our training missions," said Maj. Brad Sharpe, team chief for the 187th TFG, a Guard unit from Dannelly Field in Montgomery, Ala. "We do things like practice air-to-air combat and more low-level work. But, on the other hand, there is more pressure here. You want a scorable bomb in training, but here you want the bomb on the actual target."

—Staff photo by Jeffrey P. Rhodes

In addition to the competition, Gunsmoke gives the teams a chance to put their "real-world" skills to the test. The meet is very much like a deployment, and because the units can bring only forty people, there are many opportunities for cross training. This ground crew from the 81st TFW at RAF Bentwaters, UK, is prepping one of the unit's A-10s for launch.

Different Strokes, Different Folks

"We discussed ideas on how to make the competition more tactical at the Gunsmoke Planning Conference," said Maj. George R. "Jet" Jernigan, team chief for the 169th TFG. "But if you put things like air-to-air in, you take objectivity out, and since it's a competition, all you want is to get the rules and go play. There's a lot to be said for objectivity, but it's hard to keep everything the same for the different aircraft."

True. Because the planes are different, certain allowances, like approach speeds to a target and allotted times for loading bombs, have to be different for each type. Also, because of different missions, different equipment, and different technological ages of aircraft, all air-to-mud aircraft are not created equal.

"We would hope we wouldn't have to drop bombs at first if a war broke out," said Lt. Col. Tom "Buddha" Spada, team chief for the 81st TFW at RAF Bentwaters, the only A-10 unit in Europe. "We would want to go after the enemy with Maverick [missiles] and the gun. Level bombing and strafing are the only things we do here that we would do in wartime. But the bombing patterns are the basic skills everybody should know. Personally, we'd like to see more emphasis put on strafe."

This is not an unusual statement, considering the firepower and accuracy of the A-10's GAU-8/A Avenger 30-mm cannon.

Not surprisingly, none of the six F-16 units in Gunsmoke finished lower than eighth. With their highly accurate, digital weapons computer and aiming system, the scores of the F-16 units were bunched in a range of only 463 points. The lowest-scoring F-16 unit was less than 1,300 points away from a perfect score.

Also not surprisingly, the four F-4 units finished at or near the bottom of the standings. "We have 1950s and '60s analog computers and weapon systems," said the 187th TFG's Major Sharpe, who flies an F-4D. "There is a huge task saturation on the crew. We feel like we are backing up the computer the whole time rather than the other way around."

The two active-duty F-4 units both had E models fitted with the ARN-101 ("Arnie") weapons computer, and they did considerably better than their Guard counterparts, but still not as good as the F-16s or A-10s.

One factor should be kept in perspective. Although the F-4 units did poorly compared with the other aircraft types, only in the context of Gunsmoke is a bomb placed fifty feet away from the target considered a bad drop. In a war, that drop would still have "taken out," or at least damaged, most tactical targets.

The six A-10 units finished in the middle of the pack. "The INS [inertial navigation system] does give us some help, but the 'Death Dot' [computerized gunsight] gives the F-16s a real advantage. They have computers doing all of the work [aiming and calculating] for them," said Lt. Col. Craig Mays, team chief for the 926th TFG, an Air Force Reserve A-10 unit from NAS New Orleans, La. "With an 'iron sight' [one that is much more manual], there is a lot of pilot technique involved and a lot of error analysis needed. With only three seconds to make a pass and a correction, I'd rather shoot the gun."

Interestingly enough, the two Air National Guard A-7D units did very well in the competition (fourth and sixth place), despite flying airplanes that are twelve to eighteen years old.

"The equipment in the A-7 is

much like the stuff in the F-16. It does the same things, its just a generation sooner," noted the 121st TFW's Major Marshall. "It's like an old Timex. It's not quite as good as a Rolex, but it keeps good time and will be around for a while." The 121st TFW finished 303.5 points out of first place.

TOSS, TV, and Telephones

The technology the aircraft use to drop their bombs is impressive, but just as outstanding in its own way is the technology used in scoring the meet.

The arrival competition was judged with a high-speed camera that also records time in fractions of a second across the top of the picture, much like in a track meet. Both the time registering in the camera and the time hack given the teams were based on reports from the US Naval Observatory, so they were extremely accurate.

The timing reference point was the north edge of the Nellis control tower, and the lead aircraft in each group had to fly 500 feet above this point to stop the clock.

"Arrival was something we practiced on every training sortie we had for Gunsmoke," recalled the 169th TFG's Major Jernigan. "We arranged it with the tower at McEntire and picked a precise line and worked on it."

Bombs were scored on the range by means of the TV Optical Scoring System, or TOSS. All of the target tanks are placed precisely to within hundredths of a second on longitude and latitude lines. The electrically driven and computer-operated cameras then zoom in on the impact areas or "points" of the bombs to see how close they are to the known position of the target.

The backup to TOSS is the old M2 rangefinder used in artillery spotting. If that fails, then the judges go out to the target and measure physically. In the 1985 competition, the judges had to go to decimal points to determine the overall winner.

An added advantage of TOSS and one that is most appreciated by the ground crews is that the pictures used for scoring can also be beamed back to the flight line by microwave links. Thus, ground crews could actually see how "their" airplanes were doing while they dropped. It was just like watching a football game, even down to the loud cheering for hits.

Gunsmoke officials also took standard Air Force personal computers and used them to tally and distribute the scores.

"All of the commanders absolutely have to know what's going on at Gunsmoke," added Kenneth Lindsey, Jr., an operations research analyst at Hq. TAC, Langley AFB, Va. "With this system, we get almost instantaneous reporting."

The scores are tabulated on the range, and at the end of the day, the computer at the range is linked to the personal computer at the Red Flag headquarters building at Nellis, which is also the Gunsmoke headquarters.

The scores are then checked and released to the teams and also punched into an on-line computer. The Air Staff or a numbered Air Force headquarters staff, for example, could then call that computer and get the results transmitted to them. If they were patient, though, the computer at Nellis would call their computer twice a day and give that other machine the scores automatically.

With this system, spectators in Korea knew the scores the same day the mechanics in the hangars at Nellis knew them.

Because this was the first time computers were used, the T&V (tabulation and verification) staff backstopped the computers by hand. If all of this automation works, the Gunsmoke staff won't need as many people next time.

The computerization also helps planners do studies. The data (such as the circular error average, or how close the bombs were to the target) and scores will be analyzed, interpreted, and disseminated to fighter

—Staff photo by Jeffrey P. Rhodes

There was much more emphasis on wartime capability and less on the "show" aspects at this Gunsmoke. An integrated combat turn was added, and the teams had to drop Mk 82 500-pound air-retarded bombs (like the ones shown here) on one of the profiles. In this picture, SSgt. John W. Mitchell of the 140th Tactical Fighter Wing at Buckley ANGB, Colo., is readying the Mk 82s for his unit's static bomb-loading event.

The two Air National Guard units flying the LTV A-7D Corsair II did very well considering the fact that they were flying aircraft that are twelve to eighteen years old. Resplendent in its new paint scheme, this A-7 from the 121st Tactical Fighter Wing at Rickenbacker ANGB, Ohio, looks like a brand-new aircraft.

—Staff photo by Jeffrey P. Rhodes

units around the world, so those units can share in the lessons learned at the competition.

Loading Bombs, Fixing Airplanes

While the scores of the maintenance and weapons loading competition are stored in computers, the events themselves are scored by human beings writing down their observations.

"What we are looking for is the basic meeting of the tech order and the written requirements," said MSgt. Henry M. Johnson III, one of the maintenance judges at the competition. "Safety is of the utmost importance, followed by compliance with the tech data and professionalism."

There is an initial aircraft appearance inspection, which counts toward the top maintenance team trophy. Judges grade each unit's maintenance complex on how well the aircraft are prepared for the competition. The aircraft are inspected for corrosion, paint condition, cleanliness, and conformity to standard aircraft markings.

The aircraft of the 419th TFW, the Gunsmoke '85 overall champs, won the appearance inspection with a total of 485 out of a total of 500 possible points. Two individual aircraft, an A-7 from Rickenbacker and an F-4 from the 924th TFG at Bergstrom AFB, Tex., received perfect scores.

The Top Gun Top Five

Name	Aircraft	Unit	Score (2,500 Possible)
Maj. Danny Hamilton	F-16A	419th TFW (AFRES)	2,391.5
Lt. Col. Tom King	F-16A	419th TFW (AFRES)	2,338.5
Capt. Eric Best	F-16A	388th TFW	2,330.5
Maj. Tim Rush	F-16A	169th TFG (ANG)	2,315
Maj. Wayne Conroy	F-16A	419th TFW (AFRES)	2,302

Planes and maintenance troops are inspected daily. The aircraft are inspected for appearance (how well the crew chief is taking care of the plane) and performance, while the ground crew members are observed for proper maintenance practices and personal appearance.

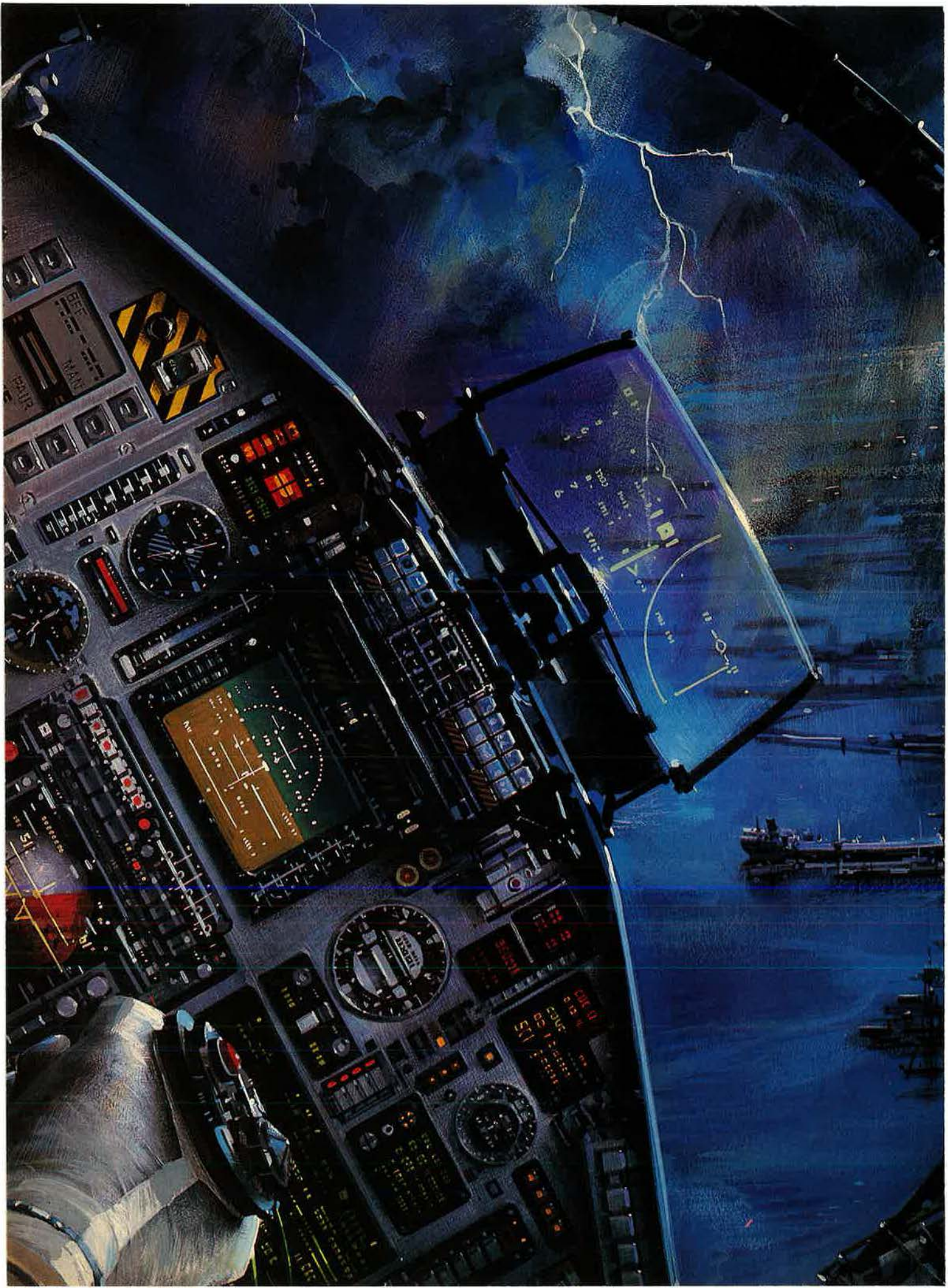
"You have to be quick, but you have to be good," said SMSgt. Ray D. Strong, another maintenance judge. "This competition could almost be related to combat. Instead of a judge looking over your shoulder, you could have people shooting at you, but you have to get those jets ready to fly."

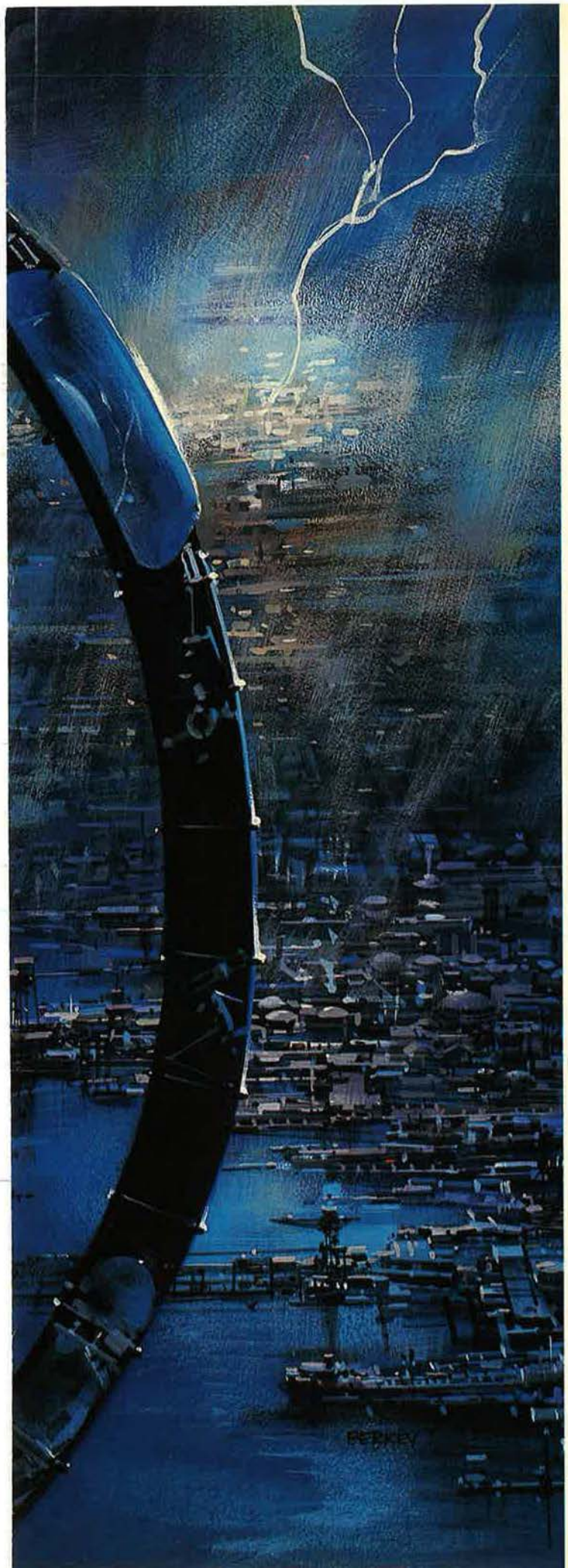
Flying a jet at 450 knots at 500 feet above the ground is considered risky, but the integrated combat turn is downright dangerous. "We do in nineteen minutes what we normally do in two and one-half hours," said TSgt. Damon L. Manning, the aircraft turnaround supervisor (ATS) for the 8th TFW out of Kunsan AB, Korea. "The ICT is the only time we [on the ground] are allowed to use fuel and ammunition together."

During the ICT, timing starts as soon as the aircraft's nose wheel crosses the aft boundary of the site. The aircraft is checked for damage (battle or otherwise), refueled, and rearmed with 100 rounds of ammunition, six inert Mk 82 airs, and flares. Engine oil and hydraulic fluid as well as liquid oxygen and the halon (a fire suppressant) bottle are also checked.

Once all of these operations are done, all of the tools and safety pins must be accounted for and the paperwork signed off before the clock is stopped. Then the judges check for any safety or mechanical violations.

There are aircraft-specific tasks





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The future. We intend to remain in the vanguard of advanced information management systems development. Regardless of the mission, environment or platform, experience is what makes Control Data's Government Systems Group one of the most reliable suppliers for systems, systems integration, hardware and software.

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that must be performed during the ICT, such as installing drag chutes in the F-4s. The A-7s have the longest allowable ICT time, and that is only thirty minutes.

Safety, however, is the primary consideration. For example, rack ejectors must be made safe, the airplane has to be chocked, and no running is allowed around the airplane. All of the load crews must be certified to perform an ICT before they are permitted to compete. "It's not a good turn if somebody gets killed or something gets broken," deadpanned Sergeant Manning.

The same crew that performs the ICT also does the static load. The static load is done at a much slower pace. It is just the normal procedure to get aircraft ready to drop bombs. This event checks the proficiency of the load crew. Even though the pace is slower than an ICT, it is far from leisurely—F-16 crews still only get thirty-one minutes to finish.

Serious Competition

The units take Gunsmoke seriously. Practices for most units began in August or September. A few units began work as early as April.

While there were no competitions for the most garishly decorated toolbox, as there had been in previous Gunsmoke competitions, that did not mean that the teams did not have to look sharp. A crisp salute before the day's mission is but one sign of the professionalism displayed by the participants.

Other Gunsmoke Trophy Winners

- *A-7 Top Gun:* Capt. Dean C. McDavid, 140th TFW, Buckley ANGB, Colo. (2,294.5 of 2,500 possible).
- *A-10 Top Gun:* Maj. Patrick J. Hoy, 51st TFW, Suwon AB, Korea (2,200 of 2,500 possible).
- *F-4 Top Guns:* Capt. Ted Brewer (pilot) and Capt. Richard Lavelle (EWO), 37th TFW, George AFB, Calif. (2,172 of 2,500 possible).
- *F-16 Top Gun:* Maj. Danny Hamilton, 419th TFW, Hill AFB, Utah (2,391.5 of 2,500 possible).
- *Arrival Competition Winner:* 169th TFG (ANG), McEntire ANGB, S. C. (+.0736 seconds).
- *Aircraft Appearance Competition Winner:* 419th TFW (AFRES), Hill AFB, Utah (485 of 500 possible).
- *Top 30° Dive Bomb:* Capt. Thomas L. Wingo, 388th TFW, Hill AFB, Utah.
- *Top 20° Low-Angle Low-Drag:* Maj. Alan G. Harding, 8th TFW, Kunsan AB, Korea.
- *Top 10° Low-Angle High-Drag:* Lt. Col. Thomas W. Pape, 121st TFW, Rickenbacker ANGB, Ohio.
- *Top 200-Foot-Level Bomb:* Maj. Alan D. Minnich (pilot) and Capt. Matthew G. Mills (EWO), 37th TFW, George AFB, Calif.
- *Top Gun Strafe:* Maj. James R. Phillips, 51st TFW, Suwon AB, Korea.
- *Top Navigation/Attack:* Capt. Luis F. Jordan, 401st TFW, Torrejon AB, Spain.

Bombing or strafing scores for the pilots of some units were monitored anywhere from ninety days to six months before team selection in order to determine the best scorers. Some teams had flyoffs between their squadrons. Once selected, though, the team members still had to complete their scheduled training requirements in addition to practicing for Gunsmoke.

Some Guard and Reserve teams had trouble getting everybody together at one time to practice because of conflicts with civilian jobs. Other units had operational readiness inspections (ORIs) to contend with in addition to getting ready.

The aircraft were monitored to determine how well they performed on the range, which ones had the most accurate equipment, and which ones were not continually down for maintenance. Once the list of available aircraft was whittled down, the pilots often chose the ones off the short list for which they had the best "feel."

"Gunsmoke enhances aviator/maintenance understanding," said the 169th TFG's Major Jernigan. "You build a long-term relationship with them to get ready for this. They better understand what I do, and I better understand what they do, because you have to work so close together while you are practicing."

The maintenance people for most Gunsmoke teams were volunteers, but some were required to come because of their job specialty. After recommendations from their supervisors, the applicant's track record and ability to do the job were evaluated and the final team picked.

Once team members were selected, there were still no guarantees. There were some automatic bids to Gunsmoke, but the 401st TFW from Torrejon AB, Spain, for instance, had to beat out the F-16s from Hahn AB, West Germany, to win the right to go to Las Vegas. The 187th TFG had to beat out ten other Guard F-4 units before they got a slot in Gunsmoke.

Special considerations were given to some Gunsmoke teams. "The range staffs in Britain bent over backwards to give us extra time and services," noted Capt. Rodney "Hawkeye" Shrader, one of the pilots for the 81st TFW.

F-16s Dominate Gunsmoke '87.

In the U.S. Air Force's recent worldwide bombing competition, the F-16 proved again that it's the world's finest tactical fighter.

Eighteen teams flying four different types of aircraft participated in the Overall Team Competition. All six F-16 teams finished in the top ten, sweeping first, second and third places. F-16 pilots also dominated the Top Gun Competition, winning the top five individual places and 17 out of the top 20.

General Dynamics congratulates all F-16 pilots and ground crews on their outstanding performance.

F-16 TEAM RESULTS AT GUNSMOKE '87	
1st Place:	388 TFW Hill AFB
2nd Place:	419 TFW Hill AFB (AFRES)
3rd Place:	401 TFW Torrejon AB, Spain
5th Place:	31 TFW Homestead AFB
7th Place:	8 TFW Kunsan AB, Korea
8th Place:	169 TFG McEntire ANGB (ANG)
Top Gun:	Maj. Danny Hamilton, 419 TFW

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LTV Aircraft Products Group
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L T V : L O O K I N G A H E A D

The "fifth-man" pilots on the teams got none of the glory, but did their share of the work anyway. These pilots had to go through all of the practices, all of the briefings and mission planning, and all of the preflight preparation just to go sit at the end of the runway in the arm/dearm area. Once his teammates took off, the fifth man would taxi back to the ramp. That fifth pilot wasn't often needed, but he had to be ready.

Other Lessons Learned

Gunsmoke not only gives pilots and ground crews a chance to display their skills. It also gives the units a chance to practice a "real-world" skill—the art of deployment.

About the only thing Nellis provides to the units is ground vehicles and bombs. Everything else—tools, ladders, parts, "Remove Before Flight" streamers, even a spare engine—has to be brought from home base with them.

"We have got to have everything here that we would possibly need," said Capt. Kirby Lindsey, maintenance chief for the 81st TFW's A-10s. "We even brought some things we wouldn't have normally brought on a deployment. We just wouldn't have the same response time here to get spare parts."

The maintenance crews at Gunsmoke are limited to forty people, and that limitation provides an opportunity for cross-utilization training. "By training people in one another's AFSCs [Air Force Specialty Codes], we are not [only] one deep in the crew chief side of the house," said CMSgt. Russ Brown, senior maintenance NCO for the 8th TFW.

All of the units had to work with Military Airlift Command in order to get their people and equipment to Nellis. Strategic Air Command's tankers also played a big role. For example, the 51st TFW and the 8th TFW both came from Korea to the US lock, stock, and barrel on KC-10s. All of the equipment and people were in the tankers, and the units' A-10s and F-16s were refueled as needed outside.

The "Brotherhood of TAC" also came through for the Gunsmoke participants. The 81st TFW was able to stop at Myrtle Beach AFB, S. C. (whose A-10s were also involved in the competition), and the 81st's aircraft were tended overnight by the base's maintenance complex. This gesture allowed the 81st TFW's maintenance folks to fly on to Davis-Monthan AFB, Ariz. (where the team practiced for Gunsmoke), rather than have to stop, unpack, fix, and repack everything at the Beach.

After the meet, several teams took care of some other business. The 81st TFW flew to Eglin AFB, Fla., to get in some live-fire practice with AGM-65B Maverick missiles. The 8th TFW flew their F-16s to Moody AFB, Ga., to swap out their aircraft. The 347th TFW at Moody is converting from F-4s to F-16s, and the "Wolfpack," as the 8th is known, turned over their old Falcons to the 347th and is upgrading to F-16C and D model aircraft.

Competition is the major thing at Gunsmoke, but not the only thing. Preparing for, involvement in, and lessons learned from Gunsmoke lead to one thing—fighter units better able to carry out their ground attack missions in wartime. ■

The Top Five Weapons Load Teams

Unit	Aircraft	Score (3,000 Possible)
51st TFW	A-10A	2,860[1]
926th TFG (AFRES)	A-10A	2,841
81st TFW	A-10A	2,794
354th TFW	A-10A	2,762.5
388th TFW	F-16A	2,705[2]

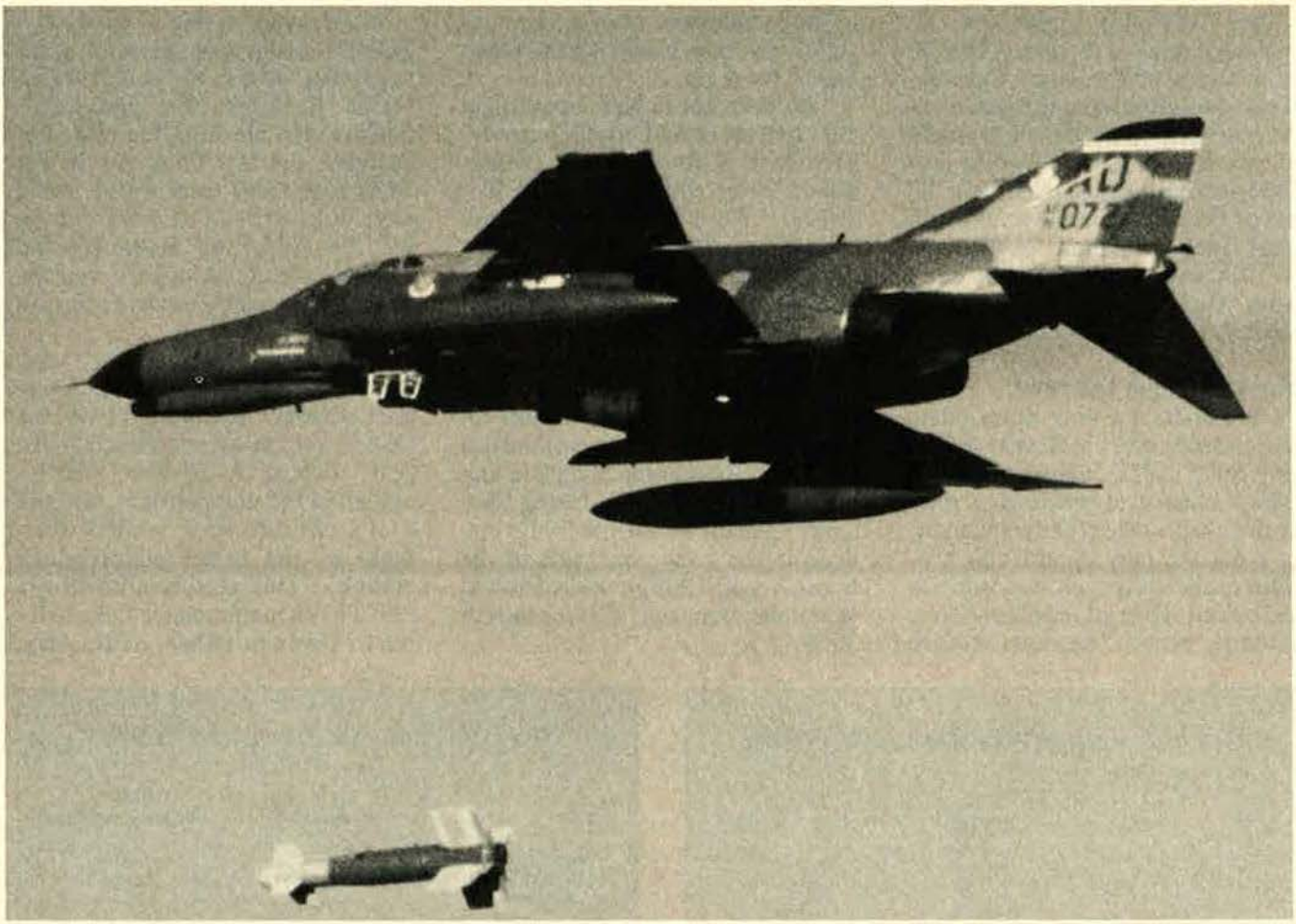
1Also Top A-10 Load Team
2Also Top F-16 Load Team
Top A-7 Load Team: 140th TFW (ANG), Buckley ANGB, Colo., 2,445 points
Top F-4 Load Team: 4th TFW, Seymour Johnson AFB, N. C., 2,661.5 points

The Top Five Maintenance Teams

Unit	Aircraft	Score (6,500 Possible)
926th TFG (AFRES)	A-10A	6,433[1]
419th TFG (AFRES)	F-16A	6,429[2]
81st TFW	A-10A	6,421
343d TFW	A-10A	6,421
103d TFG (ANG)	A-10A	6,418

1Also Top A-10 Maintenance Team
2Also Top F-16 Maintenance Team
Top A-7 Maintenance Team: 140th TFW (ANG), Buckley ANGB, Colo., 6,363 points
Top F-4 Maintenance Team: 187th TFG (ANG), Dannelly Field, Ala., 6,403 points

While all of the crews at the competition were very good, the F-16 crews scored a little higher than the rest. All of the F-16 units were bunched within a 500-point spread in the first eight places. For the second straight time, an F-16 unit, the 388th TFW from Hill AFB, Utah, was the overall winner at Gunsmoke '87.



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What's Happening at ASD

NAME AND MISSION	STATUS	CONTRACTOR
Deputy for Aeronautical Equipment (AE)		
Chemical/Biological Defense This program provides Air Force-unique chemical defense equipment, including individual and collective protection, detection, warning, and decontamination equipment/material necessary to conduct sustained combat operations in a chemical warfare environment.	RDT&E and Production	Many
Mark XV Identification Friend or Foe (IFF) System Mark XV is being developed by the Joint IFF System Program Office as a secure, antijam, high-reliability replacement for the aging Mark XII IFF. The system will be interoperable with NATO systems and will ultimately be installed on more than seventy Air Force, Army, and Navy aircraft types, all Navy ships, and several Army air defense systems. *(See also entry on p. 87.)*	Demonstration/Validation	Bendix; Texas Instruments
Modular Automatic Test Equipment (MATE) System MATE is a standardized USAF management system governing procedures architecture and hardware and software tools for acquisition of systems employing automatic test equipment (ATE). The objective is to preclude proliferation and reduce life-cycle cost of system-peculiar ATE.	Continuing	Many
Avionics Subsystems Acquisition of avionics systems common to multiple aircraft is being undertaken in this effort. Programs include standard and precision inertial navigation units, standard central air data computer, standard flight data recorder, GPS digital-to-analog converter, and fault-tolerant inertial reference assembly.	RDT&E/Production	Many
Productivity, Reliability, Availability, and Maintainability Program (PRAM) PRAM will increase combat capability while reducing current and potential USAF operations and support costs by (a) improving the reliability, maintainability, and supportability of USAF operational systems, subsystems, and equipments as well as the productivity, effectiveness, and efficiency of USAF maintenance and support organizations; (b) exploiting lower life-cycle cost alternatives in systems configurations through use of current technology components and adaptations of common equipment for multiple requirements and applications; and (c) developing new RDT&E approaches that better accommodate life-cycle cost considerations in system development, such as improved specifications, standards, and testing techniques.	Continuing	Many
Reliability and Maintainability Technology Insertion Program (RAMTIP) RAMTIP is an Air Force-wide program to develop and accelerate the transition of emerging technologies that offer the potential for improved reliability and maintainability (R&M) in fielded, in-production, and future weapon systems, subsystems, and equipments. The leverage generated by the R&M improvements will increase combat capability and supportability in support of the stated objectives of the R&M 2000 plan.	Continuing	Many
Life Support This program provides centralized management to develop life-support equipment and subsystems, such as improved aircrew helmets, flight clothing, and survival equipment, to assure maximum aircrew capability throughout all mission environments, including emergency situations.	Development/Production	Many
ACES II Ejection System ACES II is a standardized state-of-the-art ejection system for such high-performance aircraft as the A-10, F-15, F-16, and B-1B.	Production	Douglas Aircraft; Weber Aircraft
Common Support Equipment Development and production of ground-support equipment capable of supporting several types of aircraft are being undertaken. Current programs include the ground power generator program, large aircraft start system, and advanced X-ray system.	RDT&E/Production	Many
Air Base Operability This effort includes the development and production of equipment to support air base survivability and base recovery after attack. Current programs include camouflage, concealment, and deception, an aircraft ground mobility system, aircraft ground decoys, and contingency airfield lighting.	RDT&E	Many
Deputy for Airlift Trainer Systems (AF)		
AC-130U Development of twelve new side-firing gunships to replace the aging, increasingly unsupportable AC-130s currently in the USAF inventory is being undertaken. This program will emphasize substantial improvements in reliability and capability over existing AC-130 gunships. The aircraft will include a highly accurate gun suite that can be slaved to forward-looking infrared (FLIR), Low-Light-Level Television (LLLTV), or strike radar, allowing for operations at night and/or in adverse weather. ECM equipment will enhance survivability in a low- to medium-threat environment. Although the primary mission for the AC-130U is precision fire support, it will have the flexibility to perform other SOF roles, including escort, surveillance, search, rescue, and armed reconnaissance/interdiction.	Full-Scale Engineering Development	Rockwell International
MC-130H Combat Talon II This program addresses the shortfall in Combat Talon I special operations aircraft by the addition of twenty-one aircraft with integrated avionics, improved navigation accuracy, terrain-following radar, and electronic countermeasures. The aircraft will be assigned to MAC's Special Operations Forces.	Production	IBM; Lockheed-Georgia
KC-10A This effort entails the acquisition of an advanced tanker/cargo aircraft possessing both refueling and cargo mission capability to augment the existing KC-135 tanker fleet by providing rapid deployment of tactical aircraft and their support equipment and personnel to any point worldwide. Sixty aircraft are planned; fifty-six had been delivered as of August 1987. All qualification and continuation training for SAC KC-10 aircrews is at three main operating bases.	Production/Deployment and Training	Douglas Aircraft; McDonnell Douglas Training Systems, Inc.
C-20A/B The C-20 will replace the aging C-140B fleet and provide the Special Airlift Mission (SAM) fleet with intercontinental range and ability to operate from short runways. Two Gulfstream G-III aircraft are also being procured and modified to Navy requirements under the Air Force C-20 contract. Acquisition of these aircraft, which are designated C-20D, was directed by Congress to fulfill the Navy requirement for a low-density transport aircraft for government officials, cargo, and medevac transport capability.	Production/Deployment	Gulfstream Aerospace

NAME AND MISSION	STATUS	CONTRACTOR
C-5B The acquisition of fifty C-5B aircraft will partially fulfill the immediate need for additional intertheater airlift capability to support national strategy goals and the mobility requirements of a modern-day Army. Delivery and acceptance by USAF of the first C-5B occurred in December 1985, and sixteen aircraft had been delivered as of August 1987. This aircraft is basically a C-5A with configuration changes intended to improve reliability. The C-5B will provide airlift of substantial payloads, including outsize cargo, over intercontinental ranges.	Production/Deployment	Lockheed-Georgia
Air Force One Replacement of the two aging VC-137 Presidential airlift aircraft with two new, wide-body, off-the-shelf, FAA-certified aircraft will greatly enhance the ability to support the worldwide travel requirements of the President of the United States. The basic 747-200B aircraft will be modified to an executive configuration to include a state-of-the-art mission communications system.	Production/Modification	Boeing Military Airplane Co. (BMAC)
C-29A Six commercially available, FAA-certified business-jet-type aircraft equipped with a state-of-the-art flight-inspection system are being acquired. The flight-inspection mission provides worldwide, all-weather, certified instrument approaches, traffic-control and landing-system equipment, and air-ground communications during contingency or wartime operations. The six C-29As will replace the aging Lockheed C-140As and Rockwell T-39As currently accomplishing the mission. The C-29A provides a fuel-efficient, low-maintenance, longer-range system.	Source Selection	To be determined
KC-135 Improved Aerial Refueling System (IARS) This program will develop and test new and improved aerial refueling systems and subsystems to improve on the 1950s technology of the current KC-135 Air Refueling (AR) system.	Development	In selection
Joint Vertical Lift Airlift (JVX) (CV-22A) The CV-22 program will fill the need for an aircraft with increased Special Operations Forces (SOF) capabilities by using the tilt-rotor design demonstrated on the Bell XV-15 and other advanced technologies. The CV-22 will have the maneuverability and lift capability of a helicopter and speed of a fixed-wing aircraft. The CV-22 is intended to complement the SOF HH-53 and MC-130 aircraft.	Full-Scale Engineering Development	Bell-Boeing
Airdrop Program The development, test, and production of new, improved airdrop systems in coordination with the Joint Technical Airdrop Group are being carried out in this program. Activities include development and production of the C-130/C-141 Centerline Vertical Restraint System to enhance container delivery system airdrop capability, development of a gate-release device for the C-130/C-141, and conduct of system studies of improved airdrop concepts for existing and future aircraft.	Development/Production	Ver-Val Enterprises
C-130H Domestic and Foreign Military Sales The C-130H Domestic and Foreign Military Sales Program provides cargo, search and rescue, and tanker aircraft for both US domestic and foreign users.	Production/Deployment	Lockheed-Georgia
ANG C-21A This program replaces the CT-39 aircraft, acquired in the late 1950s and early 1960s, with four off-the-shelf business-type jet aircraft for the Air National Guard (ANG). This fleet of four aircraft supplements the seventy-nine C-21As operated by MAC.	Acquisition	Gates Learjet
C-22B Air National Guard Support Aircraft This program oversees the acquisition, modification, and refurbishment of four commercial Boeing 727 aircraft to be operated by the Air National Guard for use as operational support airlift aircraft. Two aircraft will be further modified to accommodate an additional 1,100 gallons in fuel capacity and landing gear rated for 170,000 pounds gross landing weight.	Modification	Boeing
C-27 The C-27 program will fill the requirement for up to eighteen new, commercially available aircraft to provide rapid-response intratheater airlift of troops and cargo. The aircraft will have the capability to operate from remote-location airfields with short, unimproved landing surfaces. This system will support operations in low-intensity conflicts.	RFP Preparation	To be determined
ANGOSTA The Air National Guard Operational Support Turboprop Aircraft (ANGOSTA) acquisition of six new, FAA-certified, current-production twin-engine turboprop aircraft is required in order to replace the current Air National Guard C-131 fleet. The ANGOSTA aircraft will be reconfigurable to fulfill multiple missions, to include passenger transport, cargo transport, and medical evacuation. The aircraft will be individually based within the CONUS and logistically supported by a contract team.	Preproduction	To be determined
Deputy for Avionics Control (AX)		
Cost-Effective Avionics AX is a joint ASD/AFALC organization. It oversees efforts to (a) ensure cost-effective, supportable, mission-capable avionics; (b) reduce life-cycle costs; (c) increase availability and reliability and improve effectiveness by assisting in the insertion of promising technologies into existing and future avionics; (d) reduce and control unnecessary proliferation of avionics by developing and advocating the use of architectural and interface standards, such as MIL-STD-1553, -1589, -1750, -1760, and -1815; (e) lead in the definition of emerging integrated modular avionics specifications and standards for USAF-wide applications; and (f) promote rational standardization by using USAF-designated standard and AFSC/AFLC-preferred avionics subsystems in new and modified aircraft avionics baselines.	Continuing	Systems and Applied Sciences Corp.; Proprietary Software Services; ARINC Research Corp.; The Analytic Sciences Corp.; Oneida Resources, Inc.
Deputy for B-1B (B-1)		
Deputy for B-1B One of the largest ASD programs, with a baselined budget of $20.5 billion (in FY '81 dollars), the B-1B program provides Strategic Air Command with a new, highly survivable, long-range penetrating heavy bomber. Modernization of this vital leg of the strategic triad allows aging B-52s to move to full-time cruise-missile standoff roles. The first production B-1B entered testing at Edwards AFB, Calif., in October 1984. First delivery to SAC at Dyess AFB, Tex., was on July 2, 1985, with Initial Operational Capability occurring on September 30, 1986. The full complement of 100 B-1Bs will be delivered in early 1988.	Development Production/Deployment	Rockwell International; Boeing Military Airplane Co.; Eaton Corp., AIL Div.; General Electric

NAME AND MISSION	STATUS	CONTRACTOR
Deputy for Engineering (EN)		
Avionics Integrity Program (AVIP) The Avionics Integrity Program (AVIP) is an ASD initiative to improve the readiness and life characteristics of avionic products. AVIP is patterned after the Aircraft and Engine Structural Integrity Program (ASIP-ENSIP). Two documents have been developed by AVIP and released for use in avionics development: A standard (MIL-STD-1796) for a management program and a product-specific MIL-PRIME process specification (MIL-A-87244). Ultimately, the suppliers and integrators of avionics will be required to prepare an avionics integrity master plan (AIMP) that will be submitted as a separate document with any proposal for avionics development. The AIMP will be evaluated as a major source-selection criterion and be incorporated into the development contract.	Ongoing	None
Mechanical Subsystems and Equipment Integrity Program (MECSIP) This program adapts the integrity process to airborne and ground-based subsystems and equipment. The integrity process is an organized and disciplined approach to the design, development, qualification, manufacture, and in-service management of a specific product to achieve and sustain safety, reliability (including durability), maintainability, and supportability. Building on the success of the Aircraft and Engine Structural Integrity Programs (ASIP-ENSIP), a corollary process has been developed that is applicable to a wide class of mechanical equipment, such as hydraulic, pneumatic, and secondary power systems and landing gear, wheels and brakes, seats, ejection systems, ground support, and training equipment. MECSIP consists of a series of time-phased actions, procedures, analyses, and tests that, when judiciously applied, will ensure more reliable, affordable, and supportable equipment and subsystems and thereby contribute to the enhancement of total system mission effectiveness and operational suitability. The draft MIL-PRIME and MIL-STD documents are in final review, with publication anticipated in the fall of 1987.	Ongoing	None
Software Development Integrity Program (SDIP) The Software Development Integrity Program (SDIP) is an ASD initiative to improve the operational capability and life-cycle supportability of aeronautical weapon system software. SDIP is part of the set of ASD integrity programs patterned after the Aircraft and Engine Structural Integrity Programs (ASIP-ENSIP). SDIP requires a software acquisition/development methodology be defined and followed on contract to incorporate software engineering discipline into the system development process. Four documents are being prepared to define the SDIP. Three of these—the standard, handbook, and MIL-PRIME specifications—exist in draft form. The Software Development Capability/Capacity Review Pamphlet was published as ASDP 800-5 on September 10, 1987. Developers will be preparing a Software Development Integrity Master Plan (SDIMP) to define the process for implementing the integrity requirements. This plan will be submitted as part of the bidder's proposal. The SDIMP will be a major factor in the source-selection criteria. Key elements of the plan will be put on contract through a System Integrity Master Schedule.	Ongoing	None
Senior Engineering Technology Assessment Review (SENTAR) A SENTAR panel is functioning as the ASD focal point for review and assessment of the AFSC laboratories' advanced technology development (6.3) programs. For both ongoing efforts and proposed new starts, the panel assesses the objectives of the programs, the technical approach, and possible payoff of technology development programs that have the potential for transition to ASD weapon system development and acquisition programs. Technology transition plans are developed by the laboratory and agreed to by the SENTAR panel and the ultimate technology user in order to establish specific technology transition criteria.	Ongoing	None
Product Assurance A strong commitment to excellence is reflected in ASD's implementation of Air Force-wide R&M 2000 initiatives. The concept of "product assurance" implies a balanced attention to quality, reliability, supportability, producibility, and user value in design of new aeronautical systems. A Product Assurance Engineering Division within the Directorate of Systems Engineering consolidates the specialists from these disciplines. A collocated Lead Product Assurance Engineer assists each SPO's Chief Systems Engineer in ensuring due consideration of the long-term needs of factory and operational "customers" in the requirements-setting, source-selection, and design-review processes. Additionally, a "corporate" product assurance office provides overall policy guidance, promotes teamwork across organizational lines, chairs independent assessments of specific programs, and administers the system of program health indicators installed to provide in-depth product assurance visibility to the ASD Commander.	Ongoing	None
MIL-PRIME Program The MIL-PRIME program is an initiative to streamline the acquisition process by improving the quality of the specifications and standards put on contract. The goal of the program is to eliminate overspecification through the process of tailoring documents to the specific weapon system's needs. This is done by imposing requirements in terms of performance parameters and limiting the contractual application of documents referenced in specifications and standards. Each MIL-PRIME document consists of a specification or standard that can be tailored to the needs of a specific acquisition situation. An associated handbook contains rationale, guidance, and lessons learned for each requirement and its associated verification. By the end of 1987, fifty-four MIL-PRIME development documents were available for program use.	Ongoing	None
Generic Integrated Maintenance and Diagnostics (GIMADS) The purpose of the GIMADS program is to integrate all aspects of an air vehicle's diagnostics capability. The objective is efficient and effective maintenance to reduce cost and increase air vehicle availability. The program is developing a systems engineering process (embodied in written guidance for AFSC program offices and industry) to integrate diagnostics with other aspects of the air vehicle design and to mature this diagnostics capability as the air vehicle is developed, tested, and deployed. To provide the technical basis for the many cost-benefit decisions required, GIMADS will investigate new ways of applying emerging technologies to solve many existing and anticipated diagnostic problems.	Ongoing	Team Leader: General Dynamics/Fort Worth; Subcontractors: Bell Helicopter, General Dynamics/Electronic Div., General Electric Co., Giordano Assoc., Hughes Aircraft Co., Marcon Industries, Inc., Rockwell Int'l, TRW
Value Engineering This proven program seeks to reduce both acquisition and logistic support costs while maintaining or improving performance. Contractors can share in savings when VE proposals are approved and implemented. This objective is accomplished by using conventional DoD value-engineering incentive techniques coupled with special emphasis on innovative approaches to insert the latest state-of-the-art technology into late full-scale development as well as current production systems. Recent changes in DoD and USAF regulations now make application of value engineering mandatory on major systems entering first or second production options. Program managers are budgeting one-half of one percent of total procurement authority to fund high-payoff proposals. Over the past four years, ASD has validated in excess of $600 million in VE savings.	Ongoing	None

NAME AND MISSION	STATUS	CONTRACTOR
Air Transportability Engineering The Air Transportability Test Loading Agency (ATTLA) is the Air Force focal point for all requests for air transportability engineering analyses and aircraft test loading as part of the DoD Engineering for Transportability Program. ATTLA provides criteria and guidance to program offices on air transportability matters during all stages of system acquisition and development of equipment. It also analyzes technical data to determine suitability for airlift certification.	Ongoing	None
Crew Station Design Facility (CSDF) This facility uses full-mission, real-time simulation as a human engineering tool to conduct man-in-the-loop studies to assess crew work load and evaluate cockpit layout and instrumentation. These efforts are in support of ASD program office development efforts. The facility currently consists of an F-16C, an F-111, and a C-135 simulator, each with its associated visual and motion systems. A small cadre of government employees designs and conducts the studies, while contractor personnel operate, maintain, program, and modify the simulators.	Ongoing	Singer-Link
Aircraft Structural Integrity Program (ASIP) This program ties together all the aspects of design (airframe strength, rigidity, damage tolerance, durability, and service life), analysis, test, and operational use to confidently establish the aircraft's service life capability. MIL-A-87221 is entering its first major scheduled review and update cycle. The primary focus of this effort will be to expand and improve the "lessons learned" sections of the handbook. Expanded guidance for the strength, durability, and damage-tolerance qualification of advanced composite structures will also be included. MIL-STD-1530 will also be updated to enhance coverage of critical structural parts, in particular critical fasteners.	Ongoing	None
Engine Structural Integrity Program (ENSIP) This program provides an organized and disciplined approach to the structural design, analysis, development, production, and life management of gas turbine engines, thereby assuring engine structural safety, increased service readiness, and reduced life-cycle costs. An update to the military standard (MIL-STD-1783) governing the structural integrity requirements and programs for gas turbine engines is currently under way. Also, the Air Force regulation that addresses ASIP, AFR 80-13, has been revised to include ENSIP. The review of the regulation by AFSC's policy division is complete. A revised version reflecting AFSC's comments and incorporating similar requirements for other integrity programs (*i.e.*, MECSIP, SDIP, and AVIP) will be sent out for final comments later this year. The requirements of ENSIP are being implemented in all ongoing Air Force engine development programs.	Ongoing	None
R&M 2000 With the recent emphasis on better weapon system reliability and maintainability, the ASD Commander challenged all of ASD to determine the best approach to achieve this much-needed improvement. The ASD team, led by the Deputy for Engineering and augmented with R&M experts from Hq. USAF, AFSC, and AFALC, studied the present situation and made recommendations to meet the goals of R&M 2000. R&M techniques utilized by the Army, Navy, and industry (both DoD and non-DoD contractors) were studied, and the appropriate adjustments were recommended to the current process—many of which were already under way. In general, the team recommended to press on with the integrity programs (ASIP, AVIP, ENSIP, MECSIP, and SDIP), to integrate R&M practices into the design process, and to institutionalize product assurance into the decision process (R&M must be ranked equal to cost, schedule, and performance during source selections and development milestone reviews/decisions). Some of the specific technical recommendations included an increased understanding of the users' environment and a strengthening of the procedures to translate the users' R&M needs into engineering requirements that can be verified prior to a program production decision. The team also endorsed the integration of Logistic Support Analysis (LSA) in the design process and reemphasized producibility as a design element. In addition, they recommend that USAF refrain from specifying "detailed design constraints" in order to provide design flexibility and shift responsibility back to the contractor. The task for EN now is to execute the plans that have been devised to meet these goals and to obtain weapon systems with more warfighting capability for the user.	Ongoing	None
Developmental Supportability Engineering (DSE) The Deputy for Engineering has made a strong commitment with the Deputy for Acquisition Logistics in implementation of enhanced ASD Logistic Support Analysis process procedures. LSA is the system engineering and design process that is selectively tailored to each system acquisition program to help ensure that system supportability and integrated logistic support objectives are met. DSE is the application of systems engineering techniques and design trade analyses during all phases of the system acquisition process in pursuit of these objectives. The thrust of the ASD initiative integrates the technical tasks of LSA into the system engineering process while retaining the management oversight within the logistics community. ASD's Directorate of Systems Engineering is responsible for application of "upfront" developmental supportability engineering on a coequal basis with other system performance requirements. The enhanced process will design in supportability from the earliest phases of systems acquisition. The plan to formalize the concept has received strong endorsement and approval by AFALC and AFSC. The MIL-STD-1388 logistic management functions will be clearly identified in Integrated Logistic Support Plans, and Developmental Supportability Engineering will be integrated into the ASD MIL-PRIME specifications and handbooks. Implementation on new ASD programs is in process.	Ongoing	None
Functional Review of Military Documents ASD manages approximately 7,700 military specifications, standards, and handbooks as either the preparing activity (PA), the Air Force spokesperson (Custodian), or a technical contributor (Reviewer). These military documents support our DoD acquisition programs. A concentrated effort has been initiated to improve the quality of these documents. Each ASD-managed document is being assessed by the responsible engineering office (REO) as to its need, applicability, and currentness. Only documents essential to ASD acquisitions are being retained; updates for those retained are being immediately scheduled. Other documents are being transferred if required for logistics support or canceled if obsolete. Due to the volume of documents, the functional review is divided into three phases: Phase I, PA documents; Phase II, Custodian documents; and Phase III, Reviewer documents. Phase I is ninety-eight percent complete, Phase II is thirty-three percent complete, and Phase III was to start approximately September 15, 1987. New documents are assessed when received.	Ongoing	None
Deputy for Reconnaissance/Strike and Electronic Warfare (RW)		
Low-Altitude Navigation and Targeting Infrared for Night System (LANTIRN) LANTIRN is an integrated system consisting of navigation pod, targeting pod, and head-up display, which displays forward-looking infrared (FLIR) video. It provides the tactical air forces with the capability to conduct close air support and interdiction missions at night and under adverse weather conditions.	Production	Martin Marietta

NAME AND MISSION	STATUS	CONTRACTOR
Precision Location Strike System (PLSS) PLSS accurately locates and classifies enemy radar emitters and can provide near real-time target location to tactical attack units for precision attacks against all types of enemy air defense systems.	Prototype	Lockheed Missiles & Space Co.
EF-111A Upgrade Program This program focuses on updating the ALQ-99E processing and jamming subsystem of the EF-111A Tactical Jamming System (TJS) to counter radar threats through the 1990s. The primary role of the EF-111A TJS is to screen attack aircraft from radars supporting hostile defensive weapon systems.	Full-Scale Development	Eaton Corp., AIL Div.
Tactical Air Reconnaissance System (TARS) TARS will develop and acquire electro-optical (EO) and infrared sensors, digital recorders, and a reconnaissance management system and data link for use on RF-4C aircraft, unmanned reconnaissance vehicles, and pods for fighter aircraft.	Full-Scale Development	In source selection
Tactical Countermeasures Dispenser Upgrade (AN/ALE-47) The ALE-47 is a joint USAF/Navy program that will provide a dispensing system capable of interfacing with radar warning receivers, tail warning systems, and other aircraft systems to provide threat-adaptive programming for expendables in multiple threat environments.	Full-Scale Development	None
Tactical Reconnaissance System (TRS) Ground Segment The Tactical Reconnaissance System technical concept features an integrated tactical reconnaissance sensor suite (on a TR-1 air vehicle) and a data link, both up and down, for communication of information and data. It prepares exploitation reports in near real time and rapidly disseminates these reports via common user and dedicated communications circuits.	Operational	Ford Aerospace
TRS Side-Looking Airborne Radar/Advanced Synthetic Aperture Radar System (ASARS) ASARS-2 is a high-resolution radar-imaging system designed to be flown on the TR-1 aircraft. It produces high-quality imagery at long standoff ranges in strip-mapping and spotlight modes. Real-time image processing and exploitation is accomplished on the ground through the ASARS-deployable processing station (ADPS) and ASARS exploitation cell (AEC) of the TRS ground station.	Production	Hughes Aircraft Corp.
Electronic Warfare Area Reprogramming Capability (EW ARC) The EW ARC is a highly interactive man/computer operation that provides Air Force users the ability to produce validated EW system change packages (mission data) when required. Its purpose is to enable the users to quickly and accurately modify EW systems mission data (threat tables, priorities, setting, etc.) in response to a change in the threat environments.	Conceptual	None
F-4G Wild Weasel Performance Update Program (PUP) The purpose of the PUP is to maintain the defense suppression capability of the F-4G Wild Weasel into the 1990s through a new signal processor, receiver group, and an increase in frequency coverage.	Full-Scale Development	McDonnell Douglas
Infrared Search and Track System (IRS&T) IRS&T is designed to detect and track distant airborne threats based on thermal signatures. It can be used either independently or as a complement to the radar.	Demonstration & Flight Test	General Electric
TR-1 Aircraft The TR-1 is a high-altitude, subsonic, long-endurance aircraft based on the current (1979) U-2 configuration. It is able to perform in any weather under all light conditions and can provide continuous near real-time (NRT) battlefield standoff threat assessment and penetration surveillance and analyses.	Production	Lockheed
Have Charcoal/Interactive Defensive Avionics System (DAS) The purpose of this program is to develop improved infrared countermeasure jammers to protect high-value Air Force aircraft from selected infrared-seeking missiles.	Full-Scale Development	None
USAF Electronic Warfare Evaluation Simulator This facility upgrade will provide the capability in an indoor laboratory environment to simulate numerous radar threats.	Upgrade	General Dynamics
Integrated Electronic Warfare System (INEWS) INEWS is a joint Air Force/Navy program to design, develop, and deploy a next-generation electronic warfare system on combat aircraft of the 1990s. In the current phase, the program will demonstrate maturing technologies that can provide both alert and response functions across the full electromagnetic spectrum. INEWS will be integrated with the avionic subsystems of the Air Force's Advanced Tactical Fighter (ATF) and the Navy's Advanced Tactical Aircraft (ATA).	Demonstration/Validation	TRW/Westinghouse; Sanders/GE
MJU-10/B IR Flare The MJU-10/B flare provides IR antimissile diversionary protection for the F-15 aircraft.	Production	Kilgore Corp.; Tracor
Damage Information Recording System (DIRS) DIRS is a high-resolution, airborne/ground-based sensor system capable of locating, identifying, and classifying airfield damage. It is also able to identify a minimum operating strip (MOS) following a conventional attack.	Full-Scale Development	None
Airborne Self-Protection Jammer (ASPJ) (ALQ-165) F-16 Integration ASPJ is a joint Navy/Air Force program to develop an internal electronic countermeasures capability for self-protection of tactical aircraft. The system enhances mission success and aircraft survivability when confronted by modern, diversified, radar-controlled weapon systems.	Full-Scale Development	ITT/Westinghouse
Deputy for Tactical Systems (TA)		
F-15E Dual-Role Fighter This two-seat version of the F-15 will provide capability for long-range, night, and adverse-weather delivery of air-to-ground munitions as well as enhanced air-to-air ability. Primary improvements include advanced cockpit technology, LANTIRN, ring-laser gyro inertial navigation system, digital light control system, conformal fuel tanks, a nine-G airframe, and a configured engine bay capable of accepting either the General Electric F110-GE-100 or Pratt & Whitney F100-PW-220 engine.	Development/Production	McDonnell Douglas Aircraft
F-15 Multi-Staged Improvement Program (MSIP) MSIP provides improvements to the F-15A/B/C/D fleet that will ensure F-15 air superiority into the 1990s. Improvements include a Programmable Armament Control Set (PACS), improved (speed, memory, supportability) central computer, MIL-STD-1760 incorporation, improved (speed, memory, ECCM, supportability) radar, and an expanded Tactical Electronic Warfare System (TEWS).	Production/Retrofit	McDonnell Douglas Aircraft

NAME AND MISSION	STATUS	CONTRACTOR
Tactical Electronic Warfare System (TEWS) Intermediate Support System (TISS) TISS will provide the user with a test system capable of supporting the new state-of-the-art TEWS suite (ALR-56C and ALQ-135 bands, 1.5 and 3). TISS will also support the existing TEWS and contains growth provisions for future TEWS updates. Stimulus/measurement capability through 40 GHz and digital testing up to 20 MHz are two examples of the extended capabilities of this full-MATE (Modular Automatic Test Equipment) system.	Development/Production	McDonnell Douglas Aircraft
Mobile Electronic Test Set (METS) METS is an initiative to enhance operational supportability and reduce the acquisition cost of the F-15E Avionic Intermediate Shop (AIS) by adaptation and modification of existing state-of-the-art test equipment currently used to support AV-8B avionics. State-of-the-art features include bubble memory, plasma display, touch panel control, and microcomputer-based architecture that allow the METS and its ancillary equipment to test twenty-two line-replaceable units (LRUs) and to be packaged into portable cases (two-person lift). This and other logistics features reduces the airlift requirements by two C-141Bs for the F-15E during deployments.	Development/Production	McDonnell Douglas Aircraft
Memory/Radar Module Test Station (MMTS/RMTS) MMTS/RMTS are two new depot test systems that will provide Air Force Logistics Command a test system capable of supporting the new state-of-the-art radar (APG-70) and new F-15E avionics systems (computer, digital displays, and avionics interface units). Both of these advanced systems contain growth provisions (hardware and software) for future avionics improvements.	Development/Production	McDonnell Douglas Aircraft
F-15 Avionics Intermediate Shop (AIS) Antenna Test Station (ATS) Improvements The present ATS is divided into two separate channels (Channels A and B), which are capable of being operated independently. The Integrated ATS (IATS) combines the stations and significantly improves the test capabilities and station maintenance, enhances mobility, and reduces the covered area required for remote operation. It supports the current F-15 APG-63 radar and the new APG-70 radar. It provides a weight reduction of 3,000 pounds, a volume reduction of 175 cubic feet, and a footprint reduction of thirty square feet.	Development/Production	McDonnell Douglas Aircraft
Air Force Infrared (IR) Maverick (AGM-65D) The AGM-65D is an air-to-ground, launch-and-leave missile that is rocket-propelled and precision-guided by an infrared sensor. This day-and-night, limited-adverse-weather munition is designed primarily to counter armored fighting vehicles and fortified structures.	Procurement	Hughes Aircraft Co.; Raytheon
Air Force Infrared (IR) Maverick (AGM-65G) The AGM-65G incorporates the existing infrared guidance control section and large Maverick warhead with unique tracking algorithms and a pneumatic actuation system to defeat a wider variety of tactical targets while retaining maximum commonality with the AGM-65D.	Procurement	Hughes Aircraft Co.; Raytheon
Navy Infrared (IR) Maverick (AGM-65F) AGM-65F is similar to the Air Force AGM-65D, but with software optimized for use against ship targets, a larger warhead, and delayed fuzing.	Procurement	Hughes Aircraft Co.; Raytheon
Marine Corps Laser Maverick (AGM-65E) This missile shares the delayed fuzing and larger warhead features of the Navy IR missile (AGM-65F), but uses a laser seeker for positive identification of targets in a close air support environment.	Procurement	Hughes Aircraft Co.
Peace Pearl Peace Pearl is Foreign Military Sales program to design, develop, and produce a fire-control system for the Chinese F-8II aircraft. The avionics upgrades are designed to give the aircraft improved air-to-air attack capabilities against high-speed penetrators at both low and high altitudes. The avionics upgrades will be produced as a Class V modification kit to be installed on the production line in the People's Republic of China. During the development phase, two aircraft will be modified with preproduction kits and flight-tested. During the production phase, fifty-five kits will be produced and delivered to China for installation in production aircraft.	Full-Scale Development	Grumman
A-7 Prototype Modification Program This prototype program is the first step in meeting the tactical air forces' and US Army's requirement for a cost-effective close air support/air interdiction aircraft to meet the expected battlefield threat of the twenty-first century. Two A-7D aircraft will undergo structural modifications and be reengined with the afterburning Pratt & Whitney F100-PW-220 engine. An engine adapter kit design and the technical interface requirements will also be procured for the General Electric F100-GE-100 engine. An eleven-month test program will be conducted at the Air Force Flight Test Center, Edwards AFB, Calif. First flight of the modified A-7 prototype aircraft is scheduled for May 1989. In addition to the two prototype aircraft, the program will provide a reprocurement data package to Air Force Logistics Command for future competitive modifications of the A-7D fleet.	Prototype	LTV
Deputy for Development Planning (XR)		
Aeronautical Applications of HPM Technology This program will prepare ASD for timely and efficient utilization of high-power microwave technology.	Preconcept Definition	To be determined
Development of Nonlinear Radar Concept This program will develop concepts for exploiting the nonlinear part of the generalized radar cross section.	Ongoing	Intelligent Signal Processing
Transatmospheric Aeronautical Systems This program will conduct preliminary design synthesis and analysis to identify technology requirements and operational capabilities and to improve understanding of transatmospheric systems for potential future mission applications.	Preconcept Study	In-house
Air Interdiction Design Analysis This analysis will examine the operational capabilities and design impacts implicit in the consideration of cross-service utilization of future USAF and USN fighter/attack aircraft.	Ongoing	In-house
Reconnaissance-Attack-Fighter Training System This project is developing concepts for an advanced jet pilot training system to train Air Force student pilots more efficiently and effectively for transition from the trainer to the twenty-first century operational fighter-attack-recce aircraft.	Preconcept Study	In-house/Lockheed-Georgia; General Dynamics-Fort Worth; McDonnell Douglas-DAC
Preliminary Aircraft Design Technology Techniques and methodology are being developed in this effort to facilitate design analysis of future aeronautical systems, leading to improved understanding and visibility of design alternatives.	Ongoing	In-house (Dynamic Engineering Inc.)

NAME AND MISSION	STATUS	CONTRACTOR
Cruise Missile Defense Mission Analysis This analysis will examine the need for strategic atmospheric defense and identify and evaluate the effectiveness of aeronautical systems concepts to defend against the post-1995 air-breathing threat.	Preconcept Definition	Battelle; McDonnell Douglas; Science Applications Int'l Corp.
Advanced Transport Technology Mission Analysis This analysis will develop a comprehensive data base to support MAC preparation of a Statement of Operational Need for a next-generation tactical airlifter and to establish the capability to perform continuing analyses as necessary in the mobility mission area.	Preconcept Definition	General Research Corp.; Boeing; McDonnell Douglas; Lockheed
Far-Term Fighter Force Modernization Investigation This investigation has determined how best to maintain the F-15, F-16, A-10, and F-111 as first-line fighters through the early twenty-first century. This force modernization effort identified key new technologies and developed plans to incorporate these technologies into current tactical aircraft.	Completed	Science Applications Int'l. Corp.; General Dynamics; McDonnell Douglas; Fairchild
Military Airlift Survivability Study (MASS) MASS has conducted a vulnerability analysis of current airlifters and performed a cost trade-off study of possible actions to increase survivability against current and future threats. The long-term objective was to develop a data base of "lessons learned" on survivability enhancements to be included in the design of future airlifter aircraft.	Completed	Illinois Institute of Technology Research Institution; Subcontractors: Lockheed, Boeing
Vanguard Vanguard is the AFSC Development Planning process and methodology that plans for the research, development, and acquisition of future USAF weapon systems. Through analysis, Vanguard identifies deficiencies in the capabilities of current and programmed forces to counter the present and projected threat over a twenty-year time span. Goals are established to eliminate these deficiencies.	Ongoing	In-house
Strategic Offense 21 This program will identify future strategic aeronautical systems and supporting technologies. Key emphasis will be placed on holding relocatable targets "at risk," countering a reactive threat, and surviving in an extended-conflict scenario.	Preconcept Definition	Frontier Technology; McDonnell Douglas
Strategic Penetration Investigation Feasibility Analysis of Penetration Aids This effort has investigated practical means to maximize the ability of strategic aeronautical systems to survive enemy defensive actions.	Completed	Boeing
Hypersonic Glide Vehicle (HGV) This program will determine the mission utility and best characteristics for an operational HGV weapon system.	Preconcept Definition	Honeywell
Special Operations Aircraft This program is to define survivable system concepts and to determine needed technology developments for a special operations vehicle.	Preconcept Definition	Lockheed
Aerial Refueling Tanker Master Plan This effort will establish future aerial refueling requirements and applications, assess current force capability in future roles, and develop a comprehensive plan to meet future needs through orderly modifications of the current force and/or new airplane acquisition(s).	Preconcept Definition	Phase I: ITT Research Institute, Frontier Technology Inc.; Phase II: To be determined
Tactical Air-to-Surface Systems (TASS) The objective of this project is to identify mission, system, and technology needs/requirements for future tactical air interdiction weapon systems.	Preconcept Definition	To be determined
Study of Unmanned Air Vehicles (SUAV) The objective of this project is to identify promising applications of unmanned air vehicles (UAVs), define UAV system concepts, and provide for recommendations of concepts to higher headquarters and using commands as solutions to mission deficiencies.	Preconcept Definition	To be determined
Aeronautical/Space Assets Interface Analysis This analysis will identify opportunities and define concepts to enhance aircraft mission capabilities through a data exchange between aeronautical systems and existing and future space-based systems. The results of this effort will be recommendations and functional requirements for future aeronautical and space system interface concepts with high-potential payoffs. A follow-on effort is planned to develop and refine the most promising system concepts.	Preconcept Definition Ongoing/Follow-on Effort in Planning	Battelle Memorial Institute; others to be determined
Mission/Flight Systems Integration Study This study will develop electronic system concepts and architectures that will provide the basis for integration of new electronic technology to enhance mission effectiveness in the next generation of aeronautical systems.	Preconcept Definition	To be determined
Follow-On Wild Weasel Recommendations for Wild Weasel airframe and configuration for use in the 1990s and beyond have been developed in this program.	Completed	McDonnell Douglas; General Dynamics; Verac
High-Reliability Fighter Concept This project will develop configurations for future tactical fighters with minimum-maintenance and self-sufficiency characteristics. A specific goal is to develop concepts enabling a tactical fighter to operate autonomously and fully mission-capable for 250 flight hours with little or no maintenance.	Preconcept Definition	Northrop; McDonnell Douglas
Embedded Trainer Concept for Tactical Aircraft Concepts for integrating various training functions into operational aircraft have been defined and assessed. In-flight embedded training for air-to-air and air-to-ground engagements, missile employment/defense, and electronic warfare with real-time feedback appears to be feasible and affordable. R&M and safety issues are being addressed before implementing embedded computer-generated threats, targets, and weapons.	Preconcept Definition	Quest & Dynamic Research Corp.; General Dynamics; McDonnell Douglas Aircraft
Hypervelocity Missile Design Integration Airframe-weapon design and integration studies to maximize operational utility are being undertaken in this project.	Preconcept Definition	In-house
Strategic Reconnaissance Aircraft This study will define viable reconnaissance aircraft concepts and assess effectiveness in a trans- and post-SIOP data-collection role.	Preconcept Definition	To be determined

NAME AND MISSION	STATUS	CONTRACTOR
Bomber Barrier Threat Negation This study will evaluate alternate methods for negating the increasingly capable Soviet airborne threat. Alternative methods to be investigated will include bomber air-to-air weapons, offensive escorts, and dedicated fighter-bombers.	Preconcept Definition	To be determined
Close Air Support Aircraft Design Alternatives (CASADA) Study This study will develop alternative new and modified aircraft weapon system design concepts, mission capabilities, and associated technological requirements for a follow-on to the A-10 aircraft to perform close air support/battlefield air interdiction (CAS/BAI) missions.	Preconcept Definition	In-house/To be determined
Complementary Multirole Fighter This feasibility study will develop a low-cost, lightweight, multirole fighter to complement the ATF in the air-superiority role by utilizing ATF technology developments, including integrated avionics, STOL, and low observables.	Preconcept Definition	To be determined
Mission Opportunities for Airship Technology (MOAT) The objective of this project is to identify and define innovative applications of lighter-than-air (LTA) systems and technologies to USAF missions.	Preconcept Definition	To be determined
Synergistic Defense Suppression System (SDSS) The objective of this project is to examine trade-offs involving the types and numbers of destructive and disruptive defense suppression assets and make recommendations to reasonably assure the success and survivability of USAF air-to-surface combat forces in the near to far term.	Preconcept Definition	To be determined
All-Mobile Tactical Air Force (AMTAF) This effort is a systematic study directed toward exploration of methods to enhance mobility for current and future USAF tactical fighter aircraft through innovative use of current and near-term technologies. It encompasses airbase and operational characteristics associated with main operating bases and dispersed operating locations.	Preconcept Definition	Verac, Inc.
Deputy for C-17 (YC)		
C-17A This program will carry out the development and acquisition of the C-17A airlift system for the rapid deployment of today's modern Army from the CONUS directly to overseas areas of conflict and for airlift of outsized cargo over both intertheater and intratheater ranges close to the forward areas. This direct-delivery dimension, combined with an outsized airdrop capability, will significantly enhance airlift support to combat forces in the field and improve mobility of our general-purpose forces.	Full-Scale Engineering Development	McDonnell Douglas
Deputy for Advanced Tactical Fighter (YF)		
Advanced Tactical Fighter (ATF) The ATF program will develop the Air Force's next-generation air-superiority fighter for operational service starting in the mid-1990s. The ATF concept is being validated during the demonstration/validation phase, to include ground-based avionics prototypes and flying prototypes to be known as YF-22A and YF-23A. The next-generation fighter concept is expected to include advanced propulsion, flight-control, and fire-control technologies; significant avionics integration; advanced system survivability features; "designed-in" supportability characteristics; and superior subsonic and supersonic maneuverability as well as nonafterburning supersonic persistence and a greatly increased combat radius. The dem/val phase of the program also includes the development/demonstration of two advanced technology fighter engines under the ATF Engine (ATFE) project. The prototypes of these engines are known as the YF119-PW-100 and the YF120-GE-100.	Demonstration/Validation	ATF: Northrop/McDonnell Douglas; Lockheed/Boeing/General Dynamics ATFE: General Electric; Pratt & Whitney
Deputy for F-16 (YP)		
F-16 Multimission Fighter The F-16 Fighting Falcon is a single-engine, lightweight, high-performance, multimission fighter capable of performing a broad spectrum of tactical air warfare tasks, including air-to-air and air-to-surface combat. Improvements added through the Multinational Staged Improvement Program (MSIP) will result in F-16C/D models with the capability to employ advanced systems, such as the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system and the Advanced Medium-Range Air-to-Air Missile (AMRAAM). The F-16A/B was selected as the Air Defense Fighter (ADF) in October 1986, and 270 of the aircraft will be modified in the ADF configuration. In addition to the US and its F-16 consortium partners (Belgium, the Netherlands, Denmark, and Norway), F-16s have been ordered by Israel, Egypt, South Korea, Pakistan, Venezuela, Turkey, Singapore, Thailand, Indonesia, Bahrain, Greece, and the US Navy.	F-16A/B: Production/Deployment; F-16C/D: Production/Deployment	General Dynamics (prime); Pratt & Whitney (F100 engine); General Electric (F110 engine); SABCA (final assembly—Belgium); Fokker (final assembly—Netherlands); Fabrique Nationale (Belgium); Kongsberg (Norway); Philips (Netherlands) F100 engine
Deputy for Advanced Technology Bomber (YS)		
Advanced Technology Bomber (ATB) This program is carrying out the engineering development of an advanced manned penetrating bomber employing low-observables technologies, with an Initial Operating Capability in the early 1990s.	Development	Northrop; Boeing; Vought; General Electric
Deputy for Simulators (YW)		
F-15E Weapon System Trainer (WST)/F-15C/D Operational Flight Trainer (OFT) Ongoing production of the F-15C/D OFTs will result in a total buy of fourteen simulators. Production of the F-15E WST has begun and will lead to deployment of six F-15E simulators.	Production	Loral
F-16A/C Weapon System Trainer (WST) This program involves the procurement of F-16 WSTs comprising Operational Flight Trainers (OFTs), Digital Radar Landmass simulators (DRLMs), Electronic Warfare Training Devices (EWTDs), and Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system simulators.	Acquisition	Singer-Link (OFT); General Electric (DRLM); AAI (EWTD); Singer-Link (LANTIRN simulator)
Air Defense Fighter (ADF) Training System The procurement of an Air Defense Fighter (missionized F-16A/B) Training System will be carried out to supply both initial and long-term training for air defense aircrews.	Development	General Dynamics

NAME AND MISSION	STATUS	CONTRACTOR
Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) System Part Task Trainer (PTT) The development and production of PTTs in F-15E and F-16 configuration to train aircrews in LANTIRN switchology, symbology, and modes of operation will be undertaken in this effort.	Development	Educational Computer Corp.
Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) System Simulator The LANTIRN simulator will be developed to provide a real-time simulation of the LANTIRN pods. It will provide mission training when integrated with the F-16 OFT.	Development	Singer-Link
EF-111A Operational Flight Trainer (OFT) Two OFTs to support EF-111A Tactical Jamming System (TJS) training have been deployed to operational sites.	Postdeployment	AAI
Guided Bomb Unit (GBU-15)/Air-to-Ground Missile (AGM-130) Part Task Trainer (PTT) A standalone PTT is being developed to provide training for tactical weapon system officers in GBU/AGM launch and guidance tasks. Three will be used for the F-4E and one for the F-111.	Development	Honeywell
TAC Computer-Based Instruction Training System (TAC CBITS) This program will involve development/procurement to provide a combined F-15/F-16 computer-based instruction and generic infrared training system/radar warning receiver capability.	Development and Acquisition	Engineering and Economics Research Inc.
B-1B Simulator System (SS) Development and production of a training system are being carried out to meet the training needs of all B-1B crew members. Included are five Weapon System Trainers (WSTs), which simulate all four crew positions, two Mission Trainers (MTs), which simulate only the offensive/defensive positions, and Cockpit Procedures Trainers (CPTs).	Development and Acquisition	Boeing
C-17 Aircrew Training System (ATS) This program will develop and acquire a totally contracted, ground-based aircrew training system capable of producing and maintaining fully qualified C-17 aircrews (pilots and loadmasters) and maintenance engine-run personnel. The contractor will operate, maintain, and support all components and guarantee the performance of all aircrew graduates.	Competitive Design	Douglas Aircraft Co.; Singer-Link; United Airlines Services Corp.
C-5 Aircrew Training System (ATS) Production of an aircrew training system is ongoing to meet the training needs of all C-5 crew members. Included are Weapon System Trainers (WSTs), Cockpit Procedures Trainers (CPTs), Part Task Trainers (PTTs), and Computer-Aided Instruction (CAI) that train all four crew positions. The contractor guarantees a trained aircrew member.	Production	United Airlines Services Corp.
C-130 Aircrew Training System (ATS) This program will develop a total aircrew training system for all C-130 courses and will convert to contracted training, similar to the C-5 ATS.	Production	Singer-Link
C-5/C-141 Aerial Refueling Part Task Trainer (ARPTT) Development of one prototype and production of six units that provide fundamental visual, audio, flight-control, and buffet cues necessary for realistic air refueling training are being undertaken.	Continuing Development and Acquisition	Reflectone
KC-135 Operational Flight Trainer (OFT) This effort involves the refurbishment of MB-26 CPTs with a digital system and the enhancement with a visual system that provides peripheral cues for engine-out training. KC-135R and KC-135A configurations will be developed. There are production options for a total of nineteen OFTs.	Development	Boeing
B-52 Offensive Avionics System (OAS) Block II Development and production of nine B-52 Weapon System Trainer (WST) and four Offensive Station Mission Trainer (MT) modification kits are being undertaken.	Ongoing	Singer-Link
Advanced Tactical Fighter (ATF) The current program is a comprehensive front-end analysis to develop the training system concept to meet the total training requirement for the ATF. This analysis is being conducted as part of the ATF documentation/validation phase.	Planning	Northrop/McAir; Lockheed/General Dynamics/Boeing
Simulator Development Activity (Project 2325) This effort involves the engineering development of aircrew flight simulator technology and investigation of training issues to satisfy current training requirements.	Ongoing	Many
Standard DoD Simulator Digital Data Base/Common Transformation Program (Project 2851) This joint development project was initiated through the Joint Logistics Commanders to develop a standard simulator data base and common transformation programs.	Development	Planning Research Corp.
Modular Simulator Design Program (Project 2968) This is an ongoing research project that will explore ways to take advantage of microcomputers and high-speed data communications in modular flight simulators.	Development	Boeing Military Airplane Co.
Ada Simulator Validation Program (Project 3147) This program will develop design and cost metrics for future simulator acquisitions using the Ada higher-order language.	Ongoing	Boeing/Burtek
Tanker-Transport-Bomber Training System (TTBTS) This effort will result in the procurement of twenty-two Operational Flight Trainers (OFTs) using already existing, off-the-shelf capabilities for specialized undergraduate pilot training (SUPT).	Planning	To be determined
C-141 Aircrew Training System (ATS) The purpose of this program is to develop a total aircrew training system for all C-141 courses that will be converted to contracted training. The contractor will guarantee a trained crew member.	Planning	To be determined
Castle Combat Crew Training School (CCTS) Modernization This project is a three-phase development effort designed to update the Castle CCTS. Phase I encompasses the Front-End Analysis (FEA) of CCTS needs and training performance criteria. Phases II and III will evolve from the FEA activity and include design, development, installation, and support of the modernized CCTS.	Development	To be determined
Special Operations Forces (SOF) Aircrew Training System (ATS) A total aircrew training system for MC-130H, MC-130E, AC-130H, and AC-130U crew members will be developed. The contractor will guarantee a trained crew member.	Planning	To be determined
KC-135 Navigational Rendezvous Trainer (T-10 Replacement) This project involves the development and production of three desktop trainers for KC-135A/Q general navigation, rendezvous, and weather avoidance procedures training.	Development	To be determined

NAME AND MISSION	STATUS	CONTRACTOR
CV-22 Aircrew Training System (ATS) This program will develop a total aircrew training system for Air Force-unique CV-22A mission training. The contractor will guarantee a mission-qualified crew member.	Planning	To be determined
Advanced Instrument Course (AIC) Current activities address the accomplishment of Front-End Analysis to determine the requirements for the entire AIC training system conducted by ATC.	Planning	To be determined
Deputy for Strategic Systems (YY)		
Short-Range Attack Missile (SRAM) II This program is to accomplish the development and manufacture of a Short-Range Attack Missile to augment and ultimately replace the AGM-69A SRAM A. The SRAM II will have greater range, improved lethality, and better reliability and maintainability.	Full-Scale Development	Boeing Aerospace Co.
Strategic Mission Data Preparation System (SMDPS) Phase II Software This software development will upgrade and expand existing B-52 automatic flight-plan-generation capabilities to include B-1 and B-52 OAS Block II and CSRL.	Deployment	Boeing Military Airplane Co.
AGM-86B Air-Launched Cruise Missile (ALCM) This program completes the final engineering tasks to integrate the AGM-86B missile with the CSRL and B-1.	Deployment	Boeing Aerospace Co.
Ground-Launched Cruise Missile (GLCM) Procurement of the ground-launched cruise missile weapon system is ongoing to perform the theater nuclear mission. GLCM will enhance deterrence by increasing nonstrategic nuclear capability, improving survivability through mobility, and increasing flexibility in the employment of dual-capability aircraft.	Production	General Dynamics/ Convair Div.; McDonnell Douglas Astronautics Co.
Common Strategic Rotary Launcher (CSRL) CSRL is a rotary launcher for internal carriage of weapons on the B-52H and the B-1B. The CSRL program will develop a multipurpose launcher that is capable of uniform or mixed weapons payloads and that can accommodate current and projected cruise missiles, short-range attack missiles, and gravity weapons.	Full-Scale Development/Production	Boeing Military Airplane Co.
ALQ-172 Electronics Countermeasures (ECM) Set This program involves major modification of the ALQ-117 ECM set on B-52H aircraft to provide an ECM defense against agile and monopulse surface-to-air-missile and advanced interceptor threats.	Production	ITT Avionics Div.
OAS Block II Software This effort involves a software program that optimizes the B-52's capability to meet increased weapon system requirements. Block II will increase present capabilities and allow the addition of the new Strategic Radar, the Common Strategic Rotary Launcher, and future weapon systems intended for integration on the B-52.	Full-Scale Development	Boeing Military Airplane Co.
Attack Radar Set (ARS) This program upgrades the reliability, maintainability, and supportability of the F/FB-111 Attack Radar Set, correcting the current decreasing trend in the availability of the attack radar.	Full-Scale Development/Production/Deployment	General Electric Co.
Terrain-Following Radar (TFR) This program upgrades the reliability, maintainability, and supportability of the F/FB-111 Terrain-Following Radar and will increase the mean time between failures (MTBF) of the TFRs.	Full-Scale Development/Production/Deployment	Texas Instruments
Digital Flight-Control System (DFCS) Replacements for the electronic portion of the F/FB/EF-111 flight-control system will be acquired to correct safety deficiencies and improve reliability and maintainability.	Full-Scale Development	General Dynamics
Deputy for Propulsion (YZ)		
F101-GE-102 Engine for the B-1B This effort involves postproduction support for the F101-GE-102 engine for the B-1B bomber. This engine shares a common core with the F110 fighter engine.	Operational	General Electric
F110-GE-100 Engine for the F-16 Acquisition of the F110-GE-100 engine for the Alternate Fighter Engine (AFE) program is being carried out. This engine is being installed in new F-16C/D aircraft. Production procurements will be competed each year with the P&W F100-PW-220 for a share of the F-16 market.	Production	General Electric
F100-PW-220 Engine for the F-15 and F-16 This is an evolutionary program to improve F100 durability and operability for the Alternate Fighter Engine competition. Increased durability to 4,000 TAC cycles or nine years' operation is accomplished through the improved life core. Operability improvements gained from the digital electronic engine control (DEEC) provide the -220 with unrestricted throttle movement throughout the flight envelope. The -220 is in production for incorporation into the F-15C/D and F-16C/D.	Production	Pratt & Whitney
F100-PW-229 Engine for the F-15 and F-16 An improved performance version of the existing F100 engine will be required to improve F-15 and F-16 system capability into the 1990s. The F100-PW-229 program is demonstrating an increased-performance version of the Pratt & Whitney F100 engine. Full-scale development of the derivative F100 engine is in progress, with qualification scheduled for late 1988. Production incorporation into the F-15E and F-16C/D will begin in the early 1990s.	Full-Scale Development	Pratt & Whitney
F110-GE-129 Engine for the F-15 and F-16 The F110-GE-129 is an increased performance version of the F110-GE-100. This engine will compete with the F100-PW-229 for F-15 and F-16 aircraft through the 1990s.	Full-Scale Development	General Electric
F119-PW-100 and F120-GE-100 for the Advanced Tactical Fighter (ATF) Currently in the demonstration and validation phase, this program is developing two new, state-of-the-art engines. The basic engine concepts and technologies are being demonstrated in a ground-test effort. Flight-quality prototype engines are being developed to power the prototype ATF aircraft competitors (YF-22 and YF-23) during flight testing in Fiscal Year 1990.	Advanced Development	General Electric; Pratt & Whitney
T406-AD-400 Engine for the CV-22A (JVX) The purpose of this program is the acquisition of the 6,000-shaft-horsepower Allison T406 engine (triservice program) for the Joint Services V-22 multimission VTOL aircraft. The USAF version of the JVX, designated CV-22A, is intended to support Special Operation Forces (SOF) in the 1990s and beyond.	Full-Scale Development	Allison

NAME AND MISSION	STATUS	CONTRACTOR
F112 Engine for the Advanced Cruise Missile This is a small turbofan engine for an advanced cruise missile.	Ongoing	Williams International
Engine Component Improvement Program This program provides continuing engineering support for all air-breathing engines used in manned aircraft in the Air Force inventory. This effort is directed toward correcting safety-of-flight conditions, improving durability/reliability/maintainability, developing repair procedures, and reducing the life-cycle cost of engines. Twenty-one families of engines are currently being supported.	Continuing	All major engine contractors
Automated Ground Engine Test Set (AGETS) AGETS is diagnostic ground-support equipment being developed and procured for the F100-PW-100 and F100-PW-200 engines. It is a computer-aided integrated test system that automatically acquires measurement data during F100 engine operation. This data is used to perform engine control system trim adjustments and to identify and isolate faulty engine components. AGETS will reduce trim time and fuel usage by about fifty percent and greatly enhance engine diagnostic capability.	Production	Pratt & Whitney
Propulsion Technology Modernization (Tech Mod) Tech Mod advances and implements state-of-the-art technology in manufacturing systems. It increases productivity and efficiency, thereby reducing acquisition cost. Tech Mod advances all manufacturing activities, specifically focusing on test, assembly, heat treatment, coatings, conventional and nonconventional machining, tooling, materials handling, manufacturing and management information systems, and advanced forgings, castings, and bearings.	Ongoing	General Electric; Pratt & Whitney; Garrett Turbine Engine Co.; Williams International; Teledyne CAE; Allison Gas Turbine; Mechanical Technology Inc.; various subcontractors
Engine Model Derivative Program (EMDP) The Engine Model Derivative Program provides the means for increasing performance of existing engines through demonstration/validation of advanced design concepts, materials, structures, and control technologies. Evaluation of derivative engines for the KC-135R and B-52 is being conducted. Tactical, Strategic, Trainer, and Airlift Engine System Roadmaps that outline future evaluations and programs by aircraft system form the planning baseline for EMDP and future YZ programs.	Continuing	All major engine contractors
F117-PW-100 (PW2040) Engine for the C-17 This program will acquire a version of the commercial PW2040 turbofan engine to power the C-17A aircraft. This fuel-efficient engine provides 40,000 pounds of thrust.	Development/Long-Lead Procurement	Pratt & Whitney
F103-GE-102 Engine for Air Force One Engine management support is being provided for the procurement of the commercial General Electric CF6-80C2B1 engine, which will power the new, wide-body Boeing 747-200B Air Force One aircraft.	Procurement/Deployment	General Electric
TF39-GE-1C Engine for the C-5B The TF39-GE-1C engine has reentered production after more than ten years and is used to power the C-5B aircraft. This high-bypass turbofan provides 41,100 pounds of thrust.	Procurement/Deployment	General Electric
Air Force Wright Aeronautical Laboratories (AFWAL)		
Avionics Laboratory (AA)		
Very-High-Speed Integrated Circuits (VHSIC) This is a joint triservice program to develop two new generations of silicon integrated-circuit technology and provide MIL-STD-qualified chips, brassboard modules, pilot production lines, computer-aided design tools, and initial system brassboard demonstrations for insertion into DoD systems. This work will extend the US integrated-circuit capability by one to two orders of magnitude in density and throughput while incorporating the latest built-in-test circuits for high-performance, compact, reliable, maintainable electronic systems.	Phase 1: In Qualification Phase 2: In Development	Phase 1: Honeywell, Hughes, IBM, TI, TRW, Westinghouse Phase 2: Honeywell, IBM, TRW
Integrated Terrain Access and Retrieval System (ITARS) This program has developed and demonstrated a digital database management system for real-time display of terrain data (perspective view, plan view, and head-up display) that is integrated with navigation systems for terrain following/terrain avoidance. The system can manage any digitized data (*i.e.*, charts, publications, tech orders) and potentially replace all paper products on the aircraft. The program is studying the value of the system for targeting systems and for use in developing an in-flight threat management system. The program will evaluate the problems of interface/interoperability with mission planning systems. ITARS is a cooperative program with the Naval Air Development Center (NADC).	Development	Hughes Aircraft
Pave Pace Pave Pace designs and demonstrates the key elements of an advanced avionics architecture for the twenty-first century that, while compatible with the Pave Pillar architecture, exploits the potential of emerging technologies in parallel processing, opto-electronics, fault-tolerant hardware and software, electronics packaging and cooling, and artificial intelligence (AI). Goals of the program are extreme availability, affordable software, and high-speed AI hardware/software to permit dramatic new capabilities in sensor intelligence and tactical decision aids. Applications include advanced strategic and tactical aircraft, hypervelocity vehicles, and robotic air vehicles.	Definition	To be determined
VHSIC 1750A Computer This is an expandable, modular computer system consisting of a MIL-STD-1750A processor module, bulk memory module, external input/output module, and support equipment module. It is classified as a VHSIC insertion program to develop computer building-block modules. Advantages over current very-large-scale integrated-circuit technology, besides the expandable, modular architecture, include two to four times throughput improvement, greater environmental operational capabilities, significantly reduced size, and greater reliability.	Development	Westinghouse
Common Signal Processor (CSP) This is a development program for a modular, high-performance, reliable, VHSIC-based, digital signal processor for next-generation avionics. It can be configured and programmed to satisfy a wide range of applications, such as for radar, communications, electronic warfare, and electro-optical systems.	Development	IBM
Ultra-Reliable Radar (URR) The URR program will demonstrate an advanced airborne radar with a mean-time-between-critical-failures (MTBCF) rate that is an order of magnitude greater than that of current radars. The development model radar will utilize advanced technologies, such as electronically scanned active element arrays, VHSIC-based common signal processing, and Pave Pillar-compatible fault-tolerant architectures.	Development	Westinghouse

NAME AND MISSION	STATUS	CONTRACTOR
Integrated Communication Navigation Identification Avionics (ICNIA) The objective of this triservice program is to demonstrate that multiple existing and planned near-term communication, navigation, and identification functions in the 2 MHz to 5 GHz frequency band can be integrated into one airborne radio system for use in tactical aircraft and helicopters. The fault-tolerant, modular architecture will utilize advanced technologies, such as VHSIC, and extensive software programmability to greatly increase reliability and operational availability while significantly reducing weight, size, and cost in comparison with discrete systems.	Development	TRW
Integrated Electromagnetic System Simulator (IESS) IESS is a dynamic RF hot bench being developed under the Integrated Communication Navigation Identification Avionics (ICNIA) program to provide realistic operational environments for development and laboratory evaluation of integrated CNI systems. IESS provides the capability for RF signal generation of tactical communications waveforms in the 2 MHz to 5 GHz frequency range, simulation of on-board avionics interfaces, real-time simulation of complex mission scenarios, and automated data collection and analysis. IESS, interfaced to existing Avionics Laboratory communications threat simulators, radar electronic warfare simulators, and man-in-the-loop testing facilities, will provide a powerful capability for the exploration and advancement of evolving integrated CNI systems and communications support technologies.	Development	TRW
Air-to-Air Attack Management This program will demonstrate, via man-in-the-loop simulation, improved survivability and lethality of single-seat fighter aircraft in a multitarget air-to-air combat scenario. These objectives will be met by increased pilot situation awareness and controlled work load that will be provided by innovative control and display technology integrated with advanced fire-control algorithms.	Development	Northrop
Coronet Prince Prototype This program will package existing countermeasure technology into an aircraft pod and demonstrate its effectiveness against ground-based optical/electro-optical tracking systems. The prototype pod will be suitable for use on high-performance tactical and special-purpose aircraft. Its performance during aircraft maneuvers and its effect on aircraft operation will be evaluated to establish a baseline design for a full-scale development program.	Fabrication	Westinghouse Electric Corp.
Silent Attack Warning System (SAWS) This advanced development program will provide hardware to demonstrate a state-of-the-art infrared detection system for missile and aircraft warning. Key to this new development is improvement in the false-alarm rate and detection probability over earlier IR threat-warning systems.	Fabrication	General Electric; Honeywell; Texas Instruments
Cruise Missile Advanced Guidance (CMAG) This program is to develop and demonstrate advanced missile guidance technology capable of providing precision autonomous terminal guidance for standoff missiles. Guidance concepts may employ CO_2 laser radar measurements and pattern recognition to provide midcourse guidance to high-value fixed and mobile targets.	Development	General Dynamics; McDonnell Douglas
High Reliability Head-Up Display (HIREL HUD) The HIREL HUD program seeks to improve cockpit display unit reliability by utilizing solid-state flat-panel display technology. A high-resolution (640 × 480 pixels, 254 lines/inch) liquid-crystal display with a compact, low-power, high-brightness illumination system suitable for use as a head-up display (HUD) video image and symbology source will be developed and demonstrated.	Development	General Electric
Color Head-Down Display The objective of this program is to develop a large-area (100 square inches), direct-view, flat-panel avionics display with a resolution of about 1,000,000 full-color pixels. The display will also have high contrast in bright sunlight. This approach will probably be Active-Matrix Liquid-Crystal Display. Emphasis will be placed on achieving thirty percent or greater yield of fully assembled displays.	Development	To be determined
Panoramic Cockpit Control and Display System (PCCADS) This program is demonstrating advanced control and display techniques in a full cockpit simulation in a dome. This new approach uses a large-area electronically controlled display, encompassing nearly the entire instrument panel of a fighter aircraft cockpit, along with advanced control techniques to automate and simplify many of the display and control functions for fighter aircraft.	Development	McAir
Artificial Neural Vision Learning System This program is to determine the applicability of artificial neural systems (ANS) technology for use in an advanced vision system and to harvest basic research efforts to combine advanced image understanding techniques with ANS processing elements for the design of systems.	Development	To be determined
Generic Algorithms for Vision Learning System This program is to establish a test-bed for developing vision experiments that combine learning mechanisms with previous image operations to form new symbolic representations and geometric relationships. It will develop an advanced vision system that contains predictive models for adapting to dynamic environments and that uses unconventional self-organizing techniques to interpret.	Development	To be determined
Embedded Resources Support Improvement Program This program will develop software supportability technologies and incorporate them into an advanced modular and extendable integration support environment to improve the software turnaround capability of Air Logistics Centers. The software performance monitor and the advanced modular integration support environment concepts have been transitioned to the ALCs. Future technologies will be transitioned to the user ALC. This program also addresses the problem of turnaround operational software in response to environment conditions and new operational requirements. Communications-navigation and radar systems will be reviewed in light of rapid turnaround of the mission initial software.	Development	ITT; Hughes; TRW; Booz-Allen & Hamilton
Intelligent Avionics The overall objective of the intelligent avionics program is to provide a learning system technology base for next-generation avionics systems that adapt in real time to extremely dynamic and hostile environments. Primary emphasis is on the exploitation of adaptive network (artificial neural) system research for avionics signal analysis, communication, and system control applications. In addition, distributed rule-based learning systems to provide adaptive planning for sensor and sensor fusion systems are being developed. The potential of evolutionary learning systems for application to sensor planning applications is also being investigated.	Development	TRW; Verac; Booz-Allen & Hamilton; Texas Instruments; AFWAL/AAA

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EW Reliability Improvement Program This task will demonstrate the ability to increase mean time between failures (MTBF) of candidate EW subsystems by one to two orders of magnitude. The approach is to freeze technical system parameters (*e.g.*, bandwidth, gain, power output, spurious signal levels) and focus attention on "weak sister" component improvement in subsystems. A parallel approach integrates MMIC technology into active phased-array apertures.	Development	TRW, Electronic Systems Group; Northrop, Defense Systems Div.; Westinghouse, Defense & Electronic Center; Texas Instruments; Raytheon, Electromagnetic Systems Div.
Expert Avionics Code Modifier The Expert Avionics Code Modifier will provide technologies for the rapid and efficient maintenance and modification of avionics application software. The key technologies will be (a) a comprehensive knowledge base about a given avionics software, (b) knowledge acquisition tools to (nonobtrusively) construct that knowledge base during development of the software, and (c) a set of specialized tools that uses that knowledge base to aid in maintenance and modification of the avionics software. The central knowledge base will be automatically updated to reflect modifications made in the software. The avionics software referred to will be written in the Ada (MIL-STD-1815A) programming language and targeted to a MIL-STD-1750A microprocessor.	Development	To be announced
Interactive Ada Workstation The Interactive Ada Workstation seeks to improve Ada programmer productivity by at least one order of magnitude through the use of symbol-processing hardware with large primary and secondary memory space, incremental compilation evaluation of Ada code fragments, multiple graphic representations of Ada source code, a Smart Librarian to help create reusable designs/code, and an intelligent help system.	Development	General Electric
High Power Countermeasures This program is to define, develop, and flight-test an improved standoff jamming capability that permits operation of jammer in sanctuary. The system will provide very high effective radiated power and electronically steered, fast-switching, narrow-beamwidth, multiple-beam jamming.	Definition	Raytheon Co.; ESD
Integrated Electronic Warfare Analysis and Modeling (INEWAM) This program is to analyze, evaluate, and model RF/EO/IR countermeasure concepts and EW advanced development prototype hardware. Current EW analysis tools do not address integrated EW countermeasures at the engagement/engineering level, nor are digital simulations documented and maintained with updated data bases. This effort will provide EW analysis in direct support to laboratory advanced development EW programs and transition to ASD engineering organizations analytical results and an integrated system of digital simulations for the Electronic Combat Digital Evaluation System (ECDES), which is establishing a core set of analytical tools as part of the AFSC RD Test and Evaluation Architecture Plan.	Definition	To be determined
Airborne Integrated Antenna System (AIAS) The objective of this effort is to conduct a requirements definition and trade-off studies to develop optimized AIAS architectures (multifunction aperture configurations, antenna electronics subsystems, and central controller) to service 2 MHz to 5 GHz RF needs of both ICNIA and INEWS terminals. Antenna pattern RF resource allocation on a dynamic, mission/threat-adaptive basis is a key AIAS feature.	Definition/Design	TRW Military Electronics and Avionics Div.
High-Accuracy Ring-Laser Gyro—Inertial Navigation System (HARLG—INS) The objective of this effort is to design, fabricate, and demonstrate a ring-laser gyro that can support an inertial navigation system accurate to 0.1 nm/hr CEP and 0.5 ft/sec. This accuracy is to be achieved after an alignment time of three minutes (goal). The size of the gyros must be such that the entire inertial instrument package fits within the volume specified for the current standard medium accuracy (0.8 nm/hr) INS. The program is one half of a dual award contract; a parallel effort is managed by the Naval Air Development Center.	Development	Rockwell International
Adaptive Tactical Navigation System This program will design, develop, and demonstrate, in a computer simulation environment, an adaptive tactical navigation system that will combine artificial intelligence (AI) techniques and advanced navigation algorithms to effectively manage the multisensor navigation suites of 1990s tactical aircraft. Functional capabilities of the systems (*i.e.*, multimode system management, robustness to countermeasures, and intelligent fault detection, isolation, and reconfiguration) will lead to improved mission effectiveness and reduced pilot work load.	Development	Technical Analytical Sciences Corp. (TASC)
Low Probability of Intercept Radio Brassboard (LPIRB) This effort is to develop and demonstrate the feasibility of a cost-effective multimode LPI/antijam/secure airborne radio system. This LPI Radio System will reduce the physical and electromagnetic vulnerability of an aircraft, which will improve its survivability and mission effectiveness. Major emphasis will be placed on LPI communication (2,400 b/s) for tactical aircraft.	Source Selection	To be determined
Airborne Imagery Transmission (ABIT) The purpose of this effort is to develop and demonstrate a modular, wideband, multiple-sensor, jam-resistant, air-to-air data link for real-time transmission/reception of reconnaissance imagery and/or wideband digital data for strategic and tactical applications. Emphasis is being given to achieving low probability of detection to reduce the vulnerability of the sensor platform while operating in a hostile environment. The extended range provided by the air-to-air data link complements the existing air-to-ground standoff surveillance reconnaissance capability and provides the theater commander with the total battlefield picture.	Development	Unisys Corp.
Flight Dynamics Laboratory (FI)		
Advanced Fighter Technology Integration (AFTI/F-16) The AFTI/F-16 research program objective is to develop, integrate, and flight-validate technologies that will improve the lethality and survivability of future advanced military fighters. Technologies include a digital flight-control system, an automated maneuvering attack system with redundant ground/aerial target-collision avoidance, G-induced loss-of-consciousness recovery system, conformal IR sensor/tracker, digital terrain management and display system with autonavigation function, automatic real-time weapon fuzing, voice interactive avionics, and a helmet sight. The next phase of the program will evaluate close air support (CAS) technologies. Demonstrations will include provisions for data link operation, digital terrain system integration, expanded sensor capabilities, pilot/vehicle interface enhancement, and extended applications of combat automation.	CAS Activity Under Contract Negotiation	General Dynamics

NAME AND MISSION	STATUS	CONTRACTOR
X-29 Advanced Technology Demonstrator The X-29 research program objective is to develop, integrate, and flight-validate advanced aerodynamic, structural, and flight-control technologies of a forward-sweptwing aircraft that can provide new design options for future military and commercial aircraft. The program will address the quantification through flight test of the measure of merit for tactical agility. Technologies include an aeroelastically tailored forward-swept wing using composite wing box covers, discrete variable camber, relaxed static stability, and digital flight controls with full-authority, close-coupled canards and three-surface pitch control.	In Flight Test	Grumman Aerospace
STOL and Maneuver Technology The program objective is to develop, integrate, and flight-test advanced technologies to provide a short-takeoff-and-landing (STOL) capability for supersonic fighters while enhancing cruise performance and maneuverability. An F-15 fighter will be modified with a two-dimensional thrust vectoring/reversing exhaust nozzle, an integrated flight/propulsion control with STOL displays/controls, and a rough-field landing gear. It will be tested to demonstrate routine and effective operation from a battle-damaged/repaired runway at night and under weather and enhanced maneuverability throughout the flight envelope.	Aircraft Modification	McDonnell Aircraft
AFTI/F-111 Mission Adaptive Wing The AFTI/F-111 program objective is to develop and flight-test a wing that increases range, maneuverability, survivability, flexibility, and agility by automatically changing shape in flight in response to pilot commands, flight conditions, and configuration. The approach is to modify an NF-111A aircraft with composite surfaces that are flexed by hydraulically powered internal mechanisms under digital computer control. The Mission Adaptive Wing replaces wing landing and takeoff devices with surfaces that improve aircraft capability continuously throughout all flight phases.	In Flight Test	Boeing
Variable Stability In-Flight Simulator Test Aircraft (VISTA/F-16) The VISTA program will design, build, and flight-test a new, high-performance, in-flight simulator to replace the NT-33. VISTA features will include a variable-stability flight-control system, direct-force generators, and fully programmable controls and displays in the evaluation cockpit. The completed VISTA aircraft will be used for (1) pre-first-flight analysis and familiarization; (2) research in flying qualities, displays, and flight control; and (3) test pilot training.	Contract Negotiation	To be determined
Integrated Control and Avionics for Air Superiority (ICAAS) The ICAAS program will develop and demonstrate key control and avionics technologies that will enable cooperating fighter aircraft to engage and defeat multiple airborne threats. The design approach will stress functional integration of target sensors, fire control, weapons, and interface with the pilot. Significant improvements in beyond-visual-range attack and pilot situation awareness are expected compared to current systems. Demonstration will include piloted simulation and flight test.	Definition	To be determined
Self-Repairing Flight-Control System (SRFCS) This advanced development program will develop and flight-demonstrate real-time control reconfiguration and on-board maintenance diagnostic technologies capable of improving flight control system (FCS) reliability, maintainability, and survivability. The reconfiguration technology provides simplification of the FCS hardware while allowing healthy control effectors to functionally substitute their control power for that of failed effectors. The maintenance diagnostics effort brings the power of artificial intelligence to the line technician to provide skill augmentation and dramatically reduce the cannot duplicate (CND) and retest OK (RTOK) rates. Fundamental technical approaches to both reconfiguration and maintenance diagnostics will be flight-tested on the NASA HIDEC F-15 to demonstrate feasibility.	Contract Modification	McDonnell Douglas
Prototype Flight Cryogenic Cooler The objective of this program is to develop, integrate, space-qualify, and life-test advanced cryogenic cooler technologies that are capable of producing cooling capacities and temperatures that meet Strategic Defense Initiative Office (SDIO) requirements. The program features the building of several full-scale prototypes to include control electronics, spaceflight qualification of each system, and endurance testing to demonstrate a five-year reliability. The successful concepts will provide three stages of cooling for the SDIO's surveillance system.	Final Design, Fabrication, and Testing	Garrett AiResearch; Arthur D. Little
Mission Integrated Transparency System (MITS) The MITS program objective is to develop a transparency system that would satisfy peacetime and wartime requirements for advanced tactical aircraft operating in 1995. The program will involve reviewing, finalizing, and prioritizing a lengthy list of requirements for tactical aircraft. The lists of requirements include those important to aircrew, maintenance, and logistics personnel. Possible transparency system designs will then be developed and evaluated using various coupon tests and analysis techniques. One full-scale design will be built and tested to demonstrate how well requirements were met.	RFP Preparation	To be determined
Hypersonic Glide Vehicle (HGV) The HGV program objective is to develop, integrate, and demonstrate through flight test a long-range, highly maneuverable, unmanned hypersonic vehicle that will improve the lethality and survivability of our strategic offensive and defensive forces. Technical challenges in this program are hypervelocity aeromechanics, structures and materials capable of withstanding peak leading-edge temperatures of up to 4,000 degrees, as well as integrated, highly adaptive flight controls and advanced avionics. The HGV is expected to be launched from a modified Minuteman I booster and will demonstrate a 4,000+ nm range, Mach 2–20 speed with maneuverability up to the 30-G level, and a large "footprint," meaning maneuver flexibility in the terminal flight phase by using advanced guidance and navigation systems.	RFP Preparation	To be determined
Supportable Hybrid Fighter Structures (SHFS) The objective of this program is to demonstrate and validate the supportability, durability, weight, and life-cycle cost advantages of an advanced hybrid structure as compared with conventional production hardware used in major airframe structures. This program will use a "building-block" approach to design and fabricate a fuselage structure, using an optimal mix of advanced metallic and composite components. Advanced structures technology and data will be a major product of this program. This improved technology base will be transitioned to the appropriate DoD and industry activities.	Source Selection	To be determined
Structural Improvement of Operational Aircraft (SIOP) This program is geared toward demonstrating improved durability and reduced life-cycle cost through design, fabrication, and installation of technologically advanced secondary components on operational aircraft. Significant improvements in durability due to integral damping technology have been validated on the A-7 center section leading-edge flap and the F-111 outboard spoiler. The next step will be to demonstrate and validate this maturing technology base on the A-10 inlet extension ring. Program payoffs include: (1) the Advanced-Design F-111 spoiler was selected as a preferred spare; (2) the Advanced-Design A-7 flap will be flown on the A-7 Plus prototypes; and (3) pending successful service testing of the Advanced-Design A-10 inlet ring, AFLC is planning to retrofit the A-10 fleet with the new rings.	Flight Test of Advanced-Design A-7 Flap and F-111 Spoiler Completed; A-10 Extension Ring in Detail Design	LTV

NAME AND MISSION	STATUS	CONTRACTOR
Materials Laboratory (ML)		
Computer Integrated Manufacturing (CIM) Computer Integrated Manufacturing (CIM) is a major initiative that will demonstrate massive cost and span-time reductions through improved integration of all manufacturing functions on and off the factory floor. In addition to information management technologies programs, three different large-scale fabrication demonstration programs are in progress: Advanced Machining System (AMS), Integrated Composites Center (ICC), and the Automated Airframe Assembly Program (AAAP).	Manufacturing Technology	General Dynamics Corp.; McDonnell Douglas Corp.; Northrop Corp.
Composite Materials Research and Development A wide variety of important new composite materials systems (fiber-reinforced organic resins) is under development to exploit their unique performance attributes for Air Force aircraft, spacecraft, tactical missiles, cruise missiles, and long-range strategic missiles. New composite concepts, such as molecular composites, are being explored. A highly integrated approach is being pursued in these developmental efforts. For each composite materials system, R&D is being performed on fibers, matrix materials, fiber/matrix interfaces, mechanics of fiber/matrix interaction, processing, quality control, and environmental effects.	Research & Exploratory Development	McDonnell Douglas Corp.; Boeing Co.; Lockheed; University of Dayton Research Institute; other numerous universities, small businesses, and aerospace companies
Advanced Powder Metallurgy Structural Alloys Rapid progress is being made in the laboratory's comprehensive powder aluminum, titanium, and magnesium structural alloy R&D program. It is structured to maximize the recent advances in rapid solidification technology that have opened up major new alloying possibilities heretofore impossible. This program couples research, exploratory development, and advanced manufacturing technology contractual efforts with a strong in-house research effort in characterization and processing to create and put into production superior aluminum alloys having improved strength, corrosion resistance, and use to 900°F.; new low-density, high-strength titanium alloys with use to 1,800°F. operating capability; and corrosion-resistant magnesium base alloys.	Research	Lockheed; Rockwell Science Center; General Electric; University of Virginia
	Exploratory Development	Pratt & Whitney; Lockheed-Calac; Boeing Co.
	Manufacturing Technology	Alcoa; Northrop
GaAs Research and Manufacturing Technology Progressive exploratory development programs are under way to improve the yield and establish the optimum processes for growing high-quality GaAs crystals for microwave devices for satellite communications, space-based and airborne active array radars, electronic countermeasures, and missile seekers. The manufacturing technology program addresses generic manufacturing issues and demonstrates new techniques for process control, assembly of components, inspection, step stress testing, and life testing of full-scale microwave modules.	Research	Cominco; General Telephone and Electronics
	Exploratory Development	Texas Instruments; Rockwell International; Stanford University
	Manufacturing Technology	Westinghouse
Laser Hardened Materials—Airborne Subsystems Hardening Research and advanced development are being conducted to provide technology to systems designers and developers for laser protection of tactical systems and their optical and electro-optical subsystems. The methodology includes studying the system mission, establishing hardening requirements, developing technology options, and assessing payoffs and penalties through comprehensive testing of actual hardware or comparable brassboards. Efforts are also directed toward new methods for preventing laser radiation damage to personnel and optical components.	Advanced Development	Texas Instrument, Inc.; McDonnell Douglas Corp.; Sierracin Research; Hughes Aircraft; Rockwell International Science Center
Manufacturing Technology for Advanced Propulsion Materials A new manufacturing technology initiative has been undertaken to provide production capabilities for engine components incorporating advanced materials systems that provide significant engine performance improvements. Manufacturing methods are to be established for titanium and superalloy integrally bladed rotor (IBR) designs; superalloy fabricated turbine blade and vane designs; titanium aluminide cases and rings; graphite polyimide composite fan airfoils and front frames; and carbon-carbon composite liners and nozzles.	Manufacturing Technology	General Electric; Pratt & Whitney
Composites Supportability The increased application of advanced composites in USAF systems has led to the establishment, within the Materials Laboratory, of an activity responsible for the overall program in composites supportability. A variety of programs is now under way to increase the in-house composites engineering expertise in advanced composite materials technology relating to supportability. In addition, a series of contractual exploratory development programs to solve user composites supportability issues is now under way. These contractual R&D programs will address the technologies of composite inspection, repair (materials, processes, and equipment), post-failure analyses, paint removal, impact-damage protection, and low-energy curing resins and adhesives. The program includes composite supportability issues at the depot, field, and base levels and the establishment of technology and materials data bases for the required activities at each level. The program will include presently used materials (graphite/epoxies) as well as potential materials of the future, including structural thermoplastics, BMIs, and polyimides. The objectives of the program are to have the technology in place to support the increasing applications of advanced composite materials before these materials, in the form of primary and secondary structures on weapon systems, find their way into the inventory in large quantities.	Exploratory Development	Northrop; General Dynamics; Boeing; Southwest Research Institute; Iowa State University; other universities, small businesses, and aerospace companies
Aircraft Composite Structure Manufacturing Manufacturing technology activities are being pursued to provide primary advanced composite structures for large aircraft to improve operational efficiency and to automate shop-floor production of composite components for small aircraft. The objectives are to establish and validate manufacturing technology for large aircraft composite wing and fuselage structures in order to produce these structures at a reasonable and predictable cost and to decrease cost and increase quality for fighter-type aircraft. For these applications, automated fabrication methods are being emphasized. The established targets (vs. conventional aluminum structures) for reduced part count and lower manufacturing cost and weight will be verified in the planned component demonstrations.	Manufacturing Technology	Rockwell International; Boeing Co.; McDonnell Aircraft

NAME AND MISSION	STATUS	CONTRACTOR
Nonstructural Materials A variety of systems-critical materials is under development. Included are −65°F. to 350°F. nonflammable hydraulic systems materials (fluids and seals), a −65°F. to 275°F. fire-resistant hydraulic fluid for current alert aircraft, −65°F. to 600–700°F. liquid lubricants and seals for advanced propulsion systems, and high-temperature solid lubricants and applications technology for both metallic and ceramic propulsion system components. In addition, conductive and high-temperature reticulated foams for aircraft fuel tanks and both environmentally protective and mission-specific coatings for aircraft are being developed. For spacecraft applications, both improved solid and low-vapor-pressure liquid lubricants as well as survivable thermal control coatings and other thermal insulator materials are under development along with a data base relative to the effect of the space environment on long-term materials performance.	Research & Exploratory Development	Hughes; University of Dayton Research Institute; General Electric; TRW; Ultrasystems; numerous other large and small businesses and aerospace companies
Failure Analysis Structural and electronic failure analyses of aerospace components and ground support equipment are an integral part of ensuring maximum useful life of military hardware. Laboratory investigations incorporating the use of sophisticated light and electron optics, microelemental analysis, and Auger and ion-scattering spectroscopy are performed to determine failure modes. Research is conducted to develop new failure-analysis techniques and methodologies for such advanced materials and devices as structural composites and integrated circuits. The issuance of recommendations for corrective actions to preclude repetitive failure occurrences provides vital information to the using organizations and is critical to maintaining safety of flight posture and fleet readiness of systems.	Exploratory Development	University of Dayton Research Institute; Technical Services Group; Boeing Co.; Northrop
Aero Propulsion Laboratory (PO)		
High-Performance Turbine Engine Technologies (HPTET) Initiative This initiative focuses resources and generates programs necessary to demonstrate a revolutionary advancement in turbine-engine technology through the 1990s. This is an integrated program between the Aero Propulsion Laboratory and the Materials Laboratory of AFWAL to ensure that individually developed materials and component technologies are compatible with the overall objective of a 100 percent engine technology improvement (*e.g.*, thrust to weight) over the Advanced Tactical Fighter engine technology level. This initiative forms the nucleus of the combined DoD/NASA Integrated High-Performance Turbine Engine Technologies (IHPTET) initiative.	Exploratory Development	Allison Gas Turbine Div., GMC; Garrett Turbine Engine Co.; General Electric Co.; Pratt & Whitney; Teledyne CAE; Williams International
Joint Technology Demonstrator Engine (JTDE) A complete technology demonstrator engine sponsored by the Navy and Air Force Aircraft Propulsion Subsystem Integration (APSI) program, these experimental engines consist of advanced high-pressure core components from the Advanced Turbine Engine Gas Generator (ATEGG) program combined with advanced low-pressure and adaptive components.	Advanced Development	Garrett Turbine Engine Co.; General Electric Co.; Pratt & Whitney Aircraft
High-Speed Propulsion This is a group of related technology programs aimed at rapidly developing an Air Force capability for high-speed flight, including turboramjet engines for Mach 5 interceptors, hydrogen-fueled engines for hypersonic cruise vehicles or space boosters, and new engine options for high-speed missiles. One of the approaches being pursued is a supersonic combustion ramjet engine (scramjet). The scramjet can operate to speeds higher than those of any other air-breathing engine.	Exploratory Development	Many
Spacecraft Power This program is to provide evolutionary and revolutionary improvements in spacecraft power systems while achieving significant reductions in weight and volume accompanied by increased survivability. Advances are made through higher-efficiency solar cells, solar concentrator and planar arrays, high-energy-density rechargeable batteries, nuclear power thermal management systems, dynamic and thermionic energy-conversion devices, power conditioning components, and electrical energy storage concepts.	Research/Exploratory & Advanced Development	Many
Solid-Fuel Ramjet Propulsion The solid-fuel ramjet is extremely rugged and conceptually is the simplest and least costly of all ramjet types. Solid-fuel ramjets that employ hydrocarbon fuels have been matured in exploratory development. Efforts are now focused on using boron-based fuels, which early tests have shown can double the performance compared to the hydrocarbon-fueled engines.	Exploratory Development	Atlantic Research Corp.; United Technologies Corp., Chemical Systems Div.
Aviation Fuel Technology This program will develop advanced fuels and fuel systems for subsonic, supersonic, and hypersonic aircraft and missiles powered by air-breathing engines. Work will continue to ensure the availability of low-cost fuels from domestic petroleum, heavy oils, oil shale, coal, and tar sands. Programs are being initiated to develop endothermic hydrocarbon fuels for potential high-Mach applications. The fundamentals of fuel atomization, fuel/air mixing, combustion, as well as fire safety for aeronautical systems are also being investigated.	Research/Exploratory & Advanced Development	Many
Expendable Turbine Engine Concept (ETEC) Demonstrator This advanced technology demonstrator engine, sponsored by the Aircraft Propulsion Subsystem Integration (APSI) program, is to address future propulsion technology requirements for small, unmanned, limited-life applications. Emphasis is on providing a technology base for a broad range of missile requirements, including subsonic and supersonic tactical and strategic systems.	Advanced Development	Allison Gas Turbine Div., GMC; Garrett Turbine Engine Co.; Teledyne CAE; Williams International
Compressor Research Facility This is a modern component test facility, fully automated and computer-controlled and designed to support both exploratory and advanced development efforts in compressor technology for the improvement of gas turbine engines. First test programs have included steady-state aerodynamic and aeromechanical mapping for both clean and distorted inlet flows. Standard pressure, temperature, and flow instrumentation; laser velocimeters; multipurpose traverses; and high-response pressure transducers have been employed. Data precision has been very high. Transient compressor operation, including post-stall performance, has been investigated, and significant new trends were uncovered. Future work will be conducted to define research compressor performance and to assist in development problem solution.	Operational	In-house
Aircraft Power This program will advance aircraft electrical and hydraulic power system technology through the development of a nonflammable hydraulic system, advanced battery systems, highly reliable fault-tolerant electrical power systems, and associated operation, distribution, actuation, and control components. Program objectives are to reduce life-cycle costs, increase power-extraction efficiency, decrease weight, and improve specific fuel consumption.	Research/Exploratory & Advanced Development	Many

NAME AND MISSION	STATUS	CONTRACTOR
Variable-Flow Ducted Rocket Demonstration This missile propulsion concept, when combined with advances in aircraft fire control and missile subsystems, will contribute to air-to-air superiority in the post-1995 time frame. An integral rocket/ramjet using a fuel-rich solid-propellant gas generator for ramjet fuel can provide a two- to fourfold improvement in total range over rocket propulsion for an equivalent size. The current objective is to complete ground tests of a flight-weight engine of this class by 1991.	Advanced Development	Atlantic Research Corp./Hercules International
Aerospace Lubrication This is a program to assure the availability of optimum lubricants, lubrication techniques, lubrication-system components (bearings, gear, and seals), and lubrication-system condition monitoring techniques to meet the needs of USAF air-breathing propulsion and power systems. Present emphasis is on the development and validation of high-temperature lubricants and lubrication system components to meet HPTET and other Project Forecast II requirements.	Research & Exploratory Development	Many
Advanced Turbine Engine Gas Generator (ATEGG) This advanced-development core engine program assesses new high-pressure components, advanced structures, and material technologies for the first time ever in an engine environment. Improvements in engine performance, durability, and life-cycle cost are mutually sought under this program. ATEGG serves as the central test-bed for new engine technologies developed under the triservice Integrated High-Performance Turbine Engine Technologies (IHPTET) initiative, which will attempt to double propulsion capability by the year 2000.	Advanced Development	Allison Gas Turbine Div.; Garrett Turbine Engine Co.; General Electric Co.; Pratt & Whitney Aircraft
4950th Test Wing		
Advanced Range Instrumentation Aircraft (ARIA) Scoring Systems This program is to provide state-of-the-art broad ocean area coverage of reentry vehicles for weapon system testing. Functions previously requiring both EC-135 and P-3 aircraft will be combined in the EC-18 ARIA aircraft. The Sonobuoy Missile Impact Location System (SMILS) will acquire and process missile impact data. Impact locations of multiple reentry bodies will be determined precisely by SMILS, using either deep ocean transponders or Global Positioning Satellites. Associated programs will collect optical data on reentry vehicles during the terminal phases of flight and will sample meteorological parameters from the surface to 80,000 feet.	Development	Applied Physics Laboratory (Johns Hopkins University); E-Systems, Inc.
EC-18B Conversion This effort is modernizing the current EC-135 Advanced Range Instrumentation Aircraft (ARIA) fleet by converting used Boeing 707-303 series aircraft and reconfiguring them as EC-18B ARIAs. The EC-18B has a larger volume and payload than the EC-135s, allowing it to hold the existing Prime Mission Electronic Equipment plus the new ARIA Scoring System. Modification and flight test of the first aircraft were completed in 1985.	Production	In-house
Mark XV Identification Friend or Foe (IFF) The Mark XV IFF program is intended to test the next generation of IFF equipment for the Air Force, Navy, Army, and NATO. It is designed to be a secure, antijam, high-reliability system that can operate in an ECM environment. The first phase of testing, completed in 1987, involves one NKC-135 and two C-141 aircraft flying 500 hours from Wright-Patterson AFB, Ohio, and Patuxent River NAS, Md. The second phase of testing, also referred to as "Service-Unique Testing," calls for the 4950th Test Wing at Wright-Patterson AFB to support Mark XV IFF testing in specified environments for the three services (Air Force, Navy, and Army). This second phase will take place in FY '90 and FY '91 and will probably have more 4950th flight activity than the first phase. Initial testing focused heavily on the digital signal-processing capability, target resolution, and new IFF interrogation techniques. *(See also entry on p. 71.)*	Development/Validation	Bendix; Texas Instruments
ECCM/Advanced Radar Test-Bed (ARTB) In support of the ECCM master plan, the ECCM/ARTB is an airborne platform for development test and evaluation of advanced radar systems and ECCM techniques, to include multisensor integration. This unique Air Force resource will support development of the B-1, F-15, F-16, and ATF radar systems and advanced technology programs into the 1990s. The area of ECCM and system-vulnerability analysis is growing steadily in importance due to tactical considerations. The test-bed represents a major step in the Air Force's ability to evaluate sensor systems in a realistic environment and early in system development. The test-bed, currently under design development, is scheduled for employment in FY '89.	Development	None
Testing Off-the-Shelf Aircraft This program provides evaluation of civil aircraft against specific military requirements. Areas of evaluation include ground handling, maintenance, flying qualities, performance, and human factors. Test results are used extensively in the source-selection process. A wide range of Technical Order Management and development services is provided to determine suitability for various maintenance levels and specialties in the Air Force. Recent evaluations of off-the-shelf aircraft have resulted in the selection and procurement of the C-12, C-18, C-20, C-21, C-22, C-23, and the Air Force One replacement aircraft.	Continuing	Many
Aerodynamic Evaluations of Modified Aircraft Aircraft utilized for advanced systems test often undergo significant external modifications. Radomes, antennas, special fairings, shaped protrusions, and movable turrets that have at one time or another been added to the 4950th Test Wing's aircraft to accommodate test requirements in the aircraft's performance, stability, and control and handling qualities are evaluated using approved flight-test techniques prior to the start of actual system evaluation. Aero-eval results are then incorporated into flight certifications and are documented for further use.	Continuing	Many
Aircraft Systems Testing A variety of aircraft components is evaluated under the management of 4950th Test Wing flight-test project directors. Avionics, control and braking systems, aerial refueling projects, and communications equipment are tested prior to Air Force procurement. Engineering support is provided for many tests, including acceptance flight testing for the C-23 and C-5B.	Continuing	Many
EC-18 CMMCA The EC-18 Cruise Missile Mission Control Aircraft will provide a standalone asset for cruise-missile testing through the year 2000. By combining the aspects of telemetry reception and real-time display, remote command and control, and radar surveillance into one airframe, cruise-missile testing will not require the large airborne support group currently used. The EC-18 CMMCA will also allow cruise-missile testing to be done off-range. This added flexibility not only frees up valuable range resources but enables greater mission realism to be added into the testing operations.	Source Selection	To be determined

A vocabulary of 656 words is sufficient for voice control in most tactical situations. But some words—including "two" and "six"—are tough.

Talking With Airplanes

BY DAVID S. HARVEY

IT WAS a classic before-and-after situation. In the "before" portion, the fighter pilot was struggling along, trying to set up some waypoints in his F-16's navigation system. At the same time, he was checking fuel, looking over his stores, and resetting the radar to ground-map mode. At 500 feet above ground level and 440 knots, the aircraft was a handful.

Through the over-the-shoulder camera, an observer could see the height creeping up through 600 to 700 and finally to 800 feet. "Whoa," said the pilot, finally taking his eyes off his knobs and switches, "that's way too high." Back under control, the aircraft resumed its low-level dash to the target.

This F-16, however, was no "plain vanilla" version. It was, instead, USAF's AFTI demonstrator. AFTI—which means Advanced Fighter Technology Integration—is a flying test-bed of new technological approaches to fighter combat. Among many new areas it is probing is the one of voice interactive avionics (also called Voice Interactive Systems, or VIS), which make controls respond to a pilot's voice commands. Researchers are interested in seeing how a work load like the one above could be lessened by having the pilot "talk" his way through the complex switching routines.

In the "after" situation, things go much more smoothly. The pilot barely bobbles from the assigned altitude. Each command is followed by an audible "beep," so the pilot knows that what he's just said has been accepted by the AFTI's computer. The smoothness of the ma-


"Display Target Status Show Threat"
"Break Right"

neuvers being flown can easily be seen; the pilot's head stays relatively still. You can feel the tension slip away.

Later, researchers at USAF's Wright Aeronautical Laboratories at Wright-Patterson AFB, Ohio, would compare the performances more formally.

Low-level navigation was just one of several tasks that the pilots were given to test the new controls, but it showed some interesting trends. When voice commands were used, average airspeed stayed at 441 knots and height at 547 feet. But when manual controls were used, things deteriorated. The AFTI's average height for the manual run was 603 feet AGL and its speed 435 knots. Additionally, not all the tasks were done in the required time. Some were done out of order.

That demonstration—extracted from a body of AFTI data gathered while probing voice controls—clearly showed what researchers looking into the human factors relationships between man and machine have long believed. As cockpits become ever more complex, the best way to handle them is to find new, more "natural" ways to handle the required control inputs.

Dawn of a Cybernetic Future?

A few years ago, the use of voice interaction was being hailed everywhere as the dawn of an ergonomic, not to say cybernetic, future. Commercial computer manufacturers were eagerly anticipating the demise of the keyboard, and it was hard to find anyone who would dispute the inherent promise.

But the creation of artificial speech has turned out to be much harder than its evangelical proponents had at first thought. The problems have been many, mostly having to do with getting computers to recognize sounds in the same way they were intended.

To make a spoken word into a "computer" word, a lot has to be done. The signal has to be recorded in some way, its waveform has to be analyzed and turned into digits (signal processing), and then it must be stored in a data bank. When the same digitized shape is entered into the memory a second time, a process of recognition must then take place. Once that has been achieved, the computer must figure out (a) that is an authentic match and (b) what it must then do to instruct the relevant system. There are many pitfalls.

Left to themselves, human beings are quite happy spieling along at about 180 words a minute, or about three times the rate of a reasonably competent typist. What's worse than this helter-skelter pace,

The Words of the Combat Pilot Fraternity

Here are the 656 "unique words" believed to cover "just about every eventuality in air-to-air and air-to-ground missions" *(see text)*. Of these, the twelve most frequently used, in order of frequency, are:

air
to
display
threat
two
me
show
status
target
data
go
the

The entire list, in alphabetical order, is:

a
about
abreast
accelerate
accept
accepted
access
accomplish
acknowledge
action
activate
active
activity
additional
advise
against
ahead
aid
aim
aims
air
airborne
aircraft
airplane
airplanes
all
allied
alter
alternate
alternates
alternative
altitude
am
amraam
amraams
an
analysis
analyze
and
any
apx
are
area
arm
armament
armed
arms
around
as
aspect
assess
assessment
assign
assignment
assignments
at
attach
attack
attackers
attempt
attempts
auto
automatic
available
avionics
avoid
avoidance
avoiding
back
band
bandit
bandits
base
bases
battle
bd
bda
beam
bearing
begin
best
better
big
bit
blind
blow
blowup
bogey
bogeys
bomber
bombers
bore
both
box
break
breakout
bring
bug
burst
buzzers
bvr
by
c
calculate
call
can
chaff
change
changes
check
chief
choose
chopper
clear
cleared
climb
close
closer
closest
closure
collision
combat
come
command
commence
commit
complete
configure
confirm
confirmed
consent
continue
control
conversion
count
counter
countermeasure
countermeasures
course
criteria
cross
crossing
cruise
cue
damage
danger
data
defeat
defend
defense
defensive
define
deploy
describe
designate
designation
detail
details
detection
direct
direction
dispense
display
divert
do
dogfight
doing
dope
drop
east
ecm
egress
eighteen
element
em
employ
encounter
endurance
enemy
engage
engaged
engagement
enlarge
enter
envelope
equipment
escort
evaluate
evasion
evasive
everybody
everything
execute
expand
expend
expendables
express
eye
fast
feet
fence
fifty
fight
fighter
fighters
file
fire
five
flare
flares
flight
fly
foe
follow
following
for
forget
formation
forty
four
friend
friendlies
friendly
front
fuel
full
future
gas
gci
gear
geometry
get
gimme
give
go
gods
going
good
got
granted
green
ground
gun
guns
guys
hahn
have
he
heading
heat
heater
helicopter
helo
help
hide
high
highest
highlight
him
history
hold
home
homeplate
hook
horizontal
hostile
hostiles
hot
how
hows
hsd
hte
hundred
i
id
identification
identify
im
impact
implement
in
into
inform
information
infra
ingress
initiate
inroute
instructions
intercept
interrogate
into
ir
irst
is
it

though, is how many words get clipped, run together, and changed by regional accents. The computer, which is dumbly trying to match this flood of acoustic signal patterns of sounds—phonemes, as they're called by linguists—to those stored in its "memory bank," is quickly overloaded.

The problems of the hows and whys of signal processing are probably better dealt with elsewhere. Suffice it to say that voice specialists today use two main methods, fast Fourier transforms and Linear Predictive Coding, to make the phonemes. Neither has yet proved good enough to handle the speed and variations of "natural" speech.

Proven Utility

Scientists working on the problems have fallen back to breaking down our speech into individual words until better computer processing—which includes artificial intelligence (AI) rule bases and the computer architectures to run them—can be brought to bear. The commercial world has dropped back, leaving the technology of voice recognition to military specialists.

"Don't get me wrong," says David Williamson, the Lab's Project Engineer for voice programs. "There's a proven utility for what we've been able to do already." Mr. Williamson, who directed the voice interactive portions of recent AFTI tests, now has some six years of work to fall back on. The AFTI tests have been extremely valuable both in applying lessons and in learning new ones.

"We've found out that pilots who accept the systems quickly find them indispensable, a fact that you can see from all the comments recorded during the AFTI tests." A review of those comments bears out his conclusion. Time and time again pilots were worried about getting more help in managing work load.

- "Pilot is overloaded. What I want to do is pay attention to the outside world at all times."
- "Voice didn't change the way I managed the a/c . . . but I did [manage the aircraft] safer and easier."
- "Speech's real advantage comes when you are real busy."

Mr. Williamson wants to move the technology forward and has recently completed a unique project. It is what AFWAL calls a "cockpit natural language" study.

In this first attempt to collect a body of language used exclusively by the combat pilot fraternity, researchers described various "mission scenarios" to a total of fifty-four fighter pilots from Air National Guard and Air Force Reserve units

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jazz	missiles	options	program	rwr	sixty	targets	verbalize
join	mission	or	project	sa	snakes	tell	vid
keep	mode	ordnance	put	saber	snap	ten	view
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link	nine	pincer	reconfirm	select	steer	through	while
load	ninety	pinch	recover	selected	steering	time	wide
location	non	pk	recovery	selection	store	to	wilco
lock	north	plan	red	self	stores	tot	will
locked	nose	planes	rejoin	send	strike	track	window
long	notify	plate	relative	sensor	striker	tracking	wing
look	now	platform	relay	separate	strikers	trail	wingman
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around the country and some from Wright-Patterson AFB. The pilots—working in a lab—were then asked to perform the missions and give voice commands similar to the ones they would use in an actual aircraft. They used simulated cockpits with "low-fidelity advanced display formatting," which represented—in an informal way—the kinds of advanced cockpits anticipated in the future.

The commands they gave were then collected and processed. The result is a collection of 656 "unique" words *(see box)* that the researchers identified as covering just about every eventuality involved in air-to-air and air-to-ground missions.

Apart from the usefulness of having such data, a secondary aim was to "carry out some language engineering," according to Mr. Williamson. This term, he says, can be considered complementary to the term "knowledge engineering" used by the AI community. The meanings of the words used in specialized situations rely heavily on their context.

Understanding Context

Or, as the report on the experiment states: "Understanding a communication depends on the social and situational context within which it occurs." This consideration, as we shall later see, is becoming vital to a new term that is creeping more and more into the language of advanced combat cockpits: situational awareness.

An interesting finding of the experiment was that F-15 pilots taking part were much more clipped in the way they "spoke" to their aircraft systems than were their colleagues out of the other communities. F-15 pilots also resorted less frequently to "voice" to command systems.

At first, AFWAL researchers thought it was because they were accustomed to a higher level of cockpit automation. But when it came time to analyze the data for the F-16, also a sophisticated aircraft, those pilots were just as prolix as some from such older aircraft as F-105s and A-7s. Maybe, they surmised, Eagle pilots are more naturally the strong, silent type.

The data collected is considered a big step forward along the road to natural language command of an aircraft system. The results have already been passed along to DARPA's (Defense Advanced Research Projects Agency) Pilot's Associate program. Work here is focused on a relatively near-term application of AI to relieve combat pilots of work load at critical times.

These, though, are highly conceptual studies. Elsewhere in USAF, some "real-world" experience is being gained from another experiment where aircrews aboard a specially equipped C-135 are trying voice communications for themselves. The aircraft involved is a Special Air Mission aircraft based at Andrews AFB, Md., called, for a reason lost in the folklore of the Air Force, "Speckled Trout."

The Trout carries some big fish around, being one of the transports available to the Chief of Staff for global missions, but it is also in use as an avionics test-bed for looking at advanced avionics systems. Jim McDowell, Program Manager for Voice Research at Wright-Patterson, has a "hands-on" problem to face: He must ensure that reliable voice templates—plus the necessary training—are available for each of the pilots who work the aircraft. On board, there are three voice interactive systems used for working the radios.

Experiments by Mr. McDowell and his team began in 1982—with actual flying in 1985—and so far have resulted in the accumulation of about sixty-three words that participating crew members must "load" into the Trout's voice spectrum analyzer. The words refer to regular actions with the radio, such as calling frequencies, changing from one controller to another, etc. The pilots can watch—and confirm—that the instruction has been received by monitoring special multifunction displays mounted on the control pedestal.

The team working the problem

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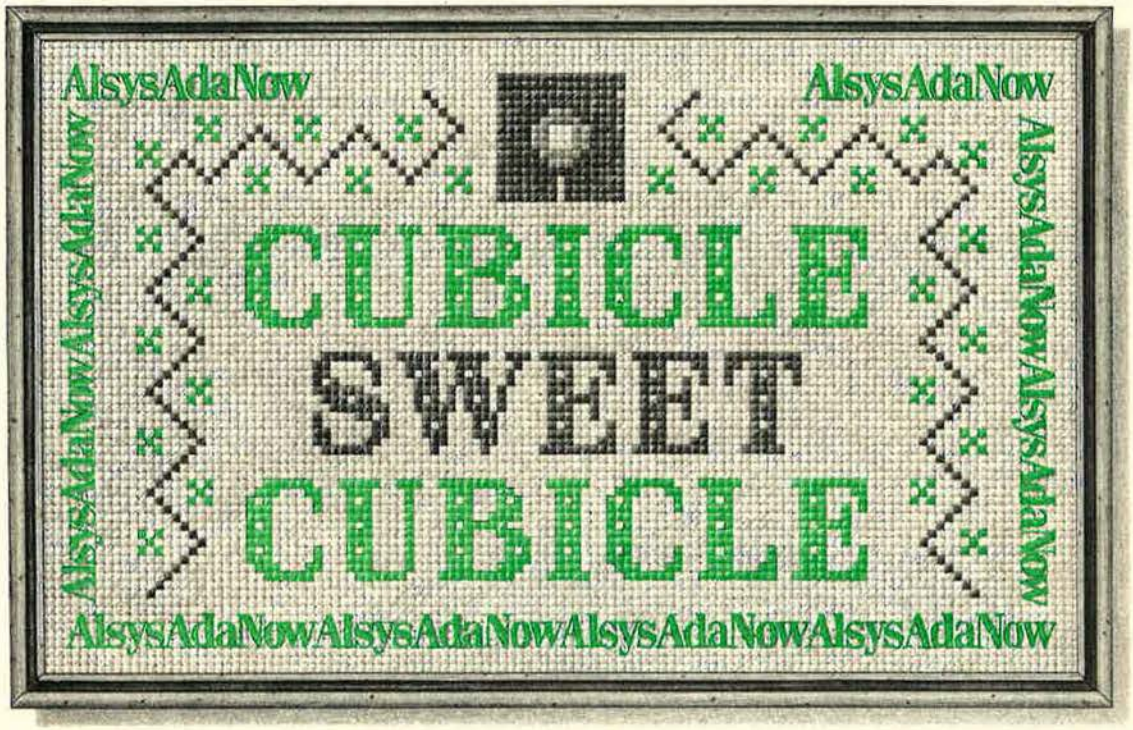

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has a dual approach. Both isolated words (called discrete words) and typical limited phrases, such as "ground now, point nine," an instruction frequently received after landing, are being tested.

"[In terms of] human factors," says Mr. McDowell, "the system looks capable of [offering] a vast improvement over what we have right now. The pilots who take the trouble to understand it—and do the training—are finding good reliability." What does reliable mean? The team is fairly happy with a range of first-time word recognition success of from eighty to ninety-eight percent among the twelve Trout pilots with whom they have worked.

Amn. Scott McLaren, Voice System Technician on the Trout project, demonstrated how care must be taken in "recording" the words that will later be spoken under actual conditions. He had trouble making the computer accept and then recognize the simple command "Victor Two," meaning VHF radio two. But when he tried again, making the word as distinct as he could manage, it worked just fine. "It takes about seven minutes to work through the single word prompts and twenty minutes for the connected [embedded] instructions," he said.

Troublesome "Two" and "Six"

Two words, "two" and "six," have caused the most trouble. "They're just loaded with variations in accent, inflection, and emphasis," he complained.

The Trout experiments are providing valuable evidence from the real world that voice recognition promises great things. Although there is no plan to put a VIS aboard at the moment, the Air Force is looking at a major upgrade of the KC-135 cockpit, and Mr. McDowell believes the technology could be part of that. He is also interested in seeing that it is added one day to B-1B cockpits. For now, though, he is anticipating further refinement of research efforts aboard the Trout.

Some additional interesting "real-world" evidence—or at least an interesting research approach—has come from a survey of combat aircraft fighter accidents. The survey was conducted by Texas Instruments—which, with Lear Siegler Inc. (LSI), was one of the two teams chosen to test VIS equipment on AFTI—in an attempt to see if there were any safety aspects that could have been enhanced by the use of such controls.

John Wester, TI's Manager for Military Speech Avionics within the Defense Systems and Electronics Group, looked at accidents involving F-15s and F-16s that occurred over a period beginning in 1980 and ending in June 1987 in what he stresses was an informal review.

"We took the narratives on 149 crashes and analyzed the data. We were looking, at the same time, for factors that would be useful in the work on AFTI." Mr. Wester divided accidents into three broad categories: aircraft where the outcome *might* have been different had there been a VIS on board, aircraft where it *probably* would have been, and aircraft where VIS would *definitely* have made a difference.

"We projected that about twenty-five to thirty percent of the aircraft in the 'probably' category would have survived. In the 'definite' category, we deduced there were seven accidents where use of a VIS would have allowed the pilot to save his flight."

Mr. Wester said that the latter category included accidents where the pilot had run into the ground because he was distracted by other tasks at the time. "It was cases where he was just going too fast. He lost his situational awareness."

The TI researchers were encouraged by their findings. "We have to make the point about VIS that it is not just a replacement for existing systems. It can reduce work load significantly."

Doing the Mental Gestalt

The growing emphasis within the cockpit/human-factors community on situational awareness is partly an attempt to show that technology can now do a lot of the mental "gestalt" that has to be done in cockpit as well as an admission that modern combat speeds and agility may be overwhelming pilots.

A strong advocate of redefining the way pilots perceive their workplace is Dr. Tom Furness of the Armstrong Aerospace Medical Research Laboratory at Wright-Patterson. Dr. Furness, whose work on the "supercockpit" has attracted wide attention, wants to put the pilot inside a sort of electronic bubble where the "real" world outside can be represented as a "virtual" world within. His cockpit would really exist inside the visor of the helmet. The pilot would sit back in this "Sensurround" environment, reaching for switches that exist only as electronic diodes, enjoying a "God's-eye" view of the world outside, and communicating with his cyber-environment by speaking to it. Perhaps.

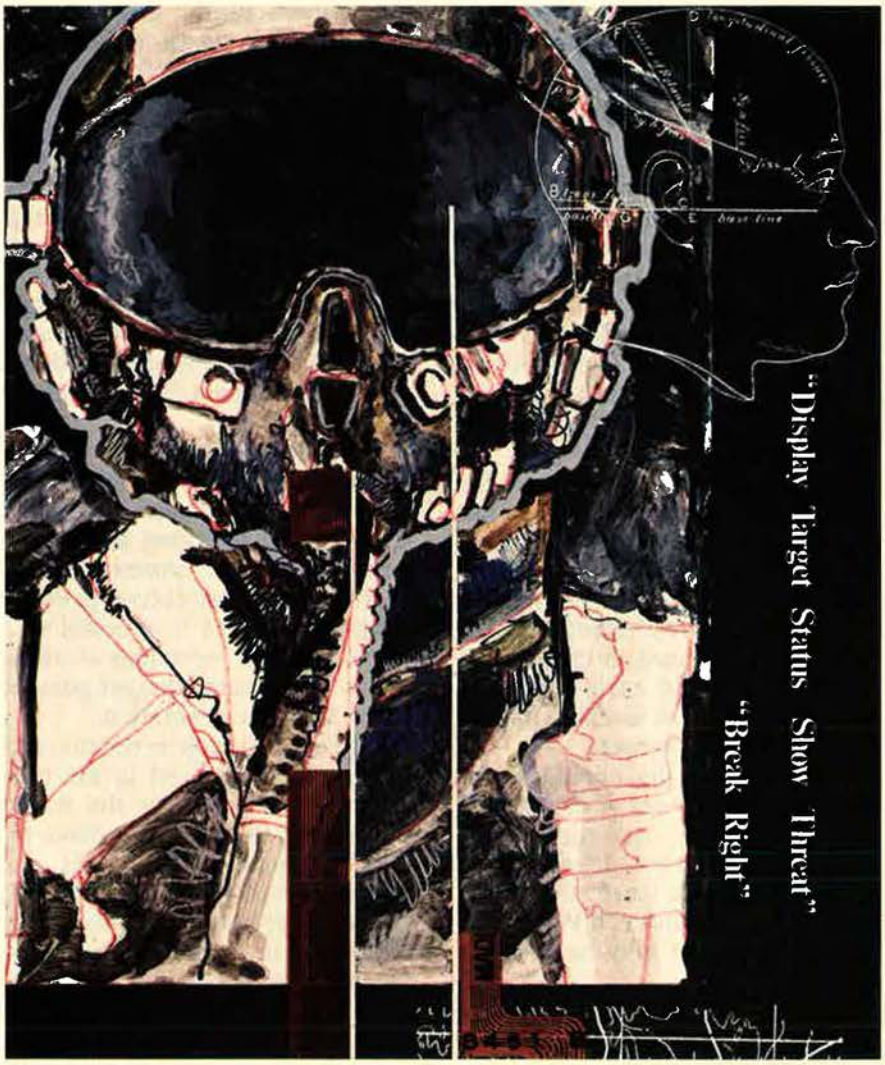
"I'm not totally sold that we have to develop the ability to make computers recognize natural speech," he said in an interview in the cluttered quarters he shares with the detritus of prospective pseudo-worlds. "We have to proceed with caution on the view that all these things are panaceas that are going to usher in a new generation."

Dr. Furness is concerned that artificial speech be used in the right way. "If we press for the wrong things, like the ability to make big vocals, connected sentences, and so forth, we could end up sacrificing performance in terms of the accuracy of speech. Would the Air Force, for example, really like to have its missiles controlled by artificial speech?"

A much more realistic approach, he says, is to think about VIS in context of everything else being done to feed gestalt-making information to the pilot. "I believe we'll find that about twenty- to fifty-word utterances would probably be sufficient."

Dr. Furness also has a hunch that under high work-load and stress conditions, humans tend to shut down the psychomotor systems involved in speech. "When you get task-loaded, speaking gobbles up a lot of cognitive energy. Actually, you stop talking, hearing, and seeing properly." However, there is, in his view, a premium place for VIS on board his supercockpit. "Anything that assists the human to interact with the machine is of immense value. The best way to use voice is as one of a number of 'multiple modalities' by which you back up voice with something else."

Experiments on the Visually Coupled Airborne Systems Simulator (VCASS), the lab's virtual world



projector helmet (which looks like Darth Vader's), have shown that voice actions in combination with something else, such as physically indicating a switch, have produced the fastest response times.

The concept of placing the pilot at the center of an artificial yet fully representative world is gaining ground. Some sort of situational awareness system is an even bet for the ATF, for example. McDonnell Douglas believes that something like its "Big Picture," an experimental "wraparound" cockpit display technology being researched jointly with USAF's Avionics Laboratory at Wright-Patterson, offers a near-term step forward into virtual worlds. It, too, relies on VIS as the communications bridge.

Meanwhile, the search for a system to do that job better goes on. Since the AFTI tests, both TI and LSI have improved the ability of their airborne speech recognizers. According to Allen Rosenhoover of General Dynamics in a paper presented last October at the Society of Automotive Engineers' Aerospace Technology Conference in Long Beach, Calif., LSI's new voice template algorithms now allow for a ninety-five percent recognition rate, up some ten percent on the approach used in AFTI. TI, meanwhile, was reporting success with improved connected-speech recognition templates.

Banding Together in Europe

In Europe, belief in VIS is so strong that countries within the European Economic Community are banding together to develop joint solutions. The UK, Italy, France, Denmark, and the Netherlands have just launched a cooperative definition phase aimed at pinning down voice-assessment methods. At least one firm active in the field, Smiths Industries, a UK aerospace leader, believes it has made breakthroughs in the way speech recognition algorithms can be applied to the task.

Duncan Tincello, a Smiths voice engineer, told attendees at the Com-Def conference in Washington, D. C., last fall that development of a graphic means of showing subjects how to "shape" their voices for more effective acceptance by the spectral analysis part of the recognizer was making a big difference to training requirements. "They take the hit and miss out," he explained. Smiths is also achieving breakthroughs in very noisy cockpit environments, such as those found in helicopters. Recent tests have shown speech-recognizer performance in the 115-dBA (decibels absolute) noise level of helicopter cockpits.

But Mr. Tincello, like his colleagues across the Atlantic, is wary of promising too much too soon. "It is apparent that interfacing is a major issue. The implications of this must be borne in mind from an early stage in any design activities."

Touted just a couple of years ago by everyone as the new way of communicating with computers, speech recognition systems have proved much trickier to produce. The technology, though, is maturing now to the point where it will begin to move more rapidly from lab bench to cockpit. Tests such as those conducted with AFTI are slated to be repeated in the near future as the curve reaches out to the sort of things envisaged by such cockpit/human-factors futurists as Tom Furness.

But many problems remain to be solved. One of the oft-repeated jokes about the smartness—or stupidity—of computers is worth retelling here as an example of what technologists are facing.

A Voice Interactive Computer System (VICS) somewhere in a Colorado mountain: "General, we are being attacked by enemy missiles."

General to VICS: "ICBMs or sub-launched?"

VICS: "Yes."

General to VICS: "Yes, what? I gotta know fast."

VICS: "Yes, *General!*" ■

David S. Harvey is Washington Editor of Defense Science and Electronics *magazine.*

Events beyond military control may put US defense capability at risk in the near future.

Storm Flags on the Budget Front

BY JAMES W. CANAN, SENIOR EDITOR

THE Air Force has come a long way in the 1980s, but is now embattled. It is more combat-capable—in its people, weapons, and other warfighting wherewithal—than it has ever been. But it faces threats that compel it to become even better—and this will be extremely difficult, perhaps impossible, under the duress of budget cuts already inflicted and even deeper cuts in the offing.

This was the broad but basic message conveyed by Air Force uniformed and civilian leaders at the Air Force Association National Symposium last October in Los Angeles. They expressed satisfaction with what has been done to make the Air Force much stronger in recent years and concern about what may be done, beyond their control, to sap that strength in the near future.

The strategic modernization program is prominent among their apprehensions. It may be in jeopardy just as it has begun to prove itself in the deployment of new bombers and ICBMs and, thereby, in its obvious influence on the Soviet Union to come to the nuclear-arms negotiating table. More sweepingly, the research, development, and acquisition programs from which USAF's weapons emerge are also worrisome amid the wintering of the defense budget. So is pilot retention, slipping sharply now. The readiness gains and reliability and maintainability advances of recent years are at risk. And these are far from all.

Even as Air Force leaders warned, "Watch out," however, they left no doubt of their resolve to do what needs to be done, one way or another, to keep the service from being fatally impoverished in the hard times ahead.

The theme of the AFA symposium, which attracted an ample audience of defense industry executives, was "The US Air Force: Today and Tomorrow." Air Force Chief of Staff Gen. Larry D. Welch put it into the perspective of USAF's place in the US defense posture.

"It is useful," said General Welch, "to remind ourselves that there is a coherent national military strategy that focuses on the goals

that we are trying to accomplish. We move from that strategy to the kinds of military tasks that we have to perform to underwrite it, to the kinds of capabilities that it takes to perform those tasks, and to the weapon systems that it takes to provide those capabilities—and it's no more complex than that."

In this, and throughout his sometimes sternly delivered speech, General Welch seemed intent on cutting through political obfuscations of what the Air Force and the national defense are all about. Equally emphatic in their presentations were Secretary of the Air Force Edward C. Aldridge, Jr., Commander in Chief of Strategic Air Command Gen. John T. Chain, Jr., and Gen. Bernard P. Randolph, Commander of Air Force Systems Command, whose topic, in keeping with USAF's need to make do in the budget downturn, was "Capitalizing on a Changing Environment."

This article sets forth the views of those speakers as expressed at the AFA symposium. Others who addressed it will be heard from in subsequent articles. They include Gen. John L. Piotrowski, Commander in Chief of US Space Command; Lt. Gen. John A. Shaud, Commander of Air Training Command; Lt. Gen. James R. Brown, Vice Commander of Tactical Air Command; Lt. Gen. Robert D. Springer, Vice Commander in Chief of Military Airlift Command; Donald N. Fredericksen, Deputy Under Secretary of Defense for Tactical Warfare Programs; and A. Denis Clift, the Defense Intelligence Agency's Deputy Director for External Relations.

Systems That Must Be Funded

"For the last seven years," declared Secretary Aldridge, "our Air Force has been on a roll, and our priorities have been right on the mark. By every measure, we are better off today than we were in 1980. But we can't stop here. . . . Unless we turn this decline in defense spending around, we may lose the military capabilities that it has taken us seven years to build. What we need to maintain and modernize our Air Force and our sister services is a real [inflation-discounted] increase in the defense budget of at least three percent annually."

General Chain did not dwell on budget problems or numbers per se. But he made it clear that the systems SAC must have in order to remain convincing as the nation's main deterrent force and as the nuclear-war executor of the Single Integrated Operational Plan (SIOP) will not come cheap and must be funded and fulfilled.

WELCH: Today's combat readiness is the best in history.

Vital among such systems, as General Chain enumerated them, are the full complement of 100 B-1B bombers and of 100 Peacekeeper ICBMs, both of which he praised in countering their critics; follow-on strategic tanker aircraft in the not-too-distant future; new airborne command posts with more room for expanded SAC battle staffs and for new computers to help with "adaptive planning" during a nuclear war; the Small ICBM (SICBM); the B-2 Advanced Technology Bomber (ATB); earth-penetrating warheads for getting at the strategic facilities that the Soviets are increasingly "digging deep" underground; and standoff weapons for bombers in both the strategic mode and in the conventional role that the CINCSAC is now proposing for B-52Gs that otherwise would be destined for "the boneyard."

Summing up SAC's accomplishments, General Chain declared that "the bottom line here is that we have significantly improved our existing systems with upgrades." He added, however, that "we have squeezed about all we can out of our current weapon systems" and that this is why the strategic modernization program, which "is already giving us a more secure and stable deterrent," must not falter under fiscal constraints.

The increasingly urgent need to sustain the momentum of all indispensable Air Force development and acquisition programs puts Systems Command squarely on the spot. General Randolph acknowledged this and said that he has reorganized AFSC's command structure because of it.

The reorganization, General Randolph explained, has two main purposes—"keeping close to the combat commands," such as SAC, "to ensure value" for them by tailoring their technologies and systems stringently to their needs and "sharpening the way we do business" with contractors in "continuing to be demanding" that they keep quality up and costs down.

"This is a very, very difficult situation we're all in," General Randolph told the symposium audience of industry executives and Air Force officers. "We're up against some very tough times, and they're here *now*." He asserted that "Air Force and DoD leaders face trade-off decisions involving the spectrum of combat capability." There will be wrenching trade-offs "within programs" too, he said, and resolving these will require "strong developer-user relationships." Finally, the General said, "once we agree on what to buy, we must use effective business tools to keep costs down."

General Welch made it clear that the Air Force is dealing from strength in its insistence that its modernization programs not be made to languish. The reason: It has shown its knack for "getting the most out of what we already have on the ramp and out of those systems that are already in production" and, thusly, cannot be accused of having wasted resources.

Moreover, said the Chief of Staff,

ALDRIDGE: Tighten belts—but avoid noose around neck.

USAF's longstanding emphasis on improving the reliability and maintainability of its systems and on "realistic training" has resulted in "the highest state of equipment readiness in our history and . . . the most combat-ready crews of all kinds that we've ever had."

Addressing the salutary results of systems-upgrade programs, General Welch declared that, in using that approach, "we've doubled the capability of the B-52. We've increased the capability of each tanker by fifty percent. We've transformed the F-16 from a day fighter into a highly effective multimission aircraft. We have continued to grow the air-superiority capability of the F-15, which is eleven years old. The approach works. It's cost-effective.

"But when our capability to meet the threat can't be satisfied [by] using that approach, we have no choice but to step up to the kinds of investments that it takes to exploit technology and produce new systems."

Making the Air Force Proud

And in this, too, the Air Force has shown its stuff, General Welch declared. He cited the strategic modernization program as a prime example, noting that the Peacekeeper missile and the B-1B bomber, despite the claims of critics to the contrary, are making the Air Force proud.

"Peacekeeper is here and now, and it works," General Welch declared, "and there is no obstacle that I can see to the first fifty [of the ICBMs] meeting their initial operational capability by December 1988, which was our long-term plan. There are great political obstacles to the second fifty, but we will persist, because we think it's the most foolish kind of shortsightedness to stop producing a system that is here, that works, that does what we need it to do, and at the lowest possible price.

"The B-1B is performing today the mission that we designed it to perform. It has some development to complete, but it is here, and it is doing its job. The ATB [Advanced Technology Bomber, or B-2 as it is now designated] and the Small ICBM are proceeding, in some cases with some political problems in development, and I see no particular cause for alarm on those programs at this point in time.

"So I think that the message is that we are embarked on carefully designed programs—conventional and nuclear—to provide the capabilities to do those tasks that underwrite the national military strategy. And so long as we continue to pay attention to that, I have high confidence that we'll continue to succeed in our deterrent mission. And that's what we're about every day."

General Welch made a major point of the strategic modernization program's positive impact on the arms-control process. The capabilities of the program's new systems make it possible for the US to "contemplate major reductions in ballistic-missile warheads and still feel confident that we have an adequate deterrent" and, by the same token, have induced the Soviets to negotiate such reductions, the General said.

He continued: "The Soviets didn't become interested in negotiating away the SS-20 [mobile intermediate-range missile] until NATO made the decision to field the US Pershing II and the GLCM [ground-launched cruise missile]. The lesson is clear to everyone. The only possibility of getting a serious agreement is in negotiating from a position of strength." And what has occurred in the INF arena "will almost certainly" carry over into the strategic arena as well, he said.

The Chief of Staff emphasized that reductions of nuclear arms do not translate into a diminution of the cost of defense as a whole. "Quite the contrary," he said. "The lowest-cost weapons are the nuclear weapons, and as we do away with some numbers of nuclear warheads, there are no cost dividends to be used elsewhere outside of defense. In fact, it increases the pressure for conventional forces."

The B-1B and the B-2

General Welch was asked whether "the veil of secrecy around the ATB" will be lifted and, if so, when. His response:

"I am in favor of whatever degree of security it takes to . . . hamper the Soviets' efforts to steal [the] technology. I am *not* in favor of any . . . level of security that unnecessarily raises the cost or makes it unnecessarily difficult to execute the program. . . . It won't be too much longer until the ATB will be in the 'visible' status and, when that occurs, it won't make sense to classify its appearance. So the current Air Force plan, which I'm confident will be approved by our bosses, is to declassify the ATB progressively as the classification becomes an obstacle to efficient progress. We certainly don't intend to declassify the basic technology—the stealth technology—that makes the ATB the unique airplane that it is."

As SAC Commander in Chief, General Chain said he has no doubt that the B-2—the ATB—"will be able to penetrate enemy airspace well into the future and hold at risk all types of targets, fixed and relocatable." Meanwhile, he said, the B-1B "has already added to this nation's deterrent capability" and has generated full confidence at SAC that it can indeed penetrate Soviet airspace.

"I'm very pleased with the B-1," he declared. "We've got some growing pains, the biggest being in the ECM system. It's not what we contracted for. Fortunately, the B-1 flies low and fast. It can penetrate at

620 to 650 [mph] at 200 feet. Its radar cross section is smaller than the F-16's." Possessing such characteristics, the B-1B, he said, "is going to be able to evade the areas it needs to evade in getting to the target. Also, you have to realize that there will have been an ICBM and SLBM [submarine-launched ballistic missile] laydown before it gets there in the first place. So I'm quite confident that the B-1, as it is today, can do the job. But we do need to get that ECM equipment working."

In underscoring the success, so far, of the US strategic modernization program and the need to keep it on track, General Chain cast it in the context of the growing Soviet strategic threat, one that says everything about the Kremlin's continued dedication to its own strategic modernization even as it makes overtures on the arms-control front.

"The Soviet buildup during the years since we deployed Minuteman and the B-52 has been massive," General Chain declared. "Today, the Soviet arsenal contains more than 6,000 strategic ballistic missile warheads. They will soon deploy a rail-mobile ICBM, the SS-X-24. Their SS-25 is mobile. They are modernizing their nuclear submarine force and their intercontinental bomber force with the Blackjack and the Bear-H."

In addition, he said, the Soviets are intent on improving their air defenses everywhere and their ABM system around Moscow and are making mobile as many offensive and defensive missile systems as they can. "They have the ability to refire from many of their ICBM silos," he said, and "are burying those things that they can't make mobile, such as they have with more than 1,500 command bunkers for the Party and military leadership."

Firm on Peacekeeper

SAC does not have the nuclear weapons needed to threaten Soviet underground facilities. Consequently, said General Chain, "I have requested earth-penetrating nuclear weapons, to be missile-delivered and air-delivered."

Peacekeeper would no doubt carry some of them. And Peacekeeper was very much on General Chain's mind at the symposium. He is firm, he said, in "working toward deployment of the second fifty Peacekeepers in the rail-garrison mode—twenty-five trains, each with two missiles" to enhance their survivability.

CHAIN: We've squeezed all we can from current weapons.

"In crisis," he said, "the force could be dispersed on the existing rail system—more than 170,000 miles of track—and would be 'lost' among the 1,500,000 rail cars and 3,000 train movements that occur daily on this nation's rail network."

The survivability-via-mobility method will also be applied to SICBM, which "should be deployed in the early 1990s," General Chain said.

He reaffirmed his proposal to assign B-52G bombers to the conventional mission under theater commanders in chief, not under SAC, rather than relegating them to retirement as previously planned. With their "lethal firepower" of fifty-one bombs apiece, the B-52Gs have "enormous conventional capability," he declared. From bases in the US, they can "attack terrorist-type targets anywhere in the world" and would be, in the broader sense, "tremendous weapons" for interdicting enemy targets behind the lines in Europe, in keeping with NATO's doctrine of Follow-On Forces Attack (FOFA), the General said.

Accordingly, SAC has developed a new concept dubbed SAR, for Strategic Area of Responsibility. Under it, theater commanders would be given operational control of B-52Gs "with no SIOP strings attached," General Chain said.

"Since the first of the year," he added, "all SAC bombers have been dually assigned conventional as well as nuclear responsibilities." To train crews to handle both, SAC created its strategic training center at Ellsworth AFB, S. D., and is devoting more of its crew training to short-notice deployments around the world, to flying at night using night-vision goggles, and to using a variety of tactics over all kinds of terrain.

The beefing up of the US bomber force and the expansion and diversification of its missions mean that SAC will surely have to have new tankers in the next few years, General Chain said. He expressed satisfaction with the additional tanker capabilities that the KC-135 reengining program and the KC-10 procurement program have made available to SAC, but said it won't be enough.

"It would be kind of dumb for our nation to have bought the warplanes and the missiles and the gravity-dropped bombs and then not have enough gas for the aircraft to get to the targets," he asserted.

AFSC Under the Gun

If there is to be a follow-on tanker, or a follow-on anything else, for that matter, Air Force Systems Command would have the job of justifying the technology and the cost if not the mission. AFSC is under the gun already. Last year, Congress directed it to cut ten percent of its headquarters staff at Andrews AFB, Md. General Randolph, on subsequently taking command, went even further. He cut the staff by an additional seven percent and transferred those slots to AFSC activities in the field to provide, as he said at the AFA symposium, "better hands-on support for the warfighting commands."

He has also realigned his Deputy Chiefs of Staff, combining the plans

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TEXAS INSTRUMENTS

and technology shops in order to make the planning process "more responsive to technology change." And he has merged all AFSC support elements—testing, logistics, civil engineering, and manpower—under one DCS for the sake of "quicker response."

General Randolph has put a premium, he explained, on obtaining program managers with operational experience (such managers now constitute less than a third of the whole, compared to half fifteen years ago) and on attracting highly talented college graduates and "molding them into professionals" in basic acquisition courses and at acquisition specialty schools.

"The procurement process is as critical as the technology it buys," General Randolph said. "Inefficiencies cost all of us time and money. Contractors can't afford to be tutoring our program managers, and we can't afford their lessons. Meeting tomorrow's challenges requires professionals on both sides of the table."

Acquisition Strategy Improvements

It also requires "a responsive corporate structure," he said, and "source-selection strategies that separate good performers [among contractors] from bad." To this end, AFSC is working up "a scientific method of using past performance as a key element in the source-selection process. The idea is to reward good performance. History has shown that the majority of the time, past performance has been a factor in source-selection decisions. It's had a positive influence in favor of the winner, and our improvements in this area will capitalize on this fact."

Over the past year, AFSC has cut in half the time it takes to select winning contractors and intends to do even better. In this, said General Randolph, it is putting stringent page limits on its requests for proposals and expects contractors to be as sparing as they can in making such proposals.

The AFSC Commander made it clear that he will foster competition whenever possible, because "we need the leverage that competition affords." Some examples: savings of $350 million over three years on combined-effects munitions production and, by having developed a second source, a situation in which "we can now buy sixty percent more IR Maverick missiles for the same total obligational authority" originally approved for the lesser number.

"Of course, competition isn't always the answer," General Randolph said, "as was proved in the search for a potential second source for the F-16."

Among the business tools that AFSC intends to employ, General Randolph mentioned multiyear procurement ("I'm a wild-eyed advocate"), which he said has saved $4 billion in thirteen AFSC programs; renegotiating contracts when changing conditions, such as inflation, call for it; tearing down and inspecting hardware to make sure it is being built as advertised; withholding progress payments "when necessary"; and "negotiating solid warranties."

"Our emphasis is not on low cost, it's on cost *realism,* particularly in the development business," General Randolph said. "Watch out for ridiculously low price tags," he admonished the contractors. "They can get you into trouble in a big hurry." He reassured them that AFSC will continue to negotiate cost-plus contracts when their risk is high, but will stick to fixed-price contracts when their risk is low. Moreover, he said, AFSC will do all it can to encourage contractors to allocate resources to independent research and development (IR&D) projects of potentially high payoff for Air Force systems, as has been the case in the development of AFSC's Project Forecast II technologies.

Trade-offs among technologies and requirements in Air Force systems will become tougher and more numerous, but are already fairly commonplace, General Randolph said. As examples, he cited the Advanced Tactical Fighter (ATF) program, in which, early on, performance characteristics were somewhat compromised in order to keep weight and costs down, and the C-17 program, wherein the airlifter's initially required sink rate was reduced by one foot per second—to fifteen feet per second—to save on aircraft weight and thus on cost.

Maintaining Technological Superiority

Fundamental to everything that AFSC does is its responsibility for "maintaining technological superiority" for USAF, General Randolph said, and "no other command has that charge." He described his command's science and technology program as "robust" and reminded the audience that the program "has been elevated to the status of an executive program with DoD." It now represents 1.5 percent of the Air Force's total obligational authority, and AFSC is shooting for two percent by 1993—a target that "reflects a corporate [Air Force] commitment to the future needs of combat commands."

"A major energizer will be research to support the National Aerospace Plane [NASP], with all its spinoffs throughout the industry," General Randolph said. "We have to continue to work the technology very hard."

Taking note of the climate of criticism in which contractors and military acquisition agencies must now operate, General Randolph told his audience that "we have to react to criticism—much of it unwarranted—in a positive way." And he said that "there are no pat solutions" to the problems being fomented by the budget downturn.

A major worry: "Right now, retention of engineers in my command is only forty-one percent, and that's a *disaster.* We've got to turn that around."

The need to continue making the Air Force attractive to the best and the brightest, with major emphasis on pilots and engineers, was much on the minds of the symposium speakers. General Welch, for example, described the US airline industry, a voracious recruiter, as "the golden parachute" for Air Force pilots who, for one reason or another, feel that their skills and dedication are not being adequately recognized and recompensed.

But it was Secretary Aldridge who dwelled at greatest length on the growing problem of retention. Calling the Air Force's people "the foundation of combat capability," he said: "We have enjoyed real successes during these past seven years in attracting and retaining some of the best young people that America

has to offer. The support of Congress for improved family housing, morale, welfare, and recreation programs, medical care, educational benefits, and adequate pay has been essential. But keeping that quality force is becoming tougher and tougher."

Noting that the Air Force must compete for "high-tech people in a high-tech society," the Secretary declared that "we can't win the competition without continuing improvements in people programs. We must reverse the trend that has led to five consecutive years of three to four percent pay caps and no increase in flight pay since 1982. In the midst of our efforts, Congress has directed a two percent reduction in the number of active-duty officers in 1988 and another three percent reduction in 1989. How can we continue to attract high-quality people with such career uncertainty?

"And because of these problems, we're losing more pilots than we're training. We've gone through a severe downturn. Before this Administration came in, we were losing three out of every four pilots, so our retention rate was twenty-five percent. In 1983, after we went through a series of pay raises and a big jump in support of military requirements and programs, we were keeping three out of every four, or seventy-five percent. Now we're back down to forty-eight percent. The airlines are hiring. There are some irritants in the pilot career field, some uncertainties, and a lot of concern out there."

Secretary Aldridge said the Air Force leadership is "looking across the board at the problems" and holding "a series of conferences" on them. "We've got to remove a lot of irritants the pilots feel they have to go through—nonflying jobs, things like that. There's not going to be one magic solution. It will take a whole series of solutions before we get this turned around, and it's going to go down some more before we get it turned around. General Welch and I regard it as our number-one priority."

Secretary Aldridge also addressed the Air Force's need to overcome force-structure shortfalls and to sustain the pace of force modernization. "We must continue to pursue our plans for modernization and growth because they are the only recourse we have to guarantee our national security in the twenty-first century," he asserted.

RANDOLPH: Tough times will require trade-off decisions.

Straight Up in Space

In considering the Air Force of tomorrow, the one that will operate in that century, "I think it is vital," said Secretary Aldridge, "to consider the newest arena for our national defense, which begins just a short distance away . . . straight up in space."

Where the US space program is concerned, things were looking up a bit as the AFA symposium took place. A few days earlier, the Air Force had launched a Titan 34D with a classified satellite payload aboard from nearby Vandenberg AFB, Calif. Titan 34D boosters had been grounded in 1986 in the aftermath of two straight failures, and now they were back in business. Other types of boosters, ordered up by the Air Force following the January 1986 disaster of the Shuttle *Challenger,* were also coming along. The Shuttles themselves were expected to be back in business by mid-1988.

Secretary Aldridge remarked on the Air Force's success in modifying the Titan II ICBM as a small space booster, in initiating development of the much larger Titan IV, and in expanding the Titan family of rockets in general. He also noted that Delta II rockets are now being built to launch the vital Navstar Global Positioning System (GPS) navigation satellites to be used by all the services.

"To complete our space recovery program," the Secretary said, "we are recommending additional steps to Congress. We must again increase the production rate of Titan IVs to provide a launch capacity of at least eight to ten per year in the early 1990s. We must augment the production base and the launch facilities to meet this launch-rate demand. We must slightly increase the number of Delta II boosters we plan to procure to launch the smaller payloads. And we will need to competitively procure an additional expendable launch vehicle—which we will call the MLV II—for launching the Defense Satellite Communications System [DSCS III]."

Making sure that the US has unconstrained access to space is highly expensive, and so is everything else that the Air Force needs to execute its multitudinous missions, Secretary Aldridge stressed. As to budget cuts, in this context, he said: "We don't mind tightening the cinch one more notch. We just want to make sure that we're tightening our belts—and not the noose around our necks."

Secretary Aldridge said that a three percent real growth of the defense budget, which he recommended, "would continue to allow us to modernize at a rate sufficient to bring adequate modern weapon systems into the inventory, keep their age down, and do the jobs we need to do to keep our reliability and sustainability up." He made it plain, however, that he would prefer an accelerated growth rate and that the US cannot safely decelerate defense spending so long as the Soviets keep stepping on the gas. "When they stop spending to modernize, then we can slow down, but, unfortunately, the choice is theirs," he declared. ■

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The tank for midgets, the aluminum fireball, and other strange tales from the camp of those critics who want only to Give Our Boys the Best.

THE REFORMERS

BY FRED REED

THE United States as a nation does not think carefully about the military, an unsatisfactory situation given the dangers of a heavily armed world and the baffling complexity of military questions. One reason for the lack of disciplined analysis is that an odd group in Washington, calling themselves Military Reformers, manages to corrupt thoughtful debate—chiefly by reducing it to clowning.

The Reformers are diverse, having little in common other than great self-esteem and matching confidence. They include free-lance intellectuals, veterans, employees of the Pentagon, technical men, journalists, men, women, and, if not children, some who are intellectually not much beyond childhood.

By and large (exceptions can be found to any of this), they believe that we need weapons employing older and simpler technology (which they tend to equate) and that most of our equipment today is badly designed and unreliable, doesn't work, or is unrelated to the realities of combat. By virtue of well-developed links with the media, they managed for some years, if not to shape, at least to confuse the debate over genuine military questions. David Evans, the defense writer of the Chicago *Tribune,* is an ardent and active Reformer, having recently hosted, for example, a Reformist caucus on Capitol Hill. The *Trib* is not a minor paper.

There is enough truth in the assertions of the Reformers in some cases and enough doubt in other cases to make these views well worth considering. My objections to the Reformers over the years have not been so much to their ideas but to their slipshod research, chicanery, hermetic pompousness, deceptiveness, emotionalism, and general ignorance. Not all of them exhibit all of these characteristics, but most show most of them. To demonstrate the degree of the problem, permit me to give a few examples.

The Curious Case of the M1 Tank

A Reformer named Dina Rasor, head of the Project on Military Procurement, led the attack in the media on the M1 tank. She obtained early on a set of unflattering test results on the tank and parlayed those results into minor celebrity and funding for her organization. Over the years she has released all sorts of information purporting to show the manifold shortcomings of the M1.

Rather less attention has been paid to the manifold shortcomings of Rasor. In Washington, the unconscious assumption is that anything derogatory to the military must be true and that the motives of the critic must be pure.

She published a book *(The Pentagon Underground)* in 1985, seldom a wise thing for a Reformer to do. In it she tells of going in 1981 with a congressional delegation to Fort Hood, Tex., to see the M1. She recounts that she got into the driver's seat, low in the front of the hull, and discovered—gracious!—that the Army had designed the tank for midgets! People of normal size couldn't fit in the M1. While she was driving, her head bumped against the turret.

Then, always alert, she discovered manifestation of the tank's poor design. She is only five feet, six inches tall, she writes, yet "I later had a crew member close the hatch while I was in the driver's seat. In order to fit, I had to dig my chin into my chest and put myself in an almost impossible driving position."

I had the same problem until I adjusted the seat.

At five feet, eleven inches, I have no difficulty fitting in the tank. Not only didn't she know about the adjustable seat, but apparently wasn't interested. The book was published in 1985, and the trip had been made in 1981, allowing ample time to make a telephone call. Her whole book is full of such tales. In one priceless passage, she asserts that Army Public Affairs in the Pentagon couldn't tell her where Fort Hood—a huge base—is located. Thus do we influence policy in Washington.

Now, various aspects of the M1 can be criticized or at least argued about by people who know something about tanks. It is heavy and getting heavier. It uses a lot of fuel. The tracks wear rapidly. How well the electronics will hold up in extended combat is questionable. The turbine exhaust may produce an excessive IR signature. These are adult questions, mostly involving conscious trade-offs that may turn out to have been bad trade-offs. But saying that the driver doesn't fit?

Ignorance of such monumental proportions is habitual among Reformers. Years ago, when I came to the military beat, I was given, at Rasor's outfit, a briefing by Pierre Sprey, a Reformer and universal expert, about the defects of the tank. Sprey proceeded to tell me many terrible things about the M1.

The general tone of his exposition struck me as implausible. I grew up at Dahlgren Naval Weapons Lab, a naval research base, and graduated in 1966 from the Marine Corps light-armor school at Camp Pendleton. Sprey's notions bore no relation either to the military I had been in or to the engineers I had known in high school. On the other hand, I didn't trust the Army. While the services had done little, if any, outright lying to me, on many occasions they had done some pretty heavy interpretation of the evidence.

Having been duly Spreyed, I showed up at Fort Knox with my calculator, stopwatch, and tape measure, confident that the Army wasn't going to fool me with a rigged acceleration test, and proceeded to badger the Army into letting me actually use the beast—drag-race it over a fifty-foot course, fire it on the move, and the rest. My real purpose was to determine who was peddling nonsense, the Reformers or the Army, so I was careful to distinguish between things I could personally verify and those I couldn't. For example, I trusted the speed of the M1 as I measured it over my acceleration course, because the Army wanted the tank to seem fast. I didn't trust the speed of the older M60, because the Army wanted the M1 to seem superior and therefore might have driven the M60 slowly. This was paranoid on my part, I know now, but then I wasn't trusting anybody.

In every case I could personally verify, from acceleration to effectiveness of turret stabilization, the Army's version proved correct.

Sprey had told me, for example, that the M1 was so dependent on its electronics that, should they fail, the tank couldn't fire. This was typical Reformery. Anything technically more advanced than the weaponry of World War II doesn't work. I turned off the engine, cut the master power, turned the turret with the hand cranks, aimed with the auxiliary sight, and twisted the manual firing handle. The tank fired.

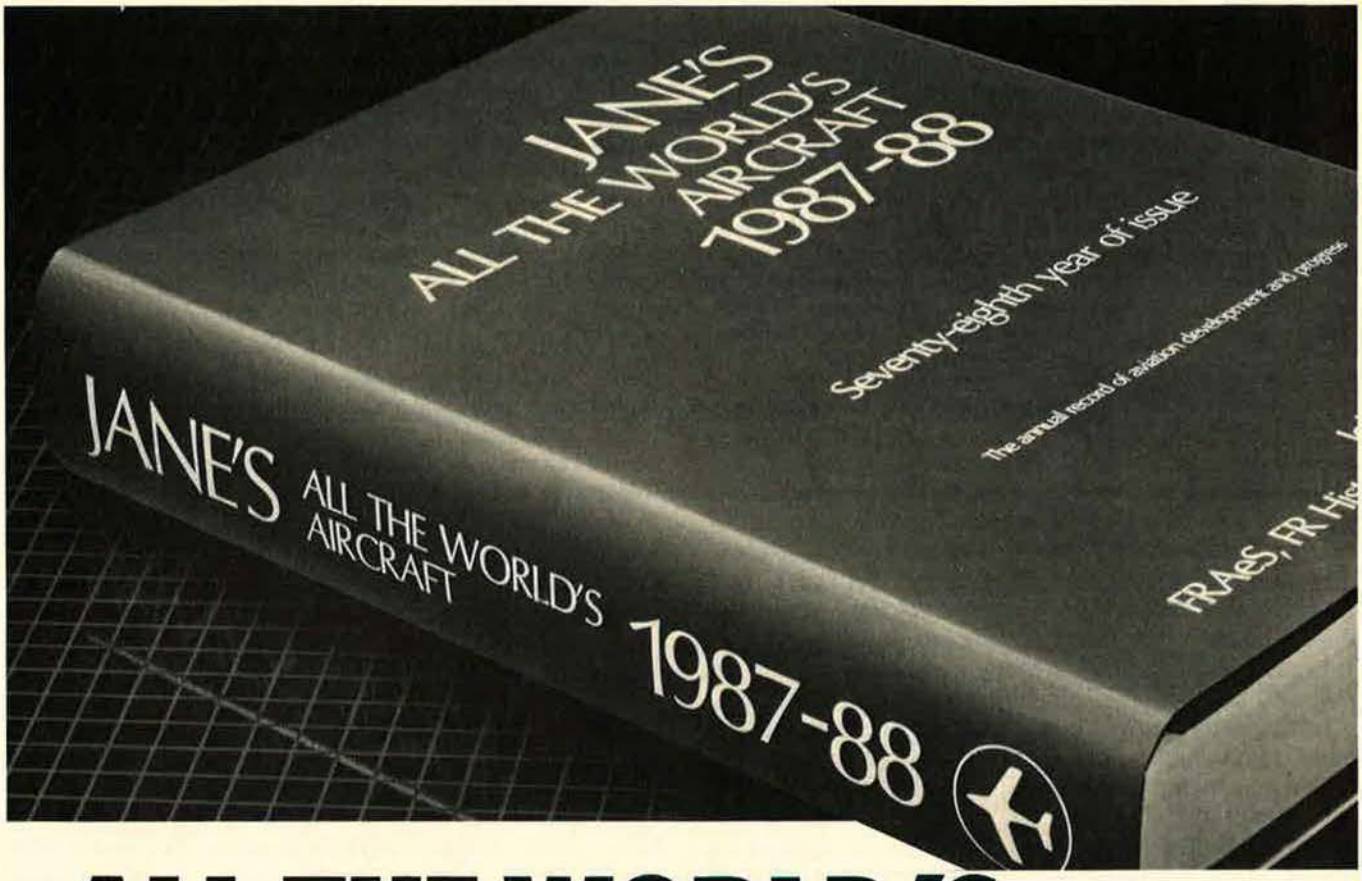
When in Doubt, Check the Manual

None of this establishes that the M1 is a good, bad, or mediocre tank. It does establish, however, that one should be very careful in accepting what the Reformers say.

Their "misstatements" could easily be avoided. For example, they could have learned that the tank will fire without electronics. They simply hadn't tried very hard to find out. For example, the firing of the gun is explained in the crew's manual, as, for that matter, is the dark and mysterious problem of adjusting the seat. There are detailed drawings. The manual is in the public domain. Before leaving Washington, I had asked Rasor's office for their copy. They didn't have one and had never read it.

Before long, one notices a pattern in the pronunciamentos of the evangelical Reformers. They mix a robust disregard for truth with a well-developed taste for parody. Observe that the Reformers do not accuse the military merely of bureaucratic ineptitude, poor judgment, and inattention in the expenditure of other people's money—the normal foibles of federal agencies. Instead, soldiers are accused of absurdity, of serious unfamiliarity with their profession, of behavior explainable only by clinically substandard intelligence, and of something bordering on lunacy. This is not analysis but a sort of literary cartooning.

Another example of comedic criticism is the assertion that the Army builds combat vehicles of flammable armor. The M2 Bradley, a sort of armored personnel carrier, uses aluminum armor. Various objections may be raised to aluminum armor, particularly in naval use (the Navy uses it extensively), and there are serious reasons for doubting whether the class of vehicles in general or the Bradley specifically is militarily advisable—but these are grown-up questions. The Reformers, seeking to lampoon rather than to describe, have decided that



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Viewpoint

Nibbled Into Mediocrity

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

Pork-barrel projects and other big expenses will probably survive the budget wrangle while important programs slow down to levels of inefficiency and reduced effectiveness.

My earliest instruction in the complexities of government budgeting came from one Corporal Cracker Brown, an immaculate gentleman from Georgia. Cracker Brown had skipped lightly through the educational system, but he had a store of shrewd, if basic, knowledge about the way the Army and its hierarchy functioned.

Never lose anything small, Cracker advised, because the Army will make you pay for it. If you are going to lose or break something, make it big, like a locomotive, cannon, or even an airplane. That will cost you nothing. It's the little things that come out of a poor soldier's pocket.

Cracker Brown dispensed his wisdom during the years of the Great Depression, when the US Army could scarcely have taken on Mexico, let alone a European power, but his words would not be so far off the mark today. The armed forces are in danger of being nibbled back to mediocrity by the workings of the Gramm-Rudman Act. Big things—pork-barrel projects and superfluous military bases—will survive; the general quality of our forces, and their readiness to perform, will suffer.

During the 1970s, our military was in pitiful shape, a fact not lost on our European allies. There was an acute shortage of spare parts and a scarcity of ammunition, and the general level of combat readiness was unacceptably low by any standard. Arguably, our failed attempt to rescue the Iranian hostages, the Desert One fiasco, can be blamed on that era's poor state of training, and that poor training is traceable, in part, to a niggardly Operations and Maintenance (O&M) budget.

These past seven years have seen a remarkable change. Today, the men and women wearing US uniforms set a high standard; the Libyan strike, for instance, with its multiple night refuelings and split-second interservice timing, is evidence of that. The cuts soon to come will almost certainly start the forces back down the readiness slope. How far down that slope is the only real question.

The growing budget deficit is frightening and is fast weakening the image of the United States as a great power. The falling dollar sends signals right down to the grass-roots level. An airman in Japan, for example, trying to get by on his devalued-dollar paycheck is acutely aware of our economic crisis. It is a long way from the days when US forces were the envy of those in whose lands they served. GI Joe, once the overseas symbol of American affluence, is now on Poverty Street, cost-of-living adjustments notwithstanding.

In all fairness, military pay, compared to what it was in former times, is generous enough, and in any case, the President has put the military force structure off limits as a target for cuts, so they will fall elsewhere. Because the aim is to reduce annual expenditure, not budget authorization, the Operations and Maintenance accounts will probably take heavy blows. Building maintenance, ammunition, spare parts, training exercises, and travel money all depend on those accounts. So do flying hours, the very guts of aircrew readiness.

In the area of flying hours, a reduction will have repercussions even beyond reduced readiness. Pilots remain in the services for a variety of reasons, but the challenge and the feeling of doing something important are certainly high on the list. If flying hours are severely cut, morale among pilots will drop like a stone, and they will begin to look for an exit. Airline pay and benefits these days are easily competitive with service remuneration, and a military pilot can almost name the airline of his choice. Pilots are already leaving the service in alarming numbers, but a sharp reduction in flying hours might well open the floodgates.

In the 1970s, US conventional forces may have been a bit questionable, but that was no great worry to the allies. NATO had given lip service to the strategy of flexible response since 1967, all the while putting its dependence on US nuclear weapons. The underlying purpose of theater nuclear missiles—cruise missiles and Pershing IIs—was to provide visible evidence of an American intention to use nukes as necessary. In theory, Peacekeepers in Wyoming may provide the same assurance, but Wyoming might as well be on the moon so far as European visibility is concerned. Now we are about to pull out the INF, and conventional forces will assume a new and urgent importance. A more inappropriate time to start American forces down the readiness slope is hard to imagine.

Perhaps, as Secretary of Defense Frank Carlucci has speculated, our force structure is larger than we can afford. Sen. Sam Nunn (D-Ga.) has even questioned the basic strategic rationale behind these forces, accusing each of the services—Army, Navy, Marines, Air Force—of pursuing its own strategy. Maybe he has a point, although there has been a distinct trend toward interservice cooperation in recent years. If there should be a serious move toward reducing the size of the military establishment, however, it must be done with strategy and its accompanying commitments in mind. Any return to undermanned units unable to perform would make its own strategic statement, that of a United States no longer willing or able to serve as the free world's leader.

Much is at stake in how our military comes out of the budget wrangle. If, as at least seems possible, the cuts are simply unthinking reductions across the board, the domestic political fallout will be minimal. Everything will be as before, just slowed down—inefficient and ineffectual. But the effect down the road on European security, to say nothing of our own long-term prospects, will be considerable and possibly irreversible. ■

Airman's Bookshelf

Self-Made Heroine

Jackie Cochran: The Autobiography of the Greatest Woman Pilot in Aviation History, by Jacqueline Cochran and Maryann Bucknum Brinley. Bantam Books, New York, N. Y., 1987. 358 pages. $18.95.

This book's purpose is revealed in its title. Both authors want to convince readers that Jackie Cochran, who died in 1980, was the greatest woman pilot and one of the most influential women of this century. They must certainly be credited with doing their utmost to prove this thesis beyond anyone's doubt.

The book combines interviews of Jackie's friends with material written by and about Cochran. According to Brinley in her author's note, "Jackie Cochran was a self-named, self-created phenomenon . . . [and] always passionately convinced of any viewpoint she happened to hold."

This, then, is both the strength and weakness of the book. It is written by, about, and for the purpose of presenting Jackie Cochran in the most favorable light possible. As Jackie states and this autobiography proves, "I've always been a very good salesman. My whole life has been built on promotion and sales, and it doesn't matter whether you are selling washtubs, cosmetics, or human ideas."

The selling of this "authentic, native-born American heroine" begins when Jackie Cochran was eight years old. Coming from an undeniably deprived background, Jackie did not know who her parents were or even her exact birthday. Cochran was a name she picked out of a phone book once she began her climb.

Much is made of the fact that Floyd Odlum, her wealthy lawyer/financier husband, obtained all the information he could find concerning her birth and parentage and kept it private in a sealed envelope. At his death, it was consigned to the fire. There are no quotations from anyone other than Cochran concerning this early part of her existence, and no one else has ever stepped forward to shed light on that period of her life.

The chapters on Jackie learning to fly are a delight to read. They are exuberant and reflect a derring-do individuality that today's advanced and expensive machinery has made impossible. The sky was her element, and she was unswerving in mastering the principles of flight. Once she learned to fly, she used it to her advantage. Like Amelia Earhart, she broke records and kept herself constantly in the public eye.

There are some interesting revelations in this book that deal with the financial and political power available to Jackie. For instance, Cochran and her friends are quick to point out that Floyd Odlum was still worth some $14 million immediately after the stock market crash of 1929.

Odlum's influence in defense circles led to his involvement in a 1949 scandal. A Pennsylvania congressman, James Van Zandt, accused the Secretary of Defense, Louis Johnson, of bestowing a sweetheart contract for the production of the B-36 to Odlum's company in return for Odlum's help in the Democratic campaign. Additionally, the book admits that the Odlums later spent approximately $30,000 in seven years for the Eisenhowers' personal expenses.

Odlum's financial and political clout undoubtedly allowed Cochran to exercise considerable influence. Time and again the book describes how she took out full-page ads and exerted political and financial pressure to achieve her objectives.

The book's most important chapters deal with her wartime contributions. When World War II broke out, Cochran was convinced that she could aid the war effort in a major way. Her idea was to recruit women for flying training in order to free male pilots for combat. For those familiar with this effort, these chapters contain no new material concerning Cochran's establishment and organization of the Women's Airforce Service Pilots (WASP).

Furthermore, certain inaccuracies, which consistently recurred whenever Jackie Cochran related her version of the WASP's inception, are once again repeated. The first of these concerns Gen. Henry H. Arnold's alleged deception by his staff, which led to the formation of Nancy Love's Women's Auxiliary Ferrying Squadron (WAFS). Correspondence preceding Arnold's decision to authorize the WAFS exists, and it is misleading to continue Cochran's version.

Another historical fiction is Cochran's feigned disinterest in Love's women pilots. Former WAFS members and official records corroborate the time and effort Cochran spent eradicating this competing women's flying organization. In the book, one of Jackie's friends describes this feud: "If Jackie Cochran was threatened, she'd respond like a tigress. And she had an awful lot of power. She could be ruthless when she wanted to pursue something. . . . People got stepped on en route. She especially didn't like competition getting too close."

In addition, Cochran deliberately revives the antagonism between herself and Oveta Culp Hobby, director of the Women's Army Corps (WAC). In a delightful exchange between Jackie and Arnold, the General asks, "How would you like to have your girls become part of the WAC?" Jackie shoots back, "How would you like to be back in basic training?"

Along with an unwillingness to subordinate her own status to that of Hobby, Jackie felt that pilots, male or female, were "temperamentally different" from women in the WAC. For Cochran, the only way for the WASP to join with the WAC was "over my dead body." Unfortunately, Cochran's inability to subordinate her own interests doomed the WASP and ensured its disbandment as soon as the war emergency was over—"if Jackie couldn't do it her way, she'd just as soon not do it anymore." It is regrettable that Jackie's insistence on doing it "her way" helped to deny women access to military cockpits for almost thirty years.

The book also provides the ra-

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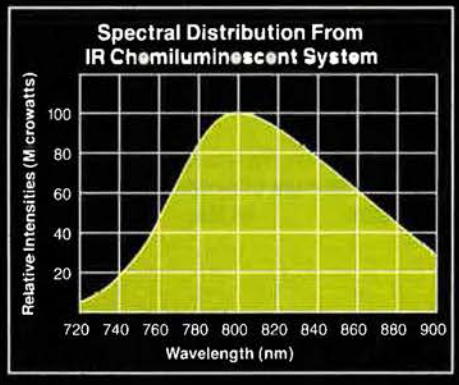

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tionale for Jackie Cochran's inability and unwillingness to support either the integration of women into the Air Force Academy or the use of women pilots in the Air Force during the 1970s. To Cochran, there was a difference between men and women. "That's what men are for—to be nice to us. If you are going to run around trying to act like men, they are going to treat us like men."

Unwilling to concede that discrimination occurs, she makes the point that she was never competing with men for their jobs or abusing the fact that she was a woman. The reality is that with her political and financial connections, it was hard for Jackie not to succeed at anything she put her mind to. In addition, she was jealous of her records and accomplishments. Although she was the first woman to break the sound barrier (in a Canadian F-86), she was also adamant that women should not be allowed to fly military aircraft.

What should not be overlooked in this or any book about Jackie Cochran's accomplishments was that she proved beyond the shadow of a doubt that ordinary women could be trained to fly any aircraft in the Army Air Forces inventory. Cochran and the WASP both proved Chuck Yeager's statement that "it makes no difference what a pilot's reproductive organs are shaped like. It's skill that matters."

—Reviewed by Maj. RitaVictoria DeArmond, USAFR. Major DeArmond is currently writing a book on the history of women in the Air Force that will be published by the Office of Air Force History.

New Books in Brief

Guadalcanal—The Island of Fire, by Robert Lawrence Ferguson. When people think of the battle for Guadalcanal, they remember the valiant Marine ground troops and the Marine and Navy aviators who carried the fight to the skies. Few recall the efforts of the Army Air Corps's 347th Fighter Group, which faced the Japanese with obsolete P-39/P-400 aircraft throughout the grueling six-month campaign. Author Ferguson, who served with the 347th's 67th Fighter Squadron "Gamecocks" on Guadalcanal, presents here a gripping account of the men and operations of the "Gamecocks," spicing his story with excerpts from his diary and many never-before-seen combat photographs. This tribute to the 347th is a long-overdue recognition of the efforts of the only AAC unit to support operations on Guadalcanal. With appendices and index. Aero/Tab Books, Blue Ridge Summit, Pa., 1987. 288 pages. $16.95.

North American F-100 Super Sabre, by David A. Anderton. The Super Sabre—the "Hun" to enthusiasts—was the Air Force's first front-line supersonic aircraft. Though the Air Force was less than eager at first to accept the aircraft in its day-fighter form, it went on to compile an impressive record as a fighter-bomber during the Vietnam War. Author Anderton traces the F-100 story from development through operational history, touching on such topics as service as a Wild Weasel aircraft, operations in the ANG, and Huns that flew with foreign air forces. Mr. Anderton has here assembled the definitive account of the Super Sabre. With photos, appendices, and index. Osprey Publishing Ltd.; distributed by Motorbooks International, Osceola, Wis., 1987. 200 pages. $19.95. ■

Valor in Two Dimensions

Shot down and surrounded by the enemy, Willard Collins and Del Peterson led the crew of Spooky 70 in a fight for survival.

BY JOHN L. FRISBEE
CONTRIBUTING EDITOR

THE Special Forces camp in A Shau Valley, about fifty miles northwest of Danang and near the Laotian border, came under attack by some 2,000 North Vietnamese regulars on March 9, 1966. The defenders, twenty US Special Forces troops and 375 South Vietnamese soldiers, were surrounded and forced to retreat to a bunker at the northeast corner of the outpost.

Air support and probably air evacuation were needed desperately—a difficult operation under ideal conditions of terrain and weather. But conditions were far from ideal.

The camp was in a mile-wide valley surrounded by mountains. There was a 400-foot ceiling and a steady rain of mortar, rocket, and automatic weapons fire that tore up the landing strip and pinned the defenders in their bunker. They were in imminent danger of being overrun.

At 11:20 on the morning of March 9, Capt. Willard Collins and his AC-47 gunship crew, who had flown a mission the previous night, were rousted from their beds and dispatched from Danang to support the A Shau garrison. In the right seat of Spooky 70 was 1st Lt. Delbert Peterson. Other members of the crew were 1st Lt. J. L. Meek, navigator; SSgt. J. G. Brown, flight engineer; and SSgts. J. Turner and R. E. Foster, who manned the 7.62-mm rapid-fire miniguns.

Collins and Peterson made two unsuccessful attempts to get under the clouds. Finally, flying at treetop height, they found their way into the valley, located the outpost, and made a firing pass at the besiegers. The vulnerable old AC-47, designed in the 1930s as a commercial airliner, took hits from ground fire as it lumbered through the narrow valley, flying close to the ground rather than at the normal gunship altitude of 3,000 feet.

Any element of surprise that may have existed was gone when Captain Collins maneuvered Spooky 70 into position for a second pass through the gauntlet of fire. As they approached the bunker, the right engine was hit hard and torn from its mounts. Collins had no more than regained control when the left engine was knocked out.

With superb airmanship, he and Lieutenant Peterson brought down the bullet-riddled gunship for a crash landing on a mountain slope. All members of the crew survived with minor injuries except Sergeant Foster, whose legs were broken by the impact. Collins and Peterson knew an enemy attack was inevitable. Since Foster could not be moved, they set up a defense at the site, rather than leaving the injured gunner and moving to more favorable terrain.

The crew, confident that a rescue helicopter would answer their call for help, repulsed the first attack, which came fifteen minutes after they hit the ground. Minutes later, a second attack was turned back, but Collins and Foster were killed in the firefight. With only four men left to defend a 360-degree perimeter, the chance of holding out until that chopper came in looked pretty bleak.

A third attack began as the distinctive sound of a USAF HH-43 competed with the din of battle. Muzzle flashes from a heavy machine gun that had been moved to within yards of the torn-up gunship were clearly visible to Lieutenant Peterson, now in command of the crew. If the gun were not silenced, the chopper would likely be downed before it could rescue the four airmen.

Del Peterson knew it was up to him.

Spraying bullets from his M-16 rifle, he charged the gun, which went silent as the helicopter dropped down to pick up Meek, Brown, and Turner, leaving Peterson, whose fate was not known, and the two dead men behind.

Delbert Peterson was carried on Air Force rolls as missing in action until February 1978, when his status was changed to killed in action. During that period, he was promoted to major. Both he and Capt. Willard Collins were awarded the Air Force Cross posthumously.

That mission was one of the few instances in the Vietnam War when both pilots of an aircraft were awarded the nation's second-highest decoration for valor. It was the only one in which the awards were made for extraordinary heroism in both air and ground combat. The self-sacrifice of those two men to save other members of the crew did, indeed, "reflect the highest credit upon [them] and the United States Air Force." ■

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Intercom

By Robin Whittle, AFA DIRECTOR OF COMMUNICATIONS

AFA's National Committees

The makeup of AFA's National Committees for 1987–88 has been determined. The following members have been named to serve on the committees.

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On the Scene

When Wright-Patterson AFB near Dayton, Ohio, was selected by the Air Force Secretary and Chief of Staff to serve as the official host for the Air Force's "Festival of Flight" fortieth anniversary celebration last September, AFA's Wright Memorial Chapter became a key player, reports Chapter President **Bill Schaff** *(see December '87 "Intercom," p. 115).* The Chapter combined its annual awards banquet, which honors top military and civilian personnel from Wright-Patterson AFB, with the "Festival of Flight" luncheon. Forty-six AFA Community Partners supported the event, which was well attended.

Featured speaker at the luncheon was **Gen. Alfred G. Hansen,** AFLC Commander. Chapter award winners honored at the luncheon were Outstanding Senior Military Officer **Lt.**

Last September, AFA National President Sam E. Keith, Jr., and his wife, Mary Sue, attended the Air Force's "Festival of Flight" fortieth anniversary celebration at Wright-Patterson AFB, Ohio. With Mr. and Mrs. Keith is Wright Memorial Chapter President William J. Schaff (right). See item.

Col. (Col. selectee) Donald L. Krump, 4950th Test Wing; Outstanding Company Grade Officer **Capt. David E. Andrews,** ASD/Propulsion Modernization Program; Outstanding Noncommissioned Officer **SMSgt. Michael T. Jackson,** ASD/Aeronautical Systems; Outstanding Civilian Executive **John P. Malorano,** AFLC/Engineering Management Directorate; and Outstanding Civilian Manager **David C. Fay,** Foreign Technology Division of AFSC.

Others included Outstanding Civilian Technician **Virginia M. Peters,** FIT/Health Care Education Division; Outstanding Reserve Officer **Col. Gerald W. Westerbeck,** AFLC/Reserve Individual Mobilization Augmentee, Engineering Services; and the Outstanding Reserve NCO, **CMSgt. Stanley C. Booney,** Hq. AFLC/Reserve Individual Mobilization Augmentee. Top AFROTC Cadet **Susan D. Lockamy** received the Chapter's Kenneth Puterbaugh Scholarship Award of $500 for being the best in her class. The award is named for a longtime Chapter leader.

Northern Pinellas County and adjacent areas along Florida's Gulf coast are now represented by AFA's new Nathan F. Twining Chapter chartered in Palm Harbor last summer, according to **Jim Sunderman,** one of the founding Chapter leaders. Participants in the chartering ceremonies, held at the Tarpon Woods Golf and Country Club, were President **Mack Blevins;** then-National Vice President/Southeast Region **H. Lake Hamrick;** Vice President **Jerry Roth;** Florida AFA leader **Roy Whitton;** Chapter Treasurer **Matt Kurzawa;** and Mr. Sunderman, who serves as Chapter Secretary. At last count, the Chapter boasted more than 100 members.

Clyde W. Jackson, then-Vice President of AFA's Thomas B. McGuire, Jr., Chapter in New Jersey, presented an AFA Community Partner renewal last fall to **Sue Gazzara,** editor of the New Egypt, N. J., *Press.*

AFA's Tidewater Chapter in the Norfolk, Va., area recently held a reorganizational meeting and celebration of USAF's fortieth anniversary at the Armed Forces Staff College. **Maj. Gen. John Doran,** Deputy Chief of Staff to the Atlantic Command Commander in Chief, addressed the meeting, reports Chapter leader **Bob Hudson.**

In California, AFA's Fresno Chapter sponsored its sixteenth annual "Gathering of Warbirds" air show at the Madera Airport in August. More than 30,000 spectators turned out to see barnstormers, skydivers, and stunt flyers as well as ground displays of historic aircraft and the myriad booths and exhibits that have become an integral part of this annual show.

The Nathan F. Twining Chapter in Palm Harbor, Fla., was chartered last summer by H. Lake Hamrick, then AFA National Vice President for the Southeast Region. Among those attending the ceremony were (from left) Chapter Treasurer Matt Kurzawa, Chapter President Mack Blevins, Mr. Hamrick, Chapter Vice President Jerry Roth, State Vice President Roy Whitton, and Chapter Secretary Jim Sunderman.

Lloyd R. Leavitt, Jr., Chapter members were guests of the 104th Tactical Fighter Group, Massachusetts Air National Guard, and were treated to a tour of Phelps Collins ANGB, Mich., that included a briefing on the A-10 as well as a flight-line view of operations with an A-10 takeoff and flyover. **Col. George W. Keefe** welcomed Chapter President **James W. Rau** and a group of Chapter members that included Chapter namesake **Lt. Gen. Lloyd R. Leavitt, Jr.,** and his wife.

AFA Board Chairman **Martin H. Harris** and active AFAer **Thomas B. Anthony** were among the dignitaries who turned out at Bob Hope Village in Fort Walton Beach, Fla., last fall to honor the comedian and witness the unveiling of both a bust of Mr. Hope done by sculptor **John Lajba** and a plaque honoring United Technologies Corp. for contributions to help build a community center at the Village. Bob Hope Village is part of the Air Force Enlisted Widows Home Foundation, Inc., which houses widows of Air Force enlisted people. Mr. Anthony is also Vice Chairman of the Foundation.

During the day, an awards ceremony was held, with **Chief Master Sergeant of the Air Force James C. Binnicker, Mr. Hope,** and CINCMAC **Gen. Duane H. Cassidy** doing the honors. Honored with the David C. Jones Pioneer Award was former **Rep. Robert L. Sikes. Robert W. Gates** received the Bob Hope Humanitarian Award. Other awards were also presented. That evening, Bob Hope's benefit show drew a crowd of more than 7,000.

Also participating in the day's

AFJROTC Cadet 1st Lt. Michele Hicks escorts AFA Board Chairman Martin H. Harris during ceremonies at the Bob Hope Village in Fort Walton Beach, Fla. Mr. Harris joined others in honoring Mr. Hope's work for the Village.

events were **Nick Masone,** President and Chief Executive Officer of the Foundation; Bob Hope Village resident **Cheri Norman;** Foundation board members **Elmo Ceconi** and **Dr. Leon Pastalan; James F. Boatright,** Deputy Assistant Secretary of the Air Force for Installations, Environment, and Safety; **Maj. Gen. Richard E. Steere,** Armament Division Commander, Eglin AFB; **Maj. Gen. Robert Patterson,** Twenty-third Air Force Commander at Hurlburt Field; Foundation Board Chairman **Thomas B. Mahoney; John McBrien,** Air Force Sergeants Association President; **Gloria Pinksaw,** AFSA Auxiliary President; and **Mr. and Mrs. Harry Gray** of United Technologies Corp.

AFA's Tacoma, Wash., Chapter sponsored its seventh Howard Scott Pro-Am Golf Tournament at McChord AFB's Whispering Firs Golf Course last fall, thanks again to its Community Partners, the Pacific Coca-Cola Bottling Co. and the Klauser Corp. This year's event boasted a purse exceeding $13,000 for a full field of fifty-two professionals and 156 amateurs, reports Communications Vice President **Jack Gamble.**

"This event regularly draws some of the top professional and amateur golfers in the Northwest, but this year—thanks to the SAFECO Classic staff—LPGA members **Marlene Hagge, Dale Eggeling,** and **Mary Bea Porter** joined us and were an added attraction," Mr. Gamble said. The Chapter's newest Community Partner, National Distributing Co., put up $500 for the exciting "closest to the pin" contest. Winner was **Lou Alleman,** the 1984 Howard Scott winner, whose attempt came within two and a half feet of the eighteenth hole.

"We met all of our objectives in staging a quality event while raising more than $5,000 for our scholarship program, which benefits area cadets and the McChord Youth Activities Fund," Mr. Gamble said.

In other Tacoma news, the annual Air Force Birthday Ball held on September 19 also served to welcome **Brig. Gen. and Mrs. John Davey** to the community. General Davey commands the newly reorganized 25th Air Division and was the featured speaker at the event. He updated guests on the reorganization of continental air defense forces and reviewed USAF accomplishments on its fortieth anniversary.

After the traditional cake-cutting ceremony by **Kathy Tenoso,** wife of 62d MAW Commander **Col. Ed Tenoso, Marian Sandstrom,** wife of then-Chapter President **Jack Sandstrom,** and **General Davey,** guests danced to the music of the Air Force Band of the Pacific Northwest ensemble "The Touch of Blue."

Several AFA chapters have recently changed their names, and others are newly established. AFA's Jacksonville, Fla., Chapter has been renamed the Falcon Chapter; the Greater Los Angeles Airpower is now the General Bernard A. Schriever/Los Angeles Chapter; AFA's Homestead Chapter is now the John W. DeMilly, Jr., Chapter; and the former Montgomery-Delaware Valley Chapter is now AFA's Freedom Chapter. New AFA chapters include the Ventura County Chapter in Camarillo, Calif., led by President **Thomas E. Pierce;** the Wilmington Chapter in Wilmington, Del., led by President **Richard E. Kyle;** AFA's Bucks County Chapter in Bensalem, Pa., led by President **Harry G. Hollenbach;** and the University Chapter in Newark, Del., led by President **James J. McAlpin.** ■

Unit Reunions

Burtonwood Ass'n
Members of the Burtonwood Association are planning to hold reunions in June 1988 in Burtonwood, England, and in October 1988 in Oklahoma City, Okla. Individuals who were stationed at Burtonwood, England, at any time since 1942 are invited. **Contact:** Molly Matthews, Burtonwood Association, 1901 Erskine Dr., Florence, Ala. 35630.

Nagoya/Komaki AB Ass'n
Veterans who served at Nagoya AB (including Komaki), Japan, will hold a reunion on May 20–22, 1988, in Nashville, Tenn. **Contact:** Art Haley, P. O. Box 181, St. Bethlehem, Tenn. 37155. Phone: (615) 647-3262.

Night Fighters
Night Fighters of World War II will hold their biennial convention on May 1–6, 1988, at the Riviera Hotel in Las Vegas, Nev. **Contact:** Alvin E. "Bud" Anderson, 8885 Plumas Circle, D-1116, Huntington Beach, Calif. 92646. Phone: (714) 960-9058.

RAF Station Manston
Units that were assigned to RAF Station Manston (Kent, England) will hold a reunion on May 21–23, 1988, at RAF Station Manston, England. **Contact:** Maj. Milton J. Torres, USAF (Ret.), 11200 S. W. 99th Ct., Miami, Fla. 33176. Phone: (305) 238-3342.

2d Ferrying Group
Air Transport Command's 2d Ferrying Group (now the Wilmington Warrior Association), which was based at New Castle AAB, Del., during World War II, will hold a reunion on April 7–9, 1988, on South Padre Island, Tex. **Contact:** Ray Kuhlman, 7 Springwood Lane, Kinston, N. C. 28501. Phone: (919) 522-0356.

3d Emergency Rescue Squadron
The 3d Emergency Rescue Squadron will hold a reunion on September 9–11, 1988, at the Ramada Inn in Grand Island, Neb. **Contact:** Warren Wegner, Box 202, Central City, Neb. 68826. Phone: (308) 946-2085.

3d Tactical Fighter Wing
Vietnam veterans of the 3d Tactical Fighter Wing have postponed their reunion from spring 1988 *(as announced in the November '87 issue)* to summer 1988. **Contact:** Lt. Col. Jack Doub, USAF (Ret.), P. O. Box 27026, San Diego, Calif. 92128.

11th Bomb Group
Members of the 11th Bomb Group will hold a reunion on May 18–29, 1988, in St. Louis, Mo. **Contact:** Robert E. May, P. O. Box 637, Seffner, Fla. 33584. Phone: (813) 681-3544.

21st Troop Carrier Squadron
Members of the 21st Troop Carrier Squadron will hold a reunion on June 17–20, 1988, in Colorado Springs, Colo. **Contact:** Floyd Smith, P. O. Box 1605, Eagle River, Alaska 99577. Phone: (907) 694-9414.

29th Air Service Group
The 29th Air Service Group, Thirteenth Air Force, will hold a reunion in July 1988 in Indianapolis, Ind. **Contact:** Frank Pace, 315 W. 15th St., Dover, Ohio 44622.

Class 41-B
Members of Flying Cadet Class 41-B (Maxwell Field, Ala.), Southeast Training Command, will hold a reunion on May 6–8, 1988, in Orlando, Fla. **Contact:** Lt. Col. Floyd B. Whitlow, USAF (Ret.), 5353 Arlington Expressway 12-A, Jacksonville, Fla. 32211.

Classes 44-H/I/J
Former Army Air Forces Pilot Classes 44-H, 44-I, and 44-J will hold a reunion on April 16–20, 1988, in Biloxi, Miss. **Contact:** Col. William A. Boutwell, USAF (Ret.), 220 N. Shore Dr. W., Biloxi, Miss. 39532.

49th Pursuit Squadron
Members of the 49th Pursuit, Fighter, and Fighter-Interceptor Squadron will hold a reunion on April 28–30, 1988, in Tucson, Ariz. **Contact:** S. D. Huff, 3200 Chetwood Dr., Del City, Okla. 73115-1933. Phone: (405) 677-2683.

Class 54-G
Members of Aviation Cadet Class 54-G will hold a reunion in September 1988 in Reno, Nev. **Contact:** Maj. Don Mikler, USAF (Ret.),

This Is AFA

The Air Force Association is an independent, nonprofit, aerospace organization serving no personal, political, or commercial interests; established January 26, 1946; incorporated February 4, 1946.

OBJECTIVES: The Association provides an organization through which we as a free people may unite to address the defense responsibilities of our nation imposed by the dramatic advance of aerospace technology; to educate the members and the public at large in what that technology can contribute to the security of free people and the betterment of mankind; and to advocate military preparedness of the United States and its allies adequate to maintain the security of the United States and the free world.

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Unit Reunions

P. O. Box 321, Hadlock, Wash. 98339. Phone: (206) 385-3826.

69th Fighter Squadron
Members of the 69th Fighter Squadron (Werewolves), Fifth Air Force, will hold a reunion on May 13–16, 1988, in Colorado Springs, Colo. **Contact:** George E. Mayer, 7445 Thomas Ave. S., Richfield, Minn. 55423. Phone: (612) 866-6073.

73d Bomb Wing Ass'n
The 73d Bomb Wing will hold a reunion on May 12–15, 1988, at the Hyatt Orlando Hotel in Orlando, Fla. **Contact:** Glenn E. McClure, 73d Bomb Wing Association, 105 Circle Dr., Universal City, Tex. 78148.

75th Bomb Squadron
Members of the 75th Bomb Squadron will hold a reunion on September 2–3, 1988, in Omaha, Neb. **Contact:** Willard A. Thomas, 1588 W. 25th Ave., Eugene, Ore. 97405. Phone: (503) 484-9900.

75th Fighter Squadron
The 75th Fighter Squadron, 23d Fighter Group, Fourteenth Air Force, will hold a reunion on May 27–29, 1988, in St. Louis, Mo. **Contact:** Myron D. Levy, 11933 Claychester Dr., Des Peres, Mo. 63131.

414th Bomb Squadron Ass'n
The 414th Bomb Squadron, 97th Bomb Group, will hold a reunion on August 24–26, 1988, in Cedar Rapids, Iowa. **Contact:** C. A. Merlo, 7335 Neckel, Dearborn, Mich. 48126.

448th Bomb Group Ass'n
Members of the 448th Bomb Group will hold a reunion on October 6–9, 1988, during the Confederate Air Force AIRSHO '88 in Harlingen, Tex. **Contact:** Leroy J. Engdahl, 1785 Wexford Dr., Vidor, Tex. 77662.

475th Fighter Group
The 475th Fighter Group "Satan's Angels" will hold a reunion on May 12–15, 1988, at the Crowne Plaza Hotel in Dallas, Tex. **Contact:** Col. John Loisel, USAF (Ret.), 2504 Overcreek Dr., Richardson, Tex. 75080. Phone: (214) 238-0398.

501st Air Force Band
Members of the 501st Air Force Band are planning to hold a reunion on May 1–4, 1988, at the Hale Koa Hotel at Fort DeRussy in Waikiki, Hawaii. **Contact:** Larry Trautman, 14718 Dunbar Lane, Woodbridge, Va. 22193. Phone: (703) 680-3952.

820th Bomb Squadron
The 820th Bomb Squadron, 41st Bomb Group, Seventh Air Force, will hold a reunion on May 19–22, 1988, at the Fort Magruder Inn in Williamsburg, Va. **Contact:** William W. Childs, 3637 Patsy Ann Dr., Richmond, Va. 23234. Phone: (804) 275-6012.

920th Air Refueling Squadron
The 920th Air Refueling Squadron will hold a reunion on April 29–May 1, 1988, in Fort Worth, Tex. **Contact:** Maj. Gordon S. Fish, USAF (Ret.), 206 Valley Ranch Rd., Weatherford, Tex. 76086.

Phu Cat AB, Vietnam
I would like to hear from members of units that served at Phu Cat AB, Vietnam, who would be interested in holding a reunion.
Please contact the address below.
John F. Forgette
2400 Donovan Ave. #73
Bellingham, Wash. 98225

Class 48-A
I would like to hear from members of Officer Candidate School Class 48-A at Lackland AFB, Tex., who would be interested in holding a reunion in June 1988.
Please contact the address below.
Lt. Col. Andrew M. Hudak, USAF (Ret.)
4331 Old Dominion Rd.
Orlando, Fla. 32812
Phone: (305) 855-0449

Class 72-06
I would like to hear from members of Undergraduate Navigator Training Class 72-06 (Mather AFB, Calif.) for the purpose of holding a reunion.
Please contact the address below.
Michael W. Haines
508 Cherry St.
Negaunee, Mich. 49866
Phone: (906) 475-6118

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Unit Reunions

Reunion Notices

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

89th Bomb Squadron

I am trying to locate members of the 89th Bomb Squadron, 3d Bomb Group, who served in New Guinea from 1942–45. I would like to organize a reunion.

Please contact the address below.

G. John Robinson
5206 Valley Oak
Austin, Tex. 78731

435th Troop Carrier Wing

Members of the 435th Troop Carrier Wing have formed an organization, and we are planning to hold a reunion in 1988. The organization is open to units that were affiliated with the 435th from 1947 through 1979 and that were based at Barksdale AFB, La., Bates Field, Ala., Donaldson AFB, S. C., Homestead AFB, Fla., and Miami International Airport, Fla.

Eligible personnel are urged to contact the address listed below.

The Flamingo Wing Association, Inc.
1370 N. E. 200th Terrace
North Miami Beach, Fla. 33179
Phone: (1-305) 651-5673

813th Med Air Evac Trans Squadron

I am looking for World War II flight nurses who served with the 813th Medical Air Evacuation Transport Squadron. I would like to organize a reunion for this year.

Please contact the address below.

Tammy Barnacastle
807 Woodland Village
Birmingham, Ala. 35216
Phone: (205) 879-1910

1094th Aviation Depot Group

Officers based at Manzano, N. M., are planning to hold a reunion in October 1988 and would like to hear from personnel who were assigned to the 1094th Aviation Depot Group, Manzano, N. M., between 1954–59. Names and addresses of former members are also needed for a forthcoming newsletter.

Please contact the address listed below.

B. K. Beckwith
2945 Gaviota Circle
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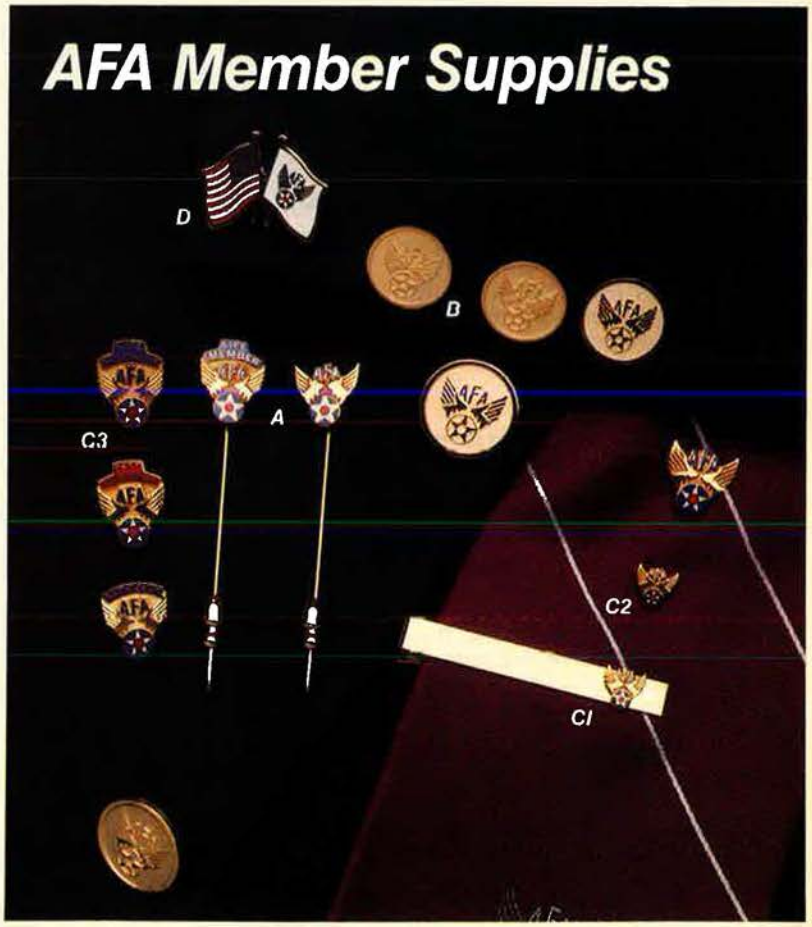

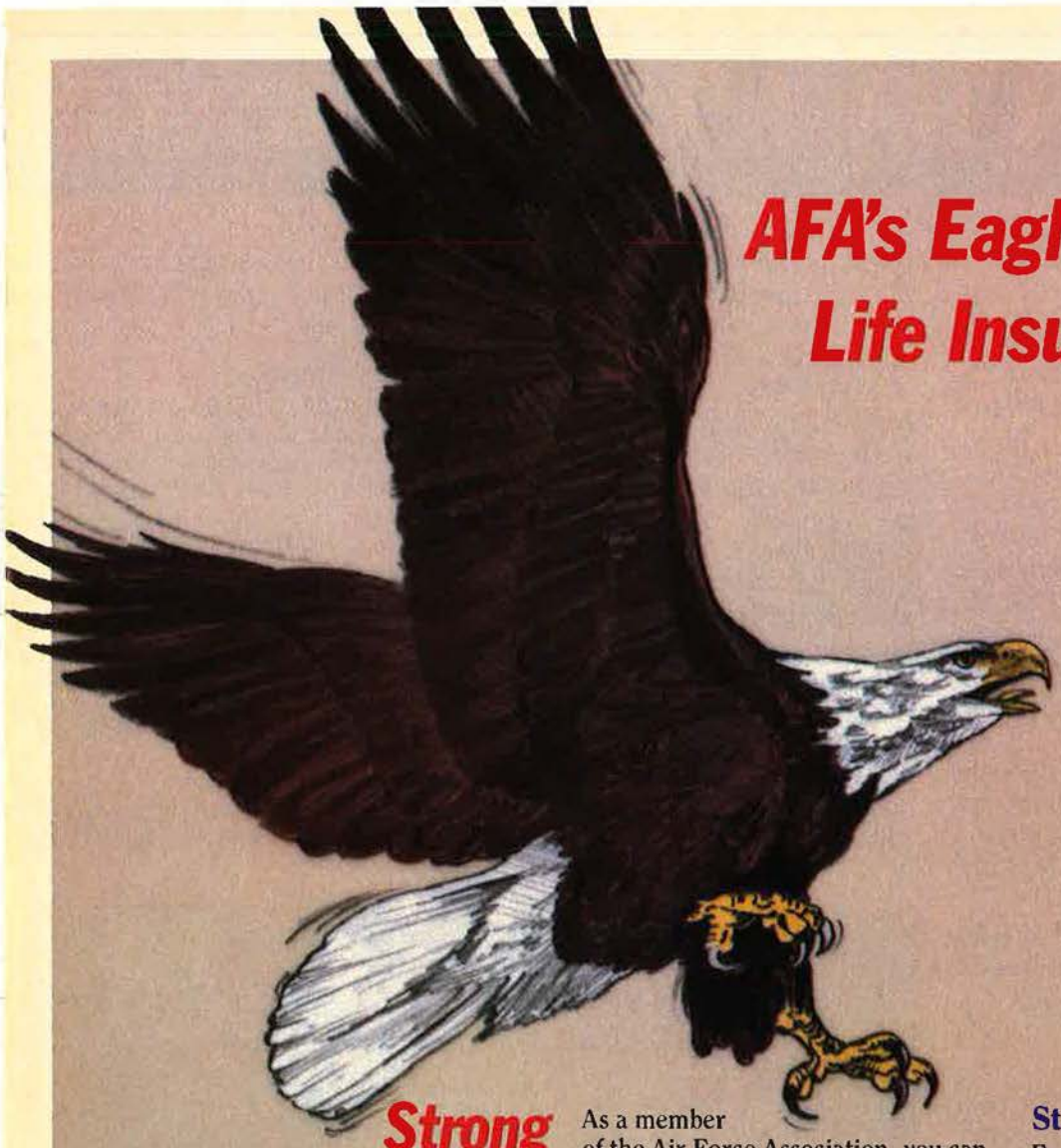

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Up to $400,000 for both flyers and non-flyers.

The cost?
As little as $.51 cents per year per thousand dollars of coverage.

Breakthrough Coverage for Flyers

AFA's Eagle Series coverage provides full scheduled benefits—regardless of age—for all deaths caused by non-war related aviation accidents . . . and one half of the scheduled benefit for deaths caused by war related aviation accidents.

Strong, Dependable Service

For information and help with any problem, you'll be served by insurance professionals on AFA's own staff . . . professionals who know your needs and care about serving you.

Get the facts now and compare.

AIR FORCE ASSOCIATION
Insurance Division
1501 Lee Highway
Arlington, VA 22209-1198

YES. Please send me complete information about AFA's Eagle Series Life Insurance program!

Name _____

Rank _____

Address _____

City _____

State _____ Zip _____

I am ☐ am not ☐ a current AFA member.

For Complete Information, mail the coupon today, or
CALL TOLL-FREE 1-800/858-2003

AFA's CHAMPLUS® . . . With the

Exceptional Basic Benefits

1. Four year basic benefit. Benefits for most injuries or illnesses are paid for up to a four-year period.

2. Up to 45 consecutive days of in-hospital care for mental, nervous or emotional disorders. Outpatient care for these disorders may include up to 20 visits by a physician or $500.00 per insured person each year.

3. Up to 30 days per year for each insured person confined in a Skilled Nursing Facility.

4. Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Residential Treatment Center.

5. Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Special Treatment Facility.

6. Up to five visits per year for each insured person to Marriage and Family Counselors under conditions defined by CHAMPUS.

And the New 'Expense Protector' Benefit

While CHAMPUS Supplement coverage was originally intended to cover the cost of medical services not provided by CHAMPUS, practitioners and service institutions may charge fees that are considerably greater than those approved for payment by CHAMPUS. And, because Supplement policies traditionally base their payments on the amount paid by CHAMPUS, the insured can be left with sizable out-of-pocket expenses. AFA's ChamPLUS® coverage includes a special feature which places a limit on these out-of-pocket expenses.

Called the 'Expense Protector' Benefit, this program limits out-of-pocket expenses for CHAMPUS covered charges in any single calendar year to $1,000 for any one insured person (or $2,000 for all insured family members combined). Once those out-of-pocket expense maximums are reached, ChamPLUS® will pay 100% of CHAMPUS covered charges for the remainder of that year.

An example of the way the 'Expense Protector' works follows. Assume you are hospitalized for 35 days, that the hospital charges you $330 per day and that this is $75 per day *more* than allowed by CHAMPUS. This would mean that you have an out-of-pocket expense of $2,625. With AFA's 'Expense Protector' benefit, your cost would be limited to $1,000. All covered costs over this amount—for the whole calendar year—would be paid by ChamPLUS®!

It's an important benefit that can mean significant savings to you and your family.

Who Is Eligible?

1. All AFA members under 65 years of age wh are currently receiving retired pay based upo their military service and who are eligible fo benefits under Public Law 89-614 (CHAMPUS their spouses under age 65 and their unmarrie dependent children under age 21, or age 23 in college.

2. All eligible dependents of AFA members o active duty. Eligible dependents are spouses under age 65 and unmarried dependent chil dren under age 21 (or age 23 if in college). (There are some exceptions for older age chi dren. See "Exceptions and Limitations.")

Renewal Provision

As long as you remain eligible for CHAMPUS benefits and the Master Policy with AFA remai

AFA ChamPLUS® Benefit Schedule

Care	CHAMPUS Pays	AFA CHAMPLUS® PAYS
For Military Retirees Under Age 65 and Their Dependents		
Inpatient civilian hospital care	CHAMPUS pays 75% of allowable charges	CHAMPLUS® pays the 25% of allowable charges not paid by CHAMPUS . . . plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year.
Inpatient military hospital care	The only charge normally made is a $7.55 per day subsistence fee, not paid by CHAMPUS.	CHAMPLUS® pays the $7.55 per day subsistence fee.
Outpatient care	CHAMPUS covers 75% of outpatient care fees after an annual deductible of $50 per person ($100 maximum per family) is satisfied.	CHAMPLUS® pays the 25% of allowable charges not paid by CHAMPUS after the deductible has been satisfied . . . plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year.
For dependents of Active Duty Military Personnel		
Inpatient civilian hospital care	CHAMPUS pays all covered services and supplies furnished by a hospital less $25 or $7.55 per day, whichever is greater.	CHAMPLUS® pays the greater of $7.55 per day or the $25 hospital charge not paid by CHAMPUS.
Inpatient military hospital care	The only charge normally made is a $7.55 per day subsistence fee, not paid by CHAMPUS.	CHAMPLUS® pays the $7.55 per day subsistence fee.
Outpatient care	CHAMPUS covers 80% of outpatient care fees after an annual deductible of $50 per person ($100 maximum per family) is satisfied.	CHAMPLUS® pays the 20% of allowable charges not paid by CHAMPUS after the deductible has been satisfied . . . plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year.

NOTE: Outpatient benefits cover emergency room treatment, doctor bills, pharmaceuticals, and other professional services. There are some reasonable limitations and exclusions for both inpatient and outpatient coverage. Please note these elsewhere in the plan description.

New 'Expense Protector' Benefit!

in force, termination of your coverage can occur only if premiums for coverage are due and unpaid, or if you are no longer an AFA member. Your certificate cannot be terminated because of the number of times you receive benefits.

Exceptions and Limitations

Coverage will not be provided for conditions for which treatment has been received during the 12-month period prior to the effective date of insurance until the expiration of 12 consecutive months of insurance coverage without further treatment. After coverage has been in force for 24 consecutive months, pre-existing conditions will be covered regardless of prior treatment. Children of active duty members over age 21 (age 23 if in college) will continue to be eligible if they have been declared incapacitated and if they are insured under CHAMPLUS® on the date so declared. Coverage for these older age children will only be provided upon a) notification to AFA and b) payment of a special premium amount.

Plan 1
For Military Retirees and Dependents
QUARTERLY PREMIUM SCHEDULE

In-Patient Benefits Only

Member's Attained Age*	Member	Spouse	Each Child
Under 50	$22.97	$ 45.12	$16.34
50-54	$34.33	$ 56.21	$16.34
55-59	$50.32	$ 60.17	$16.34
60-64	$62.98	$ 69.27	$16.34

In-Patient and Out-Patient Benefits

Under 50	$33.90	$ 61.02	$40.84
50-54	$46.59	$ 69.87	$40.84
55-59	$64.41	$ 96.11	$40.84
60-64	$77.38	$102.15	$40.84

*Note: Premium amounts increase with the member's attained age

Plan 2
For Dependents of Active Duty Personnel
ANNUAL PREMIUM SCHEDULE

In-Patient Benefits Only

	Member	Spouse	Each Child
All Ages	None	$ 9.68	$ 5.94

In-Patient and Out-Patient Benefits

All Ages	None	$38.72	$29.70

CHAMPLUS®

Coverage After Age 65

Upon attainment of age 65, the coverage of members insured under CHAMPLUS® will automatically be converted to AFA's Medicare Supplement program so that there will be no lapse in coverage. Members not wishing this automatic coverage should notify AFA prior to their attainment of age 65.

Exclusions

This plan does not cover and no payment shall be made for:

- routine physical examinations or immunizations
- domiciliary or custodial care
- dental care (except as required as a necessary adjunct to medical or surgical treatment)
- routine care of the newborn or well-baby care
- injuries or sickness resulting from declared or undeclared war or any act thereof
- injuries or sickness due to acts of intentional self-destruction or attempted suicide, while sane or insane
- treatment for prevention or cure of alcoholism or drug addiction
- eye refraction examinations
- prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses
- expenses for which benefits are or may be payable under Public Law 89-614 (CHAMPUS)

APPLICATION FOR AFA CHAMPLUS*

Group Policy GMG-FC70
Mutual of Omaha Insurance Company
Home Office: Omaha, Nebraska

Full name of Member _____
Rank Last First Middle

Address _____
Number and Street City State ZIP Code

Date of Birth _____ Current Age ____ Height ____ Weight ____ Soc. Sec. No. _____
Month/Day/Year

This insurance coverage may only be issued to AFA members. Please check the appropriate box below:

☐ I am currently an AFA Member.

☐ I enclose $18 for annual AFA membership dues (includes subscription ($14) to AIR FORCE Magazine).

PLAN & TYPE OF COVERAGE REQUESTED

Plan Requested (Check One)	☐ AFA CHAMPLUS* PLAN I (for military retirees & dependents) ☐ AFA CHAMPLUS* PLAN II (for dependents of active-duty personnel)	
Coverage Requested (Check One)	☐ Inpatient Benefits Only ☐ Inpatient and Outpatient Benefits	
Person(s) to be insured (Check One)	☐ Member Only ☐ Spouse Only ☐ Member & Spouse	☐ Member & Children ☐ Spouse & Children ☐ Member, Spouse & Children

PREMIUM CALCULATION

All premiums are based on the attained age of the AFA member applying for this coverage. Plan I premium payments are normally paid on a quarterly basis but, if desired, they may be made on either a semi-annual (multiply by 2), or annual (multiply by 4) basis.

Quarterly (annual) premium for member (age ____) $_____

Quarterly (annual) premium for spouse (based on member's age) $_____

Quarterly (annual) premium for ____ children @ $ $_____

Total premium enclosed $_____

If this application requests coverage for your spouse and/or eligible children, please complete the following information for each person for whom you are requesting coverage.

Names of Dependents to be Insured	Relationship to Member	Date of Birth (Month/Day/Year)

(To list additional dependents, please use a separate sheet.)

In applying for this coverage, I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed drugs or medicine within 12 months prior to the effective date of this insurance coverage will not be covered until the expiration of 12 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such pre-existing conditions will be covered after this insurance has been in effect for 24 consecutive months.

Date _____, 19 ____ _____
Member's Signature

Form 6173GH App.
1/88

Application must be accompanied by a check or money order. Send remittance to: Air Force Association, Insurance Division, 1501 Lee Highway, Arlington, VA 22209-1198

Bob Stevens'

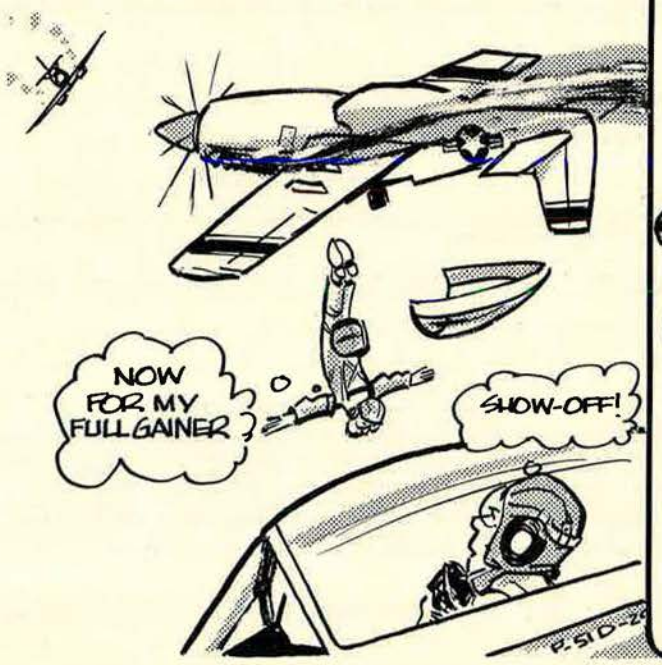
"There I was..."

HAVE YOU EVER WONDERED WHY *ANY-ONE* WOULD STEP OUT OF A PERFECTLY RUNNING AIRPLANE A MILE OR SO UP? (SPORT PARACHUTISTS WILL GIVE YOU A LOT OF SCREWY ANSWERS) **HOWEVER**, WHEN IT COMES TO A CRIPPLED OR MORTALLY WOUNDED BIRD, DON'T ASK ME. "WHY ARE WE BAILING OUT?" BECAUSE YOU'LL BE TALKIN' TO YOURSELF!

IN WWII, STORIES OF BOMBERS HANGIN' TOGETHER WERE LEGEND...

A-26s IN THE KOREAN CONFLICT WERE KNOWN TO ABSORB INCREDIBLE AMOUNTS OF FLAK...

BEFORE EJECTION SEATS, THE 1(ROLL) 2(UNLOCK CANOPY & BELT) 3(PUSH) METHOD WAS POPULAR IN FIGHTERS-



THEN THERE'S THE STORY OF THE JUMPER WHOSE CHUTE WOULDN'T OPEN. AT 5000' HE MET A GUY COMIN' *UP!*

Collins GRC-171A(V)4: The off-the-shelf UHF AM/FM/voice/data/ECCM/Have Quick II radio that meets or exceeds the U.S. Air Force GRC-XXX requirement for performance and delivery. ■ Now in production, this colocatable multi-channel NDI transceiver can be field-modified to incorporate Have Quick IIA capability. ■ More than 7,000 GRC-171 series radios are used by U.S. DOD agencies and international forces for air traffic control and data-link applications. Thus the new GRC-171A(V)4 will minimize logistics support and reduce life cycle costs. ■ For details contact: Collins Defense Communications, Rockwell International, 350 Collins Road N.E., 120-130 Cedar Rapids, Iowa 52498, U.S.A. (319) 395-1600, Telex 464-435. **Collins ACCD: The Electronic Combat Specialists.**

THE F-15: KEY PLAYER ON THE USAF TEAM.

FACT: THE LESS TIME OUR FIGHTERS NEED FOR MAINTENANCE AND REPAIR, THE MORE READY OUR DEFENSE.

Air Force fighters must be combat-ready around the clock. Because a crisis can arise anywhere, at any time. That's why the U.S. Air Force relies on the F-15 Eagle. The Eagle has proven itself to be rough, tough and ready to hit more often than any other air superiority fighter.

The Eagle is setting a new level of availability in its class. It's also setting a new level for sortie generation. And, it's proving itself much more reliable than the aircraft it replaces.

How do crew chiefs rate the Eagle for maintainability and reliability? Listen to these Eagle Keepers:

"...an excellent aircraft to maintain."

"...a beautiful aircraft...no other in the world can match it."

"The easiest and most reliable aircraft I've ever had a chance to work on."

For a strong defense, America counts on the Air Force. And the Air Force counts on the F-15 Eagle.

MVP.

MCDONNELL DOUGLAS