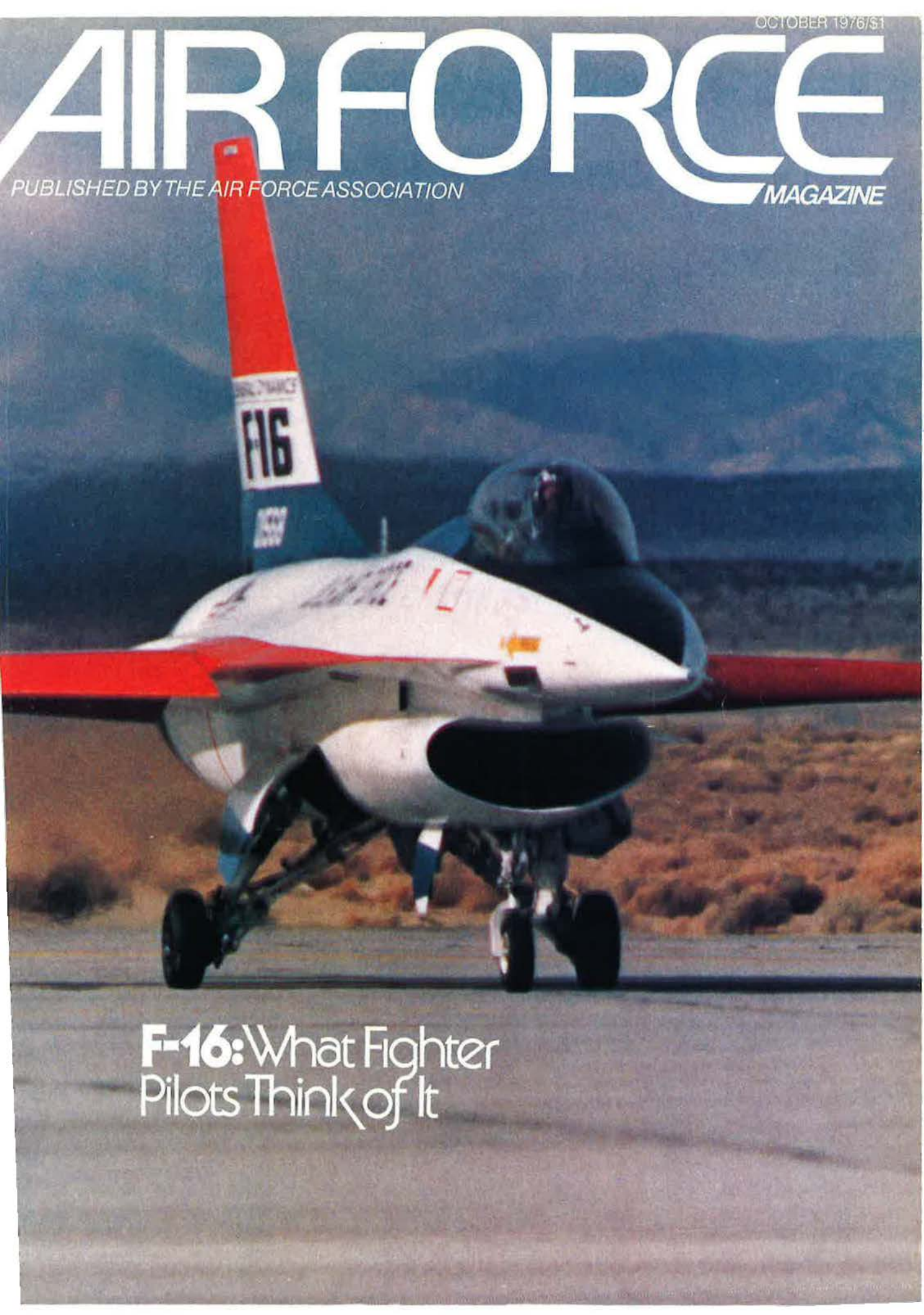
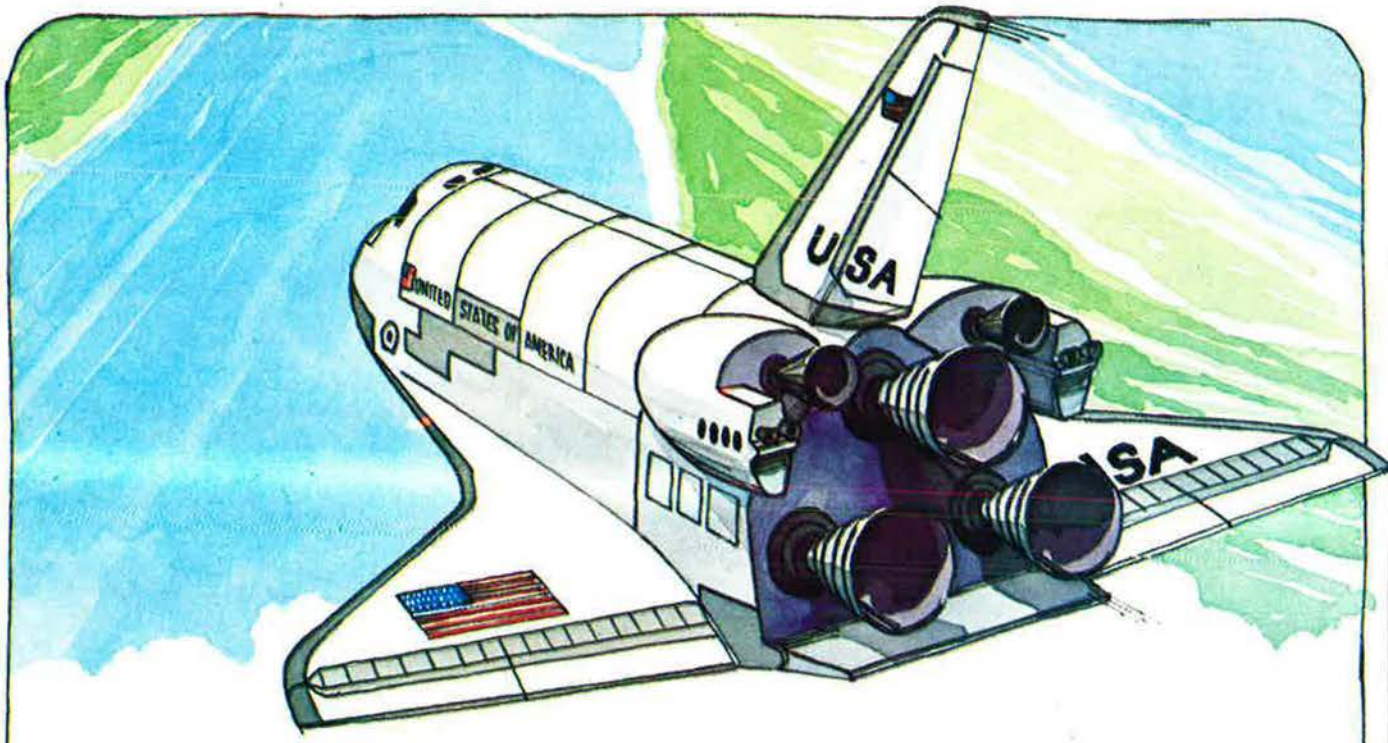
OCTOBER 1976/$1

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



F-16: What Fighter Pilots Think of It



We work with NASA on STOL, but we're big on the shuttle, too.

Diversified. That's Sperry Flight Systems. We're working with NASA on a number of projects not related to space, like STOLAND and the XV-15 tilt rotor programs.

In space, the shuttle has our attention at Sperry. We've simulated orbiter landings in NASA's Convair 990 and are modifying Gulfstream II aircraft to be used as shuttle trainers.

Perhaps our biggest contribution is the developmentof multiplexer-demultiplexer units for the orbiter and the solid rocket booster under contract to Rockwell International and NASA.

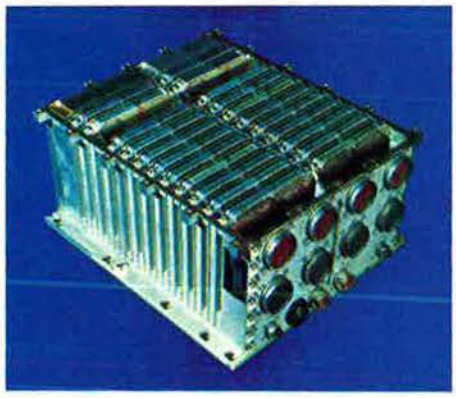
Working in conjunction with general purpose computers, MDM units will convert data from spacecraft systems into a format useable by the computer. They will also make computer signals useable by other subsystems.

Sperry MDMs can play an important role in future space shuttle payload applications.

In another related program, we have designed a shuttle payload pointing system capable of aiming a variety of space measurement devices within one arcsecond.

Our work on these varied NASA programs is an example of the breadth of our technological know-how in avionics. And we extend this knowledge to the other markets we serve... defense, commercial and general aviation.

We're Sperry Flight Systems of Phoenix, Arizona, a division of Sperry Rand Corporation, making *flying* machines do more so man can do more.



Multiplexer-demultiplexer unit.

SPERRY
FLIGHT SYSTEMS

AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

This Month

BOUT THE COVER

In the article beginning on p. 32, the Lightweight Fighter Test Director and project pilot for the Air Combat Fighter tells why the YF-16 is one of the most exciting, dynamic aircraft he's ever flown.

Departments

OCTOBER 1976
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BPA Circulation audited by Business Publication Audit

Two airplanes for

The two airplanes are one and the same: the Boeing 747 Advanced Tanker/Cargo Aircraft.

Instead of having two separate airplanes doing two separate jobs, one wide-body 747 does both.

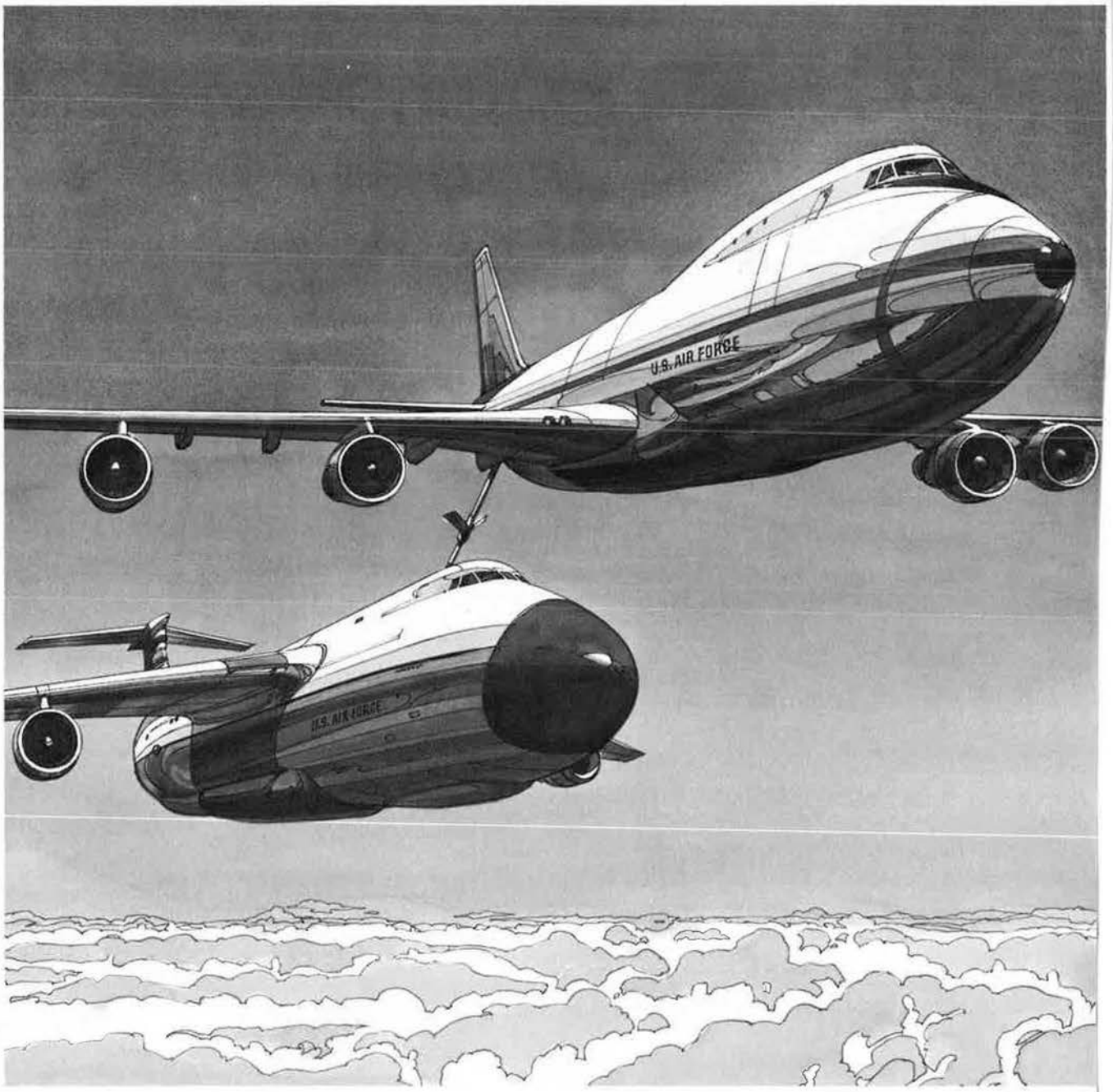
The 747 ATCA can refuel C-5A, C-141 or fighter aircraft to extend their useful range, or complement the present USAF cargo carriers by hauling "oversize" cargo.

For example, the range of the C-5A and the C-141 carrying combat loads can be significantly extended when they are teamed with the Boeing 747 ATCA.

One 747 ATCA operating from the U.S. could refuel one C-5A or four C-141s, enabling them to fly nonstop from deployment bases to the Middle East with full cargo payloads.

In another refueling mission, eleven 747 ATCAs could move an entire squadron of F-15s and 300 tons of squadron equipment to Europe in one ten-hour trip. The same mission presently requires 43 KC-135 and C-141 sorties using foreign refueling bases for the tankers.

The 747 is the only wide-body freighter aircraft now being produced. With over 50 cargo-capable



the price of one.

747s in service or on order by airlines throughout the world, Boeing has proven its ability to meet the broad-based requirements for an advanced tanker/cargo aircraft.

Considering the operational flexibility of these ATCA aircraft, the multi-mission concept is obviously an economical choice, and in the long run will save taxpayers millions of dollars.

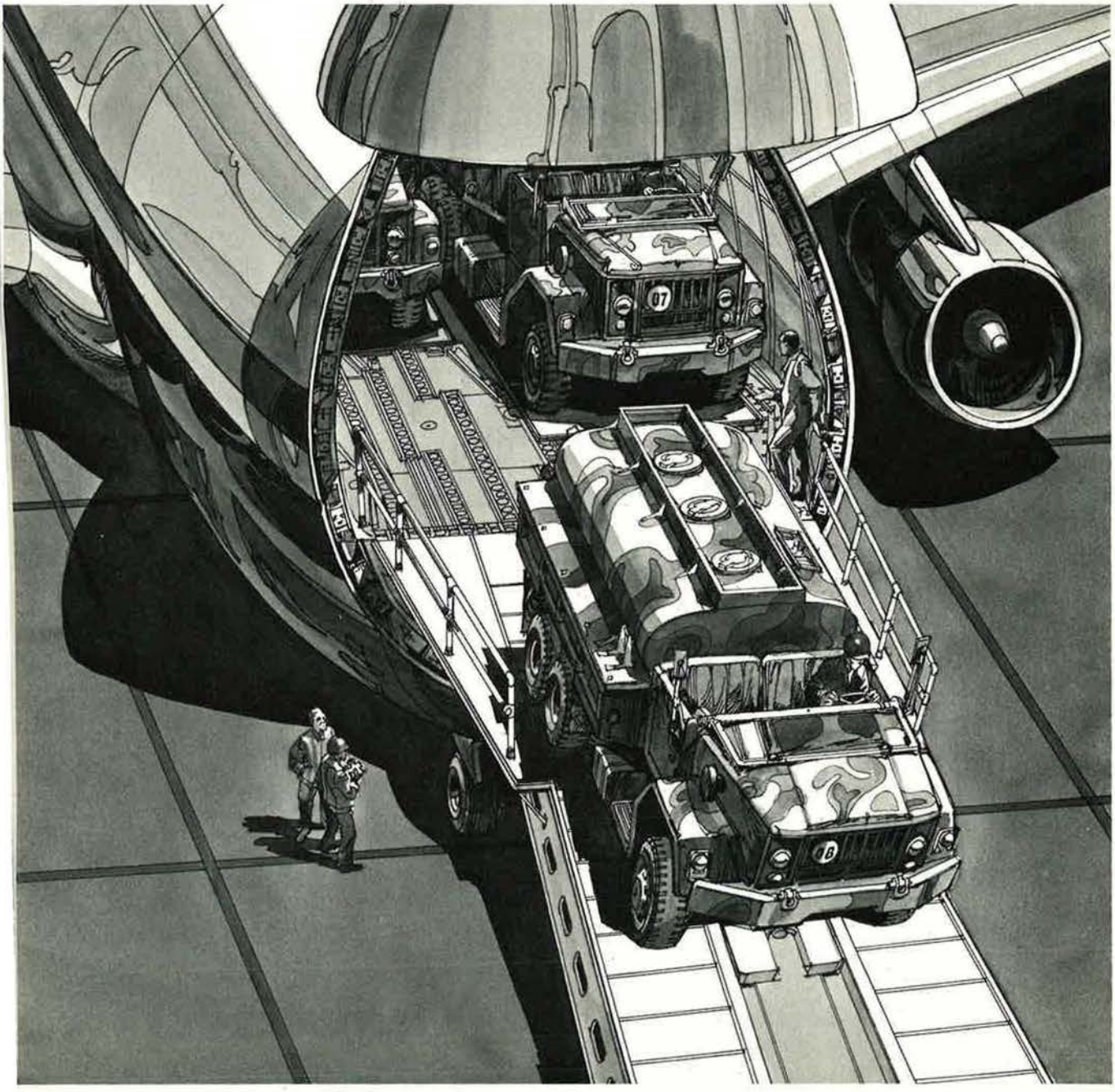
As a tanker, the 747 could cut down America's dependence on foreign bases for refueling.

As a military cargo carrier, the 747, with its oversize cargo surge capability, would enhance the ability of the Air Force to support U.S. Army deployment overseas. Especially in an emergency where large amounts of equipment must be moved quickly.

The 747 Tanker/Cargo Aircraft.

Where else could you get a cargo ship and filling station for the price of one or the other?

BOEING



AN EDITORIAL

The Risky Business of Technology Transfer

By John L. Frisbee, EXECUTIVE EDITOR

DETERRING the expansion of Soviet territory and influence rests on US technological superiority. That superiority is the product of a happy combination of natural resources and social, political, and economic institutions that have provided and encouraged public education, social mobility, individual freedom, and the rewards of a free-enterprise system. In this unique environment, the US has been and still is able to generate innovations in high technology at a rate rarely equalled elsewhere. That has been our strength, and it could be our undoing.

In contrast, the rigidly controlled, highly centralized Soviet system has produced competent scientists, but in many militarily essential technical areas it has fallen far short of US efficiency in design and serial production—in other words, in technology as distinct from basic research.

The Soviets are trying to close the technology gap by industrial espionage and by acquiring Western technology in other ways. Since 1972, their search for this technology has not been primarily through buying end products they cannot yet duplicate. Such purchases may fill a temporary need, but engineering analysis of finished products rarely reveals the details of Western design and production know-how. Hence, they have turned to other means: coproduction agreements, licensing arrangements, buying entire factories, contracting for training in high-technology areas, and so on. Through these varied routes of technology transfer they hope to fulfill Lenin's prophecy that "the capitalist countries will supply us the materials and technology we lack . . . and need for future victorious attacks upon our suppliers."

Protecting the US technological lead would be relatively simple if it were a two-dimensional matter involving only the US and the USSR, and if US exports were managed by a single government trading agency, rather than by hundreds of competing companies. Neither of these conditions exists.

The problem is subtle and complex. As it pertains to US technology exports, control involves detailed analysis of a vast array of technologies that the Soviets want to acquire and US industry is willing to sell. While no one of these technologies may in itself have direct application to military production, the combined effects of many such transfers can materially assist the USSR in creating a technological base comparable to that of the US. As Deputy Defense Secretary William Clements said in recent testimony before the House Committee on International Relations, "We cannot be assured of the use to which [technology's] end products will be put; we cannot recall it; nor is it necessarily a wasting asset."

But the issue of controlling technology transfer is, as suggested earlier, multidimensional. Much US technology is made available to allies, who are not authorized to transfer it to other nations without US approval. However, as US technology is modified by the allied recipient, it gradually loses its American identity, and its controllability, which, at best, is far from airtight. Add to that the fact that the US has no control over export of the indigenous technology of its allies except through voluntary cooperation of the members of CoCom, the Consultative Group Co-ordinating Committee (Japan and the NATO nations, excluding Iceland). The interpretation of what technology may safely be furnished the Soviets, especially in time of economic stress, varies widely among allies and, indeed, among US producers.

As a result of general laxness and inconsistency here and among our allies, the transfer of Western technology to the USSR and Pact nations has, in our opinion, got out of hand to a perilous degree. To take an example, the Soviets have bought from the West nearly 1,000 complete manufacturing plants ranging from automotive to chemical, electronic, and metallurgical production, together with technological training for Russian engineers, managers, and workers. In 1975, Western export to the USSR and Pact countries, a large part of it involving advanced technology, came to about $30 billion and was limited largely by the Soviets' shortage of hard currency rather than by Western prudence.

Somewhat belatedly, the Department of Defense, principal adviser to the Department of Commerce on the issuance of export licenses, has come to grips with the problem—at least so far as US technology is concerned. DoD is in the process of refining, simplifying and expanding its machinery and procedures for analyzing incipient dangers in the export of specific items of US technology. That reform, along with a general waning of enthusiasm for détente and the growing realization that long-term profits from trading with the USSR are apt to be illusory, should produce better control of US technology.

We believe also that US companies should be discouraged from submitting to potential Communist customers' proposals in such detail that they result in actual transfer of technology. Further, we need to review the transfer of US technology to some allies who appear less concerned than we with the Soviet threat. And we should use our influence to convince our CoCom partners that effective control of strategic technology is an essential element of Western security.

The name of the game is not to put unnecessary restraints on legitimate US and allied trade with the Communist countries. It is to assure that Lenin's prophecy remains unfulfilled.

The airlifter that's better than new.

When Hercules first flew, it was a great advance in airlift. But Hercs rolling off Lockheed production lines today are far advanced over the first models.

Payload is up 26%. Engine power, up 20%. Range stretches out 52% farther. Cruise speed is 11% faster. And structural life has risen 100%.

And while Hercules keeps getting better and better, it's also looking better and better as fuel costs reach for the sky. Herc's turboprop engines use far less fuel than fanjet engines. 50% less in some cases.

Hercules was born with a classic airlift shape, so simple and functional that it has become almost timeless. And within that simple shape, Lockheed has improved Hercules from nose to tail. All basic systems have been improved. New ones have been added.

The result: An airlifter that's far better than when it first flew. An airlifter that will be serving the Armed Services in the 21st century. An airlifter that's also been chosen by 36 other nations. An airlifter so versatile that it also serves as a tanker, search and rescue plane, ski plane, and in many other roles. An airlifter so rugged it can handle dirt, gravel, sand and snow runways.

Today Hercules is the world's biggest airlift bargain. And it keeps getting better and better.

Lockheed Hercules

Lockheed-Georgia Company

Airmail

Revamping the EMs

I've just finished reading the article in the August issue, "Revamping the Enlisted Structure," by Ed Gates. I've wondered for some time what the Air Force would eventually do about this situation.

About three and a half years ago, I joined the Army Reserve after a two-year break in service from the Air Force Reserve. I found there are a lot of similarities between the two services, but the most striking difference was in the EM-NCO structure—Army NCOs have one less rocker, E-5, 6, and 7, than their Air Force counterparts and different grade titles. And there's the Specialist grade.

Long ago, the Army faced up to the fact that an E-4 Sergeant was not the "Buck Sergeant" of days gone by. Nor was the E-7 the same man he once was. With the introduction of the E-8 supergrade in the late fifties, the insignia was shifted up and the E-8 became a Master Sergeant/First Sergeant, while the E-7 became a Sergeant First Class/Platoon Sergeant. The Marine Corps shifted, too.

The Specialist grade is an outgrowth of the Technician (with a "T" below the stripes) grade of World War II. Parallel to the "hard stripe" NCO grades, it once extended to Spec 9 but now only goes to Spec 7. But there aren't too many Spec 7s, or even Spec 6s. But watch out for the Spec 4s. Outside of a few Privates, Privates First Class—and some Spec 5s—the Spec 4s make up the bulk of the platoons.

Interestingly enough, there is still the grade of Corporal. An E-4, but hard stripe NCO. Supposedly. But very rarely seen, however, because an E-4 is still an E-4 as far as the Army is concerned.

The big promotion is to E-5 Sergeant, with the old three stripes of the Buck Sergeant. A troop has to have something going to make it—leadership potential and training. Then there are Spec 5s, an E-5 who fills a slot that does not call for an NCO but requires more responsibility and technical ability than expected of an E-4. But promotions are going to be tough unless the soldier can show NCO ability. There aren't that many Specialist 6 or 7 slots in most units, compared to the E-6 and E-7 NCO slots.

Each service has its own special requirements. But I can't help but wonder about splitting E-4s into two groups, no doubt at the same E-4 pay grade. Ceremony and certificate of appointment aside, will it lead to the peculiar Army E-4 Specialist 4/Corporal anomaly, with the really significant promotion being to E-5 because of the increase in pay?

SSgt. E-6 D. L. DuVal
Tulsa, Okla.

Air Force ROTC Honor

After reading "The Academy Honor System" in the July issue, I feel compelled to defend the honor system in a different light. I am a 1976 graduate of Miami University (AFROTC Detachment 640) and a newly commissioned second lieutenant in the USAFR. As an AFROTC cadet attending a civilian college, I was not bound to a rigid honor system as was my Academy counterpart. However, for four years I lived and worked under an honor code of my own high standards. It was and is an honor code inspired by parental influence and developed through association with other AFROTC cadets and the outstanding Air Force officers and NCOs I had the privilege to study under.

As pilot candidates, we were put to the test under the fierce and sometimes cruel competition for dwindling pilot slots. As young members of the Air Force, we were subjected to phenomenal RIFs that devastated many inspired hopes of becoming Air Force officers and pilots. Throughout my last year in ROTC, I witnessed all of my classmates react honorably and with dignity as we competed for our uncertain futures.

For those who survived the cutbacks, we now have an eleven-month delay, without pay, until we can be accepted into UPT and EAD. I'm sure I speak for all 1976 AFROTC graduates when I say that we are willing to wait out those delays and when we finally make it on to EAD, every officer who comes in contact with us will discover that we are the most dedicated, hard-working group of individuals to enter the Air Force in years. We look forward to UPT also, where we can demonstrate that ROTC graduates know how to learn and compete with integrity.

The Academy honor system has much merit, but no one should ever underestimate the honor, integrity, or quality of officers commissioned through the Air Force ROTC.

2d Lt. Robert J. Congelli
Cleveland, Ohio

• *We don't and never have.*—THE EDITORS

Here's a Couple!

I can't recall an instance, in the last ten or fifteen years, where you have printed someone's request to cancel their subscription (or drop out of AFA). Considering some of the damn-fool things you people say and do, there surely must have been some people in that category somewhere. As for me, I can't wait to see what you'll come up with next!

James V. King
North Highlands, Calif

• *See below. Reader King will love these. We also call attention to Lauran Paine's letter in March '76.*—THE EDITORS

Calling It Quits

I recently joined the Air Force Association because I felt it to be a worthwhile and fair organization.

Having just received my first copy of AIR FORCE Magazine, I asked myself—What have I done? I find that I have accidently joined another male club; that is, if your July issue is a fairly representative publication of AFA.

I would like to point out the following:

a. Page 3: Every article was written by a male.

b. Page 3: There are no women employed in the top thirteen staff positions of this magazine.

c. Page 106 ("This Is AFA"): The president, board chairman, secretary (even the secretary), and the

treasurer are all male. All the national directors are male. All the vice presidents are male.

d. Scanning the entire magazine, I found over 110 pictures of men and three pictures of women in this issue. (Does AFA even know that women exist?)

Obviously this organization does not think of women in any serious terms other than adjuncts to men. I abhor your decision to exclude women in the decision-making process of both the magazine and the organization. You are missing out on the benefit of a lot of technical expertise, knowledge, skills, and dedication.

Please cancel my subscription to AIR FORCE and terminate my membership in AFA immediately. Enclosed find my AFA membership card and lapel pin (*lapel pin?*).

Joan Gillman
Kelly AFB, Tex.

Another Sergeant's Viewpoint

Your July '76 magazine and the letter/article by CMSgts. Schmidt and Pasley force me to write this letter.

Chiefs Schmidt and Pasley, both members of AFA, contend that AFA is for everybody. I agree it *should* be; however, I did not renew my membership. Why? Because I, too, have the feeling that the AFA and its magazine are for officers.

The obvious question to that is, Why? Primarily the Association magazine gives me this feeling, reinforced over and over. If this is my perception as a Senior NCO, what, then, is the feeling of the Junior NCO/Airman? Specifically, May, June, and July, and other issues, deal with the following:

Advertising from the inside front cover throughout each entire issue deals with weapon systems, aircraft, pictures of the President, General officers, Secretary of the Air Force, and other VIPs. Even the "grip-and-grin" pictures in "AFA News" concentrate on high-ranking VIPs.

The cover of one issue is the B-1. Right, it is a beautiful aircraft, but how many enlisteds will ever pilot it? The letters to the Editor are, primarily, from high-ranking civilians/military officer personnel. Again, this is a reinforcement of a perceived idea. Granted, some of the pictures of the Chief Master Sergeant of the Air Force and Senior Enlisted Advisors-MAJCOM level do appear. Find me the average EM who identifies with such high-ranking NCOs—they are few and far between.

My point is this: I do not believe that the greater mass of AF enlisted identify with AFA. It appears to be high-ranking people/flying oriented. Fine—if this is what is desired—but it explains why "only eleven percent of the total membership" is enlisted.

Perhaps this explains, in part, why I have not renewed my one-year membership.

1st Sgt. David R. Malcolm
Hickam AFB, Hawaii

RIO's Comments

In reference to Lt. Col. William B. Mills's letter on Vietnam aces (July '76), I find it incredible that the Colonel feels the need to make a distinction between the pilot and GIB/RIO aces of the Vietnam period. As a former Air Force F-4 GIB who saw his share of MiGs, I can assure the Colonel that the enemy made no distinction, and I can state with absolute accuracy that the risk to the GIB was equal to that of the pilot.

By design, it takes the combined efforts of both the front and back seats to optimize a sophisticated two-place fighter aircraft.

It appears, sadly, that in some remote corners of the Air Force the pilot-navigator battle still rages in spite of the Vietnam lessons learned about the value of the fighter-crew concept. I wish Colonel Mills could come to the Navy, as I did, to see for himself that we make no superficial distinctions between Pilot and RIO—we are too involved in flying and fighting to waste time bickering over who gets the glory. A kill is a kill, and an ace is still an ACE!

Lt. Cmdr. Al Palmer, USN
F-14 RIO
San Diego, Calif.

Flying Sergeants

I enjoy "There I Was," by Bob Stevens. However, I feel that his cartoon about the Sergeant Pilots of WW II [July issue] was slightly misleading in the caption-comment box.

I started my flying career as a Staff Sergeant Pilot. I believe there were Sergeant Pilots who flew all types of aircraft in combat, including troop carrier C-47s, P-38s, and P-39s. I think Bob got the Liaison Sergeant Pilots mixed in with the other brand. Liaison Pilots wore an "L" in the center of the wings, and were assigned the duties outlined in the comment section of the cartoon.

Many former enlisted pilots stayed in the service and served in combat in WW II, Korea, and Vietnam, as I did. Quite a few ended up in the higher officer ranks before retiring. I have often wondered why some talented aviation writer has not detailed the history of the Flying Sergeants as it contains some very interesting material. Normally I don't respond to magazine articles, but I have noticed in several publications that the existence of the breed has been denied, and in one a statement was made doubting the role of Sergeant Pilots in combat. They did serve, some were casualties, and should receive the recognition in the history books that they deserve.

Although I served most of my career as an officer and was decorated numerous times in all three wars, the thing I am most proud of is being numbered among the Flying Sergeants.

Lt. Col. John J. Hoye, USAF (Ret.)
Glenns Ferry, Idaho

CBI Buddy

I am trying to locate an old CBI buddy from WW II—Paul Burleson—who was with me in Shanghai after the close of the war.

I also would like to hear from any fellas from the 51st Fighter Group, 26th Fighter Squadron, Fourteenth Air Force.

W. R. Worley
3360 S. Manor Dr.
Lansing, Ill. 60438

Stamps for Vets

I am retired and my hobby is gathering used stamps of all kinds that are sent to the lonely boys in our Veterans Hospitals. I have many letters from the Red Cross, the USO, and veterans hospitals all over the world thanking me for the stamps I have already sent—plus many letters asking me to send stamps. But this depends on how many I have to send.

You have no idea how lonely a boy can be in a hospital far from home with nothing to do except lie there and look at a blank wall. It is imperative for every patient to have a hobby that's both interesting and time consuming. Stamp collecting is a real therapy as it keeps the mind alert and active.

Airmail

We owe these boys a debt of gratitude that we can never repay. If any readers have stamps (both domestic and foreign) they do not want or cannot use, please send them to me for these boys.

Dave Schoenfeld
522 Shore Road
Long Beach, N. Y. 11561

Plane Search

I have been doing research on the 18th Pursuit Squadron, which was based at Elmendorf AFB during 1941–42. Information I have gathered so far indicates that the squadron started with twenty-one new or used Curtiss P-36 Mohawk aircraft. By the end of 1941 only one of these aircraft was still flying.

One of the Mohawks was lost over Turnagin Arm due to severe icing in flight. That means there are approximately nineteen of these aircraft around the landscape in Alaska.

It is my desire to locate pilots, or support people, who were with the 18th Pursuit Squadron during the time they were flying the P-36 aircraft, and attempt to track down the whereabouts of these planes.

Anyone with information, photos, and data on the aircraft is asked to write me. Any photos or diaries will be carefully handled and returned in good condition.

Dave Sternik
228 Alaska Pl.
Anchorage, Alaska 99504

USAAF in Essex

I am in the process of compiling a book on aviation in the County of Essex, England, during the Second World War. In this respect, I am endeavoring to contact members of the USAAF who served in Essex during that war.

Ian C. Mactaggart
Craig-Y-Llyn, Braintree Road,
Gosfield, Halstead,
Essex CO9 1PR, England

Historical Material Needed

I am trying to contact anyone with wartime experiences with the de Havilland Mosquito as used by the USAAF. Two hundred of these aircraft were obtained under "reverse lend-lease" and served with the following units: 25th Bomb Group (R); the 482d Bomb Group "Pathfinders"; the 492d Bomb Group "Carpetbaggers"; 416th, 422d, and 425th Night Fighter Squadrons; 3d Recon Group; and 8th Photo Group.

Photos, stories, logbooks, and notes are needed for the preparation of a series of articles for the Journal of the American Aviation Historical Society. All materials loaned will be gratefully returned.

Dana M. Bell
4452 Raleigh Ave., Apt. 201
Alexandria, Va. 22304

In Search of the Past

The 85th Flying Training Squadron is trying to recap its past. Anyone belonging to the 85th Bomb Squadron from 1941–1962 who would like to send us any information or squadron patches, please write

Lt. Col. Dale R. Ullrich
85th Flying Training Squadron
Laughlin AFB, Tex. 78840

Wingman Kuhn

I would like to contact, if possible, Lt. Edward Kuhn regarding a display we have in our museum in memory of 1st Lt. Thomas Harrigan, 458th Fighter Squadron, 506th Fighter Group, who was killed in action over Japan on July 8, 1945. Lieutenant Kuhn was Lieutenant Harrigan's wingman at that time.

John Denehy, Pres.
Memorial Military Museum Inc.
61 Center St.
Bristol, Conn. 06010

Hey, You Guys Out There

I am writing a story about the raid on Toulon, France, on August 18, 1944. The raid was flown by the 446th, 447th, and 448th Bomb Squadrons of the Fifteenth Air Force. These squadrons are now manning Minuteman missile sites around Grand Forks AFB, N. D.

What I could use are personal stories of the aircrews involved, and the story of how these squadrons got the Distinguished Unit Citations that we still wear.

If any of you are out there, please write me.

2d Lt. David G. Whitaker
1293a Redwood Dr.
Grand Forks AFB, N. D. 58205

32d TAS Patches

The 32d Tactical Airlift Squadron is beginning a unit patch display. Would appreciate receiving any new or used patches readers could send.

1st Lt. William H. Stockmann
32d TAS
Little Rock AFB, Ark. 72076

UNIT REUNIONS

Combat Pilots Association

The national convention-reunion (Group Grope III) of the Combat Pilots Association will be held in San Diego, Calif., November 12–14. Contact

Blue Leader
Combat Pilots Association
Box 91253
L. A. International Airport
Los Angeles, Calif. 90009
Phone: (213) 822-1755

36th Fighter Group

A reunion of the 36th Fighter Group will be held October 8–10, at the Ramada Inn, Fort Walton Beach, Fla. All past members invited. Contact

E. S. Wildermuth
8 Wimbledon Way
Shalimar, Fla. 32579
or
James Darnley
3 Anastasia Dr.
Fort Walton Beach, Fla. 32548

55th Fighter Group

The 55th Fighter Group will meet in Dayton, Ohio, on October 15–17, along with other 8th AF units. For further information, write

55th Fighter Group Reunion
c/o Reunion Services
Box 1304
Hallandale, Fla. 33009

305th Bomb Group

A minireunion with the 8th AF will be held by the 305th Bomb Group, Dayton, Ohio, October 15–17. Write

305th Bomb Group Reunion
c/o Reunion Services
Box 1304
Hallandale, Fla. 33009

390th Bomb Group

A reunion is being held by the 390th Bomb Group on October 15–17, in Dayton, Ohio, in conjunction with other units of the 8th AF. Contact

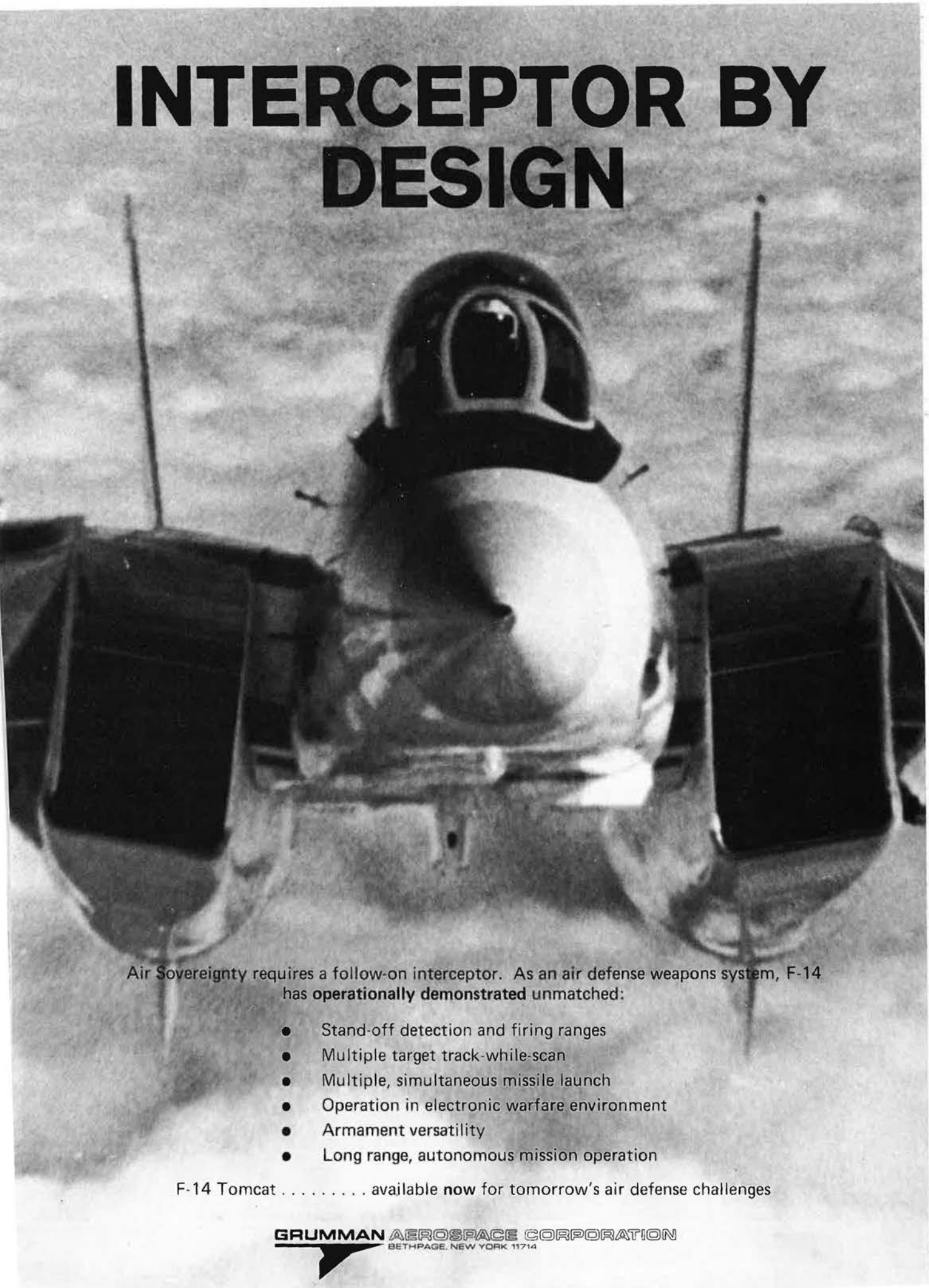
390th Bomb Group Reunion
c/o Reunion Services
P. O. Box 1304
Hallandale, Fla. 33009

868th Bomb Sqdn.

"Snoopers" of the 868th Bomb Sqdn (H), 13th Air Force, South Pacific, and the 63d Bomb Sqdn., 5th Air Force Southwest Pacific, are having reunion #3 at Lago Mar Hotel, Fort Lauderdale, Fla., November 4–7. Details from

Dr. Vince D. Splane
3236 W. Broward Blvd.
Fort Lauderdale, Fla. 3331
Phone: (305) 587-5922

INTERCEPTOR BY DESIGN



Air Sovereignty requires a follow-on interceptor. As an air defense weapons system, F-14 has **operationally demonstrated** unmatched:

- Stand-off detection and firing ranges
- Multiple target track-while-scan
- Multiple, simultaneous missile launch
- Operation in electronic warfare environment
- Armament versatility
- Long range, autonomous mission operation

F-14 Tomcat . . . . . available **now** for tomorrow's air defense challenges

GRUMMAN AEROSPACE CORPORATION
BETHPAGE, NEW YORK 11714

Airpower in the News

By Claude Witze, SENIOR EDITOR

Where the Money Is

Washington, D. C., Sept. 7

By early October, a month from this writing, the 1976 presidential contest will be boiling, and there is growing evidence that national security issues will be getting more attention than they did in other recent election years. Both party platforms indicate this, if for no other reason than that they differ to an important degree. The Democrats call for a defense budget cut of $5 billion to $7 billion. The incumbent Republicans respond that big economies already have been made and that a period of growth must lie ahead to meet the threat.

This is a good time to remind the public, so long accustomed to a different calendar, that Fiscal 1977 starts on October 1, 1976, and by that time Congress will impose a spending total for the year. And before a new President is elected, the machinery will start again to figure out what that ceiling will be in Fiscal 1978. This procedure, as well as the presidential debate now under way, will make it more and more clear that spending cuts, if they are possible, must be found in nondefense areas.

There is evidence that the idea is getting across. A major breakthrough came about a month ago. The Advisory Commission on Intergovernmental Relations, a creature of Congress, created in 1959 to monitor federal issues and problems, issued a report titled, "Significant Features of Fiscal Federalism." The report was brought to the attention of David S. Broder, the distinguished political reporter of the Washington *Post*. Mr. Broder was astounded to learn that the Pentagon has been paying a substantial part of the bill for our fast-growing welfare state. He reports finding a table, for example, that "shows the extraordinary shift from defense to domestic welfare spending in the past twenty-two years."

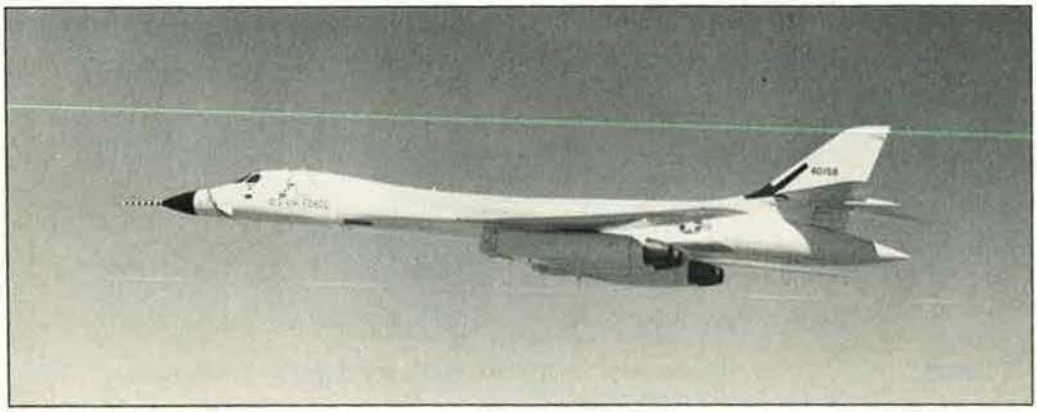
"In 1954," Mr. Broder writes with a tone of astonishment, "the federal defense budget was almost equal to the combined domestic spending of federal, state, and local governments—$47.1 billion for defense, $49.9 billion for all domestic programs. This year, the domestic expenditures have risen to 78 percent of the government pie, while defense has shrunk to 22 percent. To put it another way, half of the past two decades' rapid growth in domestic spending has been financed by taxes and deficits, and half by a shift in spending from defense to civilian programs."

The *Post* readers then were told, for the first time, the true implication of the financial facts: "Unless new international agreements are reached capping defense spending, domestic programs growth will have to slow. The armed services cannot continue to subsidize half its expanding cost." The possibility of such agreements being reached is remote. So is the possibility of cutting the defense budget.

The jolt suffered by Mr. Broder would have been eased if his newspaper provided more adequate coverage of Congress. On December 3, 1975, the House Armed Services Committee, under chairman Melvin Price, a Democrat from Illinois, opened ten days of hearings on budget problems. Mr. Price, whose committee is concerned only with authorization of funding for part of the defense budget, said it has become essential to examine "the total national security budget, the factors and procedures which go into the development of that budget, and the foreign policy considerations on which it is based."

His first witness on December 3 was Clifford J. Miller, Deputy Comptroller for Plans and Systems of the Department of Defense. The Washington *Post* was not represented at the press table at this open hearing, and no report of the proceedings was printed. What Mr. Miller told the committee that day was precisely the same thing Mr. Broder learned eight months later from the commission report. In fact, the Miller analysis is more detailed and more penetrating than the table of figures released in August. Said Mr. Miller:

"The defense program that cost $53 billion in 1964 would cost $116 billion at today's pay rates and price levels. We are getting $94



House and Senate conferees have limited B-1 production obligations to $86.4 million per month until January, when the new President is expected to decide either in favor of or against the new bomber. Earlier, Congress rejected an effort to halt all B-1 funding.

billion, so we are down about $22 billion, or roughly 20 percent. . . . Our manpower is about 20 percent below prewar levels. And our real purchases from industry are down about 20 percent. On the other hand, other federal spending has risen very sharply in real terms. What this shows is that the $189 billion [the increase in nondefense federal spending] was enough to cover not only all inflation, but to leave plenty over for real growth as well." (The amount left over for real growth in nondefense areas was $112 billion, while defense took a cut of $22 billion.)

The sudden discovery that the Defense Department is paying for a substantial part of the welfare programs came out in more of the Miller testimony, not covered by the press. AIR FORCE Magazine had the lone reporter present on December 3, 1975.

Mr. Miller said that, using figures from the Office of Management and Budget (OMB), the total federal spending in Fiscal 1976 was $349 billion. Of this, $260 billion was mandatory, covered by contracts or entitlements. This means $260 billion must be spent, unless Congress changes the law. That is about seventy-five percent of all government outlays.

This leaves only about a quarter of the outlay budget that is controllable. Two-thirds of it is in the Defense Department budget. Said Mr. Miller, unheard by Mr. Broder: "Two-thirds of the controllable outlays [in the US budget] are in defense, or conversely, two-thirds of the defense spending is controllable. Only about fourteen percent of other spending is held to be controllable. . . ."

Candidate Jimmy Carter speaks, through his platform, of cutting up to $7 billion from the defense budget. If he is like most would-be defense cutters, he will look for this 7 billion in the procurement program. Mr. Miller pointed out that only $1 out of each $8 voted for defense goes into procurement. Thus, if you wiped out the whole procurement section of the defense budget, according to the expert, you save $3 billion in outlays, for that is all the outlay, or real spending, there is in the year. There was, in Fiscal 1976, procurement obligational authority of nearly $25 billion, but it is spread over many years in the future.

The other thing that Mr. Broder and Mr. Carter can learn from the Miller presentation is that most of the Pentagon budget goes into the payroll. In 1976, the figure was $25.7 billion, as opposed to $3 billion in outlays for procurement. To cut the payroll, Mr. Miller said, you have to fire 300,000 persons to have $1 billion. Which President, or congressman, will advocate this program? Or suggest that just as much money can be saved by eliminating, for one year, the recently disclosed frauds in the Medicaid program, financed, to a substantial degree, with money sacrificed by the Department of Defense? It is estimated that this ripoff costs up to $1.5 billion a year.

In its report on the 1977 defense budget, the Senate Appropriations Committee went after a related inequity. The bill estimates the cost of retired pay for former military at $8.5 billion, out of a total spending budget of $101.1 billion. The estimate for Fiscal 1978 is $9.5 billion. The line item has increased 600 percent between 1964 and 1977. The committee report points out that this money contributes nothing to national defense; it pays for no services, equipment, weapons, systems, or capabilities. There is no other federal agency that includes the cost of paying pensions in its budget.

Says the committee: "Inclusion of the program within the defense budget distorts perception of both the actual and relative magnitude of spending for this [defense] function at a time when such considerations are very much in debate." The recommendation is that, in the future, the cost of military retired pay be shifted to a different area, such as income security or veterans benefits. "Then, perhaps," the committee says, "the size of the defense program in any given year can be debated entirely in the proper context of how well it addresses our national security needs."

All bets on the outcome of the presidential contest should be off until after the scheduled face-to-face debates between candidates Ford and Carter. The Democratic candidate will have trouble defending his party's pledge to cut up to $7 billion from the defense budget. The Democrats favor a foreign policy—including support for Israel and other allies, as well as a deep skepticism about détente—that is contradicting their skepticism about defense spending.

Collateral Reading

With the approaching election and another presidential inauguration in January, it is inevitable that defense spending will be widely debated in the months ahead. Two good sources of material are available for readers who have a serious interest in the subject. Here is how you can get your own copies:

- A 586-page transcript of hearings on the subject can be obtained by writing to the House Armed Services Committee, 2120 Rayburn House Office Building, Washington, D. C. 20515. Ask for H.A.S.C. No. 94-32, titled, "Full Committee Consideration of Overall National Security Programs and Related Budget Requirements."
- Outside of Congress, the other important document is published by the Advisory Commission on Intergovernmental Relations, 726 Jackson Place, N.W., Washington, D. C. 20575. Ask for report M-106, dated June 1976. The title is "Significant Features of Fiscal Federalism, 1976 Edition, Part 1."
- If you want to study the case against defense spending, there is a new book from the Center for Defense Information, a project of the Fund for Peace, Inc., headed by Gene R. LaRocque, the retired Navy rear admiral. It is a compilation of essays discounting Russia as a threat to peace—it claims it is the US Navy that is upsetting the balance in the Indian Ocean, for example—and lamenting our military program. The book is called *Current Issues in US Defense Policy*, and it is published by Praeger Publishers, 111 Fourth Ave., New York, N. Y. 10003. There are 254 pages, including the index. In this case, there is a charge of $18.50 a copy.

Airpower in the News

Opponents of the Rockwell International-USAF B-1 bomber project today are claiming a major victory because House and Senate conferees have agreed to a "go-slow" program. A proposal that production funding be stopped pending a decision next year by the new President was rejected. In place of it, a tether was put on B-1 production spending. USAF is restricted to production obligations of $86.4 million a month through January. Then, the new President can halt the program. Mr. Carter, the B-1 foes hope, would do this; Mr. Ford is pledged to build the airplane. The compromise, if that is what it is, would require a President Carter to take a negative action, which may be less easy to do in February than he expects. Both Congress and the public, as reflected in polls, favor a firm defense policy.

An investment expert quoted in the *Wall Street Journal* says the recent votes on defense spending by the Democratic Congress indicate support for a "budget at least sufficient to maintain current program objectives." He says that a Carter Administration, once facing full responsibility for the conduct of foreign affairs, "wouldn't risk the reduction of force levels implied by the proposed cuts in the defense budget." He thinks the words of the Democratic platform, intended to be acceptable to both wings of the party, "include a serious inconsistency between promises of an adequate US defense and maintenance of our overseas obligations . . . and a proposal to reduce defense spending."

Regardless of who wins this race, he will find the rude facts awaiting. If there are budget cuts to be made, they will have to be made whore the money is, as Willie Sutton would say. ■

The Wayward Press

Gen. Maxwell Taylor, the retired soldier and diplomat, has written a new book on national security in which he makes some comments about the press. They are worth noting. He rates some of the media "among the self-destructive forces in the nation." The General finds they use their power "to confuse, mislead, or bias the views of a public dependent on them for reliable news." He is critical of "selective reporting" that can become a kind of censorship and contribute to "widespread suspicion, distrust, and doubts about ourselves."

General Taylor did not have many examples at hand, outside of his reflections on press coverage of the war in Vietnam, but makes it clear he is concerned about possible damage to our military stature. At hand, we find the announcement in mid-August that the International Fighter System Office (SPO) of the Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, has been given an Air Force Organizational Excellence Award.

What for?

An ASD press release says the SPO was honored for outstanding work on the development and procurement of the Northrop F-5E International Fighter. Hear this: The first production contract called for 325 aircraft. The last aircraft was delivered in July 1975, eighteen months ahead of schedule, and at a cost $17.7 million less than the original program estimate.

The news value of this item, outside of a few newspapers in California and Ohio, was exactly zero. It did not fit the pattern for reporters and editors conditioned to write about overruns and schedule slippages. An "investigative reporter" could have probed beyond the USAF press release and learned that the Northrop Corp. today is assembling the 3,000th plane in the F-5/T-38 family. All of the aircraft have been delivered on time and within cost limits.

There is no evidence that the news was used in any of the major newspapers examined daily in the nation's capital, and cited daily in the *Congressional Record*. After all, news of the SPO award was not announced in a press release from the offices of Rep. Les Aspin or Sen. William Proxmire, which are among the more common sources of military news found fit to print.

* * *

Our constant watch for signs of what the newspaper world is doing to improve its public image, which still appears tarnished, has these results this month:

Item: The New York *Times*, borrowing the old efficiency report concept from the military services, has set up a system to rate its 350 reporters on job standards and overall performance. According to *Editor & Publisher*, the employees are upset and their union, the Newspaper Guild, is opposed to the idea "on the grounds that it could be used as a basis for disciplinary action." The idea is repulsive, that a man could be fired for incompetence. The *Times* now has a form to be filled out on "Reporter Job Standards." These insist that a reporter must be accurate, write understandable English, and be able to do it under deadline pressure, that he must know news when he sees it and in general be competent as a reporter. From the *E&P* report, it does not seem that the demands of the *Times* management differ much from the type of standards already set for plumbers, hairdressers, engineers, electricians, truck drivers, and other tradesmen.

Item: Elizabeth Ray, who claims she was paid by a congressman to serve as his mistress and started writing when she turned out a book about her adventure, now has appeared in the press corps. Miss Ray was a reporter, presumably with full gallery credentials, working for a magazine at the Republican National Convention. She made the transition from one profession to another with ease, and we look forward to reading her report in a publication called *Genesis*.

Item: The National Press Club, a bulwark of newspaper professionalism in Washington, has held a seminar for its members on "assertiveness training." The problem, NPC said, is, "Are you assertive enough for your job?" The seminar promised to help newsmen "distinguish among aggressive, nonassertive and assertive behavior" and "apply skills learned." The impact of the seminar on the conduct of local newsmen has not been registered, so far.

* * *

In the Washington *Post* of August 24, there is an article about the anticipated federal pay increase due in October. The lead, by Mike Causey, says it will cost the taxpayers $2.5 billion, which is a lot of money. The military are included and, Causey writes:

"Top brass, on paper, would get even bigger percentage increases [than civilians], but since the federal career salary lid would be set at $39,600 under the plan (it is now $37,800) they would, in fact, get smaller percentage boosts."

That seems clear, except to the *Post's* copy desk. Pro claims the headline, in large type: "Pay Rise a Boon to Brass." That is exactly what reporter Causey said was not true—the real boon going to civilians.

F-16: on target.

With Mach 2 speeds, plus outstanding acceleration and turn rates, it's vital for the U.S. Air Force F-16 to have a highly accurate and reliable inertial system.

Now General Dynamics has awarded a contract to Singer's Kearfott Division to develop the inertial navigation system for this maneuverable, lightweight fighter.

The precision system provides continuous knowledge of the aircraft's geographic position, velocity and heading. It contains a computer, miniaturized gimballed platform, control panel and display, and incorporates the latest state-of-the-art in integrated digital technology.

In keeping with the F-16 design to minimize life cycle cost, it is designed for high reliability and low operational cost.

Singer's Kearfott Division designs and produces advanced avionics systems and components for the aerospace industry and high-technology products for the commercial market. Major products range from inertial navigation equipment, Doppler radars and airborne computer/converter systems to microwave landing systems. For information, contact The Singer Company, Kearfott Division, 1150 McBride Avenue, Little Falls, N. J. 07424.

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AEROSPACE & MARINE SYSTEMS

the imperatives of national readiness

AFA's Symposium on "The Imperatives of National Readiness," to be held in Los Angeles, California, October 22–23, will present a broad and penetrating examination of America's defense capabilities and of the will and readiness to apply them for the deterrence or prosecution of conventional or nuclear war. Symposium topics will sweep across the horizon of readiness, from raw materials to industrial capability to logistics to allied support to the operational readiness of the Air Force.

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Assistant Secretary of Defense (I&L)

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Assistant Administrator, ERDA

Gen. Russell E. Dougherty
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Gen. Robert J. Dixon
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FINAL ANNOUNCEMENT

Aerospace World News, Views & Comments

By William P. Schlitz, ASSISTANT MANAGING EDITOR

Washington, D. C., Sept. 7

★ USAF rolled out its prototype BGM-34C multimission RPV in mid-August, constituting a major milestone in remotely piloted vehicle state of the art.

The RPV's multirole capability is to be provided through its interchangeable payload "noses"—modularized systems designed for electronic warfare, reconnaissance, and strike missions. The new vehicle can be ground- or air-launched.

A series of thirty-two test flights of five of the Teledyne Ryan-developed BGM-34Cs is scheduled to run through April of next year, with the first flight to take place at a test range near Hill AFB, Utah, in September.

In this RPV design, the Air Force is putting its money on the modular approach to mission performance and, with it, its hope for an RPV with strike capability.

The BGM-34C (a former YAQM-34U modified by Teledyne Ryan) is equipped with an improved avionics package that should translate into greatly upgraded maintainability and reliability, USAF officials said.

An adjunct to the BGM-34C program has been the incorporation by Lockheed Aircraft Services, Ontario, Calif., and Sperry Univac, Salt Lake City, Utah, of a microwave guidance system for support of BGM-34C operations into a DC-130E launch aircraft.

★ A Lockheed C-130H Hercules lived up to its name this summer when it toted an external test load of 44,510 pounds (20,189 kg) at Edwards AFB, Calif.

The modified aircraft has been equipped as an aerial launch platform with each of its four underwing pylons capable of carrying a 10,000-pound (4,536 kg) RPV—double the weight of RPVs carried aboard any previously converted Hercules.

The Hercules will be used in aerial test-launches of winged reconnaissance RPVs, which will be either controlled during flight from the mother ship or from ground stations. To that end, the Hercules is currently being equipped with a multiple control RPV system at Hill AFB, Utah, with a test program to follow.

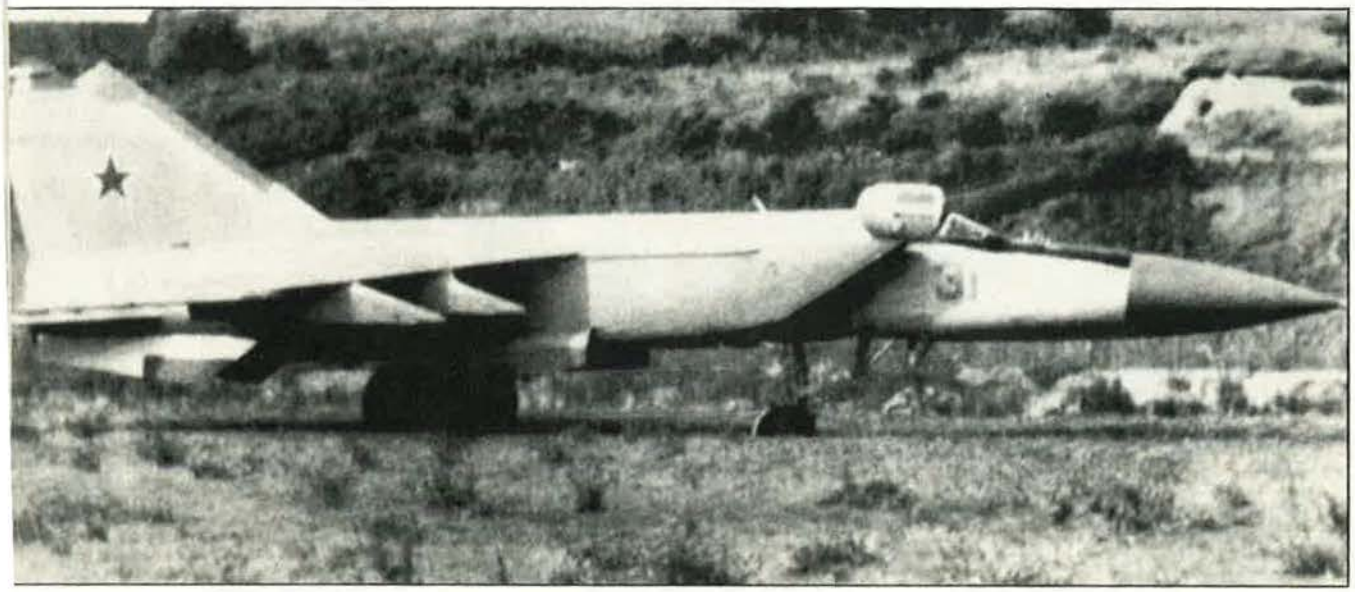
★ NASA has begun a flight-test program of the USAF-initiated Digital Fly-By-Wire aircraft control system being developed for a future generation of aircraft.

The system is being flown aboard a modified F-8 jet aircraft at the space agency's Dryden Flight Research Center, Edwards AFB, Calif., in about thirty flights that should continue through 1978.

Conventional control systems aboard the F-8 have been replaced by lightweight wires to transmit pilot signals. Three digital computers are used for primary control, with a three-channel analog system as backup if the digital system fails.

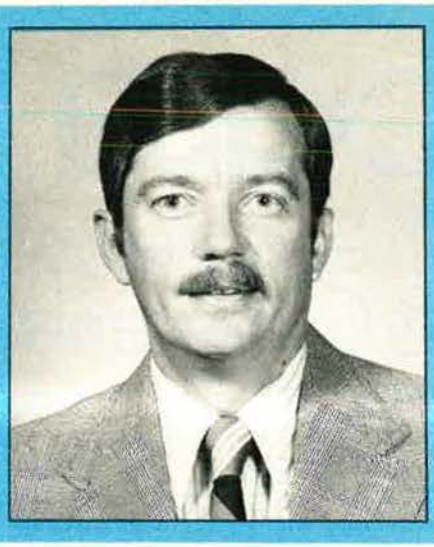
With the weight savings provided by digital control technology, USAF has estimated that future bombers and fighters could be up to twenty percent lighter, at production-cost savings of up to ten percent. The weight savings also translate directly into economies in fuel consumption, boosted passenger-carrying capacity, and smoother flight performance.

NASA officials have high hopes



his MiG-25 Foxbat, which landed in Japan in early September, was flown from a base in eastern Siberia by a Soviet pilot eeking asylum in the US. The Foxbat is the fastest and highest flying fighter in the Soviet Air Force.

Aerospace World



Maj. Terry A. Arnold is presently serving with AIR FORCE Magazine as Contributing Editor under the USAF's Education-With-Industry program. In his last assignment, Major Arnold was the Chief, Editorial Division, for the Secretary of the Air Force Office of Information Command Services Unit, at Bolling AFB, D. C. He holds a BA degree from Michigan State University and an MA degree from the University of Denver, both degrees being in radio/television production. Entering the Air Force via OTS in 1962, Major Arnold is a career Information Officer, having held various posts at base and command levels.

that the digital control technology might find application in the design of Space Shuttles, as well as in advanced transports.

★ The Air Force Systems Command and the Naval Air Systems Command are sponsoring a joint program for the development of an oxygen-generation system that may replace conventional liquid oxygen systems aboard future military aircraft.

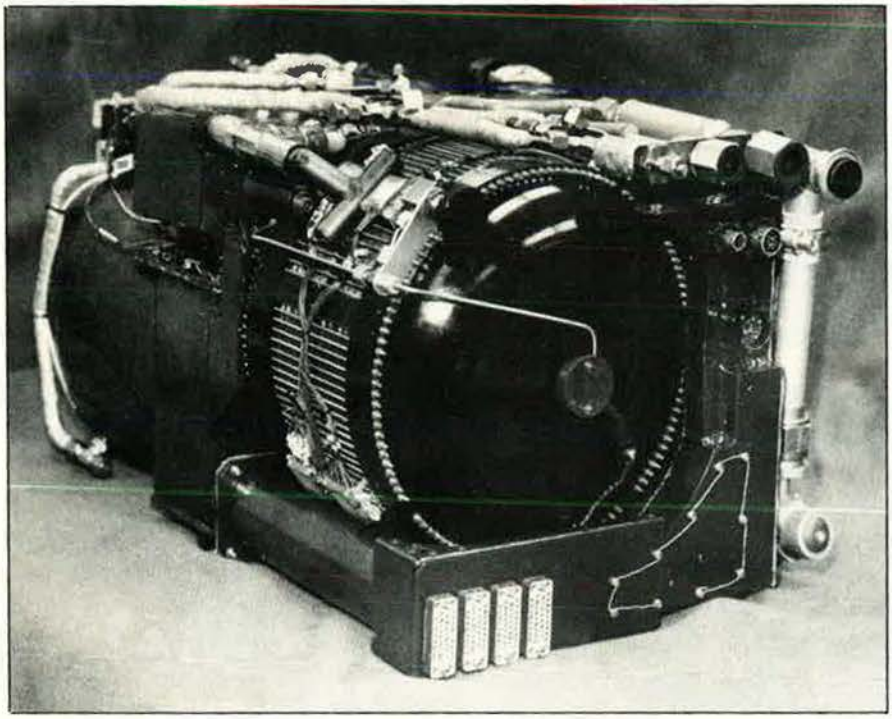
A prototype model of the system, put together by GE's Aircraft Equipment Div., Wilmington, Mass., is currently undergoing a series of environmental tests to qualify it for a developmental flight-test program next year.

The benefits of such a system are extensive:

- Cutbacks in the time and personnel required to service the standard liquid oxygen (LOX) systems, resulting in increased aircraft availability.
- Cost savings in equipment and personnel that now produce and store LOX on every air base and carrier.
- Elimination of the peacetime and combat hazards of large quantities of stored LOX—a particularly significant item aboard aircraft carriers.

To produce pure oxygen on aircraft, GE has simply reversed the process of electricity generation devised for the Gemini program. There, a highly efficient reaction was obtained by electrochemically combining hydrogen and oxygen to produce electricity, with water as a by-product.

Without going into the complexities of the new system, the end result is oxygen of 99.5 percent purity without the loss of water other than minor evaporation.



Developed by GE's Aircraft Equipment Div., this oxygen-generation system may replace conventional liquid oxygen systems aboard future military aircraft. See above.

★ Two Soviet cosmonauts returned safely to earth on August 24 following a fifty-day mission in space. Mission Commander Boris Volynov and flight engineer Vitaly Zholobov were reported in "satisfactory" condition, although suffering some sensory deprivation. (Some experts believe that the mission was terminated prematurely.)

Their spacecraft—Soyuz-21—was launched early in July toward a rendezvous with an orbiting Salyut-5 laboratory in what then was believed to be an attempt to break the eighty-four-day orbital endurance record set by an American Skylab crew in 1974. A Soviet mark of sixty-three days was established by two cosmonauts in 1975.

During their forty-eight days aboard Salyut-5, the cosmonauts were reported to have performed experiments in metallurgy as well as geologic surveys of a large area of Soviet terrain to locate deposits of mineral resources.

The Soyuz-21 flight was the first manned mission since the joint Apollo/Soyuz undertaking in 1975. The Salyut-5 spacelab is said to remain operational and is continuing in earth orbit.

★ An unmanned Soviet spacecraft —Luna-24—landed on the moon in mid-August, remained just under

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twenty-three hours, and returned to earth with a hermetically sealed sample of lunar soil.

Luna-24 landed in the Sea of Crises, about 300 miles from the Sea of Tranquility—where the first US astronauts put down in 1969.

This was the Soviet Union's first mission to the moon since Luna-23 crashed while landing there two years ago.

★ The Air Force Avionics Laboratory is attempting to simplify the delivery of airborne ordnance by combining several advanced electronics sensing devices into a common pod and sharing the same window aperture.

Under a twenty-six-month contract, General Electric Co., Utica, N. Y., is to develop a brassboard model of what has been dubbed Common Aperture Technique for Imaging Electro-optical Sensor (CATIES).

CATIES will allow two nighttime sensors—forward-looking infrared (FLIR) and low-light-level TV (LLLTV) to share a pod housing with a laser designator/ranger and laser illuminator.

The combined capability is impressive: targeting, weapon delivery, real-time reconnaissance, battle damage assessment, and navigational assistance under day, night, or adverse weather conditions.

CATIES is made possible because of recent improvements in the miniaturization of electronic components. It is anticipated that the CATIES pod will be eighteen inches in diameter, 150 inches long, and weigh about 750 pounds (340 kg). Future sensor and laser developments will further reduce the size of operational CATIES, officials said.

The FLIR and LLLTV sensor images will share the same cockpit screen, AFAL technicians said.

★ In mid-August, during the celebration of its thirty-first year of independence, Indonesia began operation of its "Palapa" (for national unity) communications satellite system.

With the orbiting of this Hughes-developed satellite, Indonesia became the first Southeast Asian nation to operate its own telecommunications satellite. See item.

Palapa is to provide telephone, television, radio, telegraph, and data transmission service to a nation of 130,000,000 people—the world's fifth largest in population—scattered throughout the thousands of islands of the world's largest archipelago some 3,100 miles (5,000 km) long.

The satellite, built by Hughes Aircraft Co. and launched from Cape Canaveral in July, is in synchronous orbit 22,300 miles (35,000 km) above the equator at eighty-three degrees east longitude over the Indian Ocean.

Thus, Indonesia has become the first Southeast Asian country to operate its own telecommunications satellite system.

Completion of the Hughes portion of the work—the satellite, a master control station, and nine ground stations—took just seventeen months. A second satellite is due for launch next year.

Two other US companies—Aeronutronic Ford and ITT—built fifteen ground stations each for the system, to be run by Perumtel, a government-owned company.

Palapa is also designed to route telecommunications traffic to such surrounding areas as Singapore, Malaysia, Thailand, and the Philippines.

★ Long under study, a NASA/ERDA project to develop a giant electricity-producing windmill has reached the construction phase.

The system would be the largest ever built, and, if it works as designed, could produce under optimum conditions enough energy per year to supply 500 homes.

The 1.5 megawatt (1,500 kilowatts) wind turbine system is to be in operation in 1978. It will be designed and built by General Electric Co. Valley Forge, Pa., and United Tech

A simple "plug-in" will give him clear radio reception under jamming conditions

Motorola's new null steerer virtually eliminates jamming signals and enhances desired signals. To do this it takes signals from multiple antennas, weights them, and sums them to form a composite antenna pattern with nulls in the direction of the jammer and lobes in the direction of the desired signals.

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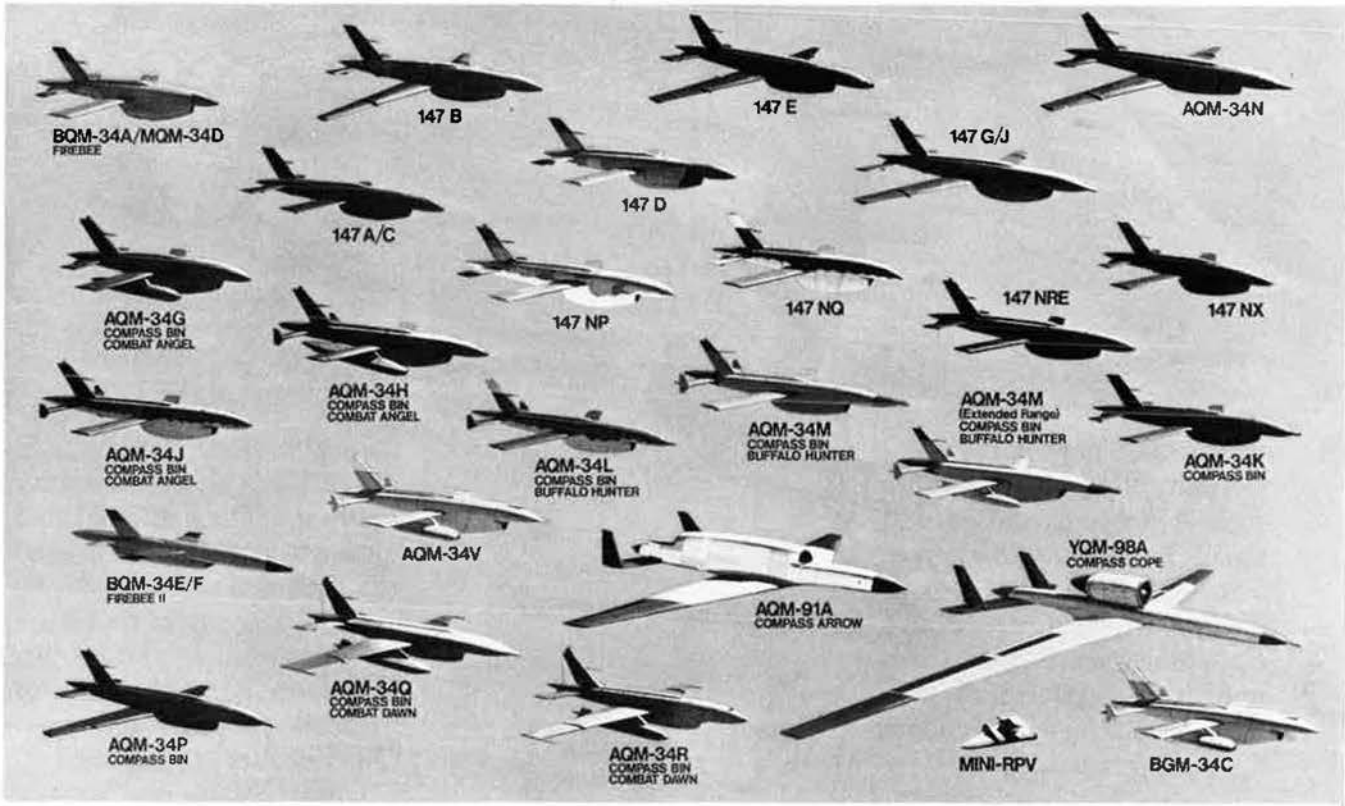

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A licensed private pilot and former USAF flight nurse, Capt. Susan D. Rogers is one of the first group of Air Force women officers to enter flight training. Here, Captain Rogers looks over the controls of a T-39 Sabreliner with USAFE's Maj. Gen. Lloyd R. Leavitt, Jr., DCS/Operations and Intelligence.

nology Corp.'s Hamilton Standard Div., Windsor Locks, Conn., at a cost of about $7 million.

The experimental system will be located at a utility company site chosen by ERDA and will supply electricity for public use.

The windmill will have two fiberglass rotor blades spanning 200 feet (61 m) at the top of a tower 150 feet (46 m) high.

The largest wind turbine currently in operation is a 100-watt system at NASA's Plum Brook test area near Sundusky, Ohio. It is being used to solve technical problems and, in the future, to test advanced turbine components. Two other systems of this type are being planned.

★ In another fuel-conservation project, ERDA's Argonne National Laboratory in Illinois is recruiting potential commercial producers of the lithium-sulfur battery it has developed.

At present, the experimental battery is much more powerful—and costly—than conventional batteries. With refinements and mass-production, it could be running compact autos by the late 1980s, ERDA says.

In fact, Argonne engineers are sparking the design of an electric-powered vehicle that could be in operation by late 1978. As envisioned, the test vehicle would have a range of about 100 miles (160 km) of stop-and-go driving and about 150 miles (241 km) of highway driving at speeds of up to fifty-five mph (88.5 km/hr) between battery changes. The battery is rechargeable with ordinary household current.

Engineers are also working on the use of banks of the new battery to store large amounts of excess electricity generated during periods of low demand, thus allowing power plant generators to run continuously at their most efficient levels without the need for "peaking" turbines, ERDA reports.

★ Investigating teams ruled out sabotage in the case of two Air Force C-141s that crashed within hours of each other on August 28. Thirty-nine people were killed.

The two StarLifters—a type of transport with an exceptional safety record among Air Force planes—were assigned to the 438th MAW, McGuire AFB, N. J.

The first C-141 broke apart during a thunderstorm and crashed in a field near RAF Mildenhall in England. It was on what was to have been a routine transatlantic flight. All fourteen crewmen and four passengers died. Lightning may have been the cause.

The second StarLifter crashed during a landing in Greenland. Of the twenty-seven military and civilian personnel aboard, six survived.

★ Hq. USAF has transferred important program control functions it formerly exercised over USAFE to a newly created organization at Ramstein AB, Germany.

The new office—called Salty Control—will "define and coordinate all USAFE programs and planning as-

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Aerospace World

sociated with command and control in Central Europe," USAF said.

The shift is being made partly to put Salty Control right on the scene in Central Europe, where other NATO nations are involved in the command and control structure.

Director of the new group is Col. H. M. Moore, who will report directly to USAFE's Deputy Chief of Staff for Operations and Intelligence.

New Deputy CINC, NORAD, is Canadian Forces Lt. Gen. David R. Adamson, former Deputy Chief of Staff for Ops.

A large part of Salty Control's mission will be to coordinate USAFE central region command and control programs and planning efforts with Allied Forces Central Europe (AFCENT) and with Allied Air Forces Central Europe (AAFCE).

★ USAF will deactivate the 14th Aerospace Force, headquartered at Colorado Springs, Colo., effective October 1.

The 14th's assigned units are being realigned under three Aerospace Defense Command air divisions in the US, the Alaskan ADCOM Region, and Hq. ADCOM in Colorado.

Aim of the move: "A more streamlined command structure" to perform the missile warning and space surveillance mission. The inactivation will cause a reduction of twenty-two military and eight civilian slots.

★ USAF has a phenomenal straight shooter in its midst, who at age nineteen brought a gold medal for archery home from the summer Olympics in Montreal.

Airman Darrell O. Pace set a new Olympic record of 2,571 points, topping the previous mark by 43 points.

Currently assigned to the 2750th Air Base Wing, Wright-Patterson AFB, Ohio, the young airman joined the Air Force last January.

Airman Pace holds the world archery championship, a title he has won twice, as well as sixteen of twenty world archery records. Among many national honors, the young marksman repeated in April as US Indoor Amateur Archery champion, first won by him in 1973.

Airman Pace is scheduled to enter technical school to train in electronics.

Capt. Phillip G. Boggs, serving at the Air Force Academy, also distinguished himself in Montreal. He came out on top in the three-meter diving competition, the only other Air Force gold medalist.

★ **NEWS NOTES**—Canadian Forces **Maj. Gen. David R. Adamson** has been promoted to lieutenant general and named **Deputy CINC,** NORAD, replacing retiring Canadian Forces **Lt. Gen. Richard C. Stovel.** General Adamson previously served as Deputy Chief of Staff for Operations, Hq. NORAD.

Dr. A. E. Babbitt, Jr., has been appointed to the new position of **System Engineer** for the Worldwide Military Command and Control System. Previously with IBM, he'll be responsible for the **direction of the WWMCCS program,** including providing technical assistance to the JCS, DoD elements, and the Unified and Specified Commanders.

The **nuclear-powered guided-missile cruiser** *Virginia,* the first of its class, has joined the fleet. Capable of thirty-knot-plus speeds, she's armed "to take the offensive in the presence of air, surface, or subsurface threats."

Died: Maj. William F. (Bill) Long, pioneer aviator whose flying schools trained thousands during World War II, in August in Dallas, Tex. He was eighty-one. ■

In December, AIR FORCE Magazine proudly presents The International Institute for Strategic Studies', "The Military Balance 1976/77."

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The International Institute for Strategic Studies

The Military Balance 1976/77

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AIR FORCE MAGAZINE

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AIR FORCE
OCTOBER 1976

DEVELOPMENT and deployment of Soviet strategic weapons are accelerating beyond the fast pace of the past few years. The riddle of why the Kremlin insists on feeding new systems into its strategic weapons pipeline at rates beyond reasonable needs—and well beyond those of the United States—continues to be wrapped in the enigma of Soviet intentions. Information about the alarming momentum of the Soviet arms race is sparse, presumably because of the negative impact its release might have on public reaction to SALT negotiations.

It is noteworthy that two organizations not known for advocating military viewpoints feel compelled to call attention to the ominous level of Soviet weapons programs. The Congressional Budget Office recently issued "SALT and the US Strategic Forces Budget," a detailed analysis asserting that since the conclusion of the 1972 Interim SALT agreement "estimated Soviet expenditures for intercontinental attack forces [ICBMs, SLBMs, and bombers] have grown substantially," and that in 1975 these costs exceeded the US level by 100 percent. In the case of ICBMs, the estimated dollar costs of pertinent Soviet programs, not counting R&D, were seven times the US level, the analysis reports in consonance with recent CIA findings. R&D on "further new and modified ICBMs is under way, [and] a new generation successor to part of the new ICBMs, tested and introduced in 1972–1975, is expected to emerge in 1978–1979," according to the Congressional Budget Office's assessment.

In terms of strategic offensive systems, the scope and magnitude of the Soviet effort have been "seriously underestimated" by US intelligence, the analysis finds. There is also this conclusion: "The very concepts of 'stability' and 'stable balance' are alien to the Soviet ideology and their view of interstate relations. Their commentary on strategic arms limitation seems to be driven by their general concept of 'the correlation of forces,' which is the world balance of military, economic, political, social, and ideological forces. This correlation

Prospects for substantive Soviet restraint in fielding offensive strategic weapons grow dimmer as the five-year Interim Agreement on such arms (SALT I) enters its final year. Although obscure in terms of rationale, there is no room to doubt the pending advent of . . .

A NEW FAMILY OF SOVIET STRATEGIC WEAPONS

BY EDGAR ULSAMER
SENIOR EDITOR

is believed and/or stated by them to be inexorably shifting over the long term in favor of the USSR vis-à-vis the United States."

The summary of the Congressional Budget Office's analysis asserts flatly that in the case of strategic offensive programs, "the SALT objectives were not achieved by the 1972 agreements. . . . Given the momentum in Soviet strategic offensive programs since SALT I, it is difficult to visualize a further increase by the Soviets in that area as a basis for a suspension of SALT. If it is assumed that a hypothetical breakdown in SALT would occur because of Soviet developments in strategic defense programs, particularly as a result of a Soviet deployment of advanced ABM capability in violation of the ABM Treaty, then a postulated US response might cost about $10 billion" in constant 1977 dollars over the next four years.

The US Arms Control and Disarmament Agency's recently released annual report to Congress also recognizes the mounting Soviet threat with candor: "During the decade 1965 through 1975, the leveling off and subsequent decline in the US military budget was accompanied by growing strategic initiative by the Soviet Union [which] has evidently been willing to bear heavy costs to maintain the momentum of its military programs. As long as this momentum continues, and the Soviet Union continues to value its growing military strength so highly, the prospects for reciprocal restraint are unpromising. Even so it has approached, and in certain respects even exceeded, a position of military equivalence to the United States."

Focusing special attention on nuclear delivery systems not covered by the Vladivostok understanding (that limits each side's ICBMs, SLBMs, and intercontinental bombers to a total of 2,400), the ACDA report disclosed that the Soviet Union is in the process of modernizing and equipping with MIRVs its more than 600 medium-range and intermediate-range ballistic missile force. This statement can only be interpreted to mean that the SS-20 solid-propellant ballistic missile is now operational. This mobile missile appears almost ideal for circumventing the SALT ceilings of 2,400 central launch systems, no more than 1,320 of which may be MIRVed. With a single warhead, the range of the SS-20—as is—can be as high as 4,000 miles, giving it intercontinental range and making it, in effect, the world's first mobile ICBM. US apprehension about this system is heightened by the fact that the SS-20 consists of the two lower stages of the SS-X-16 ICBM; by adding a third stage surreptitiously, a MIRVed SS-20 with a range of about 3,000 miles becomes an SS-X-16 with a range of more than 5,000 miles. A third consideration that the entrance of the SS-20 into the USSR's operational inventory gives rise to is its ability—due to its range—to free for retargeting against the United States the Soviet ICBMs that at present may be targeted against high-value strategic targets in the NATO countries and mainland China. (There are no medium- and intermediate-range ballistic missiles in the operational inventories of the US or NATO.)

Pointing out that many Soviet and US high-performance intratheater aircraft can deliver nuclear weapons and thereby affect the strategic balance, the ACDA report presents a tally of selected nuclear delivery systems of less than intercontinental range. The agency finds that the Soviet Union bases approximately 1,000 nuclear-capable fighter, light bomber, and attack aircraft in Central Europe, compared to about 200 US aircraft stationed in that area. In addition, the Soviets keep about 400 nuclear-capable land-based naval aircraft on forward European bases while the US deploys only 200 aircraft aboard five carriers in that region.

ACDA points to another important asymmetry in Soviet and US capabilities affecting the overall strategic balance: the USSR's "major and costly defense against aircraft—some 2,600 interceptors and 12,000 surface-to-air missiles with 5,000 radars"—deployed against NATO and Chinese forces as well as against US-based bombers.

"... the range of the SS-20—as is—can be as high as 4,000 miles..."

By contrast, ACDA points out, all US air defense missiles had been dismantled by 1974 because this country's planners concluded that formidable Soviet land-based and sea-launched ballistic missiles made US air defense totally vulnerable and, therefore, "irrelevant and illogical." As a result, the present US superiority in heavy bombers, ACDA finds, "is lessened when allowance is made for air defense."

The Imponderables of Nuclear War

ACDA's annual report advocates a US posture of increased strategic flexibility while denying the feasibility of either the USSR or the US achieving a disarming first-strike capability. The report dismisses calculations purporting to show that strategic forces are needlessly large and represent "overkill." Overkill claims are "invariably based on highly theoretical extrapolation of the effects of a single nuclear weapon on a large population concentration," and erroneously measure the adequacy of strategic forces in "terms of their ability to kill civilians." In reality, ACDA posits, "strategic forces must be large enough, and secure enough, so that what survives an attack is still an adequate deterrent. While it is possible to preserve the stability of deterrence with substantially reduced forces, this does not mean that

. . . the new generation consists of six new strategic missile designs . . .

we can reduce our forces unilaterally. It remains extremely important that the United States strategic forces be equivalent in a military sense to those of the Soviet Union, and our allies and potential adversaries must see clearly that they are equivalent."

Strategic flexibility is needed to improve the ability to deter attack and to increase the chances of controlling escalation rather than fight a nuclear war more easily: "A capacity to retaliate against military targets—such as radars, submarine pens, airfields, command bunkers, or combat forces—would be an adequate deterrent against most possible attacks and probably more credible than the wholesale slaughter of civilians. Such flexibility enhances the certainty of retaliation and thereby maintains deterrence across a wider spectrum of potential attacks. Above all, it preserves the capacity for rational human decision-making, even in the most extreme crisis," according to ACDA. Requisite improvements in missile accuracy, the agency suggests, might make it possible to reduce the "explosive power of strategic weapons and thus to reduce the unintended violence that would accompany a nuclear attack."

ACDA calls attention to the "enormous uncertainties" associated with calculating the physical effects of nuclear weapons that, of themselves, would seem to militate against their widespread use by rational leaders: ". . . a large number of explosions might bring about at least partial destruction of the ozone layer in the stratosphere that helps protect all living things from ultraviolet radiation. A massive attack with many large-scale nuclear detonations could cause even the aggressor to suffer serious physiological, economic, and environmental effects even without a nuclear response by the country attacked."

An inevitable, long-term consequence of maturing missile guidance technology, ACDA asserted, will be the increasing vulnerability of targets whose precise location is known, no matter how hard they are. But such a development would not constitute a disarming first-strike capability, which "is beyond the reach of either side today, due to the high survivability of at least two elements of strategic forces, submarines and bombers."

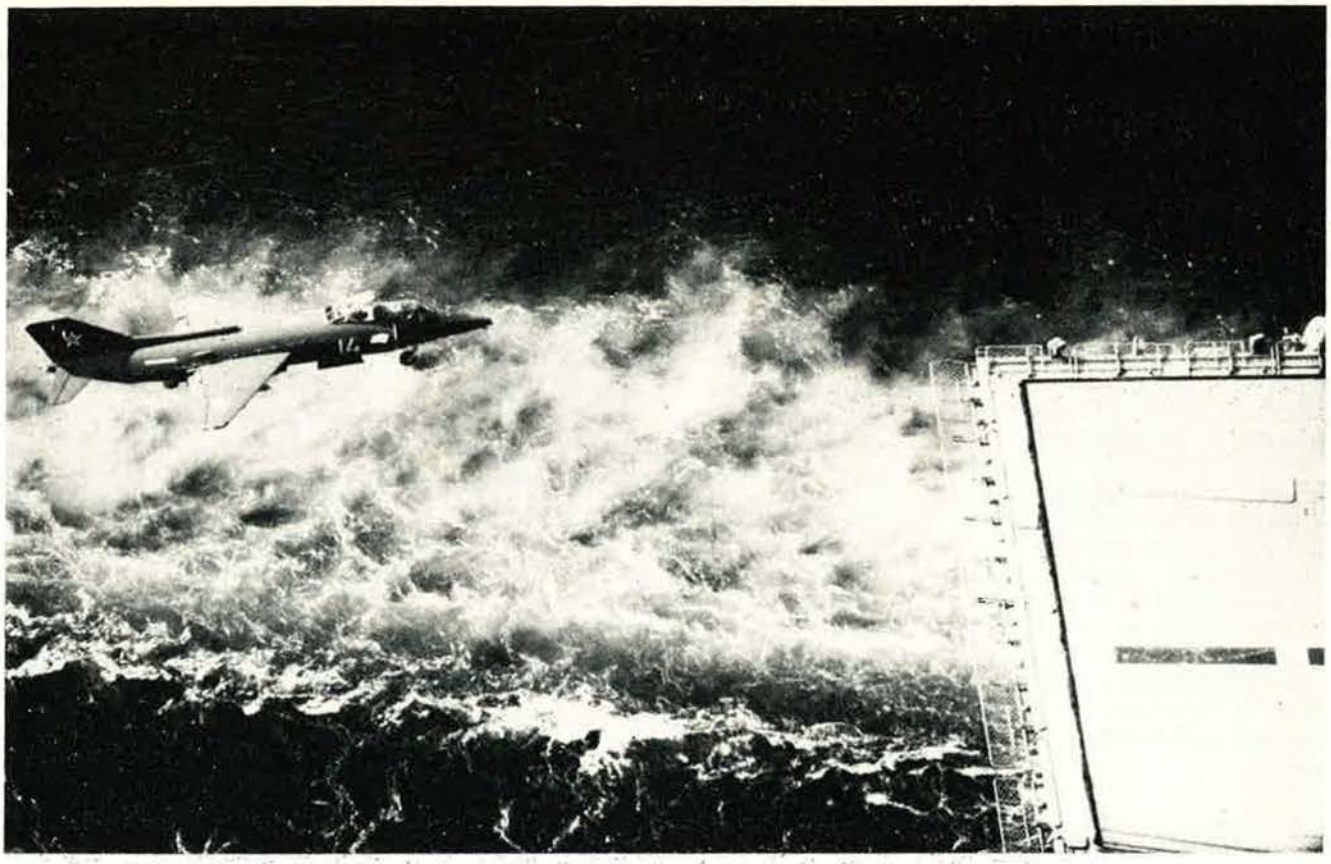
Relentless Advance of Soviet Capabilities

The Congressional Budget Office refers to Soviet development of new-generation successors to some of the Soviet ICBMs tested and introduced into the inventory during the past three years and expected to become operational within two or three years. AIR FORCE Magazine finds that the new generation consists of six new strategic missile designs. Flight test of some or all of these systems is imminent. At least one of the newest missile designs uses solid-rocket propulsion. Even if allowance is made for Soviet willingness to spend extravagantly on offensive strategic systems, full engineering development of six either completely new or significantly different derivatives of earlier designs is puzzling. The four new Soviet ICBMs developed during the past few years have barely gotten into mass production (except for the SS-X-16, which is still in flight test). They generally stretch the dimension and throw-weight limits imposed by SALT to the breaking point, and they improve warhead accuracy significantly over the systems they replace.

Characteristics of the New Soviet ICBMs

ICBM	*Warheads*	*Growth In Throw-weight Over Predecessor Missile*	*Initial Operational Capability*
SS-17 (successor to SS-11)	4	Four times	1975
SS-19 (successor to SS-11)	6	About 3 to 4 times	1974
SS-18 (successor to SS-9)			
Model 1	1	About 30%	1974
Model 2	8	About 30%	1975
Model 3	1	About 30%	1975
SS-X-16 (successor to SS-13)	1	About twice	1976 (?)

This table is from the booklet "SALT and the U.S. Strategic Forces Budget," issued by the Congressional Budget Office as Background Paper No. 8, dated June 23, 1976.



A typical example of rapid advances in Soviet military technology is the new Yakovlev Yak-36 vectored lift/thrust V / STOL fighter, shown in this US Navy photo being recovered aboard the USSR's first operational fixed-wing carrier, Kiev.

The accuracy of the first family of modern Soviet ICBMs, typified by the SS-9s and SS-11s, is generally thought to be in the one-mile CEP range. The current Soviet ICBM generation, principally represented by the SS-18 and SS-19, is in the 0.3-nm range. Most US experts believe that little improvement in this CEP can be attained with the newest Soviet ICBM designs. A relatively modest accuracy gain, of itself, is not likely to lead to a dramatic increase in the hard-target kill capability of the newest line of ICBMs. A plausible reason behind this glut of new models is that one of the second-generation systems, the SS-18, appears to be an Edsel. While it is not possible to give specific details, that system, which has been test-flown with various numbers of reentry vehicles, has exhibited instability and other difficulties. Even though it has been in the operational inventory since 1974, the problems of the SS-18 seem to persist.

Following the recent introduction into the operational inventory of the SS-N-8 4,200-mile-range submarine-launched ballistic missile (SLBM), the Soviets are now testing new high-performance SLBMs that appear to be capable of being MIRVed. In addition, the Soviets appear to be building a new SSBN model, a number of which are on the ways now and expected to enter service in a few years. These subs may be larger than the 560-foot Trident, the newest US SSBN now under development.

Possibly the most destabilizing Soviet development is the accelerating, comprehensive hardening of the Soviet infrastructure, covering civil defense, massive grain storage in underground bunkers, dispersion and hardening of industry, and elaborate measures to assure the protection and survivability of the military and national command and control apparatus. In the aggregate, these measures may put the US assured destruction capability in jeopardy. The number of Soviet troops assigned to civil defense is now thought to be about 75,000, including fifty-six active-duty general officers under the command of Col. Gen. A. T. Altunin, a member of the Soviet Central Committee.

Across-the-board improvements are taking place also in the theater warfare capabilities of the Soviet Union, including the development of a range of tactical nuclear weapons down to one-tenth kiloton yield nuclear artillery shells. At the same time, the production and stockpiling of ultra-lethal biological and chemical warfare materials is reported to be at extraordinary levels and increasing. The capability of Soviet tactical airpower is increasing with the introduction of sophisticated combat aircraft with about twice the range of the aircraft that are being replaced, efficient hardening against nuclear effects, and such advanced features as terrain-avoidance radars and laser range finders.

There is also concern about resurgence of Soviet testing of its ASAT quick-reaction killer satellite system that could destroy prime US satellites in highly elliptic orbit while they are out of sight of US tracking stations. ASAT appears capable of low-earth-orbit intercepts on the first pass, meaning it can be launched, rendezvous with, and destroy US satellites in less than one orbital revolution. ■

War and Peace—

The Soviet View

BY COLIN GRAY

In this article, the author charges that many Western leaders are suffering from intellectual myopia in regard to "stability"—maintaining the *status quo* between the Soviet Union and NATO. Indeed, he observes, because of the cast of Communist dogma, Soviet officials do not, *and cannot*, endorse Western notions of world order. There is clear evidence, which he believes is largely ignored in the West, that the Soviets are building for the long term and intend to have the means to win in any future crisis—be it diplomatic or military.

THERE is nothing mysterious about the Soviet concept of war. Shelfloads of authoritative, and strongly indicative, Soviet statements concerning it are there for the reading. If Western commentators are uncertain about Soviet aims and aspirations, they have no one but themselves to blame: The record is quite clear.

The purpose of this discussion is not to endorse Soviet strategic views, nor to condemn Western doctrinal preferences. Rather it is to specify the principal ways in which Western and Soviet strategic thought diverge. Overall, Soviet theorists have a clear view of the value of military power while Western theorists and officials do not. Looking ahead ten to twenty years, this difference could be of critical importance. The Soviet Union is not devoting eleven to thirteen percent of its GNP to defense only to achieve "rough parity" with the United States. Soviet commentators know that relative power positions do not remain static. Soviet military, and especially strategic nuclear, power has been *the* elevator of Soviet status in international politics. In all other important respects, the Soviet Union is a third-rate power. In Soviet eyes, détente was *inspired* by Western recognition of the rise in relative Soviet military power. Logically, the greater that power the greater the prospects for peace . . . and so forth. This argument should not be at all controversial; Soviet leaders and analysts have used it for years. Nonetheless, it bears little resemblance to the explanations of détente that were (and are) advanced by Western leaders.

Victory and Stability

Many Western officials and commentators see what they want to see. They ignore the clear evidence of Soviet doctrinal divergence from Western models. The Soviet Union clings to the notion of *victory*. Both at theater and intercontinental levels, Soviet officials are seeking freedom of action. They are acquiring and (probably have achieved) the capability to overrun Western Europe in a short and sharp nonnuclear campaign, while they are building toward the capacity to force partial disarmament of the strategic forces of the United States. At all levels of conflict Soviet analysts and officials appear to endorse Gen. Douglas MacArthur's dictum that "there is no substitute for victory." The contrast with much Western thought and practice could hardly be more direct.

In the European theater, NATO hopes to contain a Warsaw Pact offensive, or—at least—to give ground grudgingly and surge back eventually to the starting line. NATO's strategy and tactics are unequivocally defensive. While NATO hopes to end a war speedily with neither side seriously disadvantaged, the Soviet Union plans to wage a war with what has been termed "Darwinian ferocity," with victory as the goal. Both with respect to the European theater and to the strategic balance, the Soviet Union is purchasing military options that might just give it victory: in the successful resolution of potential confrontations that the West will choose *not* to enter; in successful deterrence in actual crises; and in the conduct of war itself.

So defensive is much Western strategic thinking that there is great lack of understanding of what the Soviet Union is about in its massive force modernization programs. If you believe that the concept of victory can have no rational place in the aspirations of nuclear-armed states, then you have to explain away Soviet military programs and Soviet doctrine as not *really* meaning what they say. Most theories of limited war are almost totally inappropriate for states locked in protracted conflict with the Soviet Union. The theorists of limited war have devoted far too much attention to appropriate limits

. . . THE SOVIET UNION PLANS
TO WAGE A WAR WITH WHAT HAS BEEN
TERMED "DARWINIAN FEROCITY" . . .

and far too little to the likely realities of war.

The NATO countries are essentially *status quo* powers, and so have generally adopted a mix of strategic and arms control policies that give the initiative to the other side. The West seeks to defend a structure of world order that seems tolerable. The Soviet Union (save for its current "holdings") is committed to changing that order in a direction that it deems benign. In their military programs and their arms control behavior, Soviet officials do not and, indeed, *cannot,* endorse Western notions of stability.

The Soviet Concept

Because of their generally defensive political and military stance, Western countries are profoundly ill-fitted to understand the alien strategic mind-set of Soviet officials, and to take timely offsetting action. A similar judgment, of course, applies to Soviet officials. Unfortunately, while their ideology misleads them, it misleads in some extremely dangerous ways. They tend to expect Western leaders to recognize the *objective* deadly danger posed by the socialist camp—and hence to be willing to resort to desperate military adventures. But they also, in best dialectical fashion, expect the capitalist-imperialist world to collapse of its own internal contradictions, and to be capable of being misled by astute Soviet officials.

Apparently presuming, with good cause, that Western officials either will not believe what they see, or will search for and find nonmalignant explanations for Soviet strategic behavior, the Soviet Union is proceeding to acquire whatever military options her economic-scientific traffic will bear. Those who believe that the Soviet military posture relating to Europe reflects nothing more ominous than (a) "the Soviet way," (b) the acquisition of bigger and better bargaining chips for negotiations, and (c) an attempt to balance the NATO threat, have no business discussing affairs of state. A parallel judgment applies to those who are not disturbed by the pace and breadth of Soviet strategic programs. To address the issue of whether Soviet military programs are defensive or offensive in orientation is totally fruitless. One can conceive of a Soviet military offensive launched in Europe for what Soviet officials believed to be sound defensive reasons, *e.g.,* to safeguard the accomplishments of socialism, West German revanchism had to be stamped out.

With certain caveats, one need not guess, even in an educated way, at the purposes that underpin the Soviet defense effort. Indeed, Soviet statements are so frank, not to say brutal, that many Western analysts have difficulty crediting what they read. Important caveats include the following: (a) the Soviet Union, by its own definition, cannot wage an unjust war; (b) the Soviet Union, therefore, cannot launch a surprise attack in the political sense, although it can in the technical military sense (this is never admitted directly); (c) all Soviet military writings have a political purpose, and the level of revealed strategic details is low compared with Western exposition; and (d) when Soviet authorities address primarily a Western audience, their views are slanted toward the propagation of beneficial disinformation. To make sense of the character of the long-term Soviet threat, Western officials should keep the following checklist in mind:

First, the Soviet Union is obliged to regard capitalist and semicapitalist countries as *enemies* that eventually will be overcome by the tide of history—probably with considerable Soviet assistance.

Second, the basic conflictual character of East-West relations is nonnegotiable and cannot be appeased or managed away by technology transfer, cultural exchanges, trade, or any other device.

Third, there can be no "normalization" of Soviet-American relations through détente, except to the important degree that the world is made relatively safe for the prosecution of conflict shorn of the acute danger of nuclear confrontation.

Fourth, the Soviet Union has no interest in institutionalizing the parity principle—as one gullible American arms controller claimed in reference to SALT I. On the contrary, Soviet officials see themselves locked into a

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NO INTEREST IN INSTITUTIONALIZING
THE PARITY PRINCIPLE . . .

dynamic contest of global dimension with the United States—wherein the balance of power is inherently unstable.

Fifth, Soviet officials believe—probably sincerely—that deterrence is fragile and could fail. They also believe (and this should be embossed in gold over desks in Washington and elsewhere) that the greater the relative military strength of the Soviet Union, the more likely it is that deterrence will not fail.

Sixth, deterrence, for which the Soviets have no single parallel term, is not seen in Moscow in the predominantly negative policy framework that it is in the West. Behind the deterrent shield, the Soviet Union seeks to further its essentially destabilizing foreign-policy goals.

Seventh, over the long term, and Soviet thinking is nothing if not pragmatic and cautious, all that is negotiable in East-West relations is how the West is to die. The Soviet Union cannot seek to institutionalize peaceful coexistence with Western countries on the basis of a recognition of the legitimate interests of others. That is an ideological impossibility.

Eighth, for reasons both of *realpolitik* and ideology, Soviet ambitions are open-ended. However, Soviet expectations, in the short and medium term, are pragmatic and bounded. What they accomplish with their military forces depends largely on what opportunities come along. Over the past decade they have been purchasing options.

Ninth, without assigning precise political intentions to the Soviet Union, it is nonetheless clear that its leaders take the possibility of war, at all levels, far more seriously than do their Western counterparts. The Soviet Union has a very impressive program for the survival of essential industry and services in nuclear war—the United States does not.

The author, Colin Gray, is a staff member of the Hudson Institute. He has written extensively on defense matters for publications both in Europe and North America, including a number of articles expressly for AIR FORCE *Magazine. Dr. Gray's book,* The Soviet-American Arms Race, *was recently published by D. C. Heath.*

Soviet forces in Europe are prepared to wage a war—NATO is not.

On the basis of the growing congruence between what they do and what they say, it must be judged that Soviet officials wish to acquire the ability to do as well as possible in wars at all levels. They may not, in the event, do very well at all. But, we assume enormous and unnecessary risks if we choose not to read the writing on the wall. Against a self-professing "deadly enemy" we array what? A NATO, the operational deficiencies of which are so familiar that they are largely accepted as the necessary price of a multinational undertaking. That price, let it be recognized, would probably translate into *defeat* in short order. At the strategic level, the major and possibly catastrophic asymmetry imposed by the Soviet domestic war-survival program is dismissed as being largely on paper (perhaps it is—but what if it is not?) or easily offset, while a functionally parallel program for the United States is deemed politically unfeasible. A serious US civil defense program (and its ramifications for industry and public education) certainly is politically unfeasible—but how long is it since a President put the full weight of his office behind a major program? In the absence of political leadership, virtually every major strategic program is politically unfeasible.

The Western Concept

While the Soviet Union energetically prepares her war-waging options at all levels, what form should Western defense activity and thought take?

First, few people believe that a Soviet-American armed conflict is at all likely. Fewer still believe that either side could emerge from such a conflict with what could fairly be described as victory.

Second, in sharply descending order of interest, Western theorists, commentators, and even officials, address the problems of war deterrence, of intrawar deterrence, and of war termination. How one prepares for, and then conducts, war against an adversary who is determined to *win* is a question that many people choose simply not to pose.

BEHIND THE DETERRENT SHIELD, THE
SOVIET UNION SEEKS TO FURTHER ITS ESSENTIALLY
DESTABILIZING FOREIGN-POLICY GOALS.

IN A WAR FOR THE HIGHEST OF STAKES . . . THE SOVIET UNION WOULD PROBABLY REJECT LIMITED STRATEGIC WAR AS INADEQUATE.

Third, at the theater and intercontinental levels, Western thought and action are focused upon prewar deterrence, and then—if necessary—on conflict control. These are sensible concerns, but they could leave us vulnerable to a dramatically different Soviet style and concept of war. Few would deny that a Soviet offensive in Central Europe would have to be stopped, or slowed down, within the first few days of a war, if it is to be stopped at all. Also, it is widely recognized that the Soviets are postured for a surprise attack and a rapid breakthrough. But NATO is not ready to meet a conventional blitzkrieg with conventional means (without many weeks of warning time), and it is close to a certainty that nuclear firepower would not be released by political authorities in time to do any good. One may object that "war is very unlikely," but it is not healthy for one side to be ready to move forward on short notice, while the defender is not ready to offer a serious defense.

Fourth, American doctrine for the employment of strategic forces has been recast in favor of greater flexibility. But, notwithstanding the logic of the flexibility doctrine, it is not at all clear that the most probable Soviet style in nuclear war-waging has been taken seriously enough. Should deterrence fail, the Soviet Union may well prove less interested in conflict containment than in the effective prosecution of war. Looking to the period after 1980, how should we wage a war with an adversary who has evacuated most of his urban population, has had a long-term industrial dispersal policy, and who pursues major military objectives? Should the United States exercise one or two of its limited nuclear options as the opening bid, it could well find itself facing a Soviet shutout reply (a Soviet attack on all land-based missile forces, bomber bases, and SSBN facilities—*and* an attack upon those American industries essential for wartime mobilization and postattack recovery). The Soviets might try to control the pace of escalation by playing according to rules recognizable to Americans, *e.g.*, their responding strikes might be large by fashionable American standards, but not so large as to suggest that the Soviet Union had shifted gears into a purely military conflict. Without denying the possibility of Soviet self-restraint, it is prudent to presume that such self-restraint is improbable. In a war for the highest of stakes, involving the most fundamental of values on both sides (and it would be so perceived by Soviet leaders), the Soviet Union would probably reject limited strategic war as inadequate. This is most likely to be so if American missile silos become as vulnerable after 1981 as the "best estimates" of the US intelligence community now predict, and if domestic war-survival programs in the US remain paper exercises.

A Usable Instrument

It is not claimed here that the Soviet Union would welcome war, nor that it will invariably expect to be victorious. All that is claimed is that the Soviet Union is bending every effort to secure the possibility of victory. The Soviets appear to believe that large, capable, and *operationally ready* armed forces could be extremely useful, either to rebuff imperialist military adventures or to exploit situations of opportunity. One need not explain Soviet motives by specific reference to the enduring pressure point of West Berlin, the attraction of intervention in Yugoslavia, or a grand sweep to the English Channel. The Soviet armed forces should do well in any of these eventualities—but those forces also serve Soviet diplomatic ends just by the fact of their existence and forward deployment.

From the outset, too many Western experts choose to place the Soviets in a "no lose" condition. In Europe, we aspire to restore the *status quo ante*, with much of what NATO could do to improve operational readiness being ruled out as "provocative." Meanwhile, with respect to the strategic balance, follow-on US weapon systems that could actually threaten the survivability of Soviet forces are resisted on the grounds that they would be destabilizing. Because our doctrines are so defensive and so attentive to stability, the likelihood that the Soviet Union sees her military forces as a usable, prospectively war-winning instrument of diplomacy is accepted with acute difficulty, if it is accepted at all. ■

. . . THOSE FORCES ALSO SERVE SOVIET DIPLOMATIC ENDS JUST BY THE FACT OF THEIR EXISTENCE AND FORWARD DEPLOYMENT.

THE YF-16 was designed and built by General Dynamics to fit the needs of the Air Force's Lightweight Fighter Prototype program. The program was conceived to enable the Air Force to examine and verify future requirements for a highly maneuverable air-superiority fighter, to explore technology advances in airframe, engine design, and aerodynamic performance, while keeping cost at a minimum.

prototype concept. In addition, it offered the lowest life-cycle costs. And from my personal association as Lightweight Fighter Test Director and project pilot, the YF-16 has been one of the most exciting, dynamic aircraft I've ever flown.

In the course of the program, the YF-16 flew 330 sorties and accumulated 417 flight-test hours. Since the award of a full-scale development contract in January 1975, the two prototypes have

non carrying 500 rounds of 20-mm ammunition. The prototype weighed approximately 22,000 pounds with a full load of fuel and all associated flight test instrumentation.

Takeoff performance of the YF-16, in either military power or full afterburner, is impressive. Even with substantial loads (two 2,000-pound bombs) takeoff roll is normally less than 4,000 feet with full military power. The maximum

Since there was no commitment at the outset for production of either of the two Lightweight Fighter participants (the Northrop Corp.'s YF-17 prototype was the other aircraft in the program), the Department of Defense and the Air Force were in a position to benefit in several different ways depending on the outcome of actual flight-test evaluations.

The YF-16 was selected for full-scale development as the Air Combat Fighter because it clearly represented a capability to fill a projected need in the aircraft inventories of both the United States and its allies. The YF-16 met all performance and handling specifications and goals set out in the

flown an additional 354 sorties for 383 hours.

All aspects of the YF-16 test and evaluation program have been conducted in a spirit of cooperative effort between the Air Force and contractor. General Dynamics Corp. had two test pilots assigned to the program; the Air Force Flight Test Center had two pilots representing Air Force Systems Command; and the Air Force Test and Evaluation Center designated two pilots to fulfill the Operational Test and Evaluation requirements.

Testing was conducted principally in the aircraft's air-superiority role; that is, a "clean" aircraft with two AIM-9 missiles on the wingtip stations and an M-61 can-

afterburner takeoff roll with a clean combat aircraft is usually 1,000 to 1,200 feet.

The primary combat envelope as designed extends from sea level to 50,000 feet and from minimum speed/maximum angle of attack up to Mach 1.6 at 30,000 feet, and then follows a descending maximum dynamic pressure line down to sea level.

In the interest of expediting a very compressed test program, the primary envelope tested in the lightweight fighter program was from 10,000 feet to 50,000 feet at all speeds from minimum to maximum. The YF-16 has reached maximum level flight speed of Mach 2.02 at 40,000 feet and ha

flown in excess of Mach 1.4 at 10,000 feet.

Since superior handling qualities and controllability were specified requirements in the lightweight fighter concept, it was important that the G and angle of attack (AOA) limiter functions and departure susceptibility be investigated early in the program.

Simply stated, the aircraft's computer system automatically imposes G and AOA limits, allowing the pilot to more confidently fly "head up" in the combat arena without exceeding these prescribed limits. With this phase completed satisfactorily, the YF-16 was cleared for simulated air combat maneuvers (ACM).

The underlying goal in the YF-16's design was to provide air-to-air combat performance, persistence, and handling qualities that were a positive step forward in technology. Flight testing to date clearly shows that the YF-16 has those characteristics.

Performance has been maximized by blending aerodynamic design, weight reductions, and control laws with the economy and power of the Pratt & Whitney F100-PW-100 turbofan engine.

Performance is definitely in the class of our next generation aircraft. Persistence is the ability to stay and fight or to loiter and be able to fight. This quality can, of course, be converted into additional range or time over target.

The fact that very little afterburner time is required during combat engagements with aircraft representing the current threat greatly enhances the YF-16's ability to stay and fight. An example is found in the results of test missions flown against an F-4E, whose own flight performance against MiG-class aircraft is fairly well established.

In one test involving two F-4Es and one YF-16, the YF-16 and one F-4E took off and climbed to 30,000 feet while setting up for an engagement. At thirty to fifty miles separation, the aircraft turned toward each other, and when visual contact was achieved the close-in engagement began and continued until one aircraft was in a clear position to achieve a gun kill.

The first F-4E was at minimum fuel after three such engagements. The second F-4E then took off and the process was accomplished again, this time at 15,000 feet. The YF-16 dominated all engagements, achieved tracking conditions, and outlasted both F-4Es with fuel remaining to fly in excess of 200 miles. The production F-16 will have even more persistence than the prototype and a much improved avionics capability.

Considerable flight-test experience has been gained and is still being gained on the YF-16 prototype aircraft. Development of the production version has as its foundation the compact but comprehensive and dynamic flight-test and evaluation program on the prototypes. Testing of the F-16A and B models is planned using the prototype test program as a model.

Performance predictions have been modified, based on actual flight-test data, while handling qualities are a result of modifications based on the first-hand experience of several pilots' evaluations of the prototypes.

Since there are differences between the prototype and production versions, let's first look at how the YF-16 flies, and then discuss the forthcoming F-16 program and some of the main features of the production weapon system.

First Impression—Exciting

Every pilot likes to fly a new aircraft, especially when it exhibits marked improvements over the pilot's existing frame of reference. It is easy to become enthralled with its uniqueness, its newness. But test pilots must remain objective, and see through the obvious strengths to identify any weaknesses. In maintaining this objectivity, pilot reports may at times seem almost negative in the findings.

We have been through the gauntlet with the prototype and the strengths have far outweighed the deficiencies. It is truly a dramatic and exciting experience to command the performance of the YF-16, especially from a cockpit whose layout affords excellent comfort and visibility. Handling the

In this exclusive AIR FORCE Magazine report, the USAF's director of the F-16 Joint Test Force assesses the new Air Combat Fighter's design, performance, and maintenance test results and the qualities that make it one of the most exciting and dynamic aircraft he has ever flown.

YF-16 PILOT REPORT

BY LT. COL. JAMES G. RIDER, USAF

aircraft through the fly-by-wire side stick controller is unique; the aircraft performs its maneuvers almost at the effortless will of the pilot.

I can recall one of my first impressions of the single-piece canopy and the visibility it offered: It's like being in a glass bubble with a clear view in all directions. This is not, of course, absolutely true, but the impression was there after experiencing the restricted visibility of other current fighter aircraft.

Switchology in the prototype is a preview of things to come in the production version. During an air-to-air engagement, the pilot can select gun or missile and its corresponding aiming symbology just by moving a switch on the throttle. There is absolutely no need to look into the cockpit because confirmation appears on the Head-Up Display (HUD). Your eyes never leave sight of your adversary in the engagement.

Thirty-Degree Reclined Seat

To fly in a thirty-degree reclined seat is best explained by sitting in the cockpit yourself, or, second best, in your own reclining lounge chair. Seat location is a part of overall cockpit design layout, optimizing the pilot's position in his task environment. Since the ninety-degree angle between the seat pan and seat back is retained, the pilot's body is much better supported than in an erect seat. Weight is distributed from just behind the knee, the backside, and up the back to just below the shoulder blades. The pilot generally sits with his head erect; this is normal and comfortable.

Only during high G maneuvers does the pilot's head contact the head rest. With this kind of support and the cockpit layout, the pilot is able to work at higher load factors (Gs) for longer periods of time.

For example, during energy maneuverability testing we were able to comfortably perform an afterburner acceleration through a level seven-G turn, achieve supersonic speeds, then continue to hold seven Gs while retarding the throttle to military power for deceleration. These maneuvers kept us at, or above, seven Gs for more than sixty seconds with no appreciable discomfort.

The seat tilt and elevated heel line not only make pulling high Gs more comfortable but seem to aid the anti-G suit in its function. Generally, pilots feel that they have a 1½- to two-G advantage over air-

Prototype design features are previews of things to come in the new F-16 "Swing-Force" fighter for the 1980s.

craft with a more erect seat in terms of performing a useful task.

Flying with a fixed side stick controller is very straight forward. All fourteen pilots who have flown the YF-16 to date have adapted to it very rapidly. If there are any tasks that cause concern, they are what we call high-gain tasks—formation flying, in-flight refueling, landing, etc. I'll discuss the flight control system later, but suffice it to say now that every pilot performs high-gain tasks early and adaptability has been rapid and natural.

At the beginning of the prototype program, there were some sensitivities discovered when pilots tended to overcontrol during their early flights. Subtle changes were readily made to the flight control system, and these tendencies were eliminated.

Before discussing the entire flight control system, one must realize that the side stick inputs for aircraft are by force only. The stick does not move. This currently seems to be completely acceptable with one possible exception. The pilot is not sure when he reaches full command and may tend to use more force than necessary. While this does not affect the aircraft control, it does cause some tiring of the pilot's right arm. The pilots currently flying the aircraft have raised this question, and we expect to evaluate a side stick that includes a small amount of movement sometime in the near future.

Fly-By-Wire

Fly-by-wire simply means that pilot commands are sent out to the flight control system as electrical signals. These signals represent requested response requirements to the quadraplex computer that passes these signals to electro-hydraulic servos moving the control surfaces. As the aircraft response to command begins, this response is fed back to the flight control computer, where it is compared to the pilot's requirements. When the two match, the signal is nulled, no further control is applied, and the aircraft maintains constant G or roll rate.

These are, in reality, the same functions performed by the pilot with a more simplified system but with less precise control response or feedback. The concept in the YF-16 using this sophisticated command and feedback loop system is one that allows the aircraft to be flown at a slightly negative static margin.

If the aircraft center of gravity were located at the overall center of pressure, there would be a condition of zero static margin. With normal aerodynamic controls, this would be difficult for a pilot to fly because there would be no trimmed condition that the aircraft would maintain. Additionally, when disturbed by moving the stick in pitch, the aircraft would tend to continue pitching up or down at the induced rate.

A situation exists if the center of gravity is too far aft that the aircraft is even considered more unstable. In the YF-16's control system, because of the G command system and the tight feedback loop, the aircraft flies at between seven and ten percent negative static margin, yet the pilot feels he is flying a very stable aircraft. Stick force per G is essentially constant for all speeds and altitudes. There is absolutely no dig-in or tuck when pulling high Gs and transitioning from supersonic to subsonic as in many current aircraft.

In the pitch channel, a fixed amount of force commands a specified G value, if not overidden by the G or AOA limiter. The roll channel responds with a roll rate proportional to the applied force up to the limit commandable. The rudders have a small amount of movement (± ½") but are also force applied vs. rudder deflection.

There are four independent electrical channels in the flight control system, coupled with two independent hydraulic systems, that are split into two channels each. The aircraft can be safely flown with malfunctions in two channels; however, immediate landing is recommended.

The system incorporates features that significantly reduce pilot workload. For example, the leading-edge flaps and trailing-edge flaperons are selected automatically to the proper position as a function of landing-gear handle position. Gear handle down—flaps go to the landing configuration. Gear handle up—flaps go to the automatic maneuvering mode. Beside the flap scheduling, the flight-control computer monitors aircraft limitations on load factor (G) and angle of attack. The pilot may

YF-16 AIR COMBAT FIGHTER—FACTS AND FIGURES

Designer and Manufacturer	General Dynamics Corp., Convair Div.
Primary Mission	Air combat fighter
Powerplant	One Pratt & Whitney F100-PW-100 afterburning turbofan engine with 25,000 pounds of thrust
Length	46 feet 6 inches
Height	16 feet 3 inches
Wingspan	31 feet (without missiles)
Internal Fuel Capacity	6,950 pounds
Maximum Weight	27,000 pounds
Armament	One General Electric rapid-fire M-61A-1 20-mm Vulcan cannon
Ammunition Capacity	500 rounds
Ordnance Capacity	Up to 15,200 pounds of mixed ordnance on nine pylon stations with partial fuel. Pylons can accommodate fuel tanks, guided and unguided bombs, air-to-air and air-to-ground missiles, countermeasure pods, and other special payloads
Takeoff Distance	1,750 feet (with 4,000 pounds of ordnance)
Performance	Mach 2 plus (max level speed at 40,000 feet)
Crew	Pilot only

maneuver "head up" and never concern himself about overstressing the aircraft or entering an undesirably high AOA region.

In the production F-16 this means that the pilot can pull nine Gs until he reaches a speed at which AOA limiting occurs and continue pulling on the AOA limiter until he slows to a speed that obtains the maximum AOA. At that point, if he continues to hold aft stick, the F-16 will hold the maximum AOA limit.

Adaptability to the fly-by-wire flight control system deserves mention. In most aircraft, handling qualities are optimized for the combat environment, with some degradation accepted for accomplishing secondary tasks. This is not the case with the F-16. While the combat environment is primary, the system has been tailored to provide different feel and gains for in-flight refueling and landing, where a somewhat different responsiveness is desired. For example, in the landing configuration, the aircraft feel is changed to one of a highly speed-stable system. Stick force commands angle of attack and the pilot can set up on speed and by feel in the side stick controller sense that his speed has changed.

For up-and-away flight, in the air combat configuration, a very highly responsive aircraft is desired, one that can be accurately positioned for air-to-air or air-to-surface tracking. Instant response to roll, pitch, and yaw inputs are necessary. The F-16 flight control system provides this capability.

Emergency Power

The YF-16 is equipped with an emergency power unit that will power both hydraulic systems and a generator. There are also two emergency batteries to back up the generator. If either the engine or hydraulic systems fail, the system automatically engages. The same type system is also included on the production F-16.

More on Performance

I've mentioned performance maneuvers previously, but there are a few other points of interest. In the air combat environment portion of the YF-16 program, accelerations from Mach 0.9 to Mach 1.6 were performed in less than one minute at test-day conditions at 30,000 feet.

Sustained high-G turns are easily performed supersonic. The significance of this is that the YF-16, and hence the F-16, is in reality a fighter that can fight supersonic. Not by just hit-and-run, but by turning and maneuvering. A fight does not have to degenerate into subsonic turning or hit-and-run.

In many of the simulated air combat engagements, we have found that transonic maneuvering is a reality.

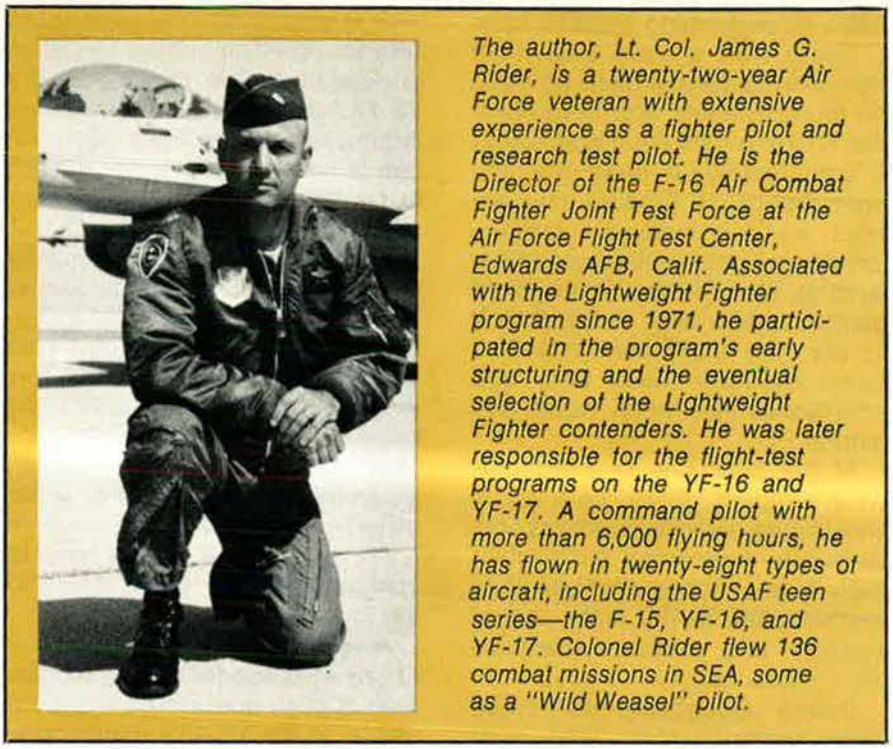
Engagements have transited the speed range from limit AOA at Mach 0.4 to 0.5 on the low speed end to above Mach 1.3. The turn and acceleration capability has negated the hit-and-run tactics used during some engagements.

Maintenance and Reliability

In the course of testing and evaluating the YF-16, we have not been interested only in how it flies. Maintainability and reliability have been equal in importance during our program. Pilots don't mention this very often, but I find it significant that factors discovered during the prototype flying have been considered in production F-16 design. Without high reliability and low maintenance man-hour expenditure, total life-cycle costs soar. In the design of the F-16 these factors were paramount. In testing, they are equal to the aspects the pilot sees. The prototype has shown up very well in this regard. Last year, the YF-16 was deployed for aerial demonstrations on two occasions. The most significant was from May 20 until July 9, when YF-16 No. 1 was flown from Fort Worth, Tex., to Europe for the Paris Air Show, a tour of seven other countries, and back to Fort Worth. During this period, thirty-three aerial demonstrations were performed and a total of fifty-five sorties flown. In this time, there were no delayed takeoffs and no missed sorties because of maintenance actions.

Full-Scale Development Testing

The F-16 Full-Scale Develop ment (FSD) program consists c flying prototype No. 2 and eigl preproduction aircraft. Six c these are single-place F-16As an two are two-place F-16Bs. The fir FSD aircraft, an F-16A, will fly December 1976 and will be use for clearing the flutter envelop gathering performance, handlir qualities, and propulsion data. Tl



The author, Lt. Col. James G. Rider, is a twenty-two-year Air Force veteran with extensive experience as a fighter pilot and research test pilot. He is the Director of the F-16 Air Combat Fighter Joint Test Force at the Air Force Flight Test Center, Edwards AFB, Calif. Associated with the Lightweight Fighter program since 1971, he participated in the program's early structuring and the eventual selection of the Lightweight Fighter contenders. He was later responsible for the flight-test programs on the YF-16 and YF-17. A command pilot with more than 6,000 flying hours, he has flown in twenty-eight types of aircraft, including the USAF teen series—the F-15, YF-16, and YF-17. Colonel Rider flew 136 combat missions in SEA, some as a "Wild Weasel" pilot.

second aircraft, also an F-16A, is assigned clearance of the flight-loads envelope and will also be used for performance and handling qualities. The third aircraft, a full avionics-equipped F-16A, will be dedicated to mission avionics integration development and evaluation. The fourth aircraft is the first F-16B and will fly in September 1977. Performance and handling quality differences between the A and B will be determined. It will also be used for initial external stores separation and certification tests. The fifth aircraft will clear the weapons delivery envelope and gather performance data with stores. The sixth F-16 will be used for climatic evaluation at extreme weather conditions. This aircraft will be deployed to the climatic laboratory at Eglin AFB, Fla., as well as to Alaska, Panama, and Yuma, Ariz. The seventh and eighth F-16s, an A and B, will be maintained by USAF maintenance personnel and flown extensively to gather quantitative reliability and maintainability data. Final verification of maintenance manuals will also be completed. The currently projected flying rate on these two aircraft is thirty sorties per aircraft per month.

The total FSD program is currently scheduled for 1,725 successful sorties. An ambitious eighty percent sortie success rate is planned and our experience with the prototypes in the lightweight fighter program justifies these expectations. Maximum effectivity of every minute of every sortie demands extensive planning and precise execution. This was achieved on the YF-16 and is expected on the F-16. We don't anticipate any wasted or low productive flying time during the F-16 FSD program.

Prototype-Production Comparison

External differences between the YF-16 and F-16 are minor. Principally, the overall length is increased approximately thirteen inches, the wing area is increased from 280 to 300 square feet, there are now nine external stores stations rather than seven, and the horizontal tail area is increased fifteen percent. With these changes, the F-16A and F-16B are identical in major structure. Only internal arrangement and canopy are different. Internally, there are a few more differences between the YF-16 and the F-16—some significant. The F-16A has approximately 400 pounds more fuel, the F100-PW-100 production engine replaces the preproduction engine, and an extensive amount of missionized avionics is included.

The production F-16 is designed for air-to-air and air-to-surface roles. The air-to-air capability will not be compromised in developing the air-to-surface capability. The avionics requirements for both are being closely integrated. Principal components of the integrated avionics weapon system package for the F-16 are the fire control radar, head-up display, fire control computer, inertial navigation unit, electro-optical display, central air data computer, and a stores management set. All components are coupled through a multiplex bus system to the fire control navigation panel on the right console of the cockpit.

Additionally, critical control functions are located on the side stick controller and the throttle. Primary flight, navigation, weapons aiming, and weapons status are presented on the head-up display. There are multiple weapons delivery modes available for air-to-surface, including both visual and radar. Optimum energy management, bingo fuel status, and optimum cruise return data are available for pilot selection to any preset destination.

The pilot can, during preflight checks, set up preplanned weapon-delivery functions, thereby making final selection a simple one- or two-switch operation.

One critical need we saw in Southeast Asia was the ability to change rapidly from an air-to-surface to an air-to-air mode without looking into the cockpit. Firing opportunities were either missed or taken without proper aiming cues because of the complicated deselect and reselect procedures. The F-16 will not only meet the need for rapid head-up selection from air-to-surface to air-to-air, but also allows equally rapid reselection of air-to-surface. This is accomplished with a switch on the throttle that for the lack of a better term is called "Dogfight."

Regardless of weapons selections made, if "Dogfight" is activated all radar and head-up display selections are made to fire either an AIM-9 missile or the M-61 cannon. The only other switch that must be positioned is the arm-safe, and it would normally be set to arm prior to entering hostile airspace. When the "Dogfight" switch is placed back to the "off" position, the previously selected air-to-surface weapon selection will be reset and the pilot may proceed with weapon delivery. The weapon system is designed so that pilots may train using exactly the same switchology.

In addition to the weapon delivery modes, fuzing options, release interval computations, and stores carriage options, the F-16 avionics package also has a comprehensive built-in self-test capability for use by either the pilot or by the maintenance technician. When a malfunction occurs in any avionics component, either in flight or during maintenance action, the malfunction is reported through the fire-control computer and presented on the fire-control nav panel. It is also stored for future reference by maintenance personnel. The pilot is given warning of any significant failure immediately, while noncritical failures on only one part of a redundant system are stored in computer memory for postflight maintenance analysis.

There is a lot of work to be done in the allocated time for F-16 full-scale development. There are new systems and complicated interfaces. Fortunately, the prototype YF-16 has provided a reasonable basis for pressing into test and evaluation of the F-16. We had a very successful test program on the prototype and are approaching F-16 test and evaluation with the same attention to detail. During F-16 full-scale development, specific strengths and weaknesses will be identified. We are hopeful the F-16 will live up to the reputation of the YF-16. Only a comprehensive evaluation will tell. ■

The tree-shaped antenna elements, shown below undergoing tests, are part of PAVE PAWS, an early warning radar system that will soon be scanning 3,000 miles over the Atlantic and Pacific Oceans.

The radar, shown at the upper right, is Cobra Dane. From Shemya Island in the Aleutians, this radar looks down a 2,000-mile corridor to collect intelligence and early warning data.

These long range eyes are being developed for the Air Force Electronic Systems Division...and both are the result of Raytheon's phased array radar technology.

As prime contractor for PAVE PAWS, Raytheon will install dual-faced, phased array radars at both Otis and Beale AFB, located on the East and West Coasts respectively. Employing the most advanced phased array and solid-state technology, the 105-foot high radars will provide rapid detection, early warning, and attack characteristics of submarine-launched ballistic missiles approaching the U.S. mainland.

We're also prime contractor for Cobra Dane. This 100-foot, phased array radar will monito Soviet missile development flights, provide early warning of ICBM launches, detect new satellites, and update known satellite orbit parameters.

PAVE PAWS...Cobra Dane. Just two examples of our continuing leadership in phased array radar technology. The same technology that we're usi in PATRIOT, the U.S. Army's air defense system for the 1980's...and in the AN/TPN-19, the Air Force's new transportable all-weather landing systen

In long-range surveillance and tracking, early warning an

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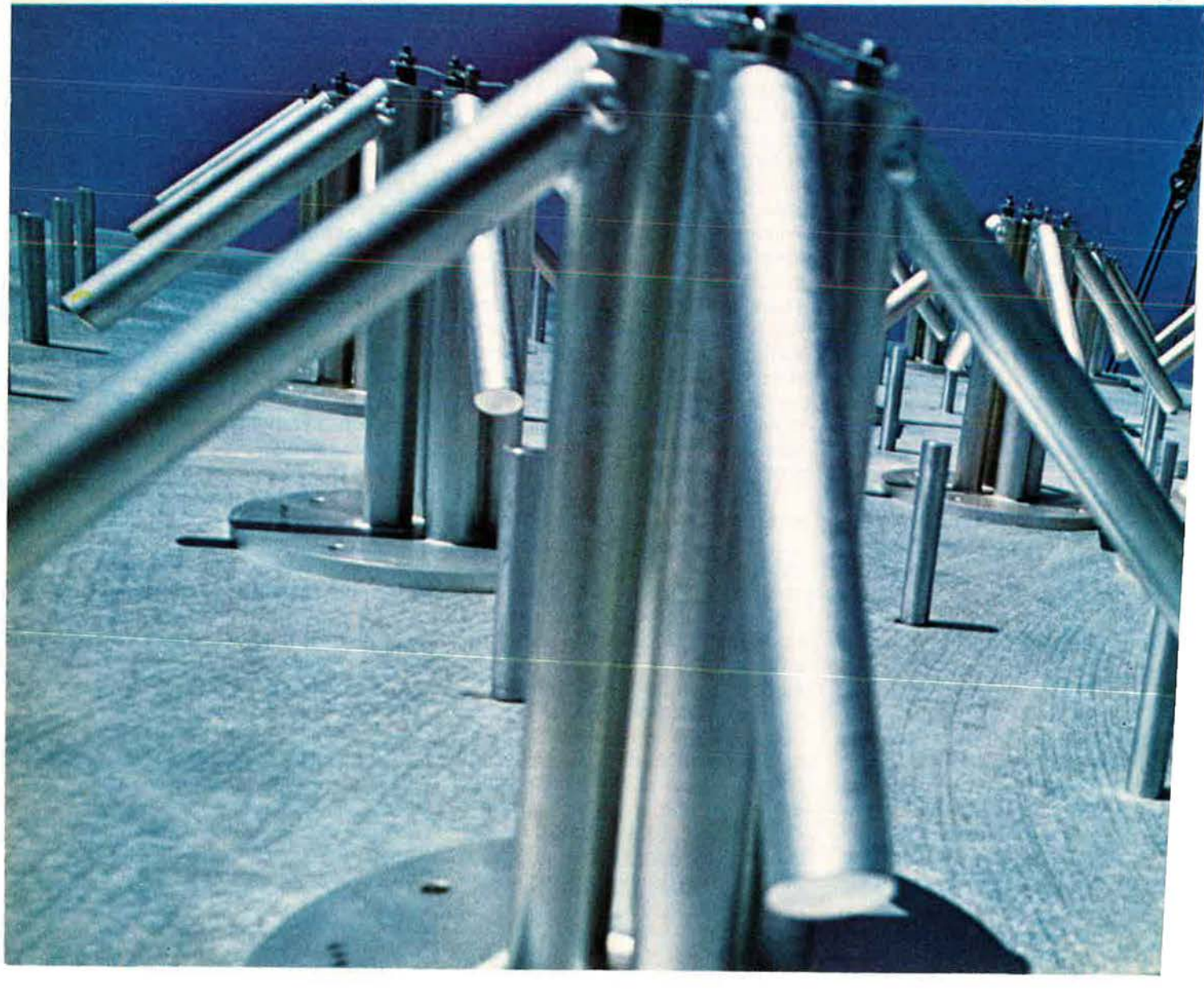

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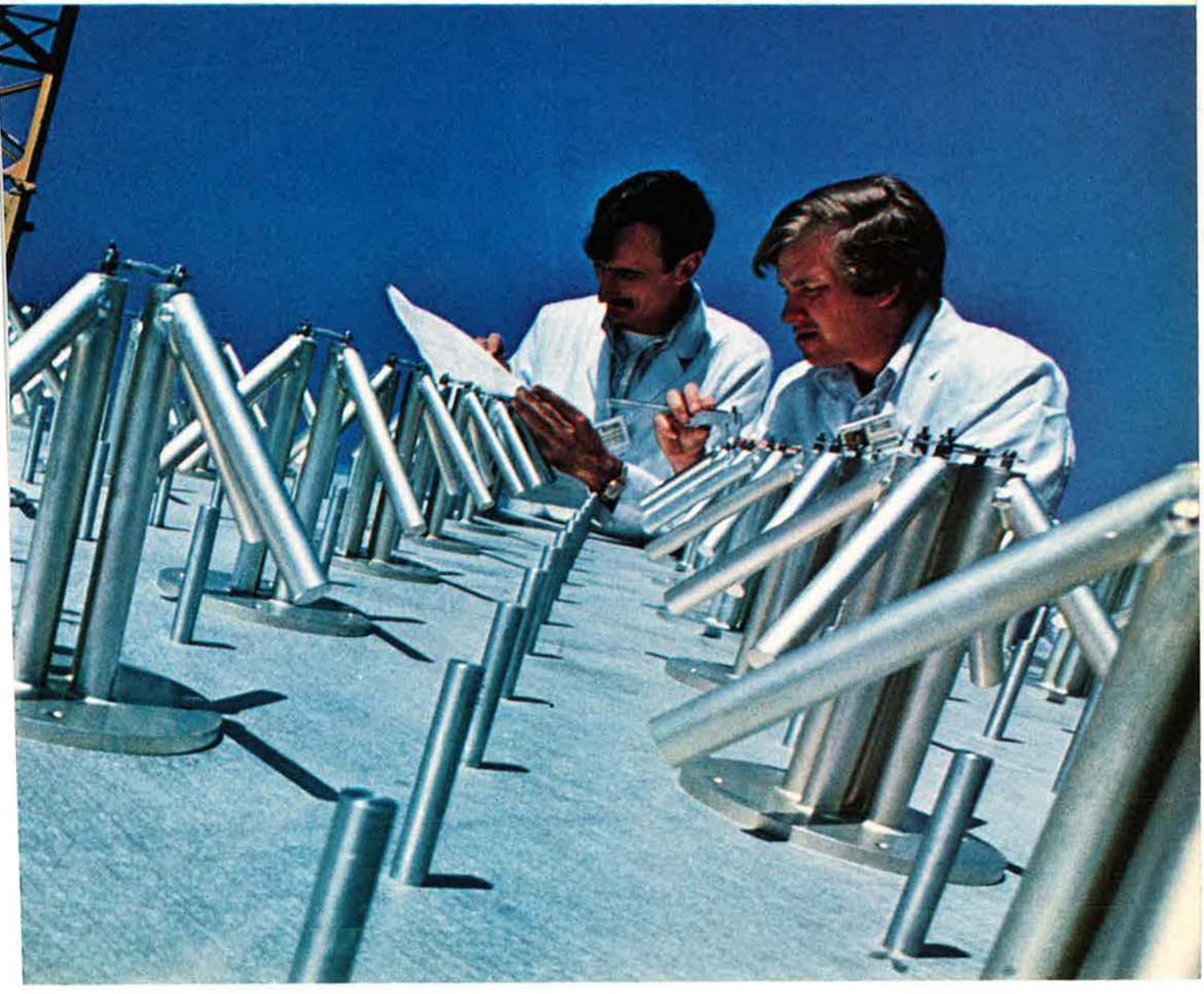


While the US faces the continuing threat of a confrontation with the Soviet Union, dangers to America's security—or at least national interests—may arise from other quarters. Here, some thoughts on . . .

The Meaning of Remaining Number One

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

AN election year is probably a poor time for reflection. The urgent, and mostly inelegant, rhetoric of this fall has the same air of immediacy, and simplicity, as press releases from the Big Eight. National defense, for instance, becomes in electioneering terms a matter of being Number One, with the forefinger in the air. As Muhammad Ali, our own Omar Khayyam, might put it:

The meaning is clear:
If you are Number One,
You have nothing to fear.

Well, maybe. A philosopher of another sort, the late Gen. Emmett "Rosy" O'Donnell, had a million or so stories. One of them had its origin in Rosy's days as a West Point football player. The scene was Yankee Stadium filled with 80,000, mainly Notre Dame, spectators, gathered for the annual Army-Notre Dame game. As the Army team trotted down the field in its pregame signal drill, one lineman looked up at the howling stands and then remarked to his neighbor, the left tackle, "Nice crowd —who we playing?"

To bring the subject back to national defense, the obvious answer is the Soviet Union. It is also, in the final analysis, undoubtedly the correct answer, for no other nation has the capability to effectively destroy us. Our safety, and probably our survival, lies in our ability to destroy Soviet Russia. So long as we have that kind of standoff, and pragmatic men are in charge on both sides, we can hope that we are not going to have an all-out nuclear war between the Russians and ourselves. And so, to remain Number One, or at least not to become Number Two, is desperately important. Nevertheless, it still does not answer completely the question in Rosy's story as to whom we are playing.

As we all know, we have yet to play the Russians. In two bloody wars, Korea and Vietnam, Russian losses were limited to observers, technicians, and other such casuals. We fought Soviet clients, but not the Soviets themselves. What is more, we have every chance of doing it again. The risk of US engagement in Korea, for instance, is infinitely greater than in Central Europe. There, where the Soviets would almost immediately run into US troops in any move into West Germany, the chance of war remains slight for that very reason.

It is George Kennan's view, in a *Foreign Affairs* article discussing the United States and the Soviet Union, that the Soviet leaders have a "keen realization of the suicidal nature of any nuclear war." Perhaps, although their impressive civil-defense efforts would at least make you wonder. Whether Ambassador Kennan is correct or not in his judgment that the Soviet leaders, beset with internal problems, will resist a world war, the fact remains that they have been very cautious in avoiding conflicts. We, on the other hand, have not, and there is no reason, short of a withdrawal into the hallucinatory cocoon of a Fortress America, to believe we can avoid them in the future. With or without Soviet assistance, it seems clear that our list of enemies, or at least adversaries, is going to lengthen. Our growing dependence on oil and other imports, and the penetration of our commercial interests all over the world, almost guarantee an occasional collision, Russians or no Russians. Just the thought of all those grand new cars, and the big mobile amusement centers known as recreational vehicles, ending up like beached whales in another oil embargo is enough to call out the Marines.

Unhappily, nothing is that simple anymore. Even if the Marines can get there and can handle the situation—neither of those propositions is a certainty—there must be provisions against the affair expanding, or breaking out somewhere else.

In a world where we may be increasingly beleaguered, it is comforting to surround ourselves with allies. Comforting, but of no great value outside the boundaries of the alliance. NATO allies, for instance, are not allies in Africa, or the Caribbean. They are just allies where our mutual interests coincide. In the world at large, we are on our own.

There are no easy answers to what kind of military forces we need in that world. The shifting fortunes of once poor and benighted lands have brought them modern arms and the ability to arm their still-poor neighbors. There is no reason to doubt that their armories will have nuclear weapons one of these days. Nuclear weapons, some kind of a delivery system, and a limited view of things make for a difficult opponent, however small and militarily inferior.

The point of all this is that defense planning for the years ahead is going to require some imaginative thought and some hard decisions. It is evident that the sheer cost of armaments and the maintenance of volunteer forces will limit what we can provide. Too much spent on one end of things means too little to spend on the other.

One thing is certain, in this otherwise uncertain process. We will only get the most for our money if our capabilities are judged on their merits, not on the basis of preserving the self-esteem and traditional role of any single service. ■

JANE'S

ALL THE WORLD'S AIRCRAFT SUPPLEMENT

Newly added canards and nose strakes are shown clearly in this ground view of the IAI Kfir-C2

IAI
ISRAEL AIRCRAFT INDUSTRIES LTD; Head Office and Works: Ben-Gurion International Airport, Lydda (Lod), Israel

IAI NESHER (EAGLE)

Following the French embargo on the delivery of Dassault Mirage 5 fighters to Israel, the decision was taken in Israel to manufacture aircraft of generally similar design to the Mirage. The ultimate outcome of this policy is the IAI Kfir, with a General Electric J79 turbojet instead of the SNECMA Atar fitted to French-built Mirage III/5s. As an interim step, IAI undertook responsibility for manufacturing spares for Mirage III-CJ fighters operated by the Israeli Air Force, and for putting into production an aircraft named the Nesher (Eagle). This comprised a locally-built airframe, similar to that of the Mirage III/5, fitted with an Atar 9C afterburning turbojet and Israeli electronics and equipment.

According to a book published in Israel in 1976, under the title *Israel, Army and Defence—Lexicon*, the prototype Nesher flew for the first time in September 1969. Deliveries began in 1972, and some 40 Neshers are said to have taken part in the October 1973 war.

IAI KFIR (LION CUB)

Following manufacture of the Nesher fighter, powered by an Atar turbojet, IAI developed a more extensively modified and further improved version of the same air-

frame, powered by a General Electric J79 afterburning turbojet engine. This installation confers a much-improved thrust/weight ratio compared with the standard Mirage 5. Details were officially made public for the first time on 14 April 1975, when two of the new aircraft, now known by the name Kfir, were displayed at Ben-Gurion Airport, Lydda.

The Kfir utilises a basic airframe similar to that of the Dassault Mirage 5, the main changes being a shorter but larger-diameter rear fuselage, to accommodate the J79 engine; an enlarged and flattened undersurface to the forward portion of the fuselage; introduction of a dorsal airscoop, in place of the triangular dorsal fin, to provide cooling air for the afterburner; and a strengthened landing gear, with longer-stroke oleos. Several internal changes have also been made, including a redesigned cockpit layout, addition of a considerable amount of Israeli-built electronics equipment, and increased internal fuel tankage compared with the Mirage 5.

Intended for both air defence and ground attack roles, the Kfir retains the standard Mirage fixed armament of two 30 mm DEFA cannon, and can carry a variety of external weapons including the Rafael Shafrir air-to-air missile. It has demonstrated stall-free gun firing throughout the flight envelope.

On 20 July 1976, at the Israeli Air Force base at Hatzerim, in the Negev, IAI gave the first public demonstration of a modified version known as the **Kfir-C2.** This has a number of changes from the previous model, the most significant of which are the addition of non-retractable, sweptback canard surfaces just aft of the engine air intakes; a small strake on each side of the extreme nose; and a 'dog-tooth' wing leading-edge, created by extending the chord on approximately the outer 40% of each half-span.

These changes, which add some 85 kg (187 lb) to the structural weight, recall the retractable 'moustaches' fitted by Dassault to the experimental Milan version of the Mirage and described in earlier editions of *Jane's*. The canard surfaces of the Kfir-C2, however, are much larger in area than those of the Milan, and by virtue of their different location they eliminate two of the principal criticisms made of the Milan installation: impairment of the pilot's view forward and downward, and the creation of adverse wake effects in the engine air intakes. The Kfir-C2 installation is, perhaps, more analogous with that of the Saab 37 Viggen.

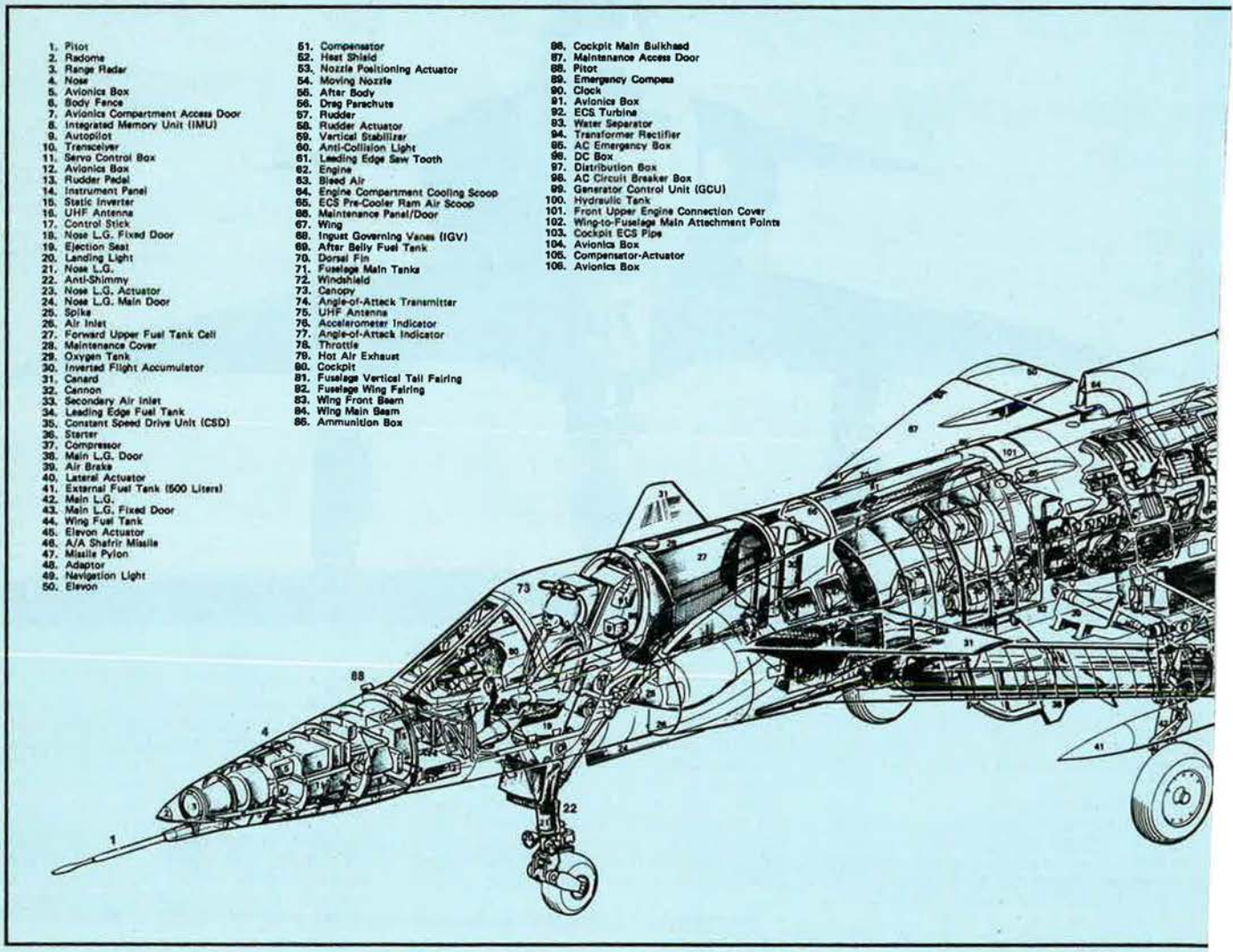
The Kfir-C2 is expected to become the principal production version, both for the Israeli Air Force and for export. The new modifications, which can be retrofitted to existing Kfirs, were designed to improve the aircraft's dogfighting manœuvrability at the lower end of the speed range and to enhance take-off and landing performance. It is claimed that, in particular, they give a better sustained turning performance, with improved lateral, longitudinal, and directional control; contribute to a very low gust response at all operational altitudes, especially at very low level; offer improved handling qualities at all angles of attack, high *g* loadings, and low speeds; reduce take-off and landing distances, and landing speeds; and permit a more stable (and, if required, a steeper) approach, with a flatter angle of approach and touchdown.

TYPE: Single-seat interceptor, long-range patrol fighter, and ground attack aircraft.

WINGS: Cantilever low-wing monoplane of delta planform, with conical camber. Thickness/chord ratio 4.5% to 3.5%. Anhedral 1°. Incidence 1°. Sweepback on leading-edges 60° 34′. All-metal torsion-box structure, with stressed skin of machined panels with integral stiffeners. Two-section elevons on each trailing-edge, with smaller elevator/trim flap inboard of inner elevon. Elevons powered by hydraulic jacks; trim flaps are servo-assisted. Small, hinged plate-type airbrake above and below each wing, near leading-edge. Kfir-C2 has additional modifications which include extended chord on outer leading-edges, and sweptback canard fixed surfaces above and forward of wings, near top lip of each engine air intake. Metal Resources Inc of Gardena, California, has an IAI subcontract to manufacture replacement wing components for Israeli Mirages.

FUSELAGE: All-metal semi-monocoque structure, 'waisted' in accordance with area rule. Cross-section of forward fuselage has

Cutaway drawing shows locations of components of the Kfir-C2



a wider and flatter undersurface than that of Mirage 5. Nosecone built of locally-developed composite materials, with (on Kfir-C2) a small horizontal strake or 'body fence' on each side near the tip. UHF antenna under front of fuselage, forward of nosewheel door. Enlarged-diameter rear fuselage, compared with Mirage 5, with approx 0.61 m (2 ft) shorter tailpipe. Ventral fairing under rear fuselage.

TAIL UNIT: Cantilever all-metal fin; rudder powered by hydraulic jack, with servo-assisted trim. UHF antenna in tip of fin. Triangular-section dorsal airscoop forward of fin, to provide cold air for afterburner cooling. No horizontal tail surfaces.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Hydraulic retraction, nose unit rearward, main units inward into fuselage. Longer-stroke oleos than on Mirage 5, and all units strengthened to permit higher operating weights. Main-gear leg fairings shorter than on Mirage; inner portion of each main-leg door is integral with fuselage-mounted wheel door. Steerable nosewheel, with anti-shimmy damper. Oleo-pneumatic shock-absorbers and disc brakes. Braking parachute in bullet fairing below rudder.

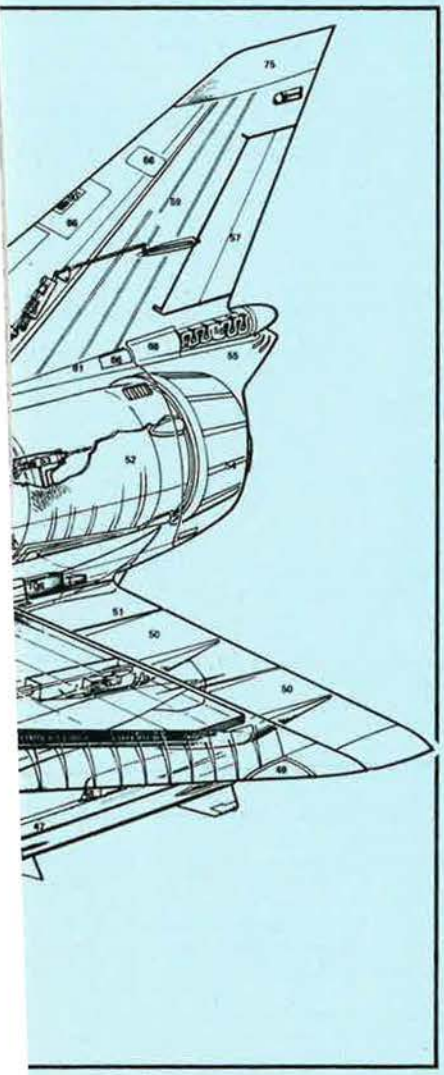
POWER PLANT: One General Electric J79 turbojet engine (modified GE-17), with variable-area nozzle, rated at 52.8 kN (11,870 lb st) dry and 79.62 kN (17,900 lb st) with afterburning. Air intakes enlarged, compared with Mirage 5, to allow for higher mass flow. Adjustable half-cone centrebody in each air intake. Internal fuel in five fuselage and four integral wing tanks. Total internal capacity is probably in the order of 4,000 litres (880 Imp gallons), perhaps slightly more. There is a refuelling point on top of the fuselage, above the forward upper tank. In addition, there are wet-points for the carriage of one or two drop-tanks beneath each wing, and one under the fuselage; these tanks may be of 500, 600, 1,300, or 1,700 litres (110, 132, 286, or 374 Imp gallons) capacity. External capability should be comparable to that of the Mirage 5, which can carry up to 4,700 litres (1,034 Imp gallons) of auxiliary fuel in external drop-tanks, or 1,000 litres (220 Imp gallons) in combination with 4,000 kg (8,820 lb) of ordnance.

ACCOMMODATION: Pilot only, on Martin-Baker JM.6 zero-zero ejection seat, under rearward-hinged upward-opening canopy. Revised cockpit layout compared with Mirage 5. Cockpit pressurised, heated, and air-conditioned.

SYSTEMS: Two separate environmental control systems (ECS), one for cockpit heating, pressurisation, and air-conditioning, and one for electronics compartments. Two independent hydraulic systems, probably of 207 bars (3,000 lb/sq in) pressure. No. 1 system actuates flying control surfaces and landing gear; No. 2 actuates flying controls, airbrakes, landing gear, wheel brakes, and utilities. Constant-speed drive unit (CSD) for essential services. Electrical system probably similar to that of Mirage 5, with DC power provided by two 24V 40Ah batteries and a 26.5V 9kW generator, and AC power by a 125VA (200V 400Hz) transformer-rectifier, a 9kVA (115/200V 400Hz) alternator, and a static inverter. Oxygen system for pilot.

ELECTRONICS AND EQUIPMENT: MBT Weapons Systems twin-computer fly-by-wire flight control system, with integrated memory unit (IMU), two-axis gyro and standby compass, autopilot, radar altimeter, angle of attack transmitter and indicator, and accelerometer indicator. Elta Electronics multi-mode computer-based navigation and weapon delivery system, with Tacan, Doppler radar, IFF/SIF, and nose-mounted fire control radar. Israeli-built head-up display and automatic gunsight. Duplicated UHF radio. Twin landing lights on nosewheel leg; anti-collision light in fin leading-edge.

ARMAMENT: Fixed armament of one IAI-



IAI Kfir-C2 taxis out for demonstration at Hatzerim AFB in the Negev, Israel (Israir photo)

Improved take-off performance is one of the benefits conferred by the Kfir-C2's canards

Basic version of the IAI Kfir, without canards (Israir photo)

built 30 mm DEFA cannon in underside of each engine air intake (125 rds/gun on Mirage 5). Seven hardpoints (three under fuselage and two under each wing) for external stores. For interception duties, one Rafael Shafrir infra-red homing air-to-air missile can be carried under each outer wing. Ground attack version can carry two 1,000 lb bombs or an air-to-surface missile under the fuselage, and two 1,000 lb or four 500 lb bombs (conventional or 'concrete dibber' type) under the wings. Alternative external stores may include rocket pods; napalm; Shrike, Maverick, or Hobos air-to-surface missiles; ECM pods; or drop-tanks.

DIMENSIONS, EXTERNAL:

Wing span	8.22 m (26 ft 11½ in)
Wing aspect ratio	1.94
Foreplane span (estimated)	3.50 m (11 ft 6 in)
Length overall	15.55 m (51 ft 0¼ in)
Height overall	4.25 m (13 ft 11¼ in)
Wheel track	3.15 m (10 ft 4 in)
Wheelbase	4.87 m (15 ft 11¾ in)

WEIGHTS:

Weight empty (interceptor, estimated):	
Kfir	7,200 kg (15,873 lb)
Kfir-C2	7,285 kg (16,060 lb)
Typical combat weight (interceptor), 50% internal fuel and two Shafrir missiles:	
Kfir	9,305 kg (20,514 lb)
Kfir-C2	9,390 kg (20,701 lb)
Max combat T-O weight (all versions)	14,600 kg (32,188 lb)

PERFORMANCE (estimated):

Max level speed above 11,000 m (36,100 ft):	
Kfir	over Mach 2.2 (1,260 knots; 2,335 km/h; 1,450 mph)
Kfir-C2	over Mach 2.3 (1,317 knots; 2,440 km/h; 1,516 mph)
Max rate of climb at S/L	14,000 m (45,950 ft)/min
Time to 11,000 m (36,100 ft)	1 min 45 sec
Stabilised ceiling (combat configuration)	above 15,240 m (50,000 ft)
T-O run at 11,000 kg (24,250 lb) AUW (Kfir)	700 m (2,300 ft)
Landing run at 9,000 kg (19,840 lb) AUW (Kfir)	450 m (1,475 ft)
Combat radius:	
interceptor, two 600 litre drop-tanks	200-288 nm (370-535 km; 230-332 miles)
ground attack, lo-lo-lo	351 nm (650 km; 404 miles)
ground attack, hi-lo-hi	700 nm (1,300 km; 807 miles)

The retractable 'moustache' foreplanes fitted to the Dassault Milan

EMBRAER

EMPRESA BRASILEIRA DE AERONAUTICA SA; Head Office and Works: Av Brig Faria Lima, Caixa Postal 343, 12200 São José dos Campos, São Paulo State, Brazil

EMBRAER EMB-111 BANDEIRANTE

The Brazilian Air Force has awarded a multi-million dollar contract to the AIL Division of Cutler-Hammer for fourteen AN/APS-128 lightweight sea patrol airborne search radar (SPAR-1) systems, for installation in the EMB-111 maritime patrol version of the Bandeirante. (This amends the designation of the radar given in the June 1976 *Supplement*.) The entire installation weighs less than 79 kg (175 lb). Deliveries were scheduled to begin in mid-1976.

The AIL radar will be fully integrated with the EMB-111's on-board inertial navigation, high-powered searchlight, signal cartridge launcher, and camera systems to provide operational flexibility over a variety of missions including surveillance, search, and rescue. The Brazilian Air Force will utilise the EMB-111 for both military and civil missions, including operations with naval vessels, sonar searches, shipping surveillance, anti-smuggling patrol, and transport of cargo and personnel.

The principal feature of the AN/APS-128, which is designed to operate in numerous roles and modes, is its ability to detect small targets over large areas under varying sea conditions. The 360°-of-rotation antenna assembly, which weighs only 17 kg (38 lb), will be mounted in the EMB-111's nose radome, and will provide more than 240° of azimuth coverage. A tilt adjustment of ± 15° permits various depression angles, and automatic roll and pitch stabilisation of the antenna compensates for the varying effects of aircraft attitudes up to ± 20° from straight and level flight.

Within the EMB-111, a 178 mm (7 in) operator's PPI will display adjustable range scales of 25, 50, and 125 nm (46, 92, and 232 km; 29, 58, and 144 miles), with 5, 10, and 25 nm (9, 18, and 46 km; 5.75, 11.5, and 29 mile) markers. The pilot's PPI can be used for navigation as well as for weather and terrain avoidance.

CANADAIR/LEAR AVIATION

CANADAIR LIMITED; Head Office and Works: Cartierville Airport, St Laurent, Montreal, Quebec, Canada H3C 3G9

In July 1974 Mr William P. Lear, designer of the original Learjet business aircraft, initiated the development of a new turbofan light transport to which he gave the name LearStar 600. A feature of this aircraft from the start was use of a supercritical wing, making the LearStar 600 the first commercial transport designed to take advantage of technology resulting from the wing aerodynamic research conducted by NASA's Richard T. Whitcomb in the 1960s. It was envisaged at first that the aircraft would have a three-engine layout, but a change was made to two rear-mounted turbofans as the design progressed.

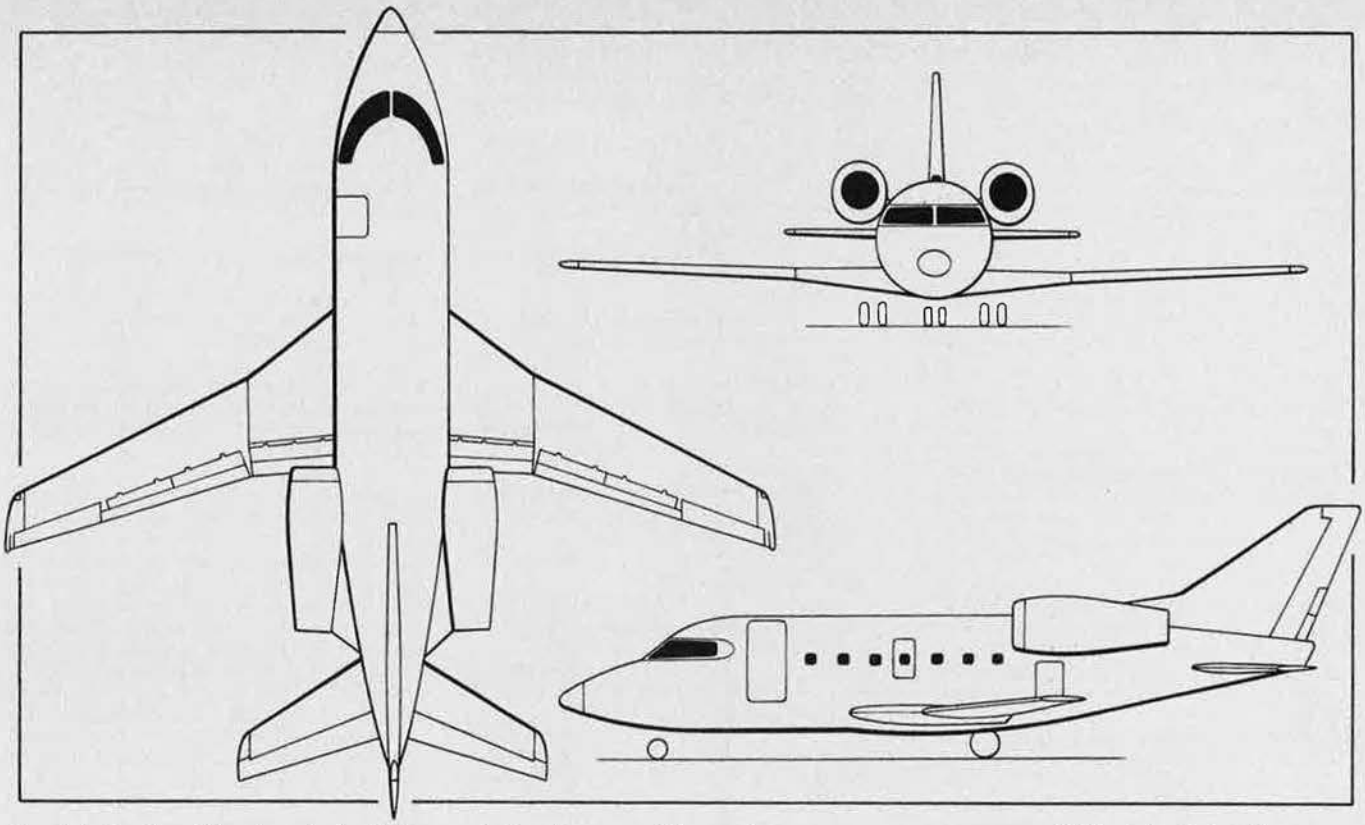
Lear Aviation Corporation planned to begin construction of a prototype in July 1975, and announced that a new company would be formed to produce the LearStar 600 if it attracted sufficient interest from prospective operators. But in April 1976 Canadair Ltd acquired from Lear Aviation an option for exclusive rights to manufacture and market the aircraft worldwide, since when a number of important design changes have been made. In particular the wing span has been increased, the fuselage now has a wide-body section, and the original tailplane anhedral has been eliminated.

With an estimated worldwide requirement for more than 1,000 business aircraft in the category of the LearStar 600 in the decade from 1978 to 1988, Canadair believes that this aircraft could capture some 40% of the market. The company is reported to require confirmation of 40–50 orders before making a production decision. Its provisional pre-production and certification schedule envisages the start of detail fabrication for three prototypes before the end of the current year, first flight around the turn of the year 1977/78, and certification by the end of February 1979. Production deliveries could then begin in the second quarter of 1979, to total 20 aircraft in that year, building up to a rate of 56 aircraft a year by 1981.

CANADAIR LEARSTAR 600

TYPE: Twin-turbofan business, priority air cargo, airline, and commuter passenger transport.

WINGS: Cantilever low-wing monoplane, built in one piece. Supercritical wing section. Sweepback at quarter-chord 25°. Two-spar structure, primarily of light alloy; spars covered with skin-stringer panels to form rigid torsion box. Replaceable wingtips. Trailing-edge flaps over 75% of span. Hydraulically-powered all-metal ailerons and outboard roll-control spoilers. Dual inboard spoilers for descent



Canadair LearStar 600 twin-turbofan business, priority air cargo, airline, and commuter passenger transport (Michael A. Badrocke)

control and ground lift dumping. Trim tabs in ailerons.

FUSELAGE: Light alloy fail-safe semi-monocoque structure of circular cross-section, with clad frames, stringers, and chemically-milled skins. Nose radome of glassfibre honeycomb.

TAIL UNIT: Cantilever light alloy structure, with swept vertical and horizontal surfaces. Fin and tailplane of multi-spar construction, with ribs and spanwise stiffened skin panels. Tailplane incidence adjusted by irreversible drive from the flap gearbox to trim the aircraft as a function of flap position. Control surfaces mechanically operated. Trim tab in rudder. All-metal honeycomb trim tabs in elevator. Tailplane leading-edge anti-iced by engine bleed air.

LANDING GEAR: Hydraulically-retractable tricycle type, with twin wheels on each unit. Main wheels retract inward into fuselage, nose unit forward. Nose unit steerable. Hydraulically-operated multiple-disc brakes. Fully-modulated anti-skid system. Provision for emergency extension of landing gear.

POWER PLANT: Two 33.36 kN (7,500 lb st) Avco Lycoming ALF 502 high by-pass ratio turbofan engines, pylon-mounted on each side of the rear fuselage, and fitted with cascade-type fan-air thrust reversers. Integral fuel tank in each wing; total capacity 8,244 litres (2,178 US gallons). Single-point pressure fuelling at up to 945 litres (250 US gallons)/min, with a supply pressure of 3.45 bars (50 lb/sq in). Provision for overwing gravity fuelling to 100% capacity.

ACCOMMODATION: Pilot and co-pilot side by side on flight deck with dual controls. Blind-flying instrumentation standard. Door on port side, forward of wing, on all versions, with built-in airstairs. Typical 11-passenger executive layout has wardrobe forward of entrance and cabinet aft of entrance on port side, with crew locker, buffet and bar, and cabinet opposite on starboard side; four swivelling armchairs in pairs, separated by tables, in centre of cabin; a rear three-place settee on the port side at the rear, with two pairs of facing seats, separated by a table, opposite; separate lavatory compartment and wardrobe to rear of cabin; and rear baggage compartment with internal access and external baggage door on port side. Typical 10-passenger executive configuration has wardrobe (port), and crew locker and lavatory (starboard) at front; two pairs of swivelling armchairs separated by tables on port side of cabin; one armchair and twin-seat separated by table, and four-place settee on starboard side; with buffet (port), bar cabinet (starboard), and separate baggage compartment with internal and external access at rear. Thirty-passenger commuter version has washroom, toilet, and stewardess seat forward of door on port side, with wardrobe and electronics bay opposite; seven pairs of seats on port side of cabin, eight pairs on starboard side, with centre aisle; and rear baggage compartment with external door on port side. All passenger versions have an overwing type III emergency exit on each side of cabin; commuter transport has a third emergency exit opposite door.

Model of the wide-bodied Canadair LearStar 600 (two Avco Lycoming ALF 502 turbofan engines)

Air cargo version has a toilet and wardrobe at front of cabin, with type III exit opposite door; upward-hinged cargo door, also forward of wing, on starboard side; completely clear cabin space, able to house five containers with a total volume of 21.24 m³ (750 cu ft), or up to 3,400 kg (7,500 lb) of general freight. Overhead exit panel above flight deck optional. Windscreen anti-iced electrically.

SYSTEMS: Pressurisation and air-conditioning by engine bleed air, with max pressure differential of 0.69 bars (10 lb/sq in). Backup cabin pressure control system standard. Dual independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), with variable-displacement pump on each engine, using synthetic phosphate ester fluid. Emergency hydraulic system. DC electrical system includes two 28V generators, one on each engine, and two standby storage batteries; AC power supplied by static inverters. DC external power receptacle. Emergency oxygen system, pressure 124 bars (1,800 lb/sq in), with automatic demand regulators on flight deck. Provision for passenger emergency oxygen system. Structural provisions for APU in rear fuselage. Engine fire detection system and two-shot extinguisher system to suppress a fire in either nacelle. Stability augmentation system, operating in conjunction with autopilot, has Mach trim compensation.

ELECTRONICS: Standard items include dual VHF-20A com transceivers, dual VIR-30A nav receivers, dual TDR-90 ATC transponders, dual FD 109Z flight directors, APS-80 autopilot, dual DME-40 DMEs, AH-55 radio altimeter, dual MC-103 compasses, ADF-60 ADF, dual 346B-3 audio systems, ADS-80 air data computer, weather radar, ground proximity warning system, and associated antennae, including HF. Provisions for HF com, second ADF, third VHF com, VLF nav system, inertial nav system, voice recorder, and flight recorder.

EQUIPMENT: Standard items include navigation, anti-collision, wing ice inspection, landing and taxi lights; duplicated lighting system for flight deck; gust locks for all control surfaces, with a safety interlock to the engine throttle linkage; electrically heated pitot systems; capacitance type fuel gauges; cabin fire extinguishers; first aid kit; smoke masks and oxygen cylinders; emergency exit lights; and emergency battery pack.

DIMENSIONS, EXTERNAL:

Wing span	18.21 m (59 ft 9 in)
Wing aspect ratio	8.5
Length overall	19.45 m (63 ft 10 in)
Height overall	6.01 m (19 ft 8½ in)
Tailplane span	7.29 m (23 ft 11 in)
Wheel track	2.95 m (9 ft 8 in)
Wheelbase	8.00 m (26 ft 3 in)
Cabin door: Width	1.01 m (3 ft 4 in)
Optional cargo door: Width	1.37 m (4 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length, excl flight deck	8.61 m (28 ft 3 in)
Max width	2.49 m (8 ft 2 in)
Max height	1.85 m (6 ft 1 in)
Volume, excl flight deck	28.09 m³ (992 cu ft)
Baggage compartment volume	4.47 m³ (158 cu ft)

AREA:

Wings, gross	39.02 m² (420 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty, equipped	6,656 kg (14,675 lb)
Operating weight empty	7,665 kg (16,900 lb)
Max fuel	6,717 kg (14,810 lb)
Payload with max fuel	426 kg (940 lb)
Max payload	3,400 kg (7,500 lb)
Max T-O weight	14,742 kg (32,500 lb)
Max ramp weight	14,810 kg (32,650 lb)
Max landing weight	14,061 kg (31,000 lb)
Max zero-fuel weight	11,068 kg (24,400 lb)
Max wing loading	377.8 kg/m² (77.38 lb/sq ft)
Max power loading	221 kg/kN (2.17 lb/lb st)

PERFORMANCE (estimated):

Max level speed at S/L	300 knots (555 km/h; 345 mph) EAS
Max operating speed above 3,050 m (10,000 ft)	375 knots (695 km/h; 432 mph) EAS
Max operating speed above 7,160 m (23,500 ft)	Mach 0.90
Max cruising speed at 11,000 m (36,000 ft), ISA, at AUW of 11,793 kg (26,000 lb)	Mach 0.88
Normal cruising speed at 12,000 m (39,000 ft), ISA, at AUW of 14,061 kg (31,000 lb)	Mach 0.85
Long-range cruising speed at 13,100 m (43,000 ft) at AUW of 14,061 kg (31,000 lb)	Mach 0.80
Max certificated ceiling	14,935 m (49,000 ft)
Max range with 8 passengers at long-range cruising speed	4,030 nm (7,468 km; 4,640 miles)

OPERATIONAL NOISE CHARACTERISTICS (FAR 36, estimated):

T-O	78 EPNdB
Approach	90 EPNdB
Sideline	87 EPNdB

CHINA

STATE AIRCRAFT FACTORY; Address: Shenyang, People's Republic of China

First official confirmation that China's aircraft industry now has the capability to design and manufacture its own supersonic combat aircraft was given in early 1975. In his military posture statement to the US Senate Armed Services Committee the Chairman of the Joint Chiefs of Staff, General George S. Brown, commented that "the Chinese are now developing a new supersonic all-weather interceptor . . . and have a number of years of R&D effort invested in this aircraft. We had expected production of the MiG-19 to terminate [at Shenyang], but we now believe that it will continue until the new interceptor is introduced."

SHENYANG F-9

In the FY 1977 report of the US Defense Department, Secretary Donald H. Rumsfeld remarked that "Tactical aviation in the PRCNAF (People's Republic of China Naval Air Force) also plays an air defense role relative to naval forces, with the **Beagle** bomber (Il-28) and **Fantan-A** fighter-bomber being the principal tactical aircraft."

Fantan-A is known to be the NATO reporting name for the F-9, a twin-engined fighter embodying technology derived from the F-6/MiG-19. Reports suggest that it first flew in the early 'seventies, and has lateral air intakes to permit use of a pointed nose radome. The F-9 is said to be somewhat larger overall than the F-6, with a wing span of about 10.20 m (33 ft 5 in), overall length of about 15.25 m (50 ft 0 in), and take-off weight of about 10,000 kg (22,050 lb). Combat radius is thought to be up to 430 nm (800 km; 500 miles), and max level speed almost Mach 2.

It is likely that a future version of the F-9, or a development of this aircraft, will be powered by two of the Rolls-Royce Spey turbofans that China is to manufacture under licence. Most F-9s delivered by 1976 serve with strike squadrons of the Chinese Air Force; others are operated by the Naval Air Force, as stated by Secretary Rumsfeld.

HAL

HINDUSTAN AERONAUTICS LIMITED; Head Office: Indian Express Building, Vidhana Veedhi, PO Box 5150, Bangalore 560 001, India

HAL ARMED LIGHT HELICOPTER (ALH)

The Helicopter Division of HAL has under development a single-engined high-performance armed light helicopter, powered by a Turboméca Astazou XX turboshaft engine mounted on top of the fuselage aft of the rotor head. Two versions are being developed: a standard version for Indian Army/Air Force use, and a variant for the Indian Navy. The former will have a capability for combat missions, communications duties, armed reconnaissance and surveillance, casualty evacuation, crew rescue, external cargo carrying, and training. The naval version will be able to perform anti-submarine search and strike, air to surface vessel search and strike, search and rescue, reconnaissance, casualty evacuation, and vertical replenishment duties at sea.

The ALH will have a light alloy semi-monocoque fuselage, with accommodation in the standard version for a crew of two and five passengers or equivalent load. A four-blade semi-rigid single main rotor, with blades made of composite materials, will be fitted, and provision is made for blade folding. A skid-type landing gear will be fitted to the Army/Air Force version; the Navy version will have a non-retractable tricycle landing gear, with a fully-castoring and self-centering nosewheel and a harpoon deck-lock securing system.

Combat equipment on the standard version will include a variety of armament combinations such as Miniguns, missiles, and rockets; the naval version will have torpedoes, depth charges, and missiles, with accompanying electronics appropriate to a given mission.

DIMENSIONS, EXTERNAL:

Diameter of main rotor	13.00 m (42 ft 8 in)
Diameter of tail rotor	1.00 m (3 ft 3¼ in)
Length overall, main rotor turning	14.915 m (48 ft 11¼ in)
Length, main rotor folded	12.195 m (40 ft 0 in)
Width, rotors folded	5.60 m (18 ft 4½ in)
Height overall	4.01 m (13 ft 2 in)
Height with rotors and tail folded	3.95 m (12 ft 11½ in)
Cabin door:	
Height	1.20 m (3 ft 11¼ in)
Width	1.10 m (3 ft 7¼ in)

DIMENSIONS, INTERNAL:

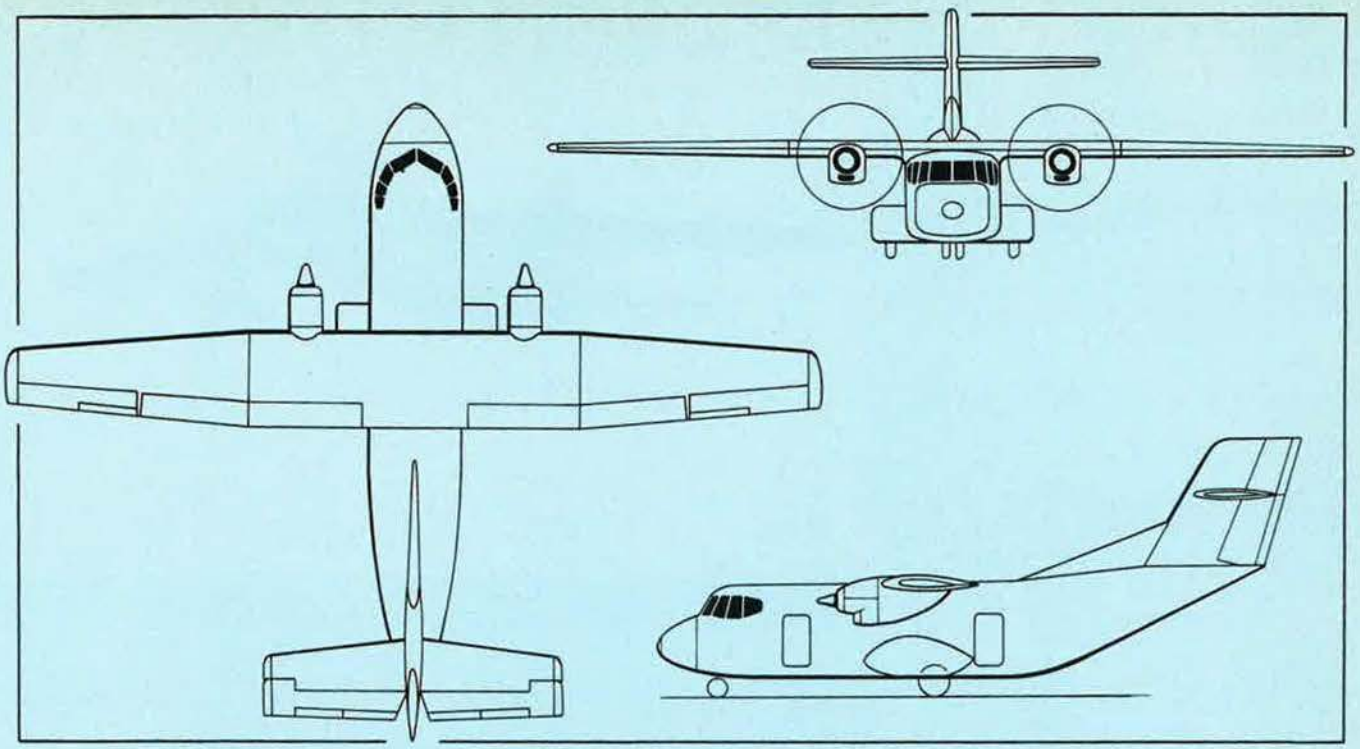
Cabin: Max width	1.35 m (4 ft 5¼ in)
Max height	1.35 m (4 ft 5¼ in)

WEIGHTS:

Weight empty, without equipment:	
Army version	1,500 kg (3,307 lb)
Naval version	1,550 kg (3,417 lb)
Max T-O weight:	
Army version	2,500 kg (5,511 lb)
Naval version	3,000 kg (6,613 lb)

PERFORMANCE (estimated, at max T-O weight):

Never-exceed speed:	
at S/L	186 knots (345 km/h; 214 mph)
at 3,050 m (10,000 ft)	not less than 162 knots (300 km/h; 186 mph)
at 4,375 m (14,350 ft)	not less than 140 knots (260 km/h; 161 mph)
Max continuous cruising speed:	
at 4,875 m (16,000 ft)	134 knots (250 km/h; 155 mph)



AIDC XC-2 twin-turboprop transport aircraft, of which a prototype is under construction (Michael A. Badrocke)

at 6,100 m (20,000 ft)
124 knots (230 km/h; 143 mph)
Normal cruising speed:
at 4,875 m (16,000 ft)
129 knots (240 km/h; 149 mph)
at 6,100 m (20,000 ft)
100 knots (185 km/h; 115 mph)
Approach speed:
normal
60 knots (110 km/h; 69 mph) IAS
precautionary
35.5 knots (65 km/h; 41 mph) IAS
autorotative
60 knots (110 km/h; 69 mph) IAS
Service ceiling 8,000 m (26,250 ft)
Hovering ceiling out of ground effect
4,875 m (16,000 ft)

AIDC/CAF

AERO INDUSTRY DEVELOPMENT CENTER/CHINESE AIR FORCE; Address: PO Box 7173, Taichung, Taiwan 400

AIDC XC-2

The basic design of the XC-2 twin-turboprop transport, which was started in January 1973, incorporates features of common interest to both military and civil operators, including quick-change capability and the ability to operate from short fields and unprepared surfaces. The aircraft, of which a prototype was under construction in mid-1976, will be able to carry up to 38 passengers or 3,855 kg (8,500 lb) of cargo.

TYPE: Twin-turboprop transport aircraft.

WINGS: Cantilever high-wing monoplane. Wing section NACA 65_3-218. Incidence 4°. No dihedral or sweepback. Light alloy three-spar fail-safe structure, built in three sections: a constant-chord centre-section and tapered outer panels. All-metal manually-operated ailerons and hydraulically-actuated Fowler-type trailing-edge flaps. Servo tab in each aileron.

FUSELAGE: Conventional all-metal semi-monocoque fail-safe structure, of basically rectangular section, upswept at rear to provide clearance for rear loading. Cabin pressurisation optional.

TAIL UNIT: Cantilever aluminium alloy three-spar structure, with sweptback fin and rudder and non-swept horizontal surfaces. Dorsal fin. Horizontal surfaces mounted halfway up main fin. Trim and balance tab in rudder and each elevator.

LANDING GEAR: Retractable tricycle type, with hydraulically-steerable twin-wheel nose unit. Single-wheel main units retract into fairings on sides of fuselage.

POWER PLANT: Two 1,082 kW (1,451 ehp) Lycoming T53-L-701A turboprop engines, each driving a Hamilton Standard 53C51-27 three-blade variable-pitch metal propeller with spinner. Fuel in rubber tanks in wings, with combined standard capacity of 3,028 litres (666 Imp gallons; 800 US gallons).

ACCOMMODATION: Crew of three (pilot, co-pilot, and flight engineer) on flight deck. Standard seating in main cabin for 38 passengers, four abreast at 787 mm (31 in) pitch. Interior layout has quick-change capability to passenger/cargo or all-cargo configuration. Access to main cabin is via forward and rear doors on port side; single door on starboard side; and a two-section loading ramp/door in underside of rear fuselage, aft of main cabin, which is openable in flight for air-drop operations. Provision for toilet, galley, and baggage compartment in passenger version.

SYSTEMS: Anti-icing and cabin heating systems standard. Hydraulic system, pressure 207 bars (3,000 lb/sq in), for flaps, landing gear, and nosewheel steering. 28V DC primary electrical system, with 300A starter/generator on each engine. Two nickel-cadmium batteries for engine starting and emergency power.

ELECTRONICS AND EQUIPMENT: Communications equipment includes UHF and VHF radios. Navigation equipment includes ADF, Tacan and transponder set. Optional equipment includes VOR/ILS and HF.

DIMENSIONS, EXTERNAL:
Wing span 24.90 m (81 ft 8.4 in)
Wing chord (centre-section, constant)
3.05 m (10 ft 0 in)
Wing aspect ratio 9.5
Length overall 19.74 m (64 ft 9 in)
Height overall 7.72 m (25 ft 3.8 in)
Tailplane span 9.12 m (29 ft 10.9 in)
Wheel track 3.86 m (12 ft 7.8 in)
Wheelbase 6.18 m (20 ft 3.4 in)
Propeller diameter 3.05 m (10 ft 0 in)
Propeller ground clearance
0.90 m (2 ft 11.5 in)

DIMENSIONS, INTERNAL:
Cabin, excl flight deck:
Length 8.095 m (26 ft 6.7 in)
Width 2.57 m (8 ft 5 in)
Height 2.23 m (7 ft 3.7 in)
Volume 45.45 m³ (1,605.0 cu ft)

AREAS:
Wings, gross 65.40 m² (704.00 sq ft)
Ailerons (total) 2.12 m² (22.80 sq ft)
Trailing-edge flaps (total)
11.69 m² (125.80 sq ft)
Vertical tail surfaces (total)
11.73 m² (126.30 sq ft)
Horizontal tail surfaces (total)
19.31 m² (207.80 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped
5,896 kg (13,000 lb)
Max payload 3,855 kg (8,500 lb)
Max T-O weight 11,340 kg (25,000 lb)
Max landing weight 11,113 kg (24,500 lb)
Max zero-fuel weight 10,120 kg (22,310 lb)
Max wing loading
173.4 kg/m² (35.51 lb/sq ft)
Max power loading
5.24 kg/kW (8.61 lb/ehp)

PERFORMANCE (estimated, at max T-O weight):
Never-exceed speed
295 knots (546 km/h; 339 mph)
Max level speed at 3,050 m (10,000 ft)
230 knots (426 km/h; 265 mph)
Max cruising speed at 3,050 m (10,000 ft)
220 knots (407 km/h; 253 mph)
Econ cruising speed at 3,050 m (10,000 ft)
175 knots (324 km/h; 201 mph)
Stalling speed, flaps down
66 knots (122.5 km/h; 76 mph)

Max rate of climb at S/L
564 m (1,850 ft)/min
Service ceiling 8,352 m (27,400 ft)
Service ceiling, one engine out
4,572 m (15,000 ft)
T-O run 534 m (1,750 ft)
T-O to 15 m (50 ft) 640 m (2,100 ft)
Landing from 15 m (50 ft) 579 m (1,900 ft)
Landing run 358 m (1,175 ft)
Range with max payload, reserves for 87 nm (161 km; 100 mile) alternate and 45 min hold
310 nm (574 km; 357 miles)
Range with max fuel, 45 min reserves
1,150 nm (2,131 km; 1,324 miles)

GRUMMAN
GRUMMAN AEROSPACE CORPORATION; Head Office and Works: Bethpage, New York 11714, USA

GRUMMAN A-6E/TRAM

An A-6E/TRAM (target recognition attack multisensor) version of the A-6E Intruder flew for the first time on 22 March 1974. The aircraft, on loan from the US Navy, was converted to the TRAM configuration to permit Navy evaluation of the concept. This was completed in July 1975, after 34 flights had made it possible for any shortcomings in the system to be identified and corrected. The Navy technical evaluation and operational testing phase, which began in February 1976, was able to verify that any problems had been resolved. Production approval for this latest and most important version of the A-6E was given in June 1976.

The mission of the A-6E is air-to-surface attack against a wide range of enemy targets, including aircraft at bases, ships, shipyards, ports, and port facilities; close air support; interdiction of rail, road, waterway, and seaborne transports; attack of enemy troops, facilities, and associated supplies. The TRAM conversion, in association with the electronics of a full-system A-6E, permits all-weather operation by day or night, under instrument or visual conditions. The TRAM system enables the crew of an A-6E to see at night, and provides new capabilities which include non-provocative day or night ship identification and surveillance, positive target identification and increased weapon accuracy, self-contained laser-guided weapons delivery, and electro-optical guided weapons delivery.

When this photograph of the TRAM-equipped A-6E was taken, the undernose turret was tracking the photographer (Howard Levy)

US Navy pilot checks the TRAM turret on an A-6E test aircraft before take-off (Howard Levy)

The A-6E/TRAM installation, in the aircraft's nose, is an electro-optical sensor package that includes a search radar antenna, a compressor, and a 0.51 m (1 ft 8 in) diameter turret projecting beneath the nose to house the detecting and ranging system. This comprises a gimbal housing for the FLIR (forward-looking infra-red) receiver, a laser designator/ranger, and a laser receiver. A high-resolution FLIR display and radar scope are mounted in the cockpit. In an attack with laser-guided weapons, the bomb-aimer/navigator observes both displays, which facilitates the handover from radar to FLIR for the terminal phase. The turret sweeps the entire terrain beneath the aircraft, permitting the pilot to manoeuvre freely after weapon release, while the bomb-aimer/navigator ensures that the laser is kept aimed at the target.

This new equipment is integrated with the electronics of a full-system A-6E, which include APQ-156 simultaneous multi-mode radar, ASQ-155 attack/navigation computer, ASN-92 inertial navigation system, C-8601/AWE armament control unit, dual ARC-159 UHF com transceivers, ARN-84 Tacan, APX-72 IFF, and USH-17 video tape recorder. Combined with the TRAM system it provides a unique detection, identification, and attack capability under adverse weather conditions. Also of importance is an ability to acquire and attack targets designated by a forward air controller on the ground. It is planned to integrate the McDonnell Douglas AGM-84A Harpoon air-to-surface anti-shipping missile for use by the A-6E and there are provisions for Rockwell's AGM-53 Condor air-to-surface missile.

Production of new A-6E aircraft is scheduled to end with the FY 1977 procurement of six, but conversion of 228 A-6As to A-6E configuration will continue through FY 1978. The inventory objective is for a total of 311 A-6E/TRAM aircraft to equip 12 US Navy and five US Marine Corps squadrons, with adequate reserves. It is anticipated that these aircraft will remain in first-line service into the 1980s.

Details of the basic A-6E airframe and power plant can be found in the current edition of *Jane's*.

At Nellis AFB, Nev., USAF's Fighter Weapons School gathers the Air Force's best fighter pilots and makes them better. Here, pilots do postgraduate work in the three T's—tactics, testing, and training . . .

Ph.D. for Fighter Pilots

BY MAJ. LESTER D. ALFORD, USAF

NELLIS AFB has earned its proud history as the Home of the Fighter Pilot, a history going back to the early 1950s and days of the USAF Gunnery School. Then, F-86 pilots learned to dogfight in the clear Nevada skies and fired their .50 calibers into targets on the barren desert floor, sharpening their skills for MiG Alley. Later, F-100s, then F-105s, provided combat crew training for another generation of fighter jocks, while Wild Weasel training spanned the gap between the early jet age and sophisticated aerial warfare of Southeast Asia. Such landmarks as "Dogbone Lake," "the Green Spot," "Thunderbird Lake," and "Sally's" are mentioned often by the "old heads" in war stories that begin, "Back when I was a Brown Bar goin' through Nellis. . . ."

Today, this tradition is carried on by myriad activities. TAC's heavy emphasis on realistic combat training is evident in all the flying activities centered here. Operation Red Flag is an ongoing mock war involving tactical air units from throughout the country, using the Nellis bombing and gunnery ranges. Large joint-service exercises, such as the recently concluded Bold Eagle 76, match aircrew skills against camouflaged targets, electronically simulated SAM sites, and a potent air-to-air threat. F-14s and F-15s will soon perform mock combat here in AIMVAL/ACEVAL, a joint service evaluation of air-to-air missile concepts, force sizes, and ratios. But to understand the full scope of Nellis' involvement in tactical training, let's look at its oldest tactical organization, the USAF Fighter Weapons School, and its formal flying training, the Fighter Weapons Instructor Course.

Unlike their predecessors of twenty-five years ago, students in this course arrive at Nellis as experienced tactical aviators. Only a handful are chosen each year for the four-month course designed to make them experts in all phases of fighter weaponry. As well as being an advanced gunnery course, its purpose is training instructors who will share their knowledge among USAF tactical units worldwide. "The course is a Ph.D. for fighter pilots," says Lt. Col. Larry Keith, Commander of the 414th Fighter Weapons Squadron. "We take our students to the outer limits in weapons and tactics, while teaching them to train others."

Exploring and defining these outer limits is the job of the USAF Tactical Fighter Weapons Center at Nellis, which reports directly to Tactical Air Command. It does this job through Tactics Development and Evaluations, Operational Test and Evaluations, and advanced specialized aircrew training. In short, tactics, testing, and training.

Flying activities of the Center, conducted at Nellis, are handled by the 57th Fighter Weapons Wing, parent unit of the Fighter Weapons School. In addition to the Fighter Weapons Instructor Course, the Wing supports the tests of new tactics and hardware, and hosts two Aggressor Squadrons. The Aggressors, equipped with F-5s and T-38s, provide adversaries in the air-to-air training at Nellis and also deploy extensively to TAC bases, providing dissimilar air-to-air training for the command's fighter crews.

From the Ground Up

The Fighter Weapons Instructor Course begins for fifteen F-4 Aircraft Commanders and eight Weapons System Operators when they gather in the main briefing room of the 414th Fighter Weapons Squadron. Distinctive, bright patches on their green Nomex flying suits identify squadrons from such faraway bases as Bitburg, Bentwaters, Torrejon, Clark, Holloman, and Homestead. Each was picked by his unit as a highly capable aviator. And each is aware of the legacy being offered him. They stare at pictures of Korean War aces McConnell, Jabara, and other Nellis alumni who patrolled the Yalu before these students entered grade school. On another wall are pictured Weapons School graduates who have downed MiGs in SEA, many of whom have returned to Nellis as instructors. The entire room is decorated with plaques and mementos of previous classes that underscore the toughness of the course. A gigantic pair of false teeth molded around a 20-mm cartridge carries the inscription, "Four months of biting the bullet." The students will soon experience how demanding the course can be.

Developing necessary debriefing skills is just as important as possessing stick and rudder abilities. Here, Maj. Rich Koehnke, 414th Fighter Weapons Sqdn. operations officer, assesses an F-5 aggressor engagement with students at the USAF Fighter Weapons School.

Further down the street at the 422d FWS, a similar scene is being repeated with four F-111 crew members. Although the F-111 course is aimed more at the specialized capabilities of that aircraft, all students will share common classes on weapons and seminars on tactics. Thus, the student is exposed not only to his own aircraft and systems, but to others, such as the F-15, which will join the Fighter Weapons School inventory later this year.

Students in both the F-4 and F-111 courses hear essentially the same thoughts in welcoming speeches. "There are no 'school solutions' in the Fighter Weapons School. We are here to teach you the basics of weapons and some tactics we have found valid. But when the balloon goes up, it will be your expertise as a Weapons Officer that determines which weapon and tactic you use. There is no way we can teach you everything you need to know either in the classroom or in the aircraft. To expand your knowledge in as many areas as possible the full facilities of the Fighter Weapons Center are at your disposal for the next four months."

Students have little time on their first day to reflect on the full facilities of the Fighter Weapons Center or the bright lights of nearby Las Vegas. They are inundated by textbooks and the schedule of academics awaiting them before flying. Only after a subject is thoroughly covered in the classroom will they practice it in the air. After the first few days of ground school, students ruefully eye a plaque donated by a previous class that reads, "1,000 hours of academics . . . and one flight!"

But F-4 flying training soon begins with the air-to-air phase, regarded as one of the most rigorous parts of the school. The aircraft is treated as a flying laboratory that will offer students a chance to practice various maneuvers and tactics. On the first sortie, they fly a series of confidence maneuvers designed to show them control characteristics of the F-4 at the outer and inner limits of the performance envelope. Students learn how the airplane reacts when it borders on an out-of-control maneuver. Even though they won't fight in these regimes, they learn to control the airplane there. The emphasis from the very beginning is instructor training, so the student must not only fly the maneuvers, but explain their aerodynamics in terms understood by the average fighter pilot. Formulas for turn rate, radius, and energy maneuverability must be mastered while such terms as corner velocity and best energy turns are blended into their vocabulary. Traditional maneuvers like the high-speed yo-yo, vertical rolling scissors, and Immelmann turn, practiced by every fighter pilot since Richthofen, are dissected and examined for their current applicability.

Show and Tell

Except for the three sorties devoted to basic fighter maneuvers, all air-to-air training is conducted against dissimilar aircraft, usually F-5s and T-38s of the Aggressor Squadrons. A student may understand maneuvers and tactics to use against another F-4, but since he probably won't face one in combat, it's important to learn what will work against a MiG and what won't. The Aggressors are masters of this art, employing enemy maneuvers, formations, and tactics that historically have proven valid. Early missions are flown one-against-one, stressing maneuvering skills and aircraft advantages. Then wingmen are added to both the Aggressor and F-4, and students learn to react in a multi-aircraft flight.

When the students return from these sorties, the mission is far from over. An extensive debriefing, which lasts longer than the premission briefing, reconstructs the engagement, turn by turn, and the entire flight is transformed into a series of

Capts. Larry Ernst and Charlie Sallee, both assigned to Luke AFB, Ariz., preflight an AGM-65 Maverick prior to launch on a tactics training mission. Each F-4 Fighter Weapons School student fires a Maverick during the terminal-guidance portion of the four-month-long course.

colorful chalk lines on a blackboard. Key points are brought out, pertinent radio calls described, and significant phases that affected the outcome are analyzed. Gun-camera film is reviewed to determine kills or misses. Portable audiotape recorders carried in each aircraft capture not only calls between aircraft and intercom calls between front and rear seaters, but pertinent comments as the crew "talks" the fight into the recorder.

Developing necessary skills to debrief these aerial engagements demands concentration and awareness as well as stick-and-rudder ability. If the student doesn't recognize his mistakes, and those of others, he won't be an effective instructor. In the first few sorties, the IP debriefs the mission but gradually the student learns to reconstruct and debrief the mission himself. Often, a flight is repeated, not because of lack of proficiency in flying, but because of a lack of understanding of what happened. "I won the fight, but lost the debriefing," lamented one student.

Future Fighter Weapons School students will soon have a valuable aid for air-to-air flight debriefings. The Air Combat Maneuvering Instrumentation (ACMI), currently being installed on the Nellis ranges, will link aircraft in an aerial engagement to a series of ground stations that measure airspeed, altitude, angle of attack, and other parameters. The ground stations are linked to a computer that determines relative position of other aircraft, firing parameters, and whether prebriefed maneuvering limits are being exceeded. The display is presented on a screen to an instructor sitting at the console, who monitors the entire fight. The computer also stores all information and will play back the entire battle, including radio calls, for flight debriefings. In addition to the real-time training value of ACMI, results of the engagements can be analyzed and used to determine effectiveness of maneuvers or tactics. The range being installed at Nellis is a prototype Air Force installation, and others will be available later at locations in the US and overseas.

Tactical Teamwork

Graduation exercises for Aerial Attack come in the dart phase. The wood and aluminum dart target, towed 1,500 feet behind another F-4, is attacked with the 20-mm internal Gatling gun. Initially students practice the racetrack and butterfly patterns, then on the third sortie attack the Combat Dart. On this mission the scenario is set as close to actual combat conditions as possible. The dart tow meets the two shooters head-on, sometimes from GCI vectors, and, after a "Tallyho" call, the battle begins.

Capt. Jack Clark, a student from Torrejon AB, Spain, describes his experiences with Combat Dart: "My wingman had the first Tallyho, so he sliced down hard into the fight while I went up in the vertical to the inside of his turn. I picked up the dart and cut across the circle, while my wingie took a quick shot. My backseater got a radar lock-on and we called an AIM-7 (Sparrow) shot, then closed for a high deflection gun pass. My wingman was in a better position by now, so I repositioned in the vertical while he attacked for a high angle shot. He fired, overshot, and the dart tow reversed on him, which gave me good position for an AIM-9 (Sidewinder) shot. He broke for my simulated missile shot and I closed for guns. My backseater locked up with the radar, with a good breakout between the tow ship and the dart. We fired a burst of about 100 rounds at 1,500 feet and I saw tracers settle into the target and big pieces fly off. Throughout the entire attack, our airspeed never got below 400 KCAS [knots calibrated airspeed], and my wingman and I maintained good mutual support until we separated from the fight."

A major part of air-to-air training is the crew coordination necessary in a two-place aircraft. Weapons System Operator Lt. Steve Heaps from Bentwaters RAF, England, describes his role on the Combat Dart mission: "Jack and I had talked quite a bit about how we'd handle the fight. I knew when to get my head in the scope to get the lock-on and when to look outside and check the wingman's six o'clock. Jack told me where to look with the radar and, on the pass where we hit the dart, I had the lock-on before he picked up a visual, so my call that the dart was ten degrees left at two miles provided him an early visual. It was a good feeling to know that the crew coordination and timing we had practiced all the way through the air-to-air phase finally paid off."

To effectively teach such realistic training requires highly capable instructors, and those at the Fighter Weapons School are chosen carefully. All are previous graduates who have extensive operational experience as weapons officers. Most have at least two combat tours in the F-4. Each instructor is a recognized expert in a particular field and teaches

The author, Maj. Lester D. Alford, entered the Air Force in 1964 through ROTC after graduation from Kenyon College. He has flown more than 2,700 hours in the F-4, including some 400 combat missions. In 1968, he was a member of the combat evaluation team that developed tactics for laser-guided bomb delivery in Southeast Asia. For the past four years, he has been assigned to the Fighter Weapons School as an instructor and as Flight Commander of the Terminal Guidance Flight. He has been involved in new tactical employment concepts for terminal guidance systems, including Maverick and Pave Spike. Major Alford has recently been assigned to Hq. USAFE in the Weapons and Tactics Division.

the academics associated with his specialty. This in-depth knowledge is translated into texts that are used not only within the School, but also as reference works by fighter crews throughout the tactical air forces. In addition to his specialty, each instructor participates in all phases of the flying training, maintaining a well-rounded knowledge of different subjects.

Liaison trips to tactical fighter units are frequently scheduled to keep the School in touch with problems of the field. Instructors brief the latest weapons and tactics being tested at Nellis and then fly with operational pilots, learning at first hand the problems and new ideas of a particular squadron.

In addition to liaison with tactical units, instructors become involved with many projects related to new systems. The trend in weapons development today brings the user into the development process much earlier than before. Thus, the Fighter Weapons Center, and the instructors, are often called upon for expertise in projects related to their specialty. The Air Combat Fighter Source Selection Board, for example, looked to the air-to-air flight for advice during the F-16 selection process.

Ideas and solutions to new and old problems are often published in the *Fighter Weapons Review,* a quarterly School publication that provides an exchange of unclassified information within a broad segment of tactical aviation. *The Tactics Analysis Bulletin,* published by the Fighter Weapons Center, covers classified material on weapons and tactics.

Down in the Weeds

Following the rigorous aerial attack training, students progress to the air-to-ground phase. New challenges await them here, as tactics and formations demand precise maneuvering as low as 100 feet. Initially single-ship, low-level navigation missions, flown both visually and on radar, terminate with simulated nuclear deliveries. Then missions on a scored range sharpen dive-bombing and gunnery skills, while sorties on the electronic warfare range expose the student to indications of SAM launches and AAA firing.

Throughout the entire course, the School employs a building block concept. Easier skills are taught as preparation for the tougher tasks. An example of this approach is the F-4 Terminal Guidance phase, in which students learn to employ the electro-optical weapons—HOBO and Maverick. On the student's first ride, he learns systems operation from the back seat while the IP demonstrates principles of low-altitude flying and maneuvers the student will fly on his next mission. On the second flight—a two-ship formation —the student aircraft commander practices medium-altitude maneuvers for the first half of the mission and then descends to low altitude to attack from a trail position. This allows adjustment to flying close to the ground in an easy formation. Then we shift to line abreast and practice delayed 90-degree turns and minimum time pop-up attacks that stress mutual support. On the third sortie, the student briefs and leads the same tactics he saw as a wingman, fires a live Maverick missile, then practices mutual support at low altitude in a limited communications environment. Thus, in only three flights, a student who has usually had no previous electro-optical experience, and little in low-altitude or limited-communication environments, is exposed to several new ideas.

Academic training continues with courses on weapons, fuzes, and optimum methods of employment. The latest precision-guided munitions are studied, along with Pave Spike, the Air Force's new laser designator system that will enter the Fighter Weapons School syllabus later this year.

In the last month of training, class members prepare a detailed plan of attack against an actual enemy target complex. In this seminar, students from both the F-4 and F-111 courses join forces to calculate which weapons will produce the highest kill probability, what type and numbers of aircraft should strike various target elements, and how many support aircraft will be needed for SAM suppression, ECM, and air-to-air refueling. Then, specific target tactics are developed for each flight. The overall plan is presented for critical review by instructors and key staff from both the Wing and Center. Experts in each phase of instruction offer comments, while senior staff members decide merits of the overall plan.

Putting It All Together

The final phase of flying training, Ground Attack Tactics, is an extension of this seminar. Scenarios detail a steadily escalating war in which various missions, including close air support, armed reconnaissance, and deep interdiction strikes are flown using live ordnance. The final tactics missions are deep-penetration strikes of a multithreat target area, defended by electronic emitter sites and the Aggressors, who team up to provide an integrated air defense network. To counter this threat, students use F-111 and F-4 strike sorties, F-105 Wild Weasel support, F-4 air-to-air flights, and limited GCI help. Ingenious plans are hatched to achieve surprise, minimize exposure time, and destroy the target. The end results embody all the students' skill and cunning, and provide accurate yardsticks of their expertise as weapons officers.

Graduation time finally nears. End-of-course critiques contain such comments as, "Flying here has been the most realistic, challenging, and rewarding of my career." "I'm grateful for the opportunity to train as I expect to fight." "I gained more knowledge here in four months than I could in virtually a full career of normal operational flying."

Yet, along with these plaudits, students usually offer constructive ideas for change in the School. Each class experiences a slightly different curriculum, reflecting comments and suggestions of previous graduates. The 57th Fighter Weapons Wing's Commander, Col. William L. Strand, sums up this aspect of the School: "We are the only Air Force unit with the assigned mission of continually exploring optimum methods of employment for tactical fighters. In this dynamic, constantly changing field, we can't afford the luxury of thinking we have all the answers. We constantly evaluate and respond to the many new ideas from the field as well as the ones we develop at Nellis. Then, bringing our students into the process closes the loop. This is what makes the Fighter Weapons School the place where fighter pilots learn to do it better." ■

Not "Bombs away!" but "Birds away!" came the cry from the World War II B-26 as the author found himself in the midst of . . .

THE GREAT PIGEON EXPERIMENT

BY LT. COL. RICHARD E. FALCONER, USAF (RET.)

IT WAS early 1944, and we were exporting bombing aircraft in job lots. The Air Transport Command, with Caribbean Wing Headquarters in West Palm Beach, Fla., handy to Morrison Field, was responsible for moving the aircraft over the first few thousand miles of the route. The initial leg seemed long and frightening to our pilots: 1,003 miles from Morrison to Borinquen Field in Puerto Rico, over water and small islands, none of the latter suitable for emergency landings. Our sea rescue system of radio checkpoints and powerful crashboats, spaced at intervals down the Bahamas, helped morale if little else. None of us cared to examine closely the realities, which bordered on black humor, of a ditching in those shark-infested waters.

Truly humorous, however, was the scheme revealed to me one morning by our chief of operations. He sat down in my office and fixed me with his hard blue gaze.

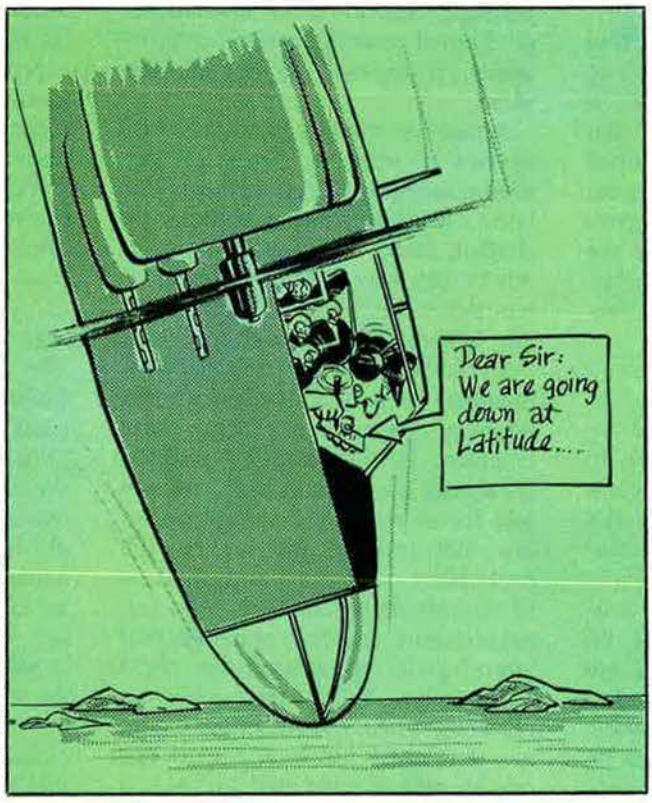
"We are about to conduct an experiment of earthshaking importance," he said. "A genius has decided that our rescue operation down the Bahamas is too expensive. He has a solution. Carrier pigeons."

"Carrier pigeons?"

"Right," said the Colonel. "If a pilot finds himself and crew plunging toward the drink from seven thousand feet, he will fill out a form describing nature of trouble, aircraft position, etc., etc.; place it in an aluminum capsule; attach the capsule to the pigeon's leg; and release the bird. The pigeon will home on Morrison Field, and on its arrival the command will know that a valuable airplane and ten good men are in bad trouble five or six hundred miles down the line."

"Then what?"

"Our genius hasn't got that far yet," said the Colonel, with possibly a trace of bitterness. "Well, we are now faced with the Great Pigeon Experiment, Phase I. I mean, you are. That phase will determine the feasi-



—CARTOONS BY BOB STEVENS

"If a pilot finds himself and crew plunging toward the drink . . . he will fill out a form."

bility of launching pigeons from an aircraft moving at, say, one-sixty mph. The General has decided that you will conduct said experiment as of six-thirty a.m. tomorrow. You will fly out to sea, launch pigeons, then return and report. Your name may go down in history along with da Vinci, Galileo, Franklin, and other famous experimenters. On the other hand, it may not."

"Holy cow, Colonel," I said, "why me? The wing historian isn't supposed to be knowledgeable about pigeon behavior."

"You will go, Major, because, to quote the General, you are our only expendable officer. If you get sucked out of the aircraft in the slipstream, the wing will survive. You will take the B-26. Granted, she cruises at about two-seventy, but that will just make our conclusions more conclusive. Right?"

I told him I didn't want any part of it.

"Our genius has a pal high up in government," he announced. "And, by the way, wear a chute when you're working over the open hatch. Take along a length of rope, also, and tie yourself in."

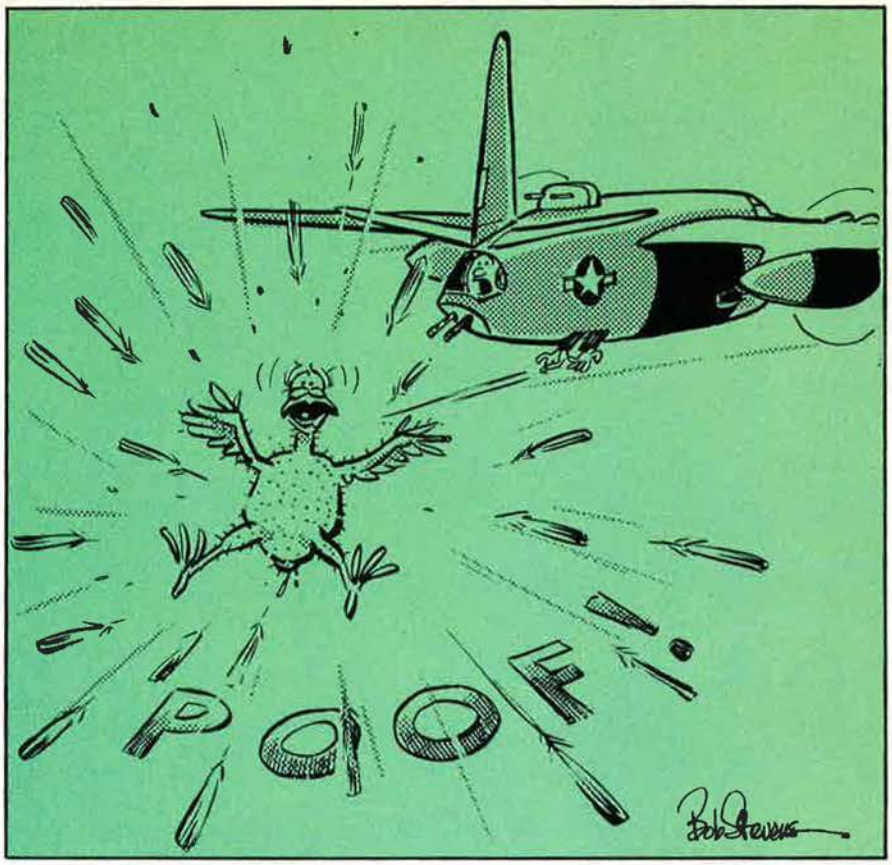
****

In the morning I found a Master Sergeant, a Corporal—both pigeon experts—and a crate of six pigeons already in the tail of the B-26. The Sergeant and I decided that I would launch the birds from the little hatch in the floor of the airplane while he observed from the tail-gunner's office.

About thirty minutes after takeoff, I opened the hatch. Although small, it yawned like hell's main gate, and the wind screamed outside like a banshee. The Corporal and I used both chutes and rope, neither of us having any desire to join our pigeons in flight.

I reached into the crate and grabbed my first victim. He was entirely friendly. I knew a moment of shame, but stifled it. Duty first, lads. I folded the pigeon's wings close to its body, head pointing aft toward home, reached down through that screaming hole, and turned him lose. I lurched and for a moment of panic thought I was going to follow the bird, which doubtless would have served me right.

The bird vanished instantly, and at once I heard the Sergeant's incredulous yell. He left his place and hollered in my ear: "Major, that damn' bird didn't have no more feathers than a baby's prat! He was plumb nekkid!"



". . . that damn' bird . . . was plumb nekkid!"

The powerful slipstream had ruined a sixth of our experiment. I wondered if the Colonel might not have had something like this in mind when he assigned us the B-26.

I tried another pigeon, with identical results. The Sergeant wanted to try a couple of launchings. With a foxy grin, he reached into his jacket and pulled out a sheaf of large paper bags. He said he would put the next bird in a bag and see what happened. It sounded reasonable. I went back to my observation post. The bag hurtled into view, dropping away from the airplane in a whirling bundle. The pigeon never had a prayer. I reported this, and the Sergeant looked crestfallen. I had a burst of inspiration: split the bag down one side and try again.

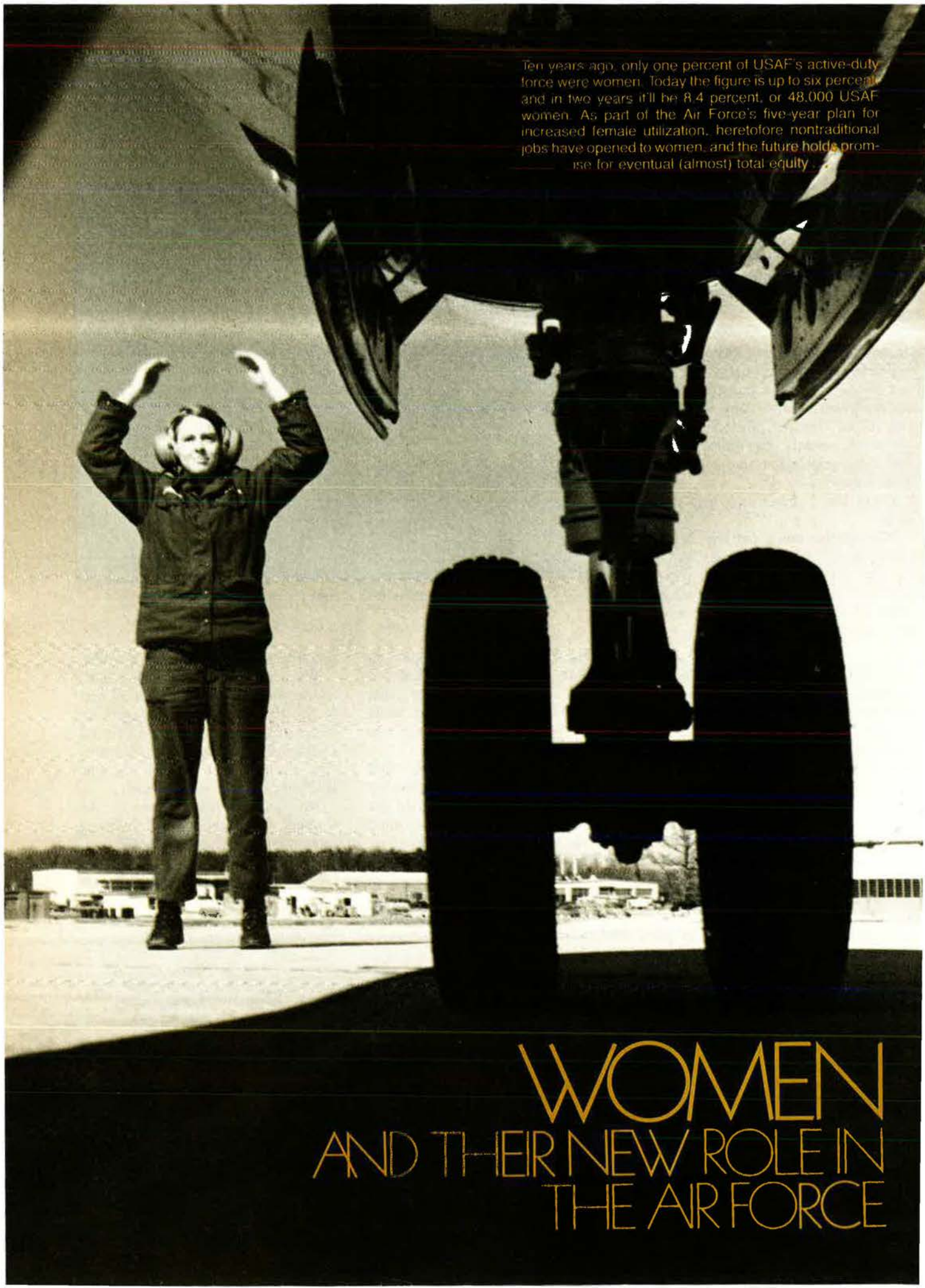
To my astonishment, it worked. The bag unfurled and released our bird. He did a couple of wild loops and snaprolls, then squared away on a course that took him straight west.

We used the two remaining birds in the same manner. One got off perfectly, the other never escaped his paper prison. Our score was two out of six, with the added scientific note that, even clad in a split bag, the bird's escape was not assured.

My detailed report went to the Colonel, and I never heard anything more about the Great Pigeon Experiment, for which I was grateful.

So, I'm sure, were the pigeons. ■

The author, a long-time member of AFA, joined the Army Air Forces in January 1942. Two years later, he was assigned to Morrison Field, Fla., as Air Transport Command wing historian, a job he says he got "probably because nobody else wanted it." It was there the incident described in this article took place. He was later assigned to Brisbane, Australia, and left the AAF in December 1945. He returned to the active Reserve in 1948, and attended Command and Staff School and various intelligence schools before his retirement in 1962. This is his first article for AIR FORCE Magazine.



Ten years ago, only one percent of USAF's active-duty force were women. Today the figure is up to six percent and in two years it'll be 8.4 percent, or 48,000 USAF women. As part of the Air Force's five-year plan for increased female utilization, heretofore nontraditional jobs have opened to women, and the future holds promise for eventual (almost) total equity . . .

WOMEN AND THEIR NEW ROLE IN THE AIR FORCE

A DECADE ago only 9,000 of the 900,000 active-duty USAF members were women. That's one percent. And many of them were anything but enchanted with their status, and their prospects, feeling they were "locked in" to a handful of typical "women's jobs" regarded as dead ends. They were not fully integrated into the regular establishment and they endured dependency and other inequities.

These drawbacks that made careers in uniform unpopular with many women were clearly mirrored in reenlistment and retention rates well below those for male airmen and officers. The Air Force and the other services were not getting a fair return on their investment in their women members.

Fortunately, most of that has changed. There has been a mild "women's revolution" in all the services, USAF particularly. And in the Reserve components and the ROTC, many more women are embracing part-time USAF military training.

Noteworthy is the USAF women's first-term reenlistment rate that, for the past several years, has topped the men's rate. The same thing is occurring in overall retention figures—the women are now leading the race.

Although the total Air Force active-duty population has fallen to 585,000, the number of women is nearly 35,000, or almost six percent of the total. Besides more than 29,000 enlisted women, the figure includes about 1,600 line officers and 3,400 nurses and other medical people *(see accompanying chart).*

And there's more. If all goes according to plan, the number of USAF women will reach 48,000, or 8.4 percent of the total force, in less than two years.

Until recently in the Reserve components, women were conspicuous by their absence. Today, some 6,700 of them serve in the Air National Guard and Air Force Reserve, and by FY '78 that figure should rise to 11,550, Pentagon authorities say. Among students, Air Force now enrolls 2,500 coeds in college ROTC units and another 10,000 in high school Junior ROTC. Prior to 1969, there were none in either program.

This boom didn't just happen, of course. A Pentagon study group in the late 1960s first explored the idea of increased utilization of women. But even the most promising military projects often move with the speed of a broken-down brewery horse, and it wasn't until early 1972 that the Defense Department intensified efforts to make the services models of equal opportunity. Until then, the main equity plank was equal basic pay and some—not all—allowances.

Expanding Opportunities

Two things touched off the drive: passage of the Equal Rights Amendment (not yet ratified by two-thirds of the states), and the need for a contingency plan to secure troops after the draft ended. With the new deal for military women definitely on, Air Force trotted out a five-year plan calling for annual woman-power increases to the aforementioned 48,000 figure. And Defense declared that women at long last would be eligible for most noncombat jobs.

Subsequently, USAF opened all but three (pilot, navigator, and missile operations) of the total of forty-eight officer career fields, and 232 of the 243 enlisted occupational specialties to them. Among the seven airmen skills still not open to women are such combat-related billets as loadmaster, in-flight refueling operator, and aerial gunner.

Although it's difficult to change habits overnight—and some weren't excited about leaving administrative and clerical work—many USAF women have opted for "nontraditional" assignments. In 1972, for instance, only twenty-three women worked in the electronics career field; today, the total exceeds 2,300. During the same period, the twenty-one in the civil engineering field has grown to more than 1,000 and includes carpenters, electricians, plumbers, and 250 metal workers.

Representative samplings of women in other nontraditional Air Force career fields show 1,498 in aircraft maintenance, 1,428 in aircraft accessory maintenance, 1,342 in command control systems operations, and 188 in missile electronic maintenance.

The security police career field, which already has 916 women members, is headed for an increase of 100 or more with the recruiting, this month and next, of specially picked security specialists for extensive training in the entire range of tasks involved in that career area.

So while new horizons are developing, about 6,500 USAF women continue to serve in the most "traditional" job area of them all—the health service. The Air Force has 3,250 nurses, headed by one of the force's two female generals, Brig. Gen. Claire Garrecht, and some 200 female physicians, dentists, veterinarians, medical administrators, and biomedical science officers. The nurses, of course, are accepting a greater medical role by assuming, under USAF's physician extender program,

USAF Women
Strength by Grade—June 30, 1976

Officer			Enlisted	
	Line	*Medical*		
Brig. Gen.	1	1	E–9	12
Colonel	5	49	E–8	30
Lt. Col.	33	245	E–7	79
Major	86	548	E–6	183
Captain	495	1,279	E–5	1,389
1st Lt.	462	849	E–4	8,422
2d Lt.	500	412	E–3	11,278
Total	1,582	3,383	E–2	5,367
			E–1	2,475
			Total	29,235

The USAF women's expansion project has resulted in a heavy influx of nonmedics into uniform in a short period, all at the entry grades. Thus, their grade structures are overloaded in the lower ranks and compare unfavorably with nurses and other health specialties. Authorities look for the passage of time and expected continued high retention of line officers and enlisted women to improve their grade distribution substantially.

BY ED GATES, CONTRIBUTING EDITOR

some of the duties traditionally performed only by doctors.

Approximately 3,000 female airmen work as health and occupational therapists, laboratory and aircrew life specialists, dental and aeromedical assistants, and in other medical jobs.

Equalizing Benefits

Expanding career opportunities isn't the whole story; law and policy changes of recent vintage also have helped make the service a better place for women to live and work.

A major breakthrough came with a Supreme Court ruling that overturned the assumption that only male members could have dependent spouses. The decision, the Defense Department said, allowed the wife in an in-service marriage to claim dependency of the couple's children; previously, such children were presumed to be dependents of the male member.

The ruling opened dependent medical care and travel payments to service women's civilian husbands, and provided women quarters and family separation allowances equal to those given servicemen.

The Pentagon, in 1974, ruled that military women who become pregnant or otherwise acquire minor children need not leave service, as was required before. Single or married, they now retain the option of staying or leaving, and many in the USAF are staying. But pregnant women are expected to perform their duties like anyone else until they cannot work comfortably or safely. At that point they go on medical leave, returning five or six weeks after delivery in a normal case. Hq. USAF disclosed that last year 1,115 Air Force women became mothers.

The chance for a more satisfactory family life within the service obviously has improved considerably in the wake of these improvements. Lt. Col. Vivienne C. Sinclair, a Hq. USAF staffer who monitors policies affecting women Air Force-wide, noted that forty-three percent of women members are married, compared to only thirty-two percent two years ago. These are not just people deciding to marry after entering military service, but include many who did so before they enlisted or were commissioned.

Most married Air Force women have Air Force husbands, Colonel Sinclair said. The service also plays helpmate to its in-service couples by assigning, wherever possible, both parties to the same or nearby stations. Ninety percent requesting co-location are so assigned.

USAF officials cited these other significant actions which have enhanced the women's movement:

- The complex management system that until recently included a special Air Staff office headed by a Director of Women in the Air Force, and separate squadrons at bases complete with a "house mother" atmo-

Nearly 7,000 women are members of the Air Reserve Forces, including (from left) A1C Patricia McMerty, Amn. Doreen Thomas, and Sgt. Ellen Rising, all assigned to the 119th Air National Guard Fighter Interceptor Group, Fargo, N. D. Here they're preparing to load a missile on a fighter aircraft.

sphere, have been eliminated. The move fully integrated women into their units of assignment and saved several hundred personnel spaces.

- Age, mental, and educational standards for entering the Air Force have been equalized. Previously, women eyeing USAF membership faced tougher rules than young men.
- Pilot and navigator training has been opened to women officers on a test basis. The first ten have already begun working for their wings. Conceivably, this project could be extended to larger numbers later on.
- For the first time, they have entered the Air Force Academy. Only four of the 157 enrolled had dropped out after the first six weeks, a lower attrition rate at that point than among male cadets in the entering class.
- They are receiving their fair share of the more sought-after assignments. Many now occupy Air Staff billets, for example, where five years ago, except for the WAF director and her assistants, there were almost none. Air Staff posts, of course, are normally reserved for the most talented people and sometimes pave the way to star rank.
- Whereas they previously couldn't serve in scores of locations, most are now open. Ninety-five percent of the short-tour sites take women, and single E-3s and below are assigned to 249 worldwide sites, nearly triple the number four years ago.

Word of improvements gets around, and many well-qualified young women are banging on USAF's door for early admission. Many don't make it. Waits for vacancies in various administrative skills stretch out for a full year. Similarly, women applicants for commissions top openings by a wide margin except in certain scientific and highly technical skills.

Progress and Problems

Not many years ago, Air Force women reenlisted at a rather dismal twenty-one percent rate, well below the men. Total losses of enlisted women exceeded thirty-three percent annually. In other words, one of every three departed each year, hardly an efficient performance. The annual male loss rate was a fairly healthy one out of five.

While the overall male turnover rate remains at about twenty percent, the figure for women has dropped to 18.5 percent. Equally impressive is their first-term reenlistment record—a lofty fifty-three percent that may be unmatched by any large group of first termers of any US military service in recent years. Second-term and "career" re-up rates, however, do find USAF men ahead, by percentages of sixty-eight to forty-eight and ninety-one to eighty.

Despite these generally favorable statistics, problems have accompanied the women's expansion-improvement program. Some who took on such traditional men's-only jobs as aircraft maintenance, helicopter mechanic, and electronics communications, couldn't handle the strenuous physical and operational demands, according to a recent report by the General Accounting Office. Inability to lift heavy equipment, change tires, carry heavy toolboxes, operate jacks, etc., was cited frequently.

GAO, the congressional watchdog of federal spending, in its report quoted an Air Force wing commander as saying, "We have created a management problem by placing women in jobs where they cannot perform their share of the work, particularly aircraft maintenance and repair. We must find a way to correct the problem."

The GAO probers, who also interviewed individual Air Force women and supervisors, added that some women receive unfair treatment because men assume they cannot perform a job. Sometimes men in units resent treating women as equals, the report added.

Military officials went to work on the problem, and the USAF Surgeon General determined that the average woman has only sixty percent of the strength of an average man. The decision came down: not all jobs should be filled with an equal distribution of women.

Accordingly, Air Force guidelines now call for measuring the physical capacity of both men and women in four stages, based on age, stamina, weight, and other factors. Recruiters use these aids in steering newcomers into jobs they can handle physically, while improperly assigned people are switched to more appropriate work.

A key USAF personnel policy-maker is Brig. Gen. Chris C. Mann, who, as Deputy Director for Human Resources, keeps close tabs on programs and problems affecting the service's nearly 35,000 women members. General Mann has spent most of her twenty-three-year military career in personnel posts. She was the first USAF woman to graduate—in 1974—from the National War College, and a year later won her star. Her husband is a retired USAF lieutenant colonel.

Women in the Other Services

Women's programs in the other military services have also boomed. The Army of a decade ago, though nearly twice the size of today's force, had only 13,000 women. Presently, it counts 46,000 and is driving for 53,000 within two years. Army assigns women to 403 of the 438 Army occupational specialties. An additional 37,000 women serve in the Army Reserve and National Guard.

Navy, which got the jump on the Air Force in training women pilots, has six flying helicopters and transports and eight more in flight training. The sea service had 8,800 women five years ago, compared to 23,000 today; it plans to add about 1,000 more.

The Marine Corps has 3,500 women members, more than double its complement ten years ago. The expansion may level off at about 3,800.

Brig. Gen. Chris C. Mann, USAF's lone woman line general, acknowledged that there have been problems with both men and women who cannot handle the physical aspects of some jobs. But she feels the efforts in testing physical capability are paying off and the assignment-utilization process is moving satisfactorily.

Grade Distribution Trends

Although the WAF establishment is ancient history and officials now consider women fully integrated in all activities, General Mann keeps a close eye on the expansion program. It's part of her job as chief of the Human Resources Development program. One new element of this project is a ten-hour human relations education course, mandatory during the next year for all E-4 sergeants and above.

The course focuses, in part, on "the treatment of Air Force women." And to underscore its emphasis on the topic, Headquarters has distributed Air Force-wide a new booklet that course instructors will use titled, *Women in the Air Force, a Guide to Better Understanding.*

Another positive step likely to enhance the women's movement is the appointment in August of Nita Ashcraft, a California management executive, as Assistant Secretary of the Air Force for Manpower and Reserve Affairs. She is the first woman appointed as the top manpower-personnel official in any US military service.

Officials are also pleased that some forty women officers hold command positions, including one wing commander. Most run lower-echelon units, but more important commands appear headed for female control as their force matures and gains more rank, something they urgently need.

As the strength-by-grade chart (*see box, p. 57*) reveals, women line officers are overly concentrated in the company grades; only 125 are field-graders. The current enlisted distribution is also overloaded in the lower grades.

General Mann said that these strength-by-grade breakouts are inevitable because of the exceedingly heavy intake of E-1s and O-1s during the force expansion of the past three years. In a few years, she added, as line officers and enlisteds move up the promotion ladder, they will fashion a grade structure proportionally much closer to the total Air Force distribution.

Still, the fact that only two USAF women currently hold star rank and just five line officers wear eagles, compared to forty-five in the health services, is difficult for some quarters to accept. Figures provided by Hq. USAF also reveal that only 302 of the 1,582 line officers hold Regular commissions, although this, too, should improve as young officers enter Regular Air Force eligibility zones.

USAF's five-year, 48,000-female-member plan, however, is clearly holding a steady course. And though it's coming to an end in FY '78, officials at Hq. USAF are already checking out personnel requirements, male and female, by career field, for the 1980 period and beyond. If total USAF troop strength holds at the budgeted figure of about 570,000, womanpower may edge up a bit further, but probably not much above 50,000, authorities believe.

At any rate, they're convinced—and there's considerable evidence to support them—that the service has come a long way in building an attractive, talented, and hard-working women's force that enjoys equity with male members on nearly all fronts.

"We have crossed most of the hurdles," General Mann declared. ■

At Tyndall AFB, Fla., 2d Lt. Sharon Mowrey and Amn. Margaret Miller use radar to help two F-106s attack a target drone.

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USAF'S CRUSADE TO STREAMLINE INDUSTRIAL PRODUCTION

Breaking with tradition, the Air Force is about to take a direct, active interest in how aerospace industry produces weapons and other military systems and in combating obsolescence of manufacturing technology and tools.

BY EDGAR ULSAMER, SENIOR EDITOR

LAST YEAR in April, Deputy Secretary of Defense William P. Clements, Jr., called urgent attention to what is rapidly becoming an Achilles' heel of US national defense—the obsolescence of the defense industry's manufacturing technology. He directed the service Secretaries to identify and "aggressively exploit" opportunities to reduce weapon-systems costs through advanced manufacturing technologies. Mr. Clements stressed creating incentives for defense contractors to make capital investments in modern, more efficient manufacturing facilities; DoD's own procurement of modern production equipment; providing "seed money" to improve manufacturing productivity; and reexamining the feasibility of multiyear contracting.

The Secretary's challenge included several specific recommendations, including the comprehensive use of computer-aided manufacturing, laser welding, diffusion bonding, and other sophisticated means to cut waste of manpower and other resources. He cited a specific example: "We are spending approximately $60 billion each year in this country to remove metal from parts where it is not needed. We should, therefore, develop and apply manufacturing processes that permit fabrication of parts closer to required net shapes. This would not only reduce metal removal costs, but would also conserve many critically short, expensive strategic materials."

The Clements memorandum formally ended an era that goes back to the birth of the airplane, and in some instances even further. That period was dominated by the notion that nobody understands manufacturing better than American industry; in general, therefore, the military buyers stayed out of the production process and developed no broad understanding of manufacturing technologies. One noteworthy exception to this unwritten rule was Air Force-sponsored development of numerical control (automated) machine tools in the 1950s that, over the past decade, cut DoD's manufacturing costs by about a billion dollars and, overall, saved the nation about $3 billion.

USAF, through the Air Force Systems Command, is clearly and enthusiastically in the forefront of the Defense Department's drive to catalyze advanced, economical manufacturing technologies and to develop the necessary in-house expertise. It is ironic, Gen. William J. Evans, AFSC Commander, points out, "that we are building the most modern Air Force the world has ever known, and that we are doing it, in many cases, with equipment that would be at home in a museum." For instance, he believes there is "a tremendous opportunity to take advantage of the computer, to assist in design, engineering, and manufacturing operations." Convinced that modernized aerospace manufacturing operations mean "superior aircraft and weapon systems at reduced costs," he states bluntly that "firms that fail to replace obsolescence and inefficiencies are going to feel the results because we are going to find better and better ways of buying efficiency." AFSC's interest in better manufacturing is understandable; more than half of its $10.7 billion current annual budget goes to acquisition, and the share will reach two-thirds by 1980.

Why has a large segment of the US aerospace industry, usually thought of as being in the *avant-garde* of technological innovation, slipped into manufacturing obsolescence? Among the reasons are the special nature of government business, the intrinsically fast obsolescence of aerospace technology, and as a consequence, the obvious difficulty of continuously raising the funds needed to keep manufacturing tools and processes up to date.

The Air Force is looking for ways to ameliorate the capitalization dilemma, according to Lt. Gen. Robert T. Marsh, AFSC's Vice Commander: "We are considering, in addition to the generally available ten percent tax credit, such incentives as termination liability, guaranteed amortization, interest credits, increased profits, and possibly entering into sharing agreements along the lines of value engineering clauses." When airlines buy aircraft, they do so on the basis of binding commitments to specified quantities; when the Air Force, or any other service, buys airplanes it can do so only in annual increments authorized and funded by Congress.

Even in the best of cases—programs with a good likelihood of steady out-year funding due to associated foreign military sales contracts—the contractor can't give definitive assurance to his banks that future Congresses will fund the full complement of aircraft or other systems that the government has programmed, that his cost calculations are based on, and that his production line must be able to handle. Defense Department proposals to change to a multiyear funding policy have been scuttled by Congress with regularity because of the sitting body's understandable unwilling-

ness to make commitments in behalf of a future Congress.

The way around this roadblock, according to General Marsh, may be "a form of termination liability. If the contractor can prove to us that certain front-end investments will be amortized over the planned production run, we then pledge that if the production run is cut short by the government he will be reimbursed for the unamortized portion of his investment. We are seriously considering such approaches."

Brig. Gen. Hans H. Driessnack, AFSC's Deputy Chief of Staff for Procurement and Manufacturing, said that the Defense Department and the Air Force see an urgent need for changes in federal tax laws to speed up plant expansion and purchase of modern manufacturing equipment through accelerated depreciation write-offs and other incentives. The straight-line depreciation standards in effect today, according to General Marsh, fail to provide industry with the incentives to modernize manufacturing equipment because of inadequate allowance for the rapid obsolescence that results from the inherently fast pace of aerospace technology.

AFSC Vice Commander Lt. Gen. Robert T. Marsh favors a form of termination liability.

Brig. Gen. Hans H. Driessnack is AFSC's new DCS for Procurement and Manufacturing.

Col. Michael A. Nassr heads AFSC's Directorate for Manufacturing that funds new production technologies.

AFSC's Business Management Posture

During the past two years, AFSC did an extensive review of the role of manufacturing within the command's mission in general and in relation to life-cycle costing in particular. These studies triggered a series of changes including the decisions to seek a "stronger business management posture" for Air Force Systems Command and to play a more active role in nurturing the industrial base in the aerospace sector.

Among the first results of this reorientation were:

- Elevation of the manufacturing function at AFSC headquarters to the DCS level by redesignating the Deputy Chief of Staff for Procurement as DCS/Procurement *and Manufacturing.*
- Consolidation of all manufacturing and related functions under a special Directorate for Manufacturing currently headed by Col. Michael A. Nassr, as a key component of DCS/Procurement and Manufacturing. The Directorate oversees an industrial preparedness budget of about $65 million that includes the Air Force manufacturing technology program and management of $1.5 billion worth of USAF-owned industrial facilities.
- Creation of deputates for procurement and manufacturing at AFSC's Aeronautical Systems Division, Electronics Systems Division, and Space and Missile Systems Organization, all to be headed by general officers; and the appointment of Directors of Manufacturing at the colonel/GS-15 level at major System Program Offices (SPOs).

The first order of business, according to General Driessnack, is to develop the Air Force's in-house expertise in various manufacturing disciplines, from labor productivity to manufacturing cost estimating: "We know that such a buildup takes time but we are going to make it as rapid as possible. We are going to establish a small Product Engineering Service Office [PESO] at Hq. AFSC to assist the field in applying such skills. Our plan is to pick up about half of the manufacturing experts we need for this office from industry. What we want is recognized experts who can hit the ground running." Colonel Nassr envisions a mix of about eighty percent civilians and twenty percent military in staffing AFSC's various manufacturing jobs. A complete training program, including specialized military and civilian career development, academic training, EWI (Education With Industry), and personnel exchanges with industry, is being prepared.

Toward Greater Productivity

The ultimate payoff of AFSC's manufacturing improvement plan must be greater productivity at Air Force-owned plants (twenty-seven at present, a number that will continue to decline over the coming years) and at contractor-owned facilities. The two principal means for achieving greater productivity are modernization of production facilities and accelerated development of new manufacturing technologies. Manufacturing tech-

N. E. Klarquist of the Manufacturing Technology Division of the Air Force Materials Laboratory is shown fitting an isothermally forged torque rib into an F-15 horizontal stabilizer.

nologies of prime concern involve airframe assembly, composite fabrication, integrated electronics, electronic standard modules, and electronic and engine component repairs, according to Colonel Nassr.

The single most promising AFSC program to enhance industrial productivity is ICAM (integrated computer-aided manufacturing), termed by General Marsh a "revolutionary new initiative that offers a chance to improve manufacturing activities to an extent hardly imagined before the age of computers." The Air Force hopes to become DoD's executive agent for ICAM. The program is still in early development and meant to accelerate and integrate various separate government-sponsored projects of the aerospace industry.

Computer-aided manufacturing, in the view of Dr. C. M. Pierce, Chief of the Manufacturing Technology Division of the Air Force Materials Laboratory at Wright-Patterson AFB, Ohio, represents a logical progression from numerical control machine tools and adaptive control. The latter is a technique developed recently under Air Force sponsorship to optimize the manufacturing processes of the F-15 and F-16 programs. Oversimplified, adaptive control links numerical control machine tools to an electronic controller that constantly adjusts the speed and feed of the tool to maintain the highest possible productivity just below the point where a breakdown would occur. Results to date have been impressive: Machining time required to produce the F-15's titanium parts has been reduced by thirty-five percent in the so-called rough-cut process and by twenty percent in the fine cutting, resulting in cost savings to the F-15 program of "several million dollars." The same adaptive control units are now being installed by General Dynamics at Air Force Plant No. 4, where the F-16 is being produced, and similar savings can be realized. This cost-saving technique is also being used in producing the Navy's F-14.

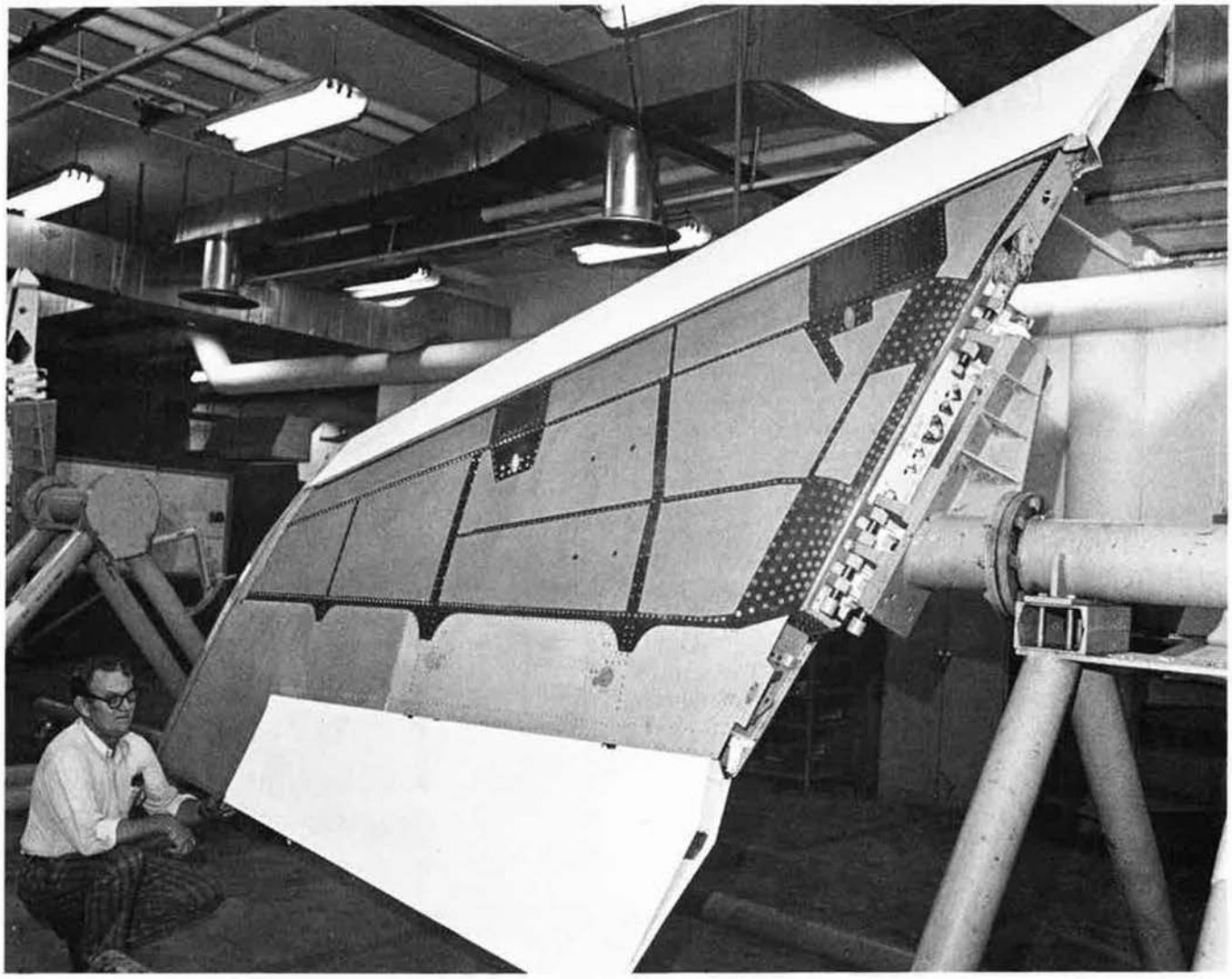
ICAM takes automation a gigantic step further and, in the process, links design to manufacturing in real-time. It puts the entire manufacturing process under direct computer control, creating a loop that extends from the automated machine tools, their programming and scheduling, to material flow, inventory control, manufacturing

DoD Establishes Federal Procurement Institute

The Defense Department, acting as the government's executive agency, is setting up a Federal Procurement Institute (FPI) in the Pentagon to oversee and improve what and how the government buys. The Institute, according to Hugh E. Witt, the Administrator for Federal Procurement Policy, Office of Management and Budget, will deal with all phases of procurement, from R&D management to contract administration. It will act as central clearinghouse for all government activities associated with planning, developing, carrying out, and evaluating procurement research and the training of procurement specialists.

Government procurement is big business, involving purchases of some $66 billion annually and about 80,000 military and civil service procurement experts. The Defense Department accounts for the lion's share in both categories, about seventy-one percent of the federal procurement dollar and about seventy-five percent of the manpower.

FPI will be guided and directed by a policy board comprised of twenty members and chaired by Mr. Witt. The members are the principal procurement executives—assistant secretaries or equivalent level—of the participating government organizations and include Assistant Secretary of Defense for Installations and Logistics Frank Shrontz as the senior DoD representative. Dr. Malcolm R. Currie, Director of Defense Research and Engineering, serves as Secretary Shrontz's backup on the Institute's policy board. FPI's primary job is "to provide leadership and assistance in improving the quality, efficiency, and performance of procurement personnel."



Vought Corp.'s Vought Systems Div. produced this wing panel, composed mainly of graphite, boron fibers, and binder materials, under contract from AFML. Composite wing sections of this type will be used on A-7 Corsair II attack aircraft.

cost estimating, automatic measuring and inspection, automated heat treat and chemical processing, and speed and feed selection. Initial studies of ICAM indicate that it can eliminate the various flaws and blemishes that mar even the best manufacturing process at present. A revolutionary aspect of ICAM is the flexibility that it introduces to the production process. Production-line shutdowns or startups can be handled quickly and cheaply and will cause less fluctuation of the labor force because of the high degree of automation of the process.

Labor's reaction to ICAM's impact on the work force is difficult to predict but there is reason to believe that it will not be significantly different from earlier experience with plant automation, in the view of Air Force experts. If the conversion to greater automation takes place gradually and is tied to retraining of employees, major work force turbulence can be avoided and opportunities for better jobs and higher pay increased. The problem may be eased further by general trends away from blue-collar jobs that of themselves, in the view of DoD's production experts, will require greater automation of the defense industry in the years ahead.

A direct and important benefit of computer-aided manufacturing, according to Colonel Nassr, is its ability to bridge the traditional gap between design engineering and manufacturing. The two functions can be linked into a common, real-time information system that enables the designer to weigh the effects of his work on the producibility of the product. This has real dollars-and-cents meaning: By knowing in real time how design details affect materials cost, machine time, scheduling, tooling equipment, and a host of other factors normally outside the ken of the design engineer, he can make instant adjustments and tradeoffs to assure a better, less costly product.

The end-result that AFSC's planners envision is a double acronym, CAD/CAM, which spells *nirvana* to DoD's weapons acquisition experts: the melding of computer-aided design and computer-aided manufacturing. A common computer data base would link all phases of design, from analysis to drafting, to all aspects of manufacturing, including process planning, tool design and manufacture, and machine-tool programming and machine-tool control. Further, there would be rapid feedback of information to the designers from the automatic inspection of the finished part.

Such an arrangement, General Marsh said, "is essential if we are really serious about low-cost manufacturing

and low-cost acquisition. It gives the only real chance for unification of the product design with the manufacturing plan in order to balance maximum product performance with the goal of cost-effective production." AFSC seeks a budget of about $20 million for ICAM, starting with FY '78.

AFSC's New Manufacturing Technologies

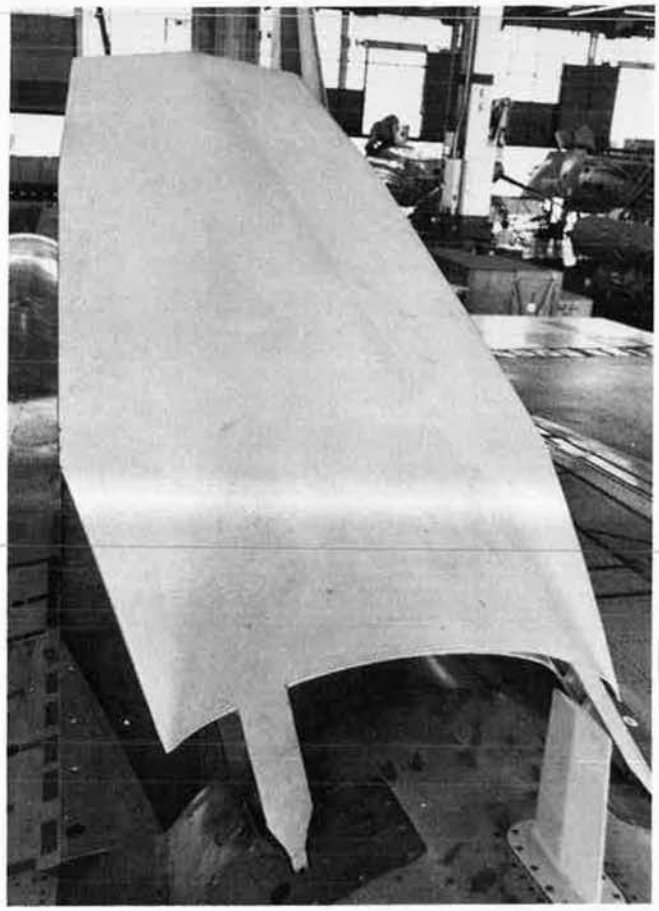
While widespread use of ICAM technologies by the aerospace industry is not likely before the 1980s, other Air Force work toward lower manufacturing costs is already paying off.

A key feature of the Air Force's new close air support A-10 aircraft is the 30-mm GAU-8 gun that provides a major portion of the weapon system's tank-killing capability. The rounds of the 30-mm gun include a special armor penetrator, made of depleted uranium. This material is both heavy and expensive to machine. The price of each penetrator, if machined from extruded rods, is about $20. Present Air Force plans call for the purchase of 18,500,000 GAU-8 rounds. The Air Force Materials Lab, working with the A-10 System Program Office, has developed techniques to forge these items. As a result, Dr. Pierce said, the unit cost has dropped from $20 to $8, at a total saving of $220 million. In a further step to bring down the GAU-8 costs, the Laboratory has found ways to cast these penetrators that could bring their price down to $4 and produce an additional cost cut of $74 million. Qualification of the cast penetrator is currently pending.

The Materials Lab, according to Dr. Pierce, funded at a cost of $328,000 the development of microwave acoustics manufacturing technologies to lower the cost of electronic tubes. These technologies were used to produce the ALQ-117 electronic countermeasures equipment of the B-52 and, so far, have led to savings of more than $5 million.

Isothermal forging is another innovative, cost-cutting manufacturing technology developed by the Air Force. The process reduces by as much as half the amount of costly titanium used in forging lightweight aircraft components and reduces or even eliminates the machining needed to produce a finished part. Predicated on the use of highly heat-resistant nickel-base alloy dies that can be heated to 1,700 degrees Fahrenheit—the temperature at which titanium is shaped—this process makes it possible to produce forgings that are close to—and eventually perhaps even identical to—the final parts configuration and exhibit more uniform mechanical properties than were attainable previously. In addition, isothermal forging techniques do not require the heavy presses needed for conventional titanium forging. More than 100 F-15 parts are being, or soon will be, forged using this new technology.

In similar fashion the Air Force Materials Laboratory demonstrated the economic and qualitative advantages of HIP—or hot isostatic pressing—a technique of "pressure cooking" superalloy discs for engines and titanium fittings for airframes. Involving temperatures of about 2,400 degrees Fahrenheit and pressures of about 15,000 pounds per square inch, HIP literally "cooks" superalloys or titanium in powdered form into solid shapes. Although still at a nascent state, the process is so controlled that dimensional tolerances can be held to plus or minus one percent of the desired finished shape. With further refinements, the process might eliminate the need for machining entirely.



This speed brake on the F-15 air-superiority fighter is made of a new graphite epoxy material developed by the Air Force Materials Laboratory and the Air Force Flight Dynamics Laboratory. This part is a less expensive, lighter weight structure than the conventional speed brake made of aluminum.

This summer AFML's Manufacturing Technology Division scored a significant advance in composite materials manufacturing with the development of a tool that simplifies fabrication of aircraft fuselage sections made of graphite epoxy materials, reduces the manufacturing cost, and improves the quality of the product. Equally pioneering are AFML-sponsored programs to improve aircraft engine manufacturing through the use of laser drilling and cutting of titanium and other superhard metals. Two different approaches were demonstrated successfully recently, one involving General Electric and the other the Boeing Co. Both processes can cut labor costs significantly and boost the quality of the product.

Selling New Manufacturing Technology

Recent analyses show that, on the average, about thirty percent of the cost of USAF's aircraft goes to labor, making it the single biggest cost factor, according to General Driessnack. Human error is a major cause of flaws and failures of aerospace products. When implemented, automated arrangements such as computer-aided

design and manufacturing can be expected to go a long way toward solving both the cost and quality problems.

The Air Force is equally concerned with increasing the efficiency and productivity of the aerospace industry's work force through improved work standards. Air Force studies indicate that between thirty and forty-five percent of the direct manufacturing labor man-hours the government pays for are "nonproductive," Colonel Nassr said. Efficient management of labor productivity based on work measurement and work standards has become a major Air Force concern. "It has not always been easy to convince industry that efficient labor management is *all* we want but we do want *that*. We don't want to run industry's plants, but we want labor productivity standards applied on our contracts," he told AIR FORCE Magazine. The B-1 program includes a work standard that future Air Force and DoD acquisition programs can be expected to emulate, he said.

Whether the Air Force Systems Command's investments in the development and demonstration of sophisticated manufacturing technologies pay off or not is determined by the aerospace industry's willingness to adopt these new techniques and invest in needed equipment. Communicating the information to industry is important and is being emphasized through special public relations drives. So far, Colonel Nassr believes, "industry has not incorporated new manufacturing technology as rapidly as we had hoped. We are spending a good deal of money on these programs and we can only justify continued investments if industry sees fit to use these cost-cutting, quality-improving approaches."

The Air Force, through its contractors, continues to develop new manufacturing technologies to a mature state and demonstrates both feasibility and economics to make adoption by the contractor as risk-free as possible. The government's primary means for asserting leverage toward the use of low-cost manufacturing technologies are production capability reviews prior to award of a contract. These reviews will become increasingly more stringent. In cases where new equipment is essential, General Driessnack said, competing contractors will be required to commit themselves to the purchase of new equipment *prior* to source selection.

Early Involvement

A previously underemphasized aspect of all management policies directed at reducing acquisition costs is, in the view of AFSC experts, the early involvement of all component elements of the acquisition process. The picture is changing now. "We want the manufacturing personnel aboard just as soon as possible," he said.

"Any delays are likely to cost us money later on," according to Colonel Nassr. The phases at which AFSC plans to seek broader participation by manufacturing groups include conceptual assessments, trade-off studies, business strategy sessions, "murder boards"—the command's free-for-all reviews of a program's planned request for proposal's overall merit—competitive as well as incentive arrangements, design reviews, and program reviews.

Concern with early involvement is mated to the government's revitalized value engineering policies. Value Engineering (VE) was in vogue in the 1960s but subsequently lost luster for a variety of reasons. VE clauses in a contract stipulate that if the contractor, with or without the government's assistance, finds ways—once the job is under way—to do it cheaper through redesign or by other means, he gets a certain percentage of the savings as extra profit. This concept and its advantages, in General Marsh's view, are as valid today as they were ten years ago.

Assuring Industrial Preparedness

It is a declared national goal to maintain industrial readiness at all times, meaning that the facilities, production equipment, and skilled workers necessary to meet the Defense Department's wartime production requirements should always be available. There is concern throughout the Defense Department about industry's ability to do so. Secretary of Defense Donald H. Rumsfeld told Congress earlier this year: "We see signs that certain sectors of our industrial base have neither the capacity nor the desire to respond to defense surge requirements, as in the case of the foundry industry and fastener manufacturers. The reduced capability of industry to respond to defense requirements has progressively serious implications for support of our forces." Steps to redress these deficiencies include means for safeguarding critical subcontractor production capabilities and establishing "an early warning system to identify, in advance, possible supplier closedowns and material shortfalls," he added.

DoD is reviewing all government-owned facilities to identify those special sectors of industry that are critical to defense needs and that require continued government ownership. Their equipment and plants will be modernized to reduce weapon-systems costs and lead times. Those plants and equipment not requiring government ownership will be removed from the DoD inventory "at an increased rate," Secretary Rumsfeld reported. In the case of USAF, the facilities phase-out program has lowered the number of Air-Force-owned plants from seventy in 1964 to twenty-seven at present, with comparable declines scheduled to continue. Phaseouts will reduce the investment in these facilities—currently about $1.5 billion—to about $1 billion two years from now. The Air Force is going out of the industrial equipment business, according to General Marsh, because of the belief that "such ownership is rightfully in the industry's domain. However, we are continuing to establish and maintain existing government-owned equipment where it has been declared necessary for industrial preparedness planning, or when industry is unable or unwilling to provide equipment."

Key industrial preparedness areas of specific concern to the Air Force are the ability of US engine producers to support mobilization plans, possible erosion of the sub-tier industrial base, and the condition of the forging and landing-gear industries, General Marsh pointed out.

Current DoD and Air Force programs stand a good chance of bringing about a turnaround in industrial preparedness that will provide what General Evans terms the proper balance of quantity and quality to provide the strength that ensures deterrence: "As with any insurance, better to have it and not need it, than to need it and not have it." ■

The Curtiss Hawks

BY BRIG. GEN. ROSS G. HOYT, USAF (RET.)

THE first pursuit plane designed and built in this country was the Thomas-Morse MB-3. Its main claim to fame was its introduction to metal airframe in the later models produced by the Boeing Co.

With the passing of the MB-3, the Army Air Service (which became the Air Corps in 1926) changed its method of designating aircraft types. From 1925 on, pursuit aircraft were designated "P," rather than using the initials of the manufacturer. And from 1925 to 1930, the Curtiss Airplane & Motor Co. dominated the Air Corps pursuit field with its Hawk biplanes.

Curtiss retained the same basic airframe for the P-1 through the P-6, with some modifications of the frame, the addition of more advanced subsystems, and frequent engine improvements. In the P-1, for example, the "C" version was the first pursuit to have toe brakes. The P-2 was created by replacing the Curtiss V-1150-1 engine of 435 hp with a Curtiss V-1400 (D12) of 500 hp. The P-3, of which only six were built, had a radial engine. There was no Curtiss P-4, and only five P-5s, with a supercharged V-1150-3 engine, were built. Out of Curtiss and Air Corps experimentation with more powerful engines and other refinements came the P-6E.

My first contact with the Curtiss Hawks was with the P-2. In September 1926, I flew a P-2 with the V-1400 (D12) engine as backup plane in the pursuit race at the Sesquicentennial Celebration at Philadelphia. I came in third, competing with an Air Corps P-1 equipped with a Curtiss V-1570-1, 600 hp engine (the Conqueror engine), and a Navy plane equally powered.

The Hawks were sturdy, easily maintained airplanes, and the Curtiss engines were exceptionally reliable. These characteristics were demonstrated many times. The 1st Pursuit Group's ski-equipped P-1s commanded by Majs. Tom Lanphier and Ralph Royce performed exceptionally well in extended subzero winter maneuvers. On March 6, 1929, I flew a P-1B on a dawn-to-dusk round trip of 3,000 miles from Bolling Field, D. C., to Kelly Field at San Antonio, Tex., and return without stopping the Curtiss V-1150-3 engine.

From July 18 to July 21, 1929, I flew a P-1C known as the Curtiss Hawk Hoyt Special from Mitchel Field, N. Y., to Nome, Alaska, and return to Valemont, British Columbia—halfway back—where I was forced down by water in the fuel. The aircraft was equipped with long-range tanks, giving it a range of 1,200 miles. Flying time totaled forty-nine hours and thirty minutes without either airplane or engine maintenance.

The flight not only demonstrated the reliability of the equipment, but also the potential of pursuit aviation to support long-range bombardment missions. The lack of such support was critical and tragic early in World War II, causing deep-penetration missions in Europe to be delayed until long-range fighters were available.

At the Spokane Air Races in 1927, Air Corps Hawks won first and second places at 201 and 189 mph. The winner had skin radiators, which accounted for its superior speed, but they were never made standard, since they would have been too vulnerable in combat. Both planes were powered by the Curtiss V-1570-23 Conqueror engine.

After the Spokane races, eight aircraft were procured by the Air Corps for service test. Continued experimentation with engines and improved streamlining led to the P-6E, similar in appearance to the P-1 but with the Conqueror engine. It still had fixed landing gear, an open cockpit, and its arma-

The P-1A and P-6E

	P-1A	P-6E
Power Plant	V-1150-1 435 hp	V-1570-23 600 hp
Wingspan	31 ft., 7 in.	31 ft., 6 in.
Length	22 ft., 10 in.	23 ft., 2 in.
Height	8 ft., 7 in.	8 ft., 10 in.
Wing area	250 sq. ft.	252 sq. ft.
Weight, Empty	2,041 pounds	2,699 pounds
Loaded	2,866 pounds	3,392 pounds
Max. S/L Speed	160 mph	198 mph
Cruising Speed	128 mph	175 mph
Initial Rate of Climb	2,170 fpm	2,400 fpm
Service Ceiling	20,200 ft.	24,700 ft.

At top: The P-1, first of the Curtiss Hawks. Lower photo: The P-6E in the sporty paint job designed by the author, then a captain.

ment was still only two .30-caliber guns. Some of the first P-6Es were used to experiment with such improvements as a closed cockpit with sliding canopy, and wing guns, neither of which appeared on production aircraft until the P-36 Hawk came out six years later.

A production order for forty-six P-6Es was placed in July 1931. We received twenty-five of them in the 17th Pursuit Squadron, 1st Pursuit Group, during the spring of 1932.

The squadron's insignia was a diving snow owl. Using that motif, I designed a painting scheme for the entire airplane, depicting it as the owl, as shown in the accompanying picture. I took the 17th Squadron to the 1932 Cleveland Air Races with twenty-two of its P-6Es so decorated, and led it in daily demonstration flights. A picture of a formation of nine P-6Es which I led in a perfect line-abreast was taken above the clouds over Selfridge Field, Mich. Through the years, it has appeared innumerable times in books and magazines. *(See General Hoyt's article, "Metamorphosis of the Fighter," October 1975 issue.)*

That picture, and the demonstration flights at the Air Races, earned the P-6E the accolade of "most beautiful fighter plane ever built."

It is doubtful that the P-6E would have been effective in combat with its two .30-caliber guns, but it was a pleasant airplane to fly, with no bad flying or landing habits. It handled easily, was a good training plane, and it remained in service until replaced by the Boeing P-26A in 1934. ■

The author, General Hoyt, was active in military aviation from 1918 until his retirement in the closing months of World War II. His report here on the Curtiss Hawks is one of a series of short reports on aircraft of that era.

What They're Saying...

Arms Verification Factors

From the Administration's 1976 Arms Control Report, prepared by the US Arms Control and Disarmament Agency:

If arms control agreements are to contribute to the security of the US and to international stability, they must be adequately verifiable. Verification—the attempt to determine whether the other parties to an arms control agreement are complying with its obligations—is a critical element of the arms control policy of the US.

The verification of arms control agreements has several purposes. First, verification serves to detect violations of an agreement, or to provide evidence that violations may be occurring. Second, by increasing the risk of detection, it helps to deter violations. Finally, by providing evidence that an agreement is in fact being observed, it enhances domestic and international confidence in that agreement, contributes to mutual trust among the parties, and creates an atmosphere conducive to further progress in arms control.

Verification depends to a considerable extent on sophisticated techniques of intelligence collection, but there are important differences in the objectives of verification and intelligence. While arms-related intelligence seeks to determine the numbers, characteristics, and activities of an opponent's military forces, verification attempts to prove a negative—that certain force levels are *not* being exceeded, that certain activities are *not* taking place. For the purposes of verification, then, it is necessary to pay attention not only to military deployment and testing areas normally used by the other parties, but also to areas which *might* be so used. For verification must begin with the possibility that violations of an agreement may occur—and assume that a concerted attempt will be made to conceal them. . . .

It is important to stress that verifiability is not a matter of black and white. Almost no agreement that proposes to limit modern weapons can be verified with total certainty through present or currently conceivable techniques of verification. Verifiability is a matter of judgment, and requires a balancing of considerations of different kinds. . . .

Assessments of verifiability must take into account, in the first place, the character of the restrictions to be imposed. Bans, for example, are in general more easily verified than numerical limits, and bans on testing or deployment are easier to verify than bans on research. Of equal importance are the characteristics of the weapons or forces to be constrained. Objects that are large and stationary (for example, missile silos) are easier to count and keep track of than objects that are small and mobile (for example, soldiers); limitations on discrete or countable objects are, as a rule, easier to verify than limitations on qualitative changes in technology. Thus, the SALT I Interim Agreement, which imposed numerical limits on objects relatively easy to count, poses fewer difficulties for verification than an agreement on reduction of forces in Europe, or an agreement involving qualitative limits on nuclear warheads.

It is one thing to determine to what extent an arms control agreement is verifiable; it is quite another to decide whether its verifiability is adequate to safeguard our security interests. The latter requires a political rather than a technical judgment. A critical aspect of the verification process is ensuring that the technical facts of verifiability are properly conveyed to those who must assess them in the light of the political questions which any arms control agreement must raise. Much will depend on an assessment of the past record of the other parties and of the current state of our relations with them. Much will depend on the risk posed by possible violations and on our ability effectively to counter them. Much will depend as well on our own foreign policy choices. Some lessened degree of verifiability may be acceptable if the political benefits of a treaty are judged to be sufficiently important.

Verification by "national technical means"—by the employment of modern techniques of intelligence gathering which do not require agreed access to the territory of the parties being monitored—is the main approach currently used. The SALT I agreements were the first arms control agreements to make explicit provision for verification by national technical means, and to forbid interference with such verification methods as well as the use of deliberate concealment measures designed to impede their operation. Although technical verification is subject to definite limits (the type of warhead contained in a missile, for example, cannot be distinguished except through observation of test firings), a continuing effort to improve such methods may permit us to expand the scope of arms control agreements in the future.

It is, of course, equally important that we maintain our present capabilities. Many of the technical systems that contribute importantly to the monitoring of current agreements (and that could prove valuable in verifying future agreements in the areas of strategic arms and nuclear testing) are located in other countries; it is extremely important to ensure their continued availability. We must also take the necessary steps to protect the secrecy of our intelligence techniques and procedures. If the detailed characteristics of our verification capabilities remain uncertain, violations are more likely to be detected; if they become known to our adversary, he is provided with a blueprint for violating an agreement with little risk of detection.

Arms control requires effective intelligence, not only for verifying agreements in force, but also for assessing the intentions and capa-

bilities of nations which are parties to agreements. The ability to make such assessments in an accurate and timely manner is essential if arms control policies are to harmonize with changing security requirements. Intelligence on intentions and trends is particularly critical as it bears on developments affecting the prospects for nuclear proliferation.

Provisions for access to the territory of, or to facilities controlled by, the other parties to an agreement also play a role in verification. On-site inspection is a feature of the 1959 treaty banning military activity in Antarctica, and inspections of stations operated on that continent by the Soviets and other signatory nations are carried out on a regular basis by US observer teams. . . .

Future progress in some areas of arms control may well depend on a greater readiness on the part of the Soviet Union and its allies to consider arrangements of this kind. In evaluating the role of on-site inspection and related measures in future agreements, however, it is important to distinguish between the symbolic or political value of such measures and their actual worth for verification. In most cases they will act primarily as a supplement to national technical means.

Military Aviation Prospects

From the National Aeronautics and Space Administration's recent study "Outlook for Aeronautics":

To meet defense needs, it is anticipated that the US will continue to maintain a balance of conventional strategic and tactical forces. The development of new military weapon systems will result from both the need to maintain a parity in strategic forces and the need to provide tactical and support forces that can effectively uphold US foreign policy.

The Strategic Arms Limitation Talks of 1972 (SALT) institutionalized the strategic stalemate. Although SALT may tend to stabilize the US demand for military aircraft, the foreign demand will tend to increase. For the ten-year period ending 1982, 122 countries will require an estimated 29,000 new military aircraft with a value of $95 billion. European countries are expected to require almost forty percent of this total, and these countries are making strong efforts to capture a large share of the world export market in addition to providing for their own needs.

The primary factors which will influence future military aviation developments may be summarized as follows:

- The two major military powers, the US and the USSR, are likely to continue to seek and maintain détente. Thus, strategic weapons will continue to be developed, but at a rate that will not disturb the present balance.
- An increased number of secondary powers will emerge, due to their abundance of natural resources and/or technological know-how, whereas progress in the poorer nations may be slower due to over-population problems and lack of food. The combination of more countries competing for political and economic influence may result in localized unrest in several parts of the world throughout the remainder of the twentieth century.
- The ability of the US to react, when necessary, to protect national interests and help preserve peace will be limited by the reduction in overseas bases that have in the past been used as staging areas. This situation will tend to emphasize the importance of both long-range sea and air logistics and short-range tactical and support forces.
- It is probable that these capabilities will be developed within constrained budgets and that new aircraft and weapon developments will feature minimum life-cycle costs and have multimission application, wherever this is feasible, in order to reduce development and production costs.

On the basis of these general considerations and as a result of more detailed discussion with the Department of Defense, it is believed that aircraft and weapons developments will take the following directions:

(1) Toward very long-range and long-endurance flight requiring more efficient subsonic aircraft.

Representative developments contributing to this direction, together with likely dates of introduction, are as follows:

Derivative Transport/ Tanker aircraft	(1985)
Long-Endurance Surveillance and Patrol Aircraft	(1985)
Very large logistic transport	(1995)

These aircraft allow long-range surveillance from the US and permit US-based forces to be deployed, when necessary, without requiring intermediate staging areas and without the necessity for refueling at the location of force deployment. Long-range logistic support and long-duration surveillance will become increasingly important.

(2) Toward more efficient short-range support and logistic capabilities requiring multimission V/STOL aircraft and rotocraft. Representative aircraft developments in this direction include the following:

Long-Range Rotocraft	(1985)
Subsonic V/STOL Fighter Aircraft	(1985)
Carrier-borne Multimission V/STOL Aircraft	(1990)

Mission requirements are expected to lead to the development of a mixture of STOL, VTOL, and advanced rotocraft for the future. These aircraft would expand the radius of control and action about aircraft carrier or supply ships and provide extended support and logistics to forward areas in localized battle situations.

(3) Toward more effective tactical systems emphasizing the optimum combination of aircraft, advanced weapons, and remotely piloted vehicles.

Included in this direction are potential developments in:

Derivative Fighter Aircraft	(1985)
Maneuvering Missiles and RPVs	(1985)
V/STOL Supersonic Fighters	(1990)
Advanced Fighter/Bomber	(1995)

These aircraft and weapons are aimed at short-range air superiority through improved local reconnaissance and greatly improved speed and weapons effectiveness; they require a high degree of design integration among airframe, propulsion system, and weapons. There will be continued derivative developments of supersonic attack and fighter aircraft, both for all-weather applications and as day fighters; some designs will have V/STOL capability. In addition, missiles and/or remotely piloted vehicles will become increasingly important. In all of these developments technology must provide low-cost approaches to offset the increasing cost trends of the past decades. Unconventional weaponry, such as lasers, may lead eventually to greater departures from conventional design. ■

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By James A. McDonnell, Jr., MILITARY RELATIONS EDITOR

Reserve Incentives—Another Try

Educational assistance, enlistment bonuses, earlier retirement pay—these and other AFA-backed incentives to improve Reserve Forces manning have attracted supporters in recent years. But not enough in high places, and Administration budget cutters have prevailed to block them.

Recently, however, several incentives have received a new look. One given a chance of success allows Reservists and Guardsmen who have qualified for retirement pay, but haven't reached age sixty to collect it, to buy up to $50,000 worth of Servicemen's Group Life Insurance. The present limit is $20,000. The plan is in the form of a legislative proposal the Defense Department has sent to the Office of Management and Budget for clearance.

Not as far along, but getting official attention, is a new version of the oft-discussed tuition assistance plan. It is designed to bolster recruiting and retention in the Reserve Forces by paying half to three-quarters of an individual's tuition costs. Medical coverage for Reserve Forces members injured while going to and from drills has also gotten some recent renewed attention.

All the Reserve Forces are understrength, and even the Air Force Reserve and Air National Guard have suffered recruiting-retention setbacks recently. The AFRES, for instance, wound up FY '76 nearly 5,000 persons short of its 53,000 goal. Against a recruiting "objective" of 10,600 persons for the year, it took in only 9,447. The Air Guard was looking for 18,522 recruits, but got only 16,125.

Many Pentagon officials urgently support new incentives to improve Reserve Forces manning, but the Administration has continued to reject virtually all new projects carrying a price tag.

Included in that group is a two-year-old DoD plan to overhaul Reserve retirement pay rules. It provides for lowering the retirement age from sixty to as little as fifty, but at steep pension reductions. The measure also contains a modest bonus payable to survivors of Reservist-Guardsmen who, though qualified for age-sixty retirement pay, die before reaching that point.

Reserve Forces members have long complained about this absence of protection and military benefits during this "limbo" period, frequently ten to fifteen years. But this pension-bonus measure has been blocked by OMB because it carries a multimillion-dollar price tag.

The $50,000 SGLI plan provides at least some dependent protection and helps "bridge the gap" during the limbo period. Supporters also note that the Survivor Benefits Program (SBP) is not effective for Reservists until they reach sixty.

Participants would pay the SGLI premiums, though they are well under typical commercial insurance rates. This, of course, means no cost to the government and explains why the Administration is expected to endorse the SGLI proposal. The $50,000 term insurance would end when the member began drawing retirement pay.

In a related development, the House Armed Services Committee has approved a Senate-passed bill giving a small group of Reserve widows SBP payments they should have received all along. Their retired Reserve husbands died after their sixtieth birthdays but before the first day of the following month, and a legal technicality has blocked their SBP benefits. Early enactment of the bill was forecast.

AFA's Deputy Assistant Executive Director James A. McDonnell, Jr., right, and John Ford discuss the House Armed Services military compensation subcommittee's recent vote in favor of improving the Survivor Benefits Program. Mr. Ford is chief counsel for the subcommittee. Mr. McDonnell testified in support of the improvements. Later, the full Armed Services Committee approved the SBP changes (see item).

SBP Changes Snagged

Significant changes to the Survivor Benefits Program designed to attract more participants ran into

a late summer snag. The occasion was a House Armed Services Committee meeting to consider a bill containing such AFA-backed features as (1) elimination of the "lock-in" for retirees without an eligible spouse, and (2) reduction from two to one year of the time a couple must be married for the survivor to collect SBP benefits.

But the bill lacked what AFA and many other organizations consider of great importance—a provision to slash the 100 percent offset of military-earned Social Security payments with the SBP annuity. So, Rep. Bob Wilson (R-Calif.) introduced an amendment reducing the offset to fifty percent, and it was initially approved 16–9.

However, Chairman Sam Stratton (D-N. Y.), whose subcommittee earlier rejected the offset change, opposed the Wilson amendment. Stratton said it was too complicated and that the Defense Department opposed it. A serious discussion between the pro- and anti-amendment forces followed. Committee Chairman Melvin Price (D-Ill.), who sided with Stratton, finally nullified the favorable vote on a technicality and adjourned the session without action on the bill. At press time, in a reopened session, the Stratton Bill, with Wilson amendments, passed 18–14. Early action by the full House is anticipated.

At the same meeting, the Committee approved (1) bonuses of up to $9,000 a year for doctors who entered service under the Berry Plan, and (2) recomputation of retired pay for about 2,800 retirees recalled voluntarily during the Vietnam War. They had not been allowed to include that service in their pay; the bill would let them.

Academy Coeds Off to Good Start

Freshmen women at the Air Force Academy were sticking it out better than their male classmates as the new class—the first ever with coeds—completed basic training in August and began the academic program. And, if the members' college board scores are a true indicator, the women will win higher grades than the men.

Statistics provided AIR FORCE Magazine show that at the completion of nine weeks of basic training at the Colorado Springs, Colo., school, only four of the 157 freshmen women—2.56 percent of them—had dropped out. This compared with a 3.55 percent attrition rate for the male cadets—fifty-one dropouts of 1,438 enrolled in June.

The Academy reported that women outscored male frosh on college boards by an average of 587 to 550 on the verbal aptitude test, 579 to 539 on English composition, and 668 to 647 on the math achievement test. Only on the math aptitude exam did the men prevail, and then only by a whisker, 647 to 642. All of these scores far exceeded the latest national average scores for college students.

The Academy did not disclose how the new cadets stood academically in their high school classes. It noted, however, that fifteen percent of the new male cadets and ten percent of the women had been high school class presidents. Forty-one percent of the women came from military families, compared to nineteen percent of the men.

The USAFA expects to enroll about 150 women annually and, starting in 1980, commission around 100 each year. Some will matriculate from the Academy Prep School.

OER System Okay, But . . .

The OER system "is working basically as designed, to the long-term benefit of both the officer corps and personnel managers." So said Hq. USAF recently in its first extended official comment on the sensitive program.

At the same time, the service acknowledged "a number of individual imperfections in management and application" of the system. And it scheduled a September 8–9 conference of command vice commanders and other high-ranking officials, including Maj. Gen. Walter D. Druen, head of the Military Personnel Center, to tackle OER problems. No major changes to the system appear likely, however.

The Headquarters comment came in a carefully worded six-page statement. It contained statistics purporting to show that an unusually high number of top ratings are not going to officers in temporary promotion zones. For example, USAF said 27.6 percent of the majors and thirty-four percent of captains eligible for promotion for the first time last year received top block ratings. Overall, top blocks cannot go to more than twenty-two percent of all officers.

Air Force said earlier expectations that most officer records will eventually show a "variety of ratings" have been confirmed. Officers passed over for promotion are faring better OER-wise under the new system, the statement also said.

Meanwhile, the controversy over OERs shows no sign of subsiding. *(See a related OER report in the August "Bulletin Board.")*

Commissary Chief: "Stores Here to Stay"

The head of the Air Force Commissary Service says that even without appropriated fund support "we'll continue to have commissaries." Some critics of funding withdrawal have declared otherwise.

Maj. Gen. Daniel L. Burkett also told a news conference that store customers can expect savings (over supermarkets) to level off at about fifteen percent, should government financial support be withdrawn. Management reforms Burkett plans to invoke, such as variable pricing, should assure the fifteen percent figure, he said. This compares with about a ten percent savings customers receive at their exchanges

Air Reserve's representative among the first USAF women to enter undergraduate pilot training is 2d Lt. Kathleen Ann Rambo, a May graduate of the University of Oklahoma. After UPT at Williams AFB, Ariz., she'll train at Altus AFB, Okla., in the C-141 for a subsequent AFRES post. She was a member of the Arnold Air Society (an AFA affiliate) National Staff in 1974–75.

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and the present 22–23 percent savings General Burkett said USAF commissary patrons now enjoy. He ruled out any new surcharge boost this year.

The government support issue has been a running battle within the government for the past two years. AFA has consistently supported the retention of the present level of customer savings through appropriations and management improvements. Pentagon officials generally feel that even if full funding is provided in FY 1977, reductions aren't far away. Burkett also told a press meeting that:

- New commissaries have been approved for Langley AFB, Va.; Sheppard AFB, Tex.; Davis-Monthan AFB, Ariz.; and Hill AFB, Utah; and present stores at Little Rock AFB, Ark., and L. G. Hanscom AFB, Mass., will be improved and enlarged. He expects six more new stores to be approved soon. Modern new stores will mean increased sales, profits, and strengthening of the store system, he said.
- Cigarette prices will rise, depending on the government's timetable for phasing out appropriated funding. USAF's stores will net $24 million a year by such action, Burkett said.
- USAF stores will keep their customers better informed about daily bargains and other changes. Publicity will be increased.

A study compiled by AFA's Junior Officer and Enlisted Councils, entitled "Making a Good Air Force Better," is receiving exposure among USAF's leaders. Here, Lt. Col. Edward W. Vogler, Commander of the 913th Tactical Airlift Group (AFRES), Willow Grove Air Reserve Facility, Pa., presents a copy to the Chief of the Air Force Reserve, Maj. Gen. William Lyon.

State Tax Issue Heating Up

New fuel was poured on the state tax controversy recently when Defense's most persistent critic, Rep. Les Aspin (D-Wis.), declared that service people "are shopping around for home states" to avoid paying state income tax. He said they were congregating in the no-tax states of Connecticut, Florida, Nevada, New Hampshire, New Jersey, South Dakota, Tennessee, Texas, Washington, and Wyoming.

The charge drew a prompt denial from the Defense Department. A spokesman provided data strongly indicating that the Aspin report, widely circulated by the wire services, was highly inaccurate.

Aspin said the Advisory Commission on Intergovernmental Relations had discovered that while nineteen percent of the US population lives in the ten no-tax states, forty-four percent of all Army members claimed those states as home for tax purposes in 1974.

Actually, Defense retorted, Army had furnished the Commission statistics showing the number of members on which income reports had been submitted to the states for 1974. Not included were figures for twelve states that don't require such reports, nor did they include Army personnel overseas. Thus, the distortion.

Representative Aspin at another point said the Commission found that of USAF personnel making more than $10,000, thirty-three percent more claimed nontax states as home than would be true if service people came proportionately from each state. Defense said it couldn't verify the derivation of that figure but that a figure of fourteen percent would be accurate.

The Advisory Commission, in a recent report to Congress, urged that (1) service people be required to declare their state of residence annually, and (2) the states garnishee military pay where the person owes back taxes. It also favors allowing more than one state to tax military pay.

A bill requiring the Defense Department to withhold service people's state taxes is in Congress, though Defense has opposed it on the grounds that the withholding operation would be costly. The Commission denies this.

The Commission also asked Congress to end the state tax exemption service members now enjoy on commissary and exchange purchases. States lose about $500 million annually because of the prohibition, the Commission stated.

Airman Job Opportunities

Headquarters is looking for airmen with "native or near-native proficiency" in Germanic and Slavic languages for duty with the USAF Intelligence Service. Overseas "accompanied" assignments are available. Those interested should contact AFIS/DPR, Washington, D. C., 20330, Autovon 22-73929/78044.

Headquarters also said there is "an urgent need" for 300 airmen,

For the second year in a row, PACAF, represented here by personnel chief Col. T. J. Reagen, right, has won the L. Joseph Brown Award for the best social actions program among major commands. Chief of Staff Gen. David C. Jones presented the award at ceremonies attended by Colonel Brown's widow and three daughters. A leader in USAF social actions programs, Colonel Brown died last year.

grades E-4 through E-7, to retrain into the Disaster Preparedness specialty (Palace Response), a selective reenlistment bonus skill. And another call has gone out for career airmen to volunteer for AFROTC unit assignments at forty-six campuses. Base personnel offices have details on both programs.

Careers in SAC Defended

Many bomber crew members over the years have contended that the way to advance their careers is to "get out of SAC." That's sometimes easier said than done, however. The question has triggered lively debate in many USAF quarters, and recently SAC's Commander, Gen. Russell E. Dougherty, jumped into the controversy.

Writing for internal publication, he said he was greatly disturbed that young SAC officer crew members, "usually captains," feel they've "got to get off this combat crew soon, get some PME, and get a good staff job, or they'll never get promoted."

Combat crew duty "is the bedrock preparation" for the crew member's entire career, Dougherty declared. There is no better way to prepare for advancement than "to develop your crew skills and experience and be the very best there is in your specialty," he said. General Dougherty also defended the new OER system, saying "it will prove useful and those who produce will not be penalized. . . ."

USAF Hispanic Americans Gain

Special people programs have been opened or expanded for the more than 13,000 USAF members of Spanish-speaking origin. Hq. USAF reported, for example, that more than fifty Latin-American clubs have been chartered throughout the Air Force. First-run Spanish language movies are now featured at bases with large Spanish populations, and similar entertainment soon will be featured at USAF clubs. Exchanges have expanded stocks of Hispanic-oriented records and magazines, Headquarters also said.

Another Pay Study Under Way

Still another military compensation study group has been formed, this one to examine Reserve Forces pays, allowances, and benefits. The thirty-five-member group, with representatives from each service, is headed by Deputy Assistant Secretary (Reserve Affairs) Will H. Tankersley and retired Navy Rear Adm. Richard G. Altmann. The probe, which began in September, is expected to last eighteen months, though if past pay study results are any indicator, it might drag out even longer. Meanwhile, virtually nothing has been heard from the Quadrennial Review of Military Compensation through the first eight months of 1976, although the highly ballyhooed group was formed in early 1975.

It is widely recognized that Reserve pay is a hodgepodge that fails to attract good people in the lower grades and should be overhauled. In related pay developments:

- As the October 1 date for the next military-federal raise neared, the plan held most likely to succeed would provide boosts of 3.62 in basic pay, 4.83 percent in BAS, and ten percent in BAQ. It would come to 4.8 percent overall. Also, persons occupying single quarters probably will receive a BAQ rebate *(see September "Bulletin Board").*

Comparable civilian raises are expected, although employee unions were complaining bitterly that larger raises were needed.

- The Consumer Price Index rose to 171.1 in July, not quite enough to set the next retiree pay raise machinery in motion. The outlook is for a boost in January to show up in February checks. Pending for early September was a House vote on the Administration's attempt to remove the one percent kicker from the pay formula.

Social Actions "Must" in AFRES

Social Actions training is now required for all officers and airmen in Air Force Reserve training categories A, B, and D. The program, mandated by the Defense Department, parallels the one for the active Air Force. It centers on instruction in drug and alcohol abuse and human relations. Unit members receive the special training as part of their regular monthly assemblies. Individual Reservists must make their own training arrangements with any active USAF base or AF Reserve or Air National Guard base or unit.

Carolina ANG Unit Lauded

South Carolina's largest Air National Guard unit, the 600-member 169th Tactical Fighter Group flying A-7Ds, sailed through a tough Operational Readiness Inspection with flying colors while on a two-week summer camp away from its home station, McEntire ANG Base, S. C. It was the first ANG unit to be so inspected away from its home base.

Tactical Air Command's IG, Brig. Gen. John B. Bennett, told Group Commander Col. Robert A. Johnson at the Travis Field, Savannah, Ga., training site, that the group performed admirably. The outfit's munitions loading crews are "as good as any we see in the active forces," Bennett added.

ORIs for Air Guard units have traditionally been conducted at their home stations. But USAF's desire to improve ANG unit readiness prompted the ORI shift to the

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summer training site, the Group said.

VA Home Loan Activity Up

The veterans' home loan guarantee program is booming, according to the Veterans Administration. The agency reported that it received 617,800 home-appraisal requests and 379,000 loan applications in FY 1976, both among the highest in the thirty-two-year history of the program. VA attributed part of the high level of activity to recent legislative changes, which liberalized eligibility requirements.

One of these, for example, lets many vets who have used their loan to regain entitlement. Another increased the number of veterans eligible for home loans. A July 1, 1976, change increased the guarantee on mobile home loans to fifty percent of the loan amount.

Since the home-loan project began in 1944, VA has received more than 10,300,000 applications and approved nearly 9,600,000 of them. Value of the loans totals $123 billion, a VA spokesman said. The agency, of course, does not lend any money; it guarantees up to sixty percent or a maximum of $17,500 of a loan made by a commercial lending institution. Although it hasn't always been so in the past, "lenders are currently receptive to VA loan requests and mortgage money is available," the spokesman said.

Veterans must apply within various time periods following discharge to qualify for different VA benefits—ten years for GI Bill educational money, for instance. But for a GI loan guarantee application to buy, build, or improve a home, there is no time limit.

Senior Staff Changes

RETIREMENTS: L/G Donald G. **Nunn;** M/G Henry **Simon;** L/G James T. **Stewart.**

Ed Gates . . . Speaking of People

Clarifying CHAMPUS's Forty-Mile Rule

The government frequently lays on new programs with the best of intentions. Expectations are high as improvements in operating procedures and huge dollar savings are envisioned. At the same time, administrators of the new projects are not to endure larger work loads, and beneficiaries won't be subjected to new, restrictive rules and regulations.

All this was doubtlessly the intent earlier this year when the Defense Department, on orders from Congress, invoked the "forty-mile" rule. This meant that all persons eligible for inpatient medical care under the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS), if living within forty miles of military hospitals, would use the military facilities unless they (1) could not provide the care or (2) granted an exception for one of several reasons. In such cases, a "certificate of nonavailability" is issued and the person goes the CHAMPUS route.

The idea seemed reasonable. Millions of persons—active-duty dependents, retirees, their dependents, and service widows—are basically eligible for CHAMPUS benefits, provided by civilian physicians at civilian hospitals but paid for in large part by the government.

But the annual CHAMPUS price tag has been moving toward the $600 million mark, while at the same time many beds in military facilities are going unfilled. The forty-mile limit rule, according to the House Appropriations Committee, would give the military a reasonably simple way to fill up those beds and help attain "maximum utilization" from the facilities. This, in turn, would trim the ever-increasing CHAMPUS outlays.

Unfortunately, the proposition hit some snags; many beds in service hospitals still aren't occupied. And the accompanying administrative changes have created new work-loads. In the meantime, up until recently at least, CHAMPUS beneficiaries have scolded the services for making it difficult to secure nonavailability statements.

Achieving maximum utilization for in-service hospitals requires more admissions. But that hasn't happened in Air Force facilities. And the Defense Department, while it couldn't be sure, strongly indicated that the other services also aren't close to reaching that goal.

The forty-mile rule became effective last February. Fig for the following three months show that, except for Ma when USAF hospital inpatient loads were abnormally because of an unusual number of respiratory cases, missions were below those for the same months of the vious year:

	1975	1976
March	24,767	27,497
April	23,886	23,861
May	23,831	23,178

Why were they lower? Mainly because of cuts in me staffs and the continuing trend in medicine to shorter finements and more reliance on outpatient care, an of said.

For the services generally, a Defense Department of said "we assume the ruling has had an effect at some fa ties," but other factors are "reducing the average lengt stay" in military facilities. He said that, although Def was collecting data from the services, it was "unabl assess the impact of the forty-mile restriction" at this tim

What about the small mountain of new paperwork spokesman said that Air Force hospitals issued 2,501 ce cates of eligibility in February. In March, the first full m in which word of the new plan had been fully circulated, issued 5,534 certificates. This was followed by 5,547 in 4,727 in May, and 5,165 in June.

This amounts to a doubling of interest. In addition, hospital must keep records citing the reasons nonavaila statements are issued. Reports flow monthly from bas commands, where they are consolidated before going t USAF.

Another new wrinkle laid on the military medical estab ment is an appeals procedure for those who believe requests for nonavailability statements are rejected un An appeal can go all the way to the respective ser Surgeon General.

Acting on instructions from Defense, the Air Force be February and May published and distributed seven se sets of guidelines covering the issuing of statements

Students at Randolph-Macon Academy, Front Royal, Va., make up the one and only AFJROTC Handbell Choir. They perform for social and church groups. From left, Norm Smith, R. G. McManus, Kathy Doyle, Tom Bowen, Susan Collins, John Johnson, Dia Linn Deiscoll, Gilbert Teal, and David Atkins. Area groups wishing performances should contact Lt. Col. D. J. Driscoll, USAF (Ret.), at the Academy (703-635-4141).

e forty-mile rule. They seemingly covered every angle, from elling out specific circumstances for issuance to a press re- ase to publicize the program. They explain the forty-mile ea maps hospital commanders must provide, procedures hen several military hospitals are in the same area, special ispensation for maternity cases (their travel limit is thirty iles), marriage and family counseling (statements are ugher to get), dental care adjunctive service, successive ad- issions, and much more.

But something backfired between dissemination of the uidelines and their application. The USAF Surgeon's Office August told hospital commanders that the instructions in e earlier guidance weren't always being followed and that numerous complaints" from beneficiaries and Congress were ling up.

The Surgeon's Office cited failure to consider unusual eographic or transportation factors in setting the forty-mile nit, failure to ensure that no maternity patient would have to avel more than thirty miles, unreasonably long delays for rgery admission, and lack of published information about peals procedures.

In his August message, the Surgeon also consolidated in new twelve-page package all the previous guidelines. This nsolidated bundle also makes clear that nonavailability cer- icates may be obtained via a phone call or letter request. nd military hospitals have been told to publicize the fact at a particular medical service is routinely or temporarily not ailable.

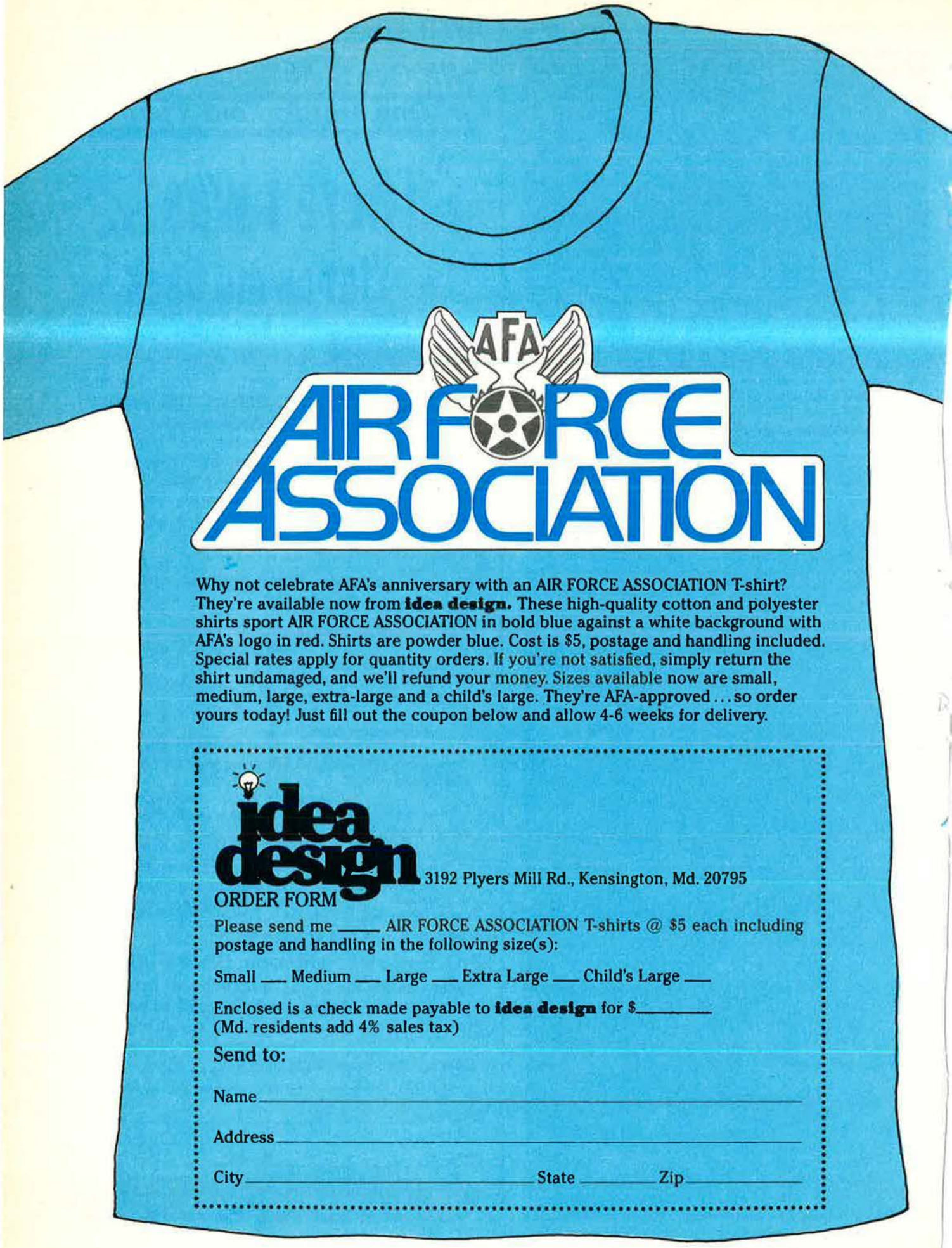
Certificates may also be given persons who, though caught the forty-mile web, had been under the continued care of vilian doctors they had grown comfortable with.

So, flexibility is allowed in the issuance of the controversial atements, and this makes good sense. Yet, for each one ued, an empty military hospital bed remains empty. The uation can place hospital commanders in a tight spot. Do y please a patient? And draw the wrath of Congress? Or e versa?

The extra paperwork brought on by the new program will obably remain a source of irritation for all quarters.

CHAMPUS has been plagued with problems from its in- ption, so perhaps this new disturbance does not come as surprise. But to individuals directly involved it can be of jor import. Hopefully, the new guidelines and judicious plication of them will result in more customer satisfaction h the certificate issuance procedure and a fall-off in com- ints.

But we wouldn't bet on it. ■



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The Bulletin Board

CHANGES: B/G Bill V. Brown, from Chief, Strat. Ops. Div., J-3, Joint Staff, OJCS, Washington, D. C., to Dep. Dir., J-3, Strat. & Gen. Ops., Joint Staff, OJCS, Washington, D. C., replacing B/G William L. Nicholson, Jr. . . . **B/G Robert W. Clement,** from Cmdr., 35th TFW, TAC, George AFB, Calif., to V/C, 12th AF, TAC, Bergstrom AFB, Tex. . . . **B/G Edwin A. Coy,** from Dep. for Space Comm. Sys., SAMSO, AFSC, Los Angeles, Calif., to Dir. of Space, DCS/R&D, Hq. USAF, Washington, D. C., replacing M/G Henry B. Stelling, Jr. . . . **B/G Charles L. Donnelly, Jr.,** from Dep. Dir. of Plans for Plans & Policy, DCS/P&O, Hq. USAF, Washington, D. C., to Dep. Dir. of Plans, DCS/P&O, Hq. USAF, Washington, D. C., replacing M/G Hoyt S. Vandenberg, Jr. . . . **M/G Billy J. Ellis,** from Dir. of Ops. & Readiness, DCS/P&O, Hq. USAF, Washington, D. C., to Dep. Insp. Gen., Hq. USAF, Washington, D. C. . . . **B/G Billy B. Forsman,** from Def./Air Attaché, Tel Aviv, Israel, to Dep. Dir. for Plans & Policy, DIA, Washington, D. C. . . . **M/G Richard C. Henry,** from V/C, SAMSO, AFSC, Los Angeles, Calif., to Dir., Dev. & Acq., DCS/R&D, Hq. USAF, Washington, D. C., replacing M/G John C. Toomay . . . **M/G Kermit C. Kaericher,** from Dep. Asst. Dir., Plans & Analysis Bureau, US Arms Control & Disarmament Agency, US Dept. of State, Washington, D. C., to Dir., Inter-American Def. College, Ft. McNair, Washington, D. C.

M/G Harrison Lobdell, Jr., from DCS/Plans, Hq. USAFE, Ramstein AB, Germany, to Commandant, National War College, Ft. McNair, Washington, D. C., replacing M/G James S. Murphy . . . **M/G Howard E. McCormick,** from Dep. Dir. (Mgmt.), Office of Dir., Telecomm. & Command & Control Sys., OASD (Telecomm.), Washington D. C., to V/C, SAMSO, AFSC, Los Angeles, Calif., replacing M/G Richard C. Henry . . . **M/G James S. Murphy,** from Commandant, National War College, Ft. McNair, Washington, D. C., to V/C, 15th AF, SAC, March AFB, Calif. . . . **B/G William L. Nicholson, Jr.,** from Dep. Dir., J-3, Strat. & Gen. Ops., Joint Staff, OJCS, Washington, D. C., to Commandant, ACSC, AU, Maxwell AFB, Ala. . . . **B/G Walter C. Schrupp,** from Dep. Dir. for Operational Forces, DCS/P&O, Hq. USAF, Washington, D. C., to Dep. Dir. of Ops. & Readiness, DCS/P&O, Hq. USAF, Washington, D. C. . . . **M/G Henry B. Stelling, Jr.,** from Dir. of Space, DCS/R&D, Hq. USAF, Washington, D. C., to V/C, ESD, AFSC, Hanscom AFB, Mass. . . . **B/G Herman O. Thomson,** from Asst. Dir. for Joint & National Security Council Matters, DCS/P&O, Hq. USAF, Washington, D. C., to Dep. Dir. of Plans for Plans & Policy, DCS/P&O, Hq. USAF, Washington, D. C., replacing B/G Charles L. Donnelly, Jr. . . . **M/G John C. Toomay,** from Dir., Dev. & Acq., DCS/R&D, Hq. USAF, Washington, D. C., to DCS/Dev. Plans, Hq. AFSC, Andrews AFB, Md. . . . **M/G Hoyt S. Vandenberg, Jr.,** from Dep. Dir. of Plans, DCS/P&O, Hq. USAF, Washington, D. C., to Dir. of Ops. & Readiness, DCS/P&O, Hq. USAF, Washington, D. C., replacing M/G Billy J. Ellis. ■

AFA News

By Don Steele, AFA AFFAIRS EDITOR

Unit of the Month

THE OKLAHOMA STATE ORGANIZATION . . . cited for effective programming in support of the AFA mission, most recently exemplified by the Oklahoma City Air Logistics Center briefing arranged for Oklahoma state legislators.

COLUMBUS DISPATCH PHOTO BY FRED SHANNON

During the Ohio State AFA's 1976 convention, held recently in Columbus, Richard Hoerle, left, President of AFA's Capt. Eddie Rickenbacker Memorial Chapter, presented Maj. Frederic D. Stanton, right, USAF (Ret.), Chairman of the Board of Trustees of Veterans Memorial, a picture of Captain Rickenbacker, America's famed World War I combat airman known as America's "Ace of Aces," who was a native of Columbus. The picture will be the first in the Veterans Memorial's hall of fame of Columbus area servicemen. During the convention Mr. Hoerle was named the State AFA's "Man of the Year."

Maj. Gen. Carl G. Schneider, Commander, Oklahoma City Air Logistics Center (ALC), recently presented a briefing to more than 100 Oklahoma State legislators on the role and missions of the Air Force, the operations of the Oklahoma City ALC, and the importance of both to the state of Oklahoma. Arrangements for the briefing were made by the Oklahoma State AFA in conjunction with the Oklahoma City ALC, and with the assistance of AFA's Thomas P. Gerrity Chapter. A reception and buffet dinner sponsored by the State AFA followed the briefing. Shown are, from left, General Schneider, Senate President Pro Tempore Gene Howard, House Speaker Bill Willis, and Oklahoma State AFA President David L. Blankenship. In recognition of this innovative and effective program, AFA President George M. Douglas names the Oklahoma State Organization as AFA's "Unit of the Month" for October.

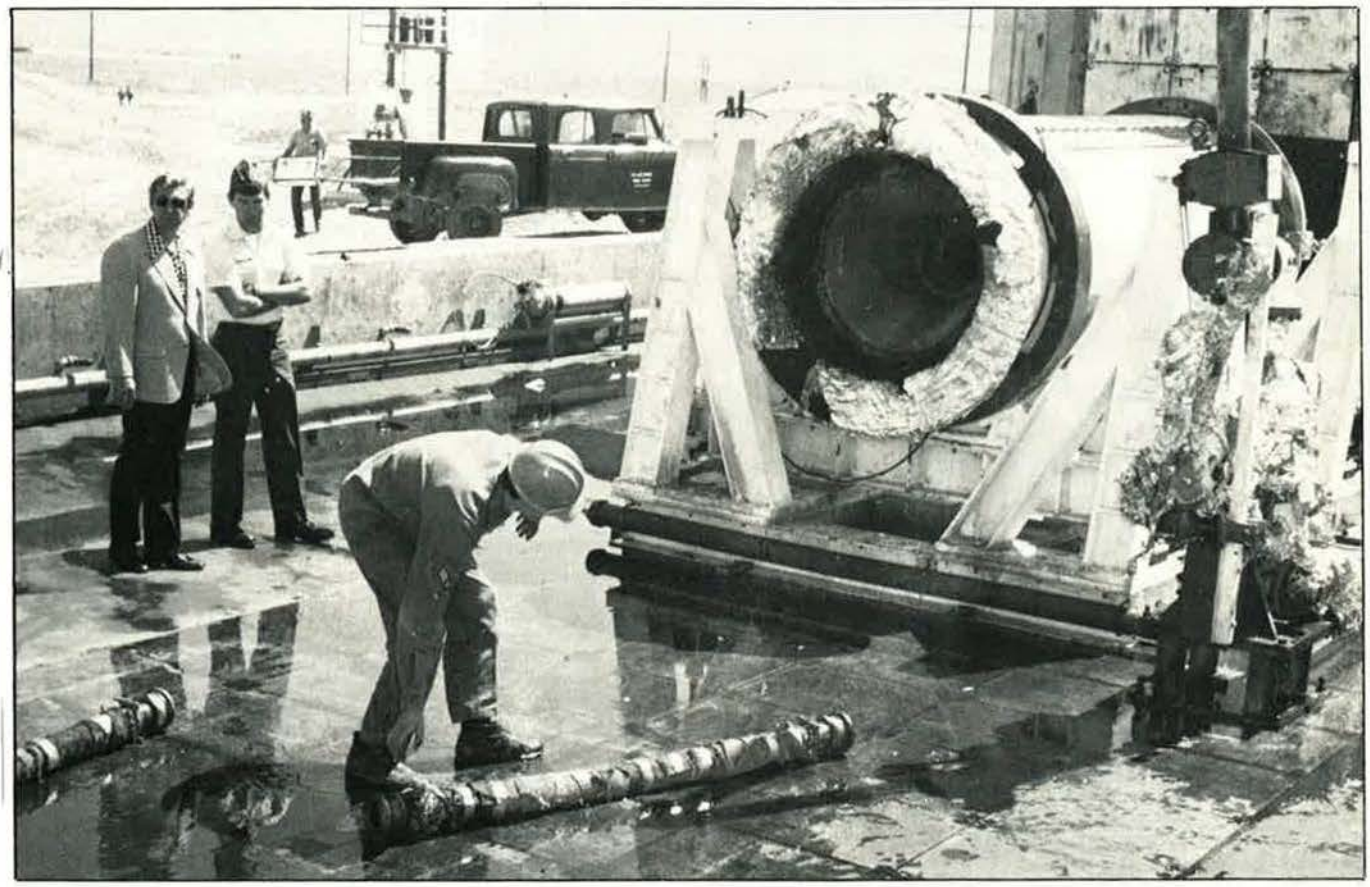
Head-table guests at the California AFA's 1976 Convention Banquet, held recently in Berkeley's Marriott Inn, included, from left, State AFA President L. T. "Zack" Taylor; Maj. Gen. John C. Toomay, Director of Development and Acquisition, Office of the Deputy Chief of Staff/Research and Development, and the guest speaker; and Martin M. Ostrow, an AFA Past National President and Board Chairman, who was the master of ceremonies. During the program, Naomi "Tillie" Honion, C. Jay Golding, and Brig. Gen. James L. Wade, AFRES, were named the State AFA's "Woman," "Man," and "Military Man" of the year, respectively. At the business session, delegates elected Dwight Ewing of Merced to succeed Mr. Taylor.

During the Illinois State AFA's 1976 Convention, Robert Duguid, right, Vice President of the Chicagoland Chapter, presented Col. Albert G. Boeck, left, 9014th Air Reserve Information Squadron Commander, a citation for "outstanding contributions to the USAF Information program and uniquely significant efforts in support of the Total Force Policy in the advancement of the national Air Reserve Information Squadron mission." At AFA's 30th Anniversary National Convention in Washington last month, the 9014th received an AFA National Special Citation for its outstanding support of AFA chapters and programs in the Chicago area.

chapter and state photo gallery

Head-table guests at the Texas State AFA's convention banquet included, from left, AFA National President George M. Douglas, who introduced the banquet speaker; Lt. Gen. John W. Roberts, Commander, Air Training Command; Steve Ritchie, the guest speaker; Texas State AFA President Vic Kregel, the master of ceremonies; Brig. Gen. H. "Jerry" Dalton, Jr., Director of Information, Office of the Secretary of the Air Force; and AFA Board Chairman Joe L. Shosid. Ritchie, then a captain and an F-4 pilot, became an ace during the Vietnam War.

At the close of the Texas State AFA's 1976 convention in Houston, State President-elect Sandy Faust, left center, presents retiring President Vic Kregel an AFA Life Membership in grateful appreciation of his dedication and his outstanding contributions to the State AFA during his two years as State President. At left is Vietnam ace Steve Ritchie; and at right is Brig. Gen. H. "Jerry" Dalton, Jr., the speaker at the convention luncheon. At AFA's National Convention in Washington, D. C., last month, Mr. Kregel was named AFA's "Man of the Year" for 1976.



During "Douglas Day at Ogden Air Logistics Center," AFA President George M. Douglas visited the Lakeside Test Range where he observed a scheduled Minuteman missile motor firing, toured the firing pad and missile storage areas, and had lunch in the Airmen's Mess Hall. Then, he met with Maj. Gen. Edmund A. Rafalko, Commander, and Brig. Gen. John R. Paulk, Vice Commander, Ogden Air Logistics Center (ALC); had a command briefing; toured the ALC's facilities, including the Distribution Directorate Automated Facility and F-4 Aircraft Production Lines; then had a rap session with the Airmen and Junior Officer Councils. The unique program was arranged by the Utah State AFA in conjunction with the Air Logistics Center. Mr. Douglas was accompanied by AFA National Directors Nathan H. Mazer and Jack C. Price, and Utah State AFA President James Taylor. In the photo, Mr. Douglas, in sport coat, and Lt. Howard Norman, Test Control Officer and one of his briefers, observe the post-firing cleanup of the spent Minuteman missile motor.

AFA News

Brig. Gen. Stuart H. Sherman, Jr., seated third from right, Commander, 1st Strategic Air Division (SAC); California State AFA President L. T. "Zack" Taylor, standing left; and Robert H. Goddard Chapter President Bob Hull, standing right, join all the military and civilian personnel at Vandenberg AFB who were honored at the Chapter's recent Awards and Honors Banquet at the Vandenberg AFB Officers' Club. General Sherman was the guest speaker, and Messrs. Taylor and Hull were principals in the program.

Net proceeds from the Sky Harbor Chapter's First Arizona Air Force Ball, a black-tie, fund-raising event held recently in Phoenix (see p. 144 in the September issue), benefited the Arizona Wheelchair Pilots Association, an organization established in 1973 to pursue specific aviation goals for wheelchair-bound individuals. In the photo, Sky Harbor Chapter President C. W. Swindell, right, presents a check for the $1,400 net proceeds to Howard Chard, President of the Arizona Wheelchair Pilots Association.

During recent ceremonies in his office at Robins AFB, Ga., Maj. Gen. William R. Hayes, right, Commander, Warner Robins Air Logistics Center (ALC), presented H. C. "Butch" Strawser, left, a plaque in appreciation for outstanding support to Robins AFB and the Warner Robins ALC while serving as President of AFA's Middle Georgia Chapter.

Jack Withers, Vice President for AFA's Great Lakes Region, recently installed the newly elected officers of the Ohio State AFA during a luncheon at the Dayton Engineers Club. In the photo, Mr. Withers, right, is shown congratulating Edward H. Nett, the newly installed Ohio AFA State President. Other officers installed are: Robert L. Hunter, Chairman of the Executive Committee; Gerry Kaufhold, Executive Vice President; Charles Spencer, Secretary, and Kenneth Banks, Treasurer.

chapter and state photo gallery

During a luncheon recently sponsored by AFA's Thomas B. McGuire, Jr., Chapter, the chapter and the McGuire AFB's Youth Activities Group shared in $14,000 profits from their food concessions at the base's Memorial Day Open House, and the chapter honored the some 150 volunteers who worked to make the Open House a success. In the photo, Chapter President Bill Demas, left, presents a check representing one-half the profits to Col. Archer L. Durham, McGuire AFB Commander, who accepted on behalf of the Youth Activities Group.

At a recent luncheon sponsored by AFA's Blue Barons Chapter, Colo., the guest of honor, Brig. Gen. Warren C. Moore, Commander, Lowry Technical Training Center (ATC), received the Blue Barons' DSM, the chapter's highest award, for his continuing support of aerospace education on the high school and college levels in Colorado, and an AFA Certificate of Merit for his outstanding support of the Colorado State AFA's Aerospace Education programs. In the photo, Chapter President Noel Bullock, right, makes the presentation to General Moore.

Three of the four AFJROTC and CAP cadets who were awarded $300 scholarships by AFA's Eglin Chapter are flanked by principals in the chapter's Annual Scholarship Banquet. They are, from left, Col. Roderick G. Giffen, Commander, 3201st Air Base Group; Dr. Malcolm Crotzer, Chapter President; AFJROTC Cadet George Williams; CAP Cadet Steve Walker; AFJROTC Cadet Kenneth Watson; Vietnam ace Steve Ritchie, the guest speaker; and Brig. Gen. Thomas McMullen, Commander, USAF Tactical Air Warfare Center, Eglin AFB. The chapter established the Merit Scholarship Award program in 1974 as an annual program to honor and encourage deserving JROTC and CAP cadets in Florida's Fort Walton Beach area.

—USAF PHOTO BY SSGT. BOB TIPTON

INTERESTED IN JOINING A LOCAL CHAPTER?

For information on AFA Chapters in your area, write:

Assistant Executive Director/Field Operations
Air Force Association
1750 Pennsylvania Ave., N. W.
Washington, D. C. 20006

At a recent Salt Lake Chapter general membership meeting, Chapter Past-President Leigh Hunt, right, describes the programming that garnered the chapter the State AFA's Outstanding Chapter of the Year Award for two consecutive years, and a National AFA Exceptional Service Award for Community Relations at AFA's 1976 National Convention. Listening to his story are, from left, Chapter President George Thiergartner; Maj. Gen. Larry M. Killpack, Vice Commander, Air Training Command; and CAP Lt. Cheryl McNeil. General Killpack and Lieutenant McNeil shared the podium as guest speakers.

—PHOTO BY EDWARD LILE

AFA State Contacts

Following each state name, in parentheses, are the names of the localities in which AFA Chapters are located. Information regarding these Chapters, or any place of AFA's activities within the state, may be obtained from the state contact.

ALABAMA (Auburn, Birmingham, Huntsville, Mobile, Montgomery, Selma): **James B. Tipton,** 3032 Hill Hedge Dr., Montgomery, Ala. 36111 (phone 205-263-6944).

ALASKA (Anchorage, Fairbanks): **Edward J. Monaghan** 2401 Telequana Dr., Anchorage, Alaska 99503 (phone 907-279-3287).

ARIZONA (Phoenix, Tucson): **Robert J. Borgmann,** 2431 E. Lincoln Cir., Phoenix, Ariz. 85016 (phone 602-955-7845).

ARKANSAS (Blytheville, Fort Smith, Little Rock): **Jack Kraras,** 120 Indian Trail, Little Rock, Ark. 72207 (phone 501-225-5575).

CALIFORNIA (Apple Valley, Edwards, Fairfield, Fresno, Hawthorne, Hermosa Beach, Long Beach, Los Angeles, Marysville, Merced, Monterey, Novato, Orange County, Palo Alto, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Mateo, Santa Barbara, Santa Monica, Tahoe City, Vandenberg AFB, Van Nuys, Ventura): **Dwight M. Ewing,** P. O. Box 737, Merced, Calif. 95340 (phone 209-722-6283).

COLORADO (Aurora, Boulder, Colorado Springs, Denver, Ft. Collins, Grand Junction, Greeley, Littleton, Pueblo): **Edward C. Marriott,** 11934 E. Hawaii Cir., Aurora, Colo. 80012 (phone 303-934-5751).

CONNECTICUT (East Hartford, Stratford, Torrington): **Margaret E. McEnerney,** 1476 Broadbridge Ave., Stratford, Conn. 06497 (phone 203-377-3517).

DELAWARE (Dover, Wilmington): **Herman T. Meinersmann,** 505 Central Ave., Laurel, Del. 19956 (phone 302-875-5058).

DISTRICT OF COLUMBIA (Washington, D. C.): **James M. McGarry,** 2418 N. Ottawa St., Arlington, Va. 22205 (phone 703-534-2663).

FLORIDA (Bartow, Broward, Cape Coral, Ft. Walton Beach, Gainesville, Jacksonville, New Port Richey, Orlando, Panama City, Patrick AFB, Redington Beach, Sarasota, Tampa): **John H. deRussy,** 529 Andros Ln., Indian Harbour Beach, Fla. 32937 (phone 305-773-2339).

GEORGIA (Athens, Atlanta, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **James D. Thurmond,** 219 Roswell St., Marietta, Ga. 30060 (phone 404-252-9534).

HAWAII (Honolulu): **James Dowling,** 2222 Kalakaua Ave., Honolulu, Hawaii 96815 (phone 808-923-0492).

IDAHO (Boise, Pocatello, Twin Falls): **Larry L. Leach,** 6318 Bermuda Dr., Boise, Idaho 83705 (phone 208-344-1671).

ILLINOIS (Belleville, Champaign, Chicago, Elmhurst, O'Hare Field): **Hugh L. Enyart,** 112 Ruth Dr., O'Fallon, Ill. 62269 (phone 618-398-1950).

INDIANA (Logansport, Marion, Mentone): **William Pfarrer,** 604 Green Hills Dr., Logansport, Ind. 46947.

IOWA (Des Moines): **Ric Jorgensen,** 4055 Kingman, Des Moines, Iowa 50311 (phone 515-255-7656).

KANSAS (Topeka, Wichita): **Albin H. Schweers,** 7221 Woodward St., Overland Park, Kan. 66204 (phone 816-374-4267).

KENTUCKY (Louisville): **Charles R. Head,** 9412 Habersham Dr., Louisville, Ky. 40222 (phone 502-425-9237).

LOUISIANA (Alexandria, Baton Rouge, Bossier City, Monroe, New Orleans, Shreveport): **Norman L. Gunn,** 4510 Willowwick Blvd., Alexandria, La. 71301 (phone 318-487-2431).

MAINE (Limestone): **Alban E. Cyr,** P. O. Box 160, Caribou, Me. 04736 (phone 207-492-4171).

MARYLAND (Andrews AFB, Baltimore): **James W. Poultney,** P. O. Box 31, Garrison, Md. 21055 (phone 301-363-0795).

MASSACHUSETTS (Boston, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **Frederick J. Gavin, Jr.,** 38 Tremlett St., Boston, Mass. 02124 (phone 617-282-2059).

MICHIGAN (Detroit, Kalamazoo, Lansing, Marquette, Mount Clemens, Oscoda, Petoskey, Sault Ste. Marie, Southfield): **Dorothy Whitney,** 3494 Orchard Lake Rd., Orchard Lake, Mich. 48033 (phone 313-682-4550).

MINNESOTA (Duluth, Minneapolis, St. Paul): **Joseph J. Sadowski,** 1922 Malvern St., St. Paul, Minn. 55113 (phone 612-631-2781).

MISSISSIPPI (Biloxi, Columbus, Jackson): **Billy A. McLeod,** P. O. Box 1274, Columbus, Miss. 39701 (phone 601-328-0943).

MISSOURI (Kansas City, Knob Noster, Springfield, St. Louis): **Robert E. Combs,** 2003 W. 91st St., Leawood, Kan. 66206 (phone 913-649-1863).

MONTANA (Great Falls): **James E. Huber,** P. O. Box 685, Great Falls, Mont. 59403.

NEBRASKA (Lincoln, Omaha): **Lyle O. Remde,** 4911 S. 25th St., Omaha, Neb. 68107 (phone 402-731-4747).

NEVADA (Las Vegas, Reno): **Cesar J. Martinez,** 4214 Grace St., Las Vegas, Nev. 89121 (phone 702-451-3037).

NEW HAMPSHIRE (Manchester, Pease AFB): **William W. McKenna,** RFD #5, Strawberry Hill Rd., Bedford, N. H. 03102 (phone 603-472-5504).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, E. Rutherford, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Newark, Trenton, Wallington, West Orange): **Leonard Schiff,** 246 Franklin Ave., Cliffside Park, N. J. 07010 (phone 201-861-2950).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): **William J. Denison,** 2615 Vista Larga Ave., N. E., Albuquerque, N. M. 87110 (phone 505-264-1733).

NEW YORK (Albany, Bethpage, Binghamton, Buffalo, Catskill, Chautauqua, Griffiss AFB, Hartsdale, Ithaca, Long Island, New York City, Niagara Falls, Patchogue, Plattsburgh, Riverdale, Rochester, Staten Island, Syracuse): **Kenneth C. Thayer,** R. D. #1, Ava, N. Y. 13303 (phone 315-827-4241).

NORTH CAROLINA (Charlotte, Fayetteville, Goldsboro, Greensboro, Raleigh): **Dozier E. Murray, Jr.,** 1600 Starbrook Dr., Charlotte, N. C. 28210 (phone 704-523-0045).

NORTH DAKOTA (Grand Forks, Minot): **Leo P. Makelky,** 611 16th Ave., S. W., Minot, N. D. 58701 (phone 701-839-5186).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Newark, Toledo, Youngstown): **Edward H. Nett,** 1449 Ambridge Rd., Centerville, Ohio 45459 (phone 513-433-1341).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **David L. Blankenship,** P. O. Box 51308, Tulsa, Okla. 74151 (phone 918-835-3111, ext. 2207).

OREGON (Corvallis, Eugene, Portland): **Philip G. Saxton,** 15909 N. E. Morris, Portland, Ore. 97230 (phone 503-254-0145).

PENNSYLVANIA (Allentown, Beaver Falls, Chester, Erie, Homestead, Horsham, King of Prussia, Lewistown, New Cumberland, Philadelphia, Pittsburgh, State College, Washington, Willow Grove, York): **Lamar R. Schwartz,** 390 Broad St., Emmaus, Pa. 18049 (phone 215-967-3387).

RHODE ISLAND (Warwick): **Matthew Puchalski,** 143 TAG RIANG, Warwick, R. I. 02886 (phone 401-737-2100, ext. 36).

SOUTH CAROLINA (Charleston, Columbia, Greenville, Myrtle Beach, Sumter): **Roger K. Rhodarmer,** 412 Park Lake Road, Columbia, S. C. 29204 (phone 803-788-0188).

SOUTH DAKOTA (Rapid City): **James Anderson,** 913 Mt. Rushmore Rd., Rapid City, S. D. 57701.

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tullahoma): **Thomas O. Bigger,** ARO, Inc. (SE/WA), Arnold AFS, Tenn. 37389 (phone 615-455-2611, ext. 247).

TEXAS (Abilene, Austin, Big Spring, Commerce, Corpus Christi, Dallas, Del Rio, El Paso, Fort Worth, Houston, Laredo, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **E. F. Faust,** P. O. Box 9495, San Antonio, Tex. 78204 (phone 512-223-2981).

UTAH (Brigham City, Clearfield, Ogden, Provo, Salt Lake City): **James H. Taylor,** 629 N. 1st E., Farmington, Utah 84025 (phone 801-825-9511, ext. 2373).

VERMONT (Burlington): **Ronald R. Corbin,** 204 Staniford Rd., Burlington, Vt. 05401 (phone 802-862-2847).

VIRGINIA (Arlington, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **John Pilot,** 807 Whitney Rd. N. W., Apt. A306, Roanoke, Va. 24012 (phone 703-563-3253).

WASHINGTON (Port Angeles, Seattle, Spokane, Tacoma): **Margaret A. Reed,** P. O. Box 88850, Seattle, Wash. 98188 (phone 206-575-2875).

WEST VIRGINIA (Huntington): **Evelyn E. Richards,** 10 Berkley Pl., Huntington, W. Va. 25705 (phone 304-529-4901).

WISCONSIN (Madison, Milwaukee): **Charles W. Marotske,** 7945 S. Verdev Dr., Oak Creek, Wis. 53154 (phone 414-762-4383).

WYOMING (Cheyenne): **Robert R. Scott,** 508 W. 27th St., Cheyenne, Wyo. 82001 (phone 307-634-2121).

AFA News photo gallery

AFA leaders and guests at the newly chartered Andrews Area Chapter's recent dinner honoring the USAF's Thunderbirds included, from left, Maj. Chris Patterakis, Thunderbirds Commander; Maj. Gen. Ralph J. Maglione, a former Thunderbird Commander, now Director of Legislative Liaison, Office of the Secretary of the Air Force; Chapter President Thomas "Tony" Anthony; Brig. Gen. William E. Brown, Jr., Commander, 1st Air Base Wing (MAC), Andrews AFB; Span Watson, National President, Tuskegee Airman, Inc.; and Richard C. Emrich, Vice President for AFA's Central East Region. In addition to those shown in the photo, distinguished guests included Maj. Gen. William C. Norris, Commander, 76th Airlift Division (MAC), Andrews AFB; members of the USAF Thunderbirds; a group of Tuskegee airmen; and Frank C. Fini, Executive Director, Air Force Sergeants Association.

Support the Enlisted Men's Widows Home Foundation

The Air Force Enlisted Men's Widows Home Foundation, Inc., was founded by a group of active-duty and retired Air Force NCOs in June 1967, to provide a residence for widows and widowers of Air Force Enlisted retirees.

In June 1975, the Foundation's initial facility, Teresa Village, opened its doors and now has forty-two residents—thirty widows and six retired couples. By the end of this calendar year, it is expected that the 100-unit apartment complex near Fort Walton Beach, Fla., will be filled to capacity.

AFA has carried a resolution supporting the Foundation continuously since 1973. Since January 1, 1976, AFA units have contributed more than $11,000 to the Foundation, and many AFA members have contributed on a personal basis. But, with a large monthly mortgage payment, assistance to residents whose incomes are very small, and plans for future expansion, the Foundation desperately needs additional support NOW.

We urge AFA units to conduct fund-raising functions to benefit the Foundation. To help in such efforts, a 12-minute audio-visual slide briefing on the purpose and operation of the Home is available on loan by writing to the Foundation at the address listed below.

AFA members can participate on a personal basis by joining the Foundation's "Buck-a-Month Club." Contributions are tax-deductible, and contributors receive the Foundation's quarterly newsletter and a wallet-size "benefactor" card.

Demonstrate AFA's support of the Foundation by sending your contribution TODAY!

To: Enlisted Men's Widows Home Foundation, Inc.
354 Woodrow Street
Fort Walton Beach, Florida 32548

Enclosed is my check for $_____ to help with your good work.
( ) I intend to participate in your "Buck-a-Month Club."

Name _____

Address _____

City _____ State _____ Zip _____

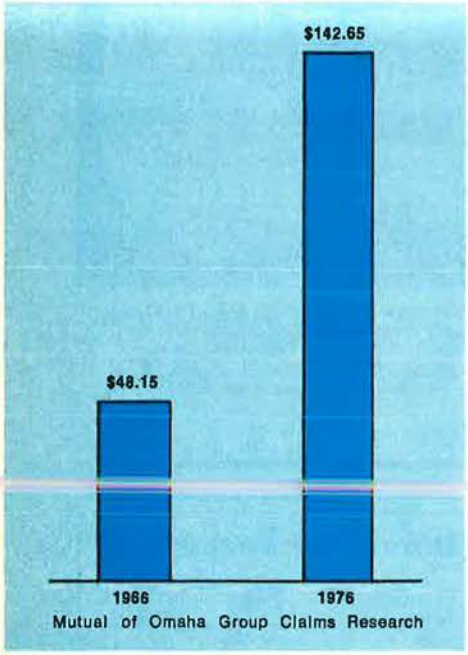
( ) I am an AFA member at large.
( ) I am a member of AFA's _____ Chapter.

NOW BETTER THAN EVER

AFA HOSPITAL

APPLY NOW! Current Enrollment Period Ends Nov. 19, 197

Hospital Costs Are Out of Sight!



Mutual of Omaha Group Claims Research

Why Pay Money Out of Your Pocket When You Are Hospitalized?

Every family has extra expenses when a family member is hospitalized. But that doesn't mean you have to pay them if you're covered by AFA's Hospital Indemnity Insurance.

A Simple, Practical Plan

AFA Hospital Indemnity Insurance benefits—now available up to $80 per day—begin on the first day you are hospitalized—for covered sickness and accidents—and continue for as long as 365 days. No deductible. No waiting period. And benefits are payable in addition to all other insurance or government benefits you might receive. Benefits are paid directly to you unless you request payment to a hospital at the time you submit a claim.

How It Works

Under AFA's Program, you have three basic plans to choose from. You simply select the one which best meets your needs.

Individual plan . . . coverage for you; Limited family plan . . . coverage for you and your spouse; Full family plan . . . coverage for you, your spouse, and all of your dependent children.

Under each plan you have a choice of coverage . . . $20, $40, $60, or $80 per day. Depending on the plan you select, your spouse would receive 75% of your daily benefit and each child would receive 50% of your daily benefit. And, in all cases, benefit payments would be made for up to 365 days in the hospital for each covered illness or accident for each insured member of your family.

New Hospital Out-patient Benefits:

If you require hospital out-patient treatment within 48 hours of a covered accident or other emergency sickness, this new AFA benefit will pay $20.00 for each out-patient visit. There is no limit to the number of times you or insured members of your family may receive out-patient treatment at the hospital for accidental injuries, but such treatment for emergency sickness is limited to 5 visits per year ($100). Of course, no more than one payment, per insured person, may be made during any 24-hour period and, naturally, payments under the out-patient benefit plan will only be made if you are not confined in the hospital overnight.

The optional $20/day hospital out-patient benefit may be added to any of the basic plans.

Premium for Hospital Out-patient Benefit

Plan	Annual Cost	Semi-Annual Cost
INDIVIDUAL PLAN	$ 3.00	$1.50
LIMITED FAMILY PLAN	$ 6.00	3.00
FULL FAMILY PLAN	$11.50	5.75

BENEFIT SCHEDULE

PREMIUM SCHEDULE

INDIVIDUAL PLAN

Member's Attained Age	Plan A-1 Member: $20 per day Annual	Plan A-1 Semi-Annual	Plan B-1 Member: $40 per day Annual	Plan B-1 Semi-Annual	Plan C-1 Member: $60 per day Annual	Plan C-1 Semi-Annual	Plan D-1 Member: $80 per day Annual	Plan D-1 Semi-Annual
Under 40	$ 31.00	$ 16.50	$ 57.00	$ 29.50	$ 84.00	$ 43.00	$110.00	$ 56.00
40-49	$ 39.00	$ 20.50	$ 72.00	$ 37.00	$105.00	$ 53.50	$138.00	$ 70.00
50-59	$ 56.00	$ 29.00	$106.00	$ 54.00	$156.00	$ 79.00	$206.00	$104.00
60-64	$ 81.00	$ 41.50	$156.00	$ 79.00	$231.00	$116.50	$306.00	$154.00
65 & over*	$ 59.00*	$ 30.50*	$ 65.00*	$ 33.50*	$ 72.00*	$ 37.00*	$ 79.00*	$ 40.50*

LIMITED FAMILY PLAN

Member's Attained Age	Plan A-2 Member: $20 per day Spouse: $15 per day Annual	Plan A-2 Semi-Annual	Plan B-2 Member: $40 per day Spouse: $30 per day Annual	Plan B-2 Semi-Annual	Plan C-2 Member: $60 per day Spouse: $45 per day Annual	Plan C-2 Semi-Annual	Plan D-2 Member: $80 per day Spouse: $60 per day Annual	Plan D-2 Semi-Annual
Under 40	$ 63.00	$ 32.50	$113.00	$ 57.50	$164.00	$ 83.00	$215.00	$108.50
40-49	$ 76.00	$ 39.00	$140.00	$ 71.00	$204.00	$103.00	$268.00	$135.00
50-59	$109.00	$ 55.50	$207.00	$104.00	$304.00	$153.00	$402.00	$202.00
60-64	$156.00	$ 79.00	$301.00	$151.50	$446.00	$224.00	$591.00	$296.50
65 & over*	COVERAGE ONLY AVAILABLE UNDER INDIVIDUAL PLAN							

FULL FAMILY PLAN

Member's Attained Age	Plan A-3 Member: $20 per day Spouse: $15 per day Children: $10 per day Annual	Plan A-3 Semi-Annual	Plan B-3 Member: $40 per day Spouse: $30 per day Children: $20 per day Annual	Plan B-3 Semi-Annual	Plan C-3 Member: $60 per day Spouse: $45 per day Children: $30 per day Annual	Plan C-3 Semi-Annual	Plan D-3 Member: $80 per day Spouse: $60 per day Children: $40 per day Annual	Plan D-3 Semi-Annual
Under 40	$ 78.00	$ 40.00	$142.00	$ 72.00	$206.00	$104.00	$270.00	$136.00
40-49	$ 91.00	$ 46.50	$169.00	$ 85.00	$246.00	$124.00	$323.00	$162.50
50-59	$125.00	$ 63.50	$235.00	$118.50	$346.00	$174.00	$457.00	$229.50
60-64	$172.00	$ 87.00	$331.00	$166.50	$490.00	$246.00	$646.00	$324.00
65 & over*	COVERAGE ONLY AVAILABLE UNDER INDIVIDUAL PLAN							

*Coverage for members age 65 and over is only provided through the AFA Senior Age Benefits Program (see details above) under the individual plan. In the event you become age 65 while insured under the basic program, your coverage will be transferred automatically to the AFA Senior Age Benefit Program on the first renewal date of the certificate following your 65th birthday.

NOTE: Your premium is automatically adjusted to the rate for your attained age on renewal.

UNDERWRITTEN BY: Mutual of Omaha Insurance Company, Home Office: Omaha, Nebraska

NDEMNITY INSURANCE

- **Increased Benefits Up to $80 Per Day**
- **New Coverage for Outpatient Care**

rovision for Pre-Existing Conditions
Health conditions for which the insured as received medical treatment or advice or as taken prescribed drugs or medicine ithin 12 months prior to the effective date his insurance, are considered to be pre-xisting conditions. Coverage for such pre-xisting health conditions will begin after 12 onsecutive months during which time he is overed under the policy and receives no edical treatment or advice and takes no uch prescribed drugs or medicine.

enewal Provision
As long as the Master Policy with AFA mains in force, termination of your cover-ge can occur only if premiums for cover-ge are due and unpaid, or if you are no nger an AFA member. Your certificate cannot be terminated because of the number of times you receive benefits.

Eligibility
All members of the Air Force Association who are citizens of the United States are eligible to become insured under this program. Members of their families are also eligible for coverage, under the Full Family Plan; dependent children will be insured between the ages of 14 days and 19 years (unmarried children between the ages of 19 and 23 are also eligible if they are wholly dependent upon the principal insured for support and are attending school or college on a full-time basis.)

Exceptions
Your Plan does not cover losses resulting from (1) hospital confinement commencing prior to the date the protected person or eligible dependent becomes insured under this certificate; (2) declared or undeclared war or act of war; (3) service in the Armed Forces of any country, except the United States; (4) acts of intentional self-destruction or attempted suicide while sane or insane; (5) pregnancy, including childbirth or resulting complications; (6) confinement in any institution primarily operated as a clinic, convalescent home, rest home, nursing home, or home for the aged, drug addicts, or alcoholics, or hospitalization involving nervous or mental disorders where no charge is made for confinement expense.

Senior Age Benefits
If you are age 65 or over, write AFA for brochure which explains how Senior Age Benefits cover costs not paid by Medicare.

APPLICATION FOR AFA HOSPITAL INCOME INSURANCE

Mutual of Omaha

Group Policy GMG-6900
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 _____ (Month / Day / Year) Height _____ Weight _____ Soc. Sec. No. _____

PLAN OF INSURANCE (Check One)

Member Only	☐ A-1	☐ B-1	☐ C-1	☐ D-1
Member and Spouse	☐ A-2	☐ B-2	☐ C-2	☐ D-2
Full Family	☐ A-3	☐ B-3	☐ C-3	☐ D-3

HOSPITAL OUTPATIENT BENEFITS (Check One)

☐ Yes ☐ No

METHOD OF PAYMENT (Check One)

☐ Annual ☐ Semiannual

I enclose my initial premium in the amount of:

BASIC COVERAGE $_____

HOSPITAL OUTPATIENT COVERAGE $_____

TOTAL PAYMENT $_____

This insurance coverage may only be issued to AFA members. Please check the appropriate box below:

☐ I am currently an AFA member.

☐ I enclose $10 for annual AFA membership dues (includes subscription ($9) to AIR FORCE magazine).

If this application requests coverage for dependents (Limited Family Plan or Full Family Plan), please complete the following information and list only those persons for whom you are requesting coverage.

Names of Dependents To Be Insured	Relationship to Member	Date of Birth (Month-Day-Year)

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 premium amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) 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 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.

Date _____, 19_____ _____ (Member's Signature)

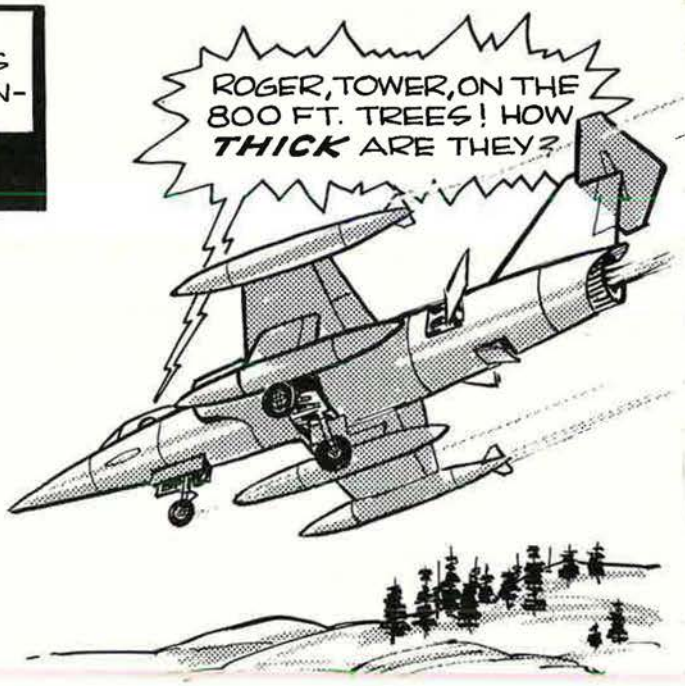
NOTE: Application must be accompanied by check or money order.
Send remittance to:
Insurance Division, AFA, 1750 Pennsylvania Ave., N.W., Washington, D. C. 20006. 3788GH App Rev. 9/76

CURRENT ENROLLMENT PERIOD ENDS NOVEMBER 19, 1976

Bob Stevens'

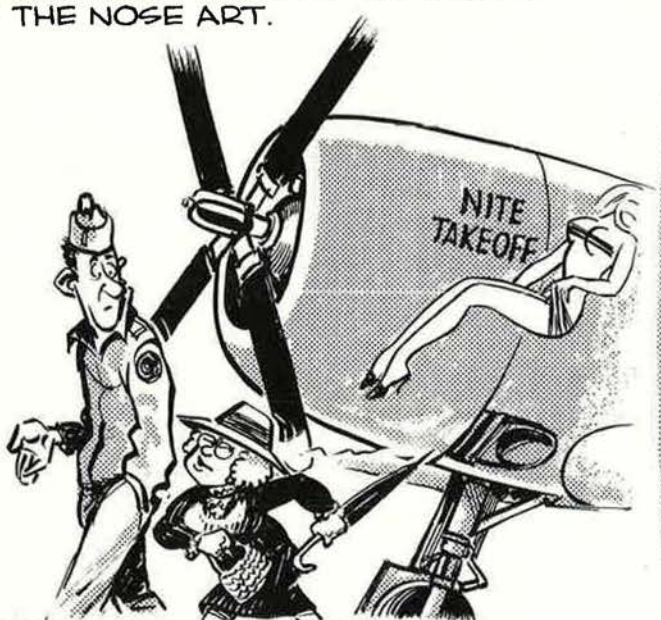
"There I was..."

THIS MONTH IT'S POTPOURRI TIME; ONE "OLDIE", ONE NOT-SO-OLD, and ONE THAT IS IMMORTAL—AS LONG AS THEY KEEP ON BUILDING DUAL-CONTROLLED AIR MACHINES, INSTRUCTORS, and STUDENTS.

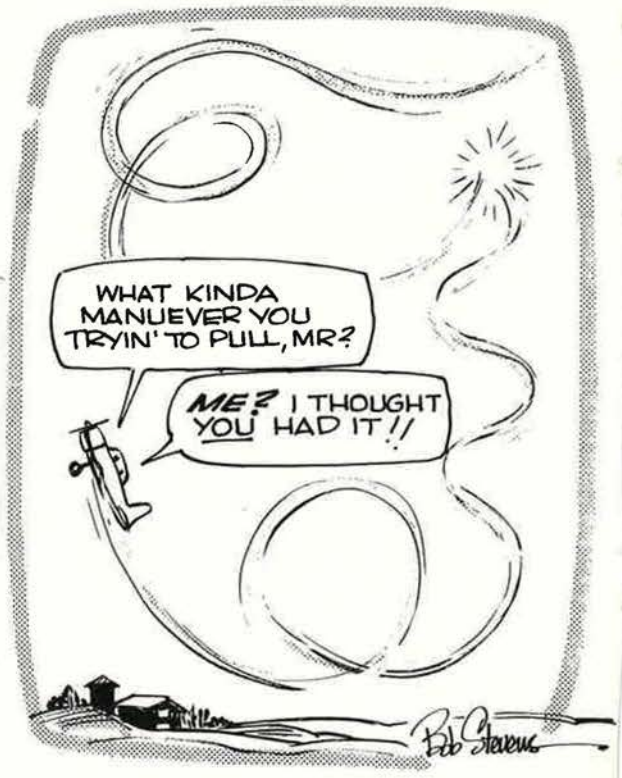


THANKS TO DICK EHLERT
FT. WALTON BEACH, FLA.

THEN THERE WAS THE MOTHER WHO VISITED HER SON'S WW II OUTFIT and WASN'T OVERLY IMPRESSED BY THE NOSE ART.



"WELL, IT'S ALL VERY NICE, SONNY, BUT I DIDN'T NOTICE ANY PICTURES OF THE PILOT'S MOTHERS UP THERE!"



Why is this fighter more reliable and efficient?

One reason is this unit.

The fighter is the USAF F-16. The unit is the Garrett Pressure Transducer.

The pressure transducer is utilized in the F-16's pneumatic sensor assembly to provide key redundant inputs to the automatic flight control systems. It has to be reliable and efficient.

Garrett's pressure transducer is inexpensive and proven. Over 1,000 have been manufactured to date. In addition to the F-16, they are used on the B-1 supersonic strategic bomber, the Air Launch Cruise Missile, the YC-14 AMST jet transport, the F-14 fighter, the JA-37, and in the Space Shuttle's central air data computers.

For more information on Garrett's Pressure Transducer, call us at (213) 323-9500, or write to Sales Manager, Electronic Systems Sales, AiResearch Manufacturing Company of California, 2525 W. 190th Street, Torrance, CA 90509.

GARRETT

The Garrett Corporation
One of The Signal Companies

GARRETT PRESSURE TRANSDUCERS

The reliable answer

Getting muscle to the front.

The USAF/McDonnell Douglas YC-15 is a tactical STOL transport prototype. It can fly 40% faster than the C-130 it is designed to replace. It can take off or land on short unimproved combat airstrips with typical payloads of:

6 cargo pallets and 40 troops at one time.

Or, a 203 mm (8-inch) self-propelled howitzer.

Or, a 175 mm self-propelled gun.

Or, an M113A1 armored personnel carrier, an M551 armored recon/airborne assault vehicle, and a jeep.

Or, 8 jeeps.

Its mission? To help the U.S. Army get muscle when and where it needs it. At the front.

The YC-15

McDONNELL DOUGLAS