JULY 1977 $1

AIR FORCE MAGAZINE

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THE ELECTRONIC AIR FORCE

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AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

JULY 1977
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This Month

BOUT THE COVER

As noted in the introduction to this July issue's special section on electronics, the striking photograph of a man-made cloud is a by-product of an experiment in which barium elements were released at very high altitudes in an operational communications test. The electronics section begins on p. 29.

Departments

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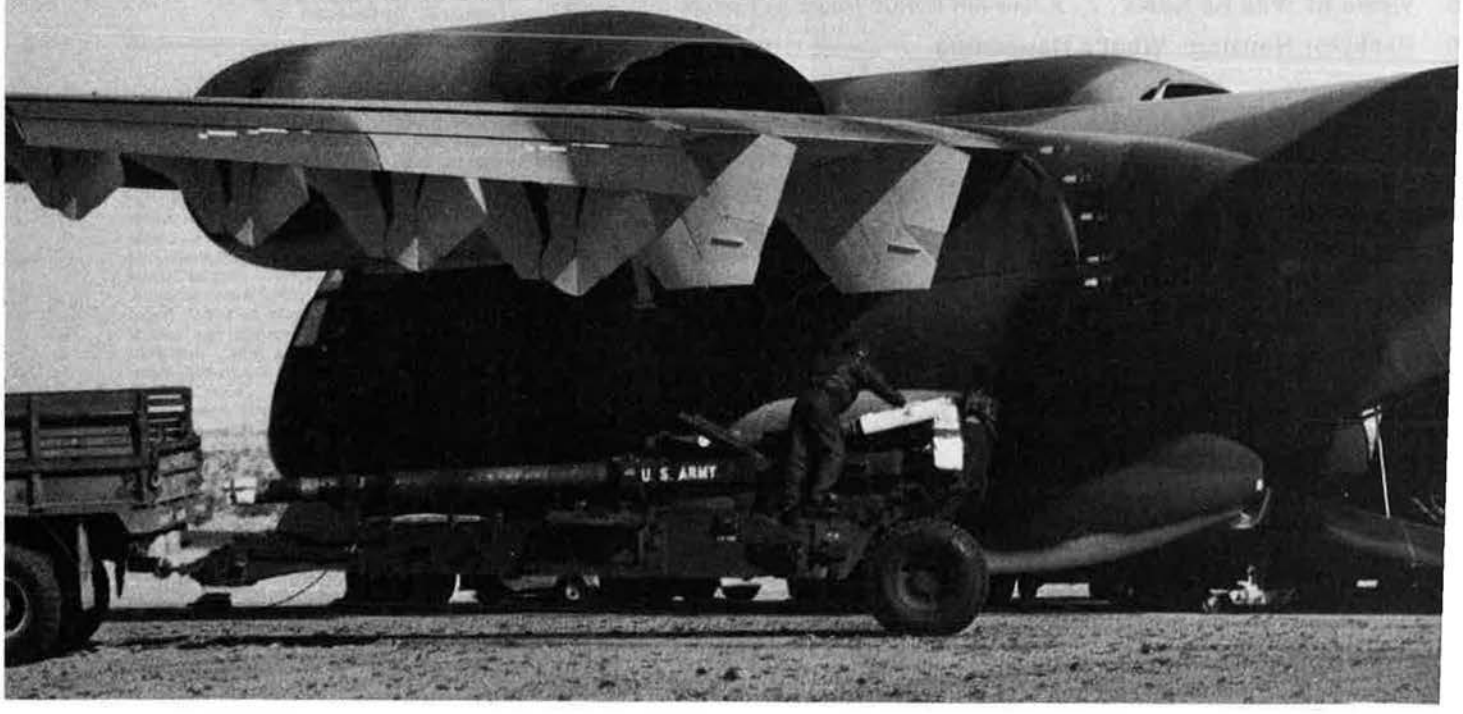

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BOEING YC-14

AN EDITORIAL

Electronics— The Great Equalizer

By John L. Frisbee, EXECUTIVE EDITOR

FOR many years, the US has relied on qualitative superiority to offset the Soviet numerical advantage in military manpower and strategic, tactical, and aerospace defense systems. American primacy in the field of electronics has been a major factor in the balancing process.

Throughout this period, the US electronics industry has offered an embarrassment of riches—or apparent riches—from which US defense planners have not always chosen either wisely or well. Be that as it may, electronics has been the great equalizer in an era of growing Soviet numbers.

The burgeoning capabilities—and complexity—of electronic systems have, as pointed out elsewhere in this issue, made them the most expensive part of a military airplane and, for that matter, of other aerospace systems. From one-third to one-half the cost of some aircraft lies in their electronic equipment. Still, because of sometimes spotty reliability, avionics continues to be the limiting factor on aircraft operational readiness.

Cost and deficiencies notwithstanding, electronic devices are destined to further permeate every phase of Air Force activity, from planning to personnel and logistics management, to combat operations, and the many functions that support operational capability.

Through an expanding use of electronics, significant additional improvements in administrative and operational efficiency are possible without a parallel increase in life-cycle cost. The Electronic X study, published by the Director of Defense Research and Engineering in January 1974, pointed out that, in fact, "massive savings might be achieved" by addressing the troubling issues of rising acquisition costs, poor field reliability, and shrinking quantities of weapons.

The need for greater electronics efficiency at lower cost is underlined by a narrowing of our overall qualitative technological lead and by the Soviets' heavy investment in electronics with emphasis on electronic warfare. As reported in the August 1975 issue of this magazine, "The Soviets believe that NATO forces in general, and US forces in particular, depend too heavily on communications and thus could be hamstrung by massive jamming and other electronic warfare measures."

The urgency of achieving better control of electronics R&D, procurement, and maintenance is further underscored by President Carter's recently expressed concern over the continuing Soviet arms buildup—especially in the NATO area—a concern that has been echoed by Secretary of Defense Harold Brown. At the same time, the Carter Administration has cut former President Ford's FY '78 Defense budget by some $2 billion, and the services have been directed to reduce projected Defens budgets by perhaps as much as $15 billion over the nex five years. Nevertheless, Secretary Brown foresees th need to continue developing new systems, but system "that will be inexpensive enough so that they can b procured in substantial numbers." That will place heavy burden on USAF system planners, particularly i the area of electronics.

In this Electronics issue of AIR FORCE Magazine Senior Editor Edgar Ulsamer's two articles give an over view of current and projected Air Force electronics pro grams. Because of the urgent need to exercise tighte control of electronics development and procurement, w have rounded out the Electronics section of this issu with articles by four Air Force officers whose duties ar intimately involved with the definition and managemer of electronic programs. Lt. Gen. Alton D. Slay, USAF' Deputy Chief of Staff/Research and Development, out lines a proposed Air Force avionics policy aimed a controlling proliferation, improving reliability, and de creasing costs. Lt. Gen. Bryce Poe II reports on the cor tributions of AFLC's Acquisition Logistics Division to en hancing the efficiency and effectiveness of Air Forc electronic systems. Maj. Gen. Lawrence Skantze review the capabilities of the E-3A airborne warning and contr aircraft and the management lessons derived from i development, and Col. Francis Dubé discusses proc dures for improving electronic warfare programs.

Achieving the Air Force goal of more effective, mo reliable, and less expensive electronics will involve dif cult choices and tradeoffs between what can be do and what must be done, between standardization a innovation, between sophistication and reliability, b tween capability and cost, and, as Colonel Dubé h put it, between "do-it-right" and "do-it-now." Progre toward an electronic nirvana will have to be a coope tive venture of the Air Force and the electronics indust The most formidable obstacle is not technical comp tence.

In General Slay's judgment, "We need to attack . the basic attitudes and folklore in this business that ha not changed much and probably will not change with forcing." That goes for both members of the Air For Industry team. But nothing less will do, for there is area of technology and no segment of American indus that is more critical to the defense of our glo interests.

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Airmail

Sharing the Blame

In his highly useful article on SALT, published in the May issue ["SALT: Asking the Right Question"], John Lehman offers a partial defense of the 1972 accords on strategic arms between the US and the USSR. The United States, he tells us—echoing one of the favorite defenses of SALT employed by former Secretary of State Kissinger—had no ongoing strategic programs in 1972, while the Soviets were deploying strategic missiles at a rapid rate. Whatever its other defects, he suggests, SALT I at least prevented the USSR from acquiring an even wider margin in numbers of strategic missiles over the US.

There are several difficulties with this argument. It assumes, for example, that in the absence of SALT the Soviets would have continued to construct new missile launchers on a massive scale, rather than switching to qualitative improvements, *e.g.*, MIRVs, as their technological capacities increased. Most important for my purposes here, however, is the fact that Dr. Lehman does not adequately apportion blame for the unhappy situation in which the United States found itself in 1972. While it is certainly true that Robert McNamara, inspired by strategies of "finite" or perhaps "minimum" deterrence and MAD, halted deployment of new strategic systems by the US in 1966, others had the opportunity to reverse that decision. Inspired by the same basic philosophy of strategic deterrence, they failed to do so.

As Marvin and Bernard Kalb pointed out in their highly laudatory biography of Henry Kissinger, in 1969 the JCS, alarmed at the pace of the Soviet strategic buildup, recommended that the US resume construction of ICBMs. Henry Kissinger, however, persuaded President Nixon to reject this recommendation, on grounds that to do so would escalate the arms race, unnecessarily antagonize the Russians, and thus jeopardize SALT. *(See* Kissinger, *pp. 108–109.)*

As much as Robert McNamara, therefore, Dr. Kissinger is responsible for the fact that in 1972 the US had no offensive strategic programs under way. In one respect, in fact, the decision which he made in 1969 is less defensible than McNamara's earlier decisions, since by 1969 the extent of the Soviet strategic buildup had become clear.

James E. Dornan, Jr.
Senior Research Consultant,
Strategic Studies Center
Stanford Research Institute
Arlington, Va.

Kudos to Kuter . . .

A vote of thanks for courage:

To Gen. Laurence S. Kuter, USAF (Ret.), for his "The Sanctity of Soviet Signatures" [May '77, p. 11]. Let us all pray it isn't like "blowing against the wind."

Col. Patrick H. Henry, USAF (Ret.)
Spring Valley, Calif.

. . . And to Witze

As a long-time admirer of "The Wayward Press," I must say Claude Witze excelled his previous epics with the offbeat account of "Lindbergh's Journalistic Flight," an extremely well-written (what else of Witze?) and extremely interesting story containing unusual information. This coming in the May issue, which also contained the indispensable Air Force Almanac 1977, to me means AIR FORCE Magazine continues to outdo itself, month by month.

Flint O. DuPre
Dallas, Tex.

The Second Front

In the April '77 issue, Lt. Gen. Ira Eaker makes an . . . observation in the article "Conversations With Albert Speer." He said, "Your view (*i.e.*, Speer's) of the bomber offensive as constituting a second front is one I have never seen advanced elsewhere."

General Eaker must not have read the British magazine, *The Aeroplane*, published in London during the war years, or he has forgotten its content. [Major Ganote gives excerpts from six 1941–1944 issues of the magazine, all referring specifically or by implication to the bomber offensive as a "front."

These quotes alone and a full reading of the magazine shows th concept of the air war against Ge many as being a "Second Front was commonly held by both th British and the Germans. In fact, seems that the editor of *The Aero plane* coined the concept in Decem ber 1941. Mr. Speer just reused World War II phrase.

Maj. Marvin D. Ganote
Wright-Patterson AFB, Ohi

Not Left in Limbo

Every month I look forward to re ceiving my issue of the magazine. am particularly interested in the an nual Almanac. There is a wealth o information consolidated in this sin gle issue.

The photo of the senior enliste advisor along with each commande of the various major command and separate operating agencies i an excellent idea. I believe, how ever, that not showing the Chie Master Sergeant of the Air Force i a gross omission. I would hope tha future editions of the Almanac elim inate this oversight.

CMSgt. Grady N. Ellio
Pope AFB, N. C.

• *The Chief Master Sergeant of th Air Force has not been included i the May issue since we don't cove the Air Staff. No slight is intended He is always included in our Com mand and Staff Photochart in th September issue.*—THE EDITORS

We Agree

Having read AIR FORCE Magazine "Guide to USAF Bases at Home an Abroad" [May '77], I noticed on one (Scott AFB, Ill.) to be nam after an enlisted man. Sure amongst the millions of airmen a NCOs who have served are son who meet the criteria for naming base after.

Capt. Dennis J. Ty
Wurtsmith AFB, Mi

Most Appropriate Name

Brig. Gen. Benjamin S. Kelsey's teresting and revealing article the April issue, page 13, about fly the Curtiss XP-55 in 1943 ["Fly the XP-55: 'Interesting, But Not N essarily Pleasant' "] brought to m a more mundane feature of this plane that was probably not wi known and even less remembe

When the XP-55 was at W Field, I noted that with its ca

onfiguration of control surfaces in ront and wing, engine and prop in ne rear, it gave the definite impres- ion that it was flying backward.

With this in mind, I always have ad a secret admiration for the un- nown genius somewhere who nought up what has to be one of ne most apt aircraft names of all me: The Curtiss Ascender.

Col. William H. Adkins, USAF (Ret.)
Albuquerque, N. M.

'W II Glider Pilots

s long-time members of the Air orce Association and faithful read- 's of AIR FORCE Magazine, we onsider ourselves qualified to reg- ter the following complaint:

Since the very beginning of the a gazine, there has been a seg- ent of aviation history that has e n seriously and grossly over- ooked and/or ignored. With the ex- eption of the August 1968 page of ob Stevens's cartoons, there has een no mention of the US Army Air Corps World War II glider program n AIR FORCE Magazine.

We believe it is time to let the ounger generation in on the fact hat the Army Air Corps flew some- ing besides bombers, fighters, and ransports. Many of the older gen- ration have heard very little of the rogram, except for the surviving ormer members of the Glider In- ntry Regiments of the 82d, 101st, 7th, and 11th Airborne Divisions, ho rode the Waco CG-4A or Brit- h Horsa glider into combat in such ajor engagements as Sicily, Nor- andy, Southern France, Holland, erman Rhineland, Bastogne, Bur- a, and the South Pacific.

Thousands of glider infantry sol- rs, supplies of all kinds, and avy battle equipment were trans- rted into these clambakes by ders. The pilots who flew them ffered heavy losses, both during approach to the landing zones d during the landings. Further ses were encountered fighting ngside the airborne infantry ops while awaiting evacuation. s waiting time was several days the most part.

There were approximately 5,000 der pilots trained when the ools were shut down in mid- 4. Several different types of glid- were used, but the Waco CG-4A "Old Faithful." This grand old was enshrined in the Air Force seum at Dayton, Ohio, last June 6, 1976. Gen. Matthew Ridgway, D-Day Commander of the 82d Airborne Division was guest of honor. Col. Phil Cochran of CBI fame was also there.

On p. 58 of the May '77 issue, we identified the AFSC Senior Enlisted Advisor as CMSgt. Francis W. Roper. We should have shown CMSgt. Robert D. Harrison instead. Here he is. We regret the error.—THE EDITORS

Our organization, the National World War II Glider Pilots Association, has, in the past eight years, rounded up some 1,400 pilots who flew these gliders. A large gathering of these jocks, who were known during WW II as the Forgotten Bastards of the AAF, will take place this coming September, when the organization conducts its seventh annual reunion [*see p. 12*]. A comprehensive collection of artifacts, pictures, and many other items connected with the WW II glider program will be on public display during the reunion. This collection is known as the WW II Glider Pilot War Room and is permanently maintained at our Association Headquarters in Dallas, Tex.

Several books have been published about the WW II glider program, some of which are: *The Glider War,* by Col. James E. Mrazek, former 82d Airborne Division Glider Infantry; *The Longest Day,* by Cornelius Ryan, covers the Normandy Operation; *A Bridge Too Far,* by Cornelius Ryan, covers the Holland Operation; and *The Glider Gang,* by Dr. Milton Dank, former glider pilot. [*A review of Dr. Dank's book in the June '77 issue makes note of the lack of recognition of the glider forces.—The Editors*]

We have not forgotten the men who kept our gliders flying, the mechanics, who often rode with us in training, and labored long hours to keep the birds in top condition, and sweated us out. Our Association has made special provisions to enroll these men into the organization as Associate Members.

George F. Brennan
National Representative, and
Jack C. Riddle
National WW II Glider Pilots Association
Albuquerque, N. M.

Air Force's "People's Programs"

Glad to see an article in your April '77 issue concerning "people's programs" ["More Than Just a Place to Work," by Ed Gates]. These are indeed important programs and richly deserve recognition. As one who works in Morale, Welfare, and Recreation (and I totally agree with the "uninspired heading" definition), I would like to offer the following:

First, Mr. Gates's overview of the MWR program was essentially accurate. (Except theaters are no longer included in MWR.) He must be a tennis player, however, since he termed tennis support a "drawback" to the total MWR program. This is not correct. Tennis continues to be popular; Civil Engineer support of tennis court upgrade projects is reasonably strong; most Air Force tennis courts are in good shape; and, finally, there are few Air Force Sports Championships currently conducted. Tennis, along with basketball, softball, volleyball, golf, racquetball (which Air Force will not recognize as a sport even though it is currently more popular than tennis), etc., are not being supported with Air Force tournaments.

Second, open messes are popular MWR entities; and costs are soaring. This is no different from clubs on the outside. What is different, and what might force more "all ranks" operations despite General Davis's feelings, are the rules managers must abide by. Another area where General Davis could help open messes is the Alcohol Abuse program. Open messes were involved with prevention of alcohol abuse long before formalization of the Air Force program. And open messes do encourage moderation by offering alternatives to alcohol within their total program. Yet, the Alcohol Abuse program tends to zero in on open messes, which drives members to outside clubs

Airmail

that are not concerned with alcohol abuse.

Third, of the forty Air Force "people programs" listed, MWR owns one-third of them. And, despite continual promises to bolster support for the program, little has materialized. The MWR program is an extensive program requiring top-level managers. If Air Force plans to "push MWR managers to maintain strong programs," they better support managers as well. If Air Force is going to advertise the MWR program as a "bennie," it must provide support, *i.e.*, "take care of its own."

Capt. Dayton G. Dickey
APO San Francisco

Their Right to Speak

Concur with readers Olmsted and Hackett ("Airmail," April '77) in that the maintenance man and his role justifies better coverage in AIR FORCE Magazine. But let's *not* hear it from the pilot, as you stated. Let the maintenance troops speak for themselves.

Capt. Thomas A. Klimas
Randolph AFB, Tex.

Stearman #18353

I'm in the process of restoring and writing a book concerning a Stearman PT-17 that I bought three years ago. The airplane, an A75N1, tail number (designator number) 18353, was manufactured in Wichita, Kan., and delivered to the Army Air Corps in August 1941. It was commissioned as an AAC trainer at the Riddle-McKay Aero College, Clewiston, Fla. It spent virtually its entire military career at Clewiston, first with the 75th Fighter Training Detachment and then with the 2155th Base Unit. It was transferred to the RFC (Reconstruction Finance Corporation) in October 1945, and sold as surplus at Bush Field, Ga.

I would like to contact anyone who knew of this airplane at Riddle-McKay during this August 1941–October 1945 period—instructors, cadets, crew chiefs, mechanics, commanding officers, etc. Failing knowledge of this specific aircraft, information about the school, training units and/or other people who might have known number 18353 would be very helpful.

The Albert F. Simpson Historical Research Center informs me that the following men were ranking American officers (apparently *the* ranking official was an RAF officer): November 1942–September 1943, Capt. Thomas E. Persinger; September 1943–November 1944, Capt. Benjamin J. Durham, Jr.; November 1944–March 1945, 1st Lt. Alfred G. Schuber; March 1945–September 1945, Maj. Robert P. Ford.

I would appreciate information on the present whereabouts of these gentlemen. This could be one place to start my search. My ultimate goal is to obtain the names and addresses of men who flew this plane, photos of the aircraft, logs, etc.

Thomas F. Faught, Jr.
5525 Dunmoyle St.
Pittsburgh, Pa. 15217

Tales of the P-26

As a "plain plane nut," I look forward to and thoroughly enjoy Brig. Gen. Ross G. Hoyt's series, "Flying the Early Birds."

I particularly enjoyed his article on the P-26A in the January issue.

General Hoyt states that "Some [P-26s] were still in service with the 3d Pursuit Squadron in the Philippines when the Japanese struck there in December 1941. The P-26 was no match for the Japanese Zero. Most were destroyed on the ground or in the limited air combat that took place. This sounded the death knell for the P-26."

I would like to make a correction and add a few notes. First, the US Army Air Force's 3d Pursuit Squadron in the Philippines was not equipped with P-26s at the outbreak of the war. The 3d was flying our front-line fighter, the P-40E.

The 6th Pursuit Squadron of the Philippines Army Air Corps, stationed at Zablan Field, Luzon, was equipped with twelve P-26s in 1941 (along with two Boeing P-12s and two Martin B-10Bs).

Always hopelessly outclassed by the faster and heavier armed Japanese fighters and bombers, for seventeen days the Filipino pilots flew fighter-interceptor missions against superior forces, and recce missions over enemy territory with their P-26s.

We suggest that readers keep their letters to a maximum of 500 words. The Editors reserve the right to excerpt or condense as required in the interests of space or good taste. Names will be withheld on request, but unsigned letters are not acceptable.

Despite repeated Japanese bomb ing and strafing attacks agains PAAC airfields, the enemy was un able to sound ". . . the death kne of the P-26." Rather, it was th Americans who wrote an end to th career of the little air force.

On December 24, word was re ceived from the Far Eastern Ai Force Headquarters at Ft. McKin ley, near Manila, for the PAAC t gather its six remaining P-26s an twelve Stearman PT-13s, and de stroy all their aircraft.

Bitter and full of frustration, th exhausted Filipino pilots and crew watched with tear-filled eyes a their men were forced to put torch to their little Boeing "Pea shooters," along with the airfi el installations.

Author Walter D. Edmonds wr ot in his *They Fought With What T. e Had:* "This unfortunate order wa only a part of the wild confusio of the Air Force High Command but to the Philippine Army Ai Corps, it was sheer tragedy."

After destroying their planes, th PAAC was ordered to join the re treat to Bataan, and there the fought as infantry until the end.

Although they won their littl niche in history, too little is know or written about the individual hero ism of the Filipino pilots. Two o the P-26 pilots, Capt. Jesus A. Villa mor, and Lt. José Gozar, wer awarded the American Distinguishe Service Cross. All the other P-2 pilots received the Silver Star wit Oak Leaf Cluster. After WW II, th Filipino pilots also received th Philippine Gold Cross with th Bronze Anahaw Leaf, many of th awards made posthumously.

General Hoyt also refers to th assignment of the P-26s to Hawa Panama, and the Philippines. O little amusing sidelight was on related to this writer about a wa dering P-26.

In early 1930, a new Army A Corps second lieutenant, Kirtley Gregg, was assigned to Panan When his unit received their lit Boeing fighters, Lieutenant Gre marked his initials on the inside the cockpit of the P-26 he flew. was later reassigned to Hawaii, a the same P-26 had also been tra ferred to Hawaii. In 1940, Ma Gregg, then Commander of the 1 Pursuit Squadron, along with unit, was reassigned from Selfri to Nichols Field, Philippines. W the 17th arrived at Nichols, they

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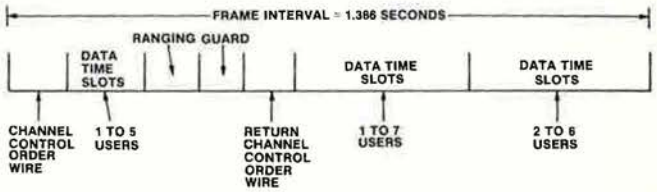

BASIC DAMA FORMAT STRUCTURE

For more information on the present contract or to discuss other spectrum stretching applications, please call Jack Esry 602/949-3142 or write to him at Motorola's Government Electronics Division, P.O. Box 2606, Scottsdale, AZ 85252.

MOTOROLA

The mind to imagine . . . the skill to do

Airmail

only P-26s to fly while their P-35As were being assembled.

One day, Major Gregg was walking along a row of neatly parked P-26s when he spotted a familiar aircraft. A closer check showed the little fighter still had his initials scratched inside the cockpit. Major Gregg immediately claimed the Peashooter as his own.

Major Gregg's and the rest of the 17th's P-26s were later turned over to the PAAC's 6th Pursuit Squadron.

S. Samuel Boghosian
Fresno, Calif.

Plaques in the Attic

Headquarters, 3d Air Force, Office of Information recently received five WW II plaques from a British family who found them in their attic. I am writing in hope that some AIR FORCE Magazine readers may know the whereabouts of the original owners.

Housed in a pine presentation case lined in brown velvet, the plaques are in the form of a circular fifteen-inch mahogany frame, with plate glass (now cracked) face. The plaques bear the crest of the 303d Bombardment Group (H), and the inscription "Hell's Angels." They are engraved: "as presented by the Officers and Men of the 303d in June, 1945." The unit transferred from RAF Molesworth to Casablanca during that time frame, and the cracked plaques may have been abandoned, misplaced, etc.

The plaques are personalized to Lt. Col. John R. Martin, Maj. Wm. C. Heller, Col. James H. Wallace, Lt. Col. Wm. R. Calhoun, and Maj. Glynn F. Schumake.

We would appreciate hearing from anyone with information on these individuals.

Lt. Col. Steve Hinderliter
Director of Information
Hq., Third Air Force
APO New York 09127

Search For Escapees

I am doing research on American airmen who were shot down or forced down over occupied countries during World War I and World War II. The specific information needed is how and when shot down, by what type of aircraft, where, by what route they escaped, and who helped them escape. I realize this is a tall order but any help would be appreciated.

Terry Treadwell
Royal Air Forces Escaping Society
Duke of York's Headquarters
(Right Wing)
Chelsea, SW3 4RX, England

Guide to Museums

Military historian compiling a guide to World War II museums and memorabilia seeks information on little-known museums and war reminders worldwide.

Memorabilia to be listed includes static aircraft displays, abandoned airfields, and battle scars.

D. Colt Denfeld
c/o University of Connecticut
Storrs, Conn. 06268

UNIT REUNIONS

CCK-Trashaulers

All Tactical Airlifters formerly assigned to Ching Chuan Kang AB, Taiwan, are alerted to the upcoming CCK-Trashaulers II reunion at FOL St. Louis, Bel Air Hilton Hotel, August 5–8. Pass the word and send name and address for more information to

CCC-Trashaulers II
P. O. Box 54
Scott AFB, Ill. 62225

Chemical Warfare Service

The Chemical Warfare Service Officers of the 2d and 20th Air Forces of WW II are planning a reunion this fall. For information contact

Sheldon F. Eldridge
235 McKinley Pl.,
Ridgewood, N. J. 07450

Kentucky ANG

The Kentucky ANG (123d Tac Recon Wing) is planning a 30-year reunion to be held Sunday, August 28. All past and present members are urged to attend. Programmed are a fly-over by our current aircraft—RF-4 Phantoms—static displays of previous unit aircraft, food, drinks, music, hospitality. Also a KyANG 30th Anniversary Book of photos, names, history, and memorabilia of the unit at $12 per copy. Further information from

Maj. Richard H. Jett, KyANG
Office of The Adjutant General
Dept. of Military Affairs
Boone National Guard Center
Frankfurt, Ky. 40601
Phone: (502) 564-6764

Tuskegee Airmen

The 99th and 553d Fighter Sqdns., 332d Fighter Group, 477th Bomb Group (M), 118th and 126th ABUs (Sq. F), and all supporting units of WW II of Tuskegee Institute, Stateside and overseas, are holding a reunion at Tuskegee Augus 17–20. Further information from

Herbert E. Carter
201 Bulls Ave.
Tuskegee Institute, Ala. 3600

WW II Glider Pilots

The 7th annual national reunion of the National WW II Glider Pilots Association [see p. 9] will be held September 22–2 at the Hilton Inn, Albuquerque, N. M Contact

Mrs. Virginia B. Randolph
Reunion Secretary
136 West Main St.
Freehold, N. J. 07728

11th Materiel Sqdn.

The 11th Materiel Squadron, 11th Ser vice Squadron, WW II, Port Moresby, i compiling a roster, with a fall '77 reunio in mind. Please contact

John J. Heckler
76 East Harbor Dr.
Teaticket, Maine 0253

43d Air Service Sqdn.

The "Yankee Machine Shop in the Bush," the 43d Air Service Squadron will hold its 14th annual reunion Augus 6–7. Further information from

Gilbert (Whip) Whipple
Rt. 2, Box 274
Cottonwood, Calif. 9602
Phone: (916) 347-4105

62d TC Sqdn.

The Yacht Club Association of the 62 Troop Carrier Squadron (WW II) wil conduct its 3d reunion for all forme members of the unit between Decembe 1942 and the end of the war. Bash wil be held in Atlanta, Ga., August 10–14 All interested persons contact

David E. Mondt
Box 155
Boone, Iowa 5003

98th BG/W

The 1st reunion of the 98th Bombar ment Group/Wing will be held at th Holiday Inn West, in Spokane, Wash August 12–14. Spread the word. Co tact

James V. King
P. O. Box 206
North Highlands, Calif. 956

301st TC Sqdn.

The officers of the 301st Troop Carr Squadron are planning a get-togeth this fall. Need names and address Contact

Paul Thompson
P. O. Box 11
Cozad, Neb. 69

490th Bomb Sqdn.

The "Burma Bridge Busters" of 490th Bomb Squadron will hold their reunion at the High Point Motor Chicopee, Mass., August 4–6. Con

George H. Townsend
190 Pool Rd.
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The mind to imagine . . . the skill to do

Airpower in the News

By Claude Witze, SENIOR EDITOR

Free Speech and the B-1

Washington, D. C., June 6

If you look closely, you can find evidence that the light has dawned. In back of the current annual wrangle over the federal budget, there is growing realization that the Defense Department is not the place where taxpayers' dollars are spent profligerously and there is little hope the threats to national security will wane in the near future. It is reported that the Carter Administration is mapping a shakeup in the welfare programs, which have grown in recent years at the expense of our military arsenal, that will save millions of dollars. This will be done by tightening welfare eligibility rules for a starter, and the savings will amount to at least $3 billion a year. Even more can be conserved by the elimination of widespread fraud now rampant across the board in the dispersal of funds voted for improvement of our society.

There is a new study on Capitol Hill, from the staff of the Senate Budget Committee, that says payroll taxes, imposed to finance Social Security and unemployment compensation, are the fastest growing source of federal revenue. And, they add to both inflation and unemployment. Now comes a report from the General Accounting Office on a study of contracts awarded by federal agencies. The focus is on $9.1 billion in research and development awards made in Fiscal 1975 by six agencies. The six are: the Federal Maritime Administration, the Environmental Protection Agency, the Federal Aviation Administration, the National Highway Traffic Safety Administration, the Federal Railroad Administration, and the Office of the Secretary of Transportation. Much of the $9.1 billion they spent has been wasted, says GAO. That's enough to buy at least a few B-1 bombers for the Defense Department, which was not named in the GAO report as a miscreant. The report may also give Sen. William Proxmire and Rep. Les Aspin, and their staffs, new fields to plow in their hunt for misspent taxpayers' dollars.

All of these things, and more, are adding to the discomfort of the liberal proponents of policies denigrating the requirements of national security. The discovery, for example, that higher payroll taxes add to inflation and unemployment must be as jolting to Hubert Humphrey as the disclosure of waste outside the Pentagon is to the Proxmire-Aspin axis.

The doctors who have been prescribing bad medicine are losing patients, and they know it. Both George McGovern and George Meany, representing the liberal and labor camps, have been screaming that the Carter White House has let them down because it appears to recognize the limitations that must be placed on growth of the welfare state, lest we fall into the same abyss now occupied by Great Britain. There have been some White House meetings on legislative priorities, and out of them comes the report that there is a deepening division between the President and Democratic leaders in Congress. This arose mainly from Jimmy Carter's insistence that he will have a balanced budget by 1981, come hell or high water. Such an attitude, says the New York *Times*, is "a position regarded as political heresy by Democrats in Congress who stress the need for social welfare programs."

Sen. Alan Cranston, the California Democrat who is the majority whip, said: "We can't sacrifice everything to a balanced budget. Government programs should not only stress a balanced budget and fighting inflation but also reducing unemployment and fighting for those who need help." At that point Mr. Cranston had not seen the Budget Committee report that says higher payroll taxes, imposed to help those who need help, contribute substantially to both inflation and unemployment.

At the beginning of June, both Defense Authorization and Defense Appropriations decisions are awaited in Congress. The First Budget Resolution, portrayed as a muddle in this space last month, finally has fought its way through Congress, and we have what the two Budget Committees call a "target." The defense target agreed upon calls for budget authority of $118.5 billion and an outlay of $11 billion in Fiscal 1978. The House-Senate conference that came up with these figures lasted three days and was dominated by the defense issue. The outcome cuts the White House defense request $1.6 billion in budget authority and $947 million in outlays. The figures were $4.1 billion and $2.3 billion in the original House resolution that was rejected in mid-May.

From the viewpoint of the White House, probably the major improvement made in conference is a reduction in the projected deficit from $69 billion to $52.6 billion. This comes about because of reforms proposed in areas outside defense that, the Budget Committees believe, can produce new savings. The fact remains that the target resolution cuts total White House requests for all federal spending by $3.8 billion, and nearly half of this was taken from defense.

The authorization bills, which cover only weapons procurement, military research, and civil defense, remain in limbo. The Senate has voted to approve spending, in these areas, of nearly $36 billion. This amount is $121.6 million more than the Carter request and $83.8 million more than was approved by the House in April. At this writing, the Senate Appropriations Committee has not been heard from, but the House Defense Appropriations Subcommittee has announced it will recommend total defense spending at a level of $111.2 billion. The full committee report is not due for

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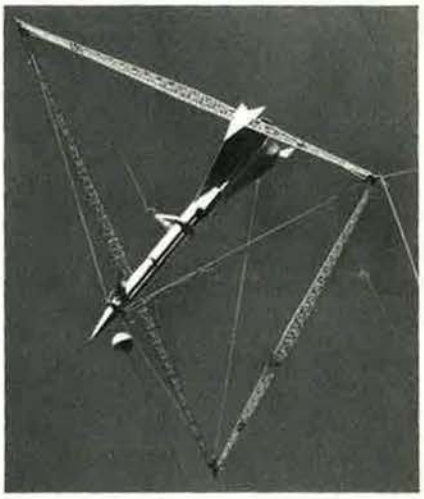

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Airpower in the News

The decision on whether or not to proceed with production of the Air Force B-1 bomber, shown here in flight, remained controversial as deadline neared.

couple of weeks, but Chairman George H. Mahon said there would be no elimination of major weapons procurement; there is a long list of small reductions.

The major issue on the Hill is the Navy's shipbuilding program. The Senate has voted to authorize $81.6 million for down payment on another *Nimitz*-class carrier. President Carter does not want the money, and the House did not even try to include it in its version of the bill. The authorization conference, when it comes, will be a heated one.

Air Force observers are fascinated this year, and sometimes amused, by the efforts of some to make the Rockwell International B-1 bomber a major issue, which it is not. The Gerald Ford Administration laid the question of production squarely on the desk of President Carter, where it lies today, but will not remain long. So far, there has been no effort, in either house of Congress, to deny funding for the first increment of five airplanes and long-lead procurement for the next thirteen. Sen. Barry Goldwater has made the only speech on the B-1, and that was when the authorization debate opened on May 16. Because cost dominates all discussion of the B-1, he devoted most of his attention to the dollar curve. Here are some of the facts put in the *Congressional Record* by Mr. Goldwater:

- The real cost growth since 1970, exclusive of inflation, is seventeen percent.
- The cost of each aircraft, including R&D, is $48.5 million in 1970 dollars.
- Inflation is the dominant factor in driving the cost to the present estimate of $101.7 million per aircraft.
- Inflation and schedule changes, both beyond control of the Air Force, have added more than $50 million to the cost of each airplane.

The next day, the Senate approved the authorization bill, 90 to 3, and voted to fund the B-1 project. And the Associated Press reported from the Pentagon that the cost of the B-1 project was estimated to have grown by nearly $2 billion since December "because of the Carter Administration's program stretchout and inflation." If 244 bombers are built, which is unlikely, this would bring the price to $101.7 million per aircraft. With fewer airplanes, the cost will be higher for each bomber.

At this point, the dismayed National Campaign to Stop the B-1 Bomber, a coalition of thirty-six church, pacifist, and labor organizations, took up its cudgels. The coalition called a press conference at the National Press Club in Washington on May 18. The spokesmen, who had been thrown into a state of confusion by the White House and action on Capitol Hill, hoped to make news damaging to the B-1. The real headline, if any newspaper had seen fit to print it, was that the backers of the National Campaign to Stop the B-1 Bomber have become just as disillusioned with the Carter Administration as the Messrs. McGovern and Meany. A pretty girl named Nancy Ramsey, representing the Women's International League for Peace and Freedom, said that if Jimmy Carter approves the B-1 production program, "it will be a breach of faith." A young man named Robert Brammer, a spokesman for the coalition, repeated some of the pledges offered by the President in last year's campaign, in which he opposed production of the bomber at that time, and charged that the Carter Administration appeared to be ready to violate another of its campaign pledges.

The press conference was pathetic. It drew no attention in the newspapers and the lone TV network that appeared with a camera quickly withdrew after no film exposure. The next day, the Washington *Post* gave the coalition some publicity, but only under a lead announcing that the cost of the aircraft now is estimated at $101.7 million per plane. This was a fact revealed on the Senate floor three days earlier by Mr. Goldwater, in a speech ignored by newsmen. The AP had reported the increase, two days earlier, from a Pentagon announcement.

Back in February, the National Campaign to Stop the B-1 Bomber had given Midge Costanza, the President's ombudsman, a list of fourteen questions, most of them loaded, and demanded replies from Mr. Carter. She said they would go on his desk and "someone would answer them. On top of this the National Campaign tried to move in on the decision-making. The organization requested that Jeremy Stone, of the Federation of American Scientists, be allowed to name independent defense experts to either participate in the NSC (National Security Council) study or evaluate the study's criteria and conclusions before Carter's decision. On top of this, if the NSC decided to endorse the B-1, the National Campaign demanded a private meeting with the President before he made his decision.

At the press conference, it was disclosed that the White House had provided eight and a half answers to the fourteen questions. There was no announcement that the Administration would let Mr. Stone's appointees contribute to the decision-making. The spokesmen did not hide their disappointment

learning that the answers they did receive were prepared by the Pentagon and never were seen by the President. They said, in fact, that they were "somewhat angry" and that processing through the Defense Department "was not what we expected from President Carter." Mr. Stone said he still wanted to meet with the President "to explain why the B-1 is a big mistake." He said Mr. Carter could prove his "real independence" only by killing the B-1 program.

The questions that were answered by the Pentagon via Midge Costanza brought no surprising replies. The material clearly was taken from already published material. The National Campaign did not seem to appreciate the fact that the paragraphs they were given placed repeated emphasis on cost-effectiveness of the B-1 system as a key factor in the decision-making process. The implication was clear that, contrary to the National Campaign's contention, the probable cost-effectiveness would be high.

The National Campaign to Stop the B-1 Bomber was not finished. On the evening of May 24, at Washington's Mayflower Hotel, there was a dinner to honor both the Air Force and Rockwell International "for the greatest achievement in aeronautics or astronautics in America" in the previous year. They were to be awarded the 1976 Robert J. Collier trophy "for the highly successful design, development, management, and flight test of the B-1 strategic aircraft system." The award is given annually by the National Aeronautic Association and the dinner sponsored by the National Aviation Club. The 650 black-tie guests were greeted at the hotel by a picket line of National Campaign protesters.

Inside, at a reception preceding the affair, an unexpected guest turned out to be Terry Provance of the American Friends Service Committee and an active leader of the National Campaign. Provance was casually dressed, which led an NAA official to ask him whether he was a member of the hotel staff. Provance said he was employed by the hotel. Still, he was recognized as a professional anti-B-1 demonstrator and was asked to leave. He was offered a refund for the ticket he had purchased. Provance did leave the reception, but returned to the ballroom as the presentation ceremonies were about to start and disrupted the affair by demanding an opportunity to speak for five minutes. He was ushered out by security guards. At the same time, officials of the National Aviation Club, spurred by Sen. Barry Goldwater and California Rep. Robert K. Dornan, decided to give Provance the opportunity he sought. In a display of liberalism unmatched by their critics, the military and industry participants listened to Provance's five-minute harangue. He was polite and was politely received. He argued that the B-1 is not needed for national security, that the money should be spent for social programs, and that the aircraft is a "gas guzzler." If he was rude, it was only in his declaration that the B-1 team should not be given the Collier Trophy.

Air Force Chief of Staff Gen. David C. Jones, who spoke later, pointed out that the young dissenter had properly been given a chance to exercise his right to freedom of speech. And also that the B-1, if it ever is required to enter combat, will do so in defense of that right. ■

The Wayward Press

The Wayward Press is accused, from time to time, of paying too much attention to major newspapers, particularly those published in Washington and New York. Readers of many small dailies, and some of their editors, ask for attention. An extraordinary number of these complaints come from subscribers of the Austin (Tex.) *American-Statesman*, who are enraged by that paper's consistent antimilitary editorial bias.

Examination of the *American-Statesman* shows that banner headlines are given to almost any story that may reflect discredit on the armed forces. A thirty-two-year-old citizen, about to enter local politics, is described as coming "from a lower-middle-class background, the son of a career Air Force sergeant." An Air Force dining-in, to the *American-Statesman*, is "an officially sanctioned drunken brawl."

Back in late March, the US Readiness Command held a joint exercise in central Texas that was called "Gallant Crew '77." It involved more than 30,000 soldiers and airmen, all under the command of Lt. Gen. W. W. Marshall, who is Deputy Commander in Chief of the Readiness Command. The purpose of the exercise, made clear in press releases from the headquarters at MacDill AFB, Fla., was "to train and evaluate selected active and Reserve Army and Air Force units in offensive and defensive operations." The maneuvers were made as realistic as possible. Many of the participants had never been in a war and needed field experience with their equipment, much of it highly complex. The war game lasted more than two weeks, including time for preparation and recovery. As a military exercise, there was nothing exceptional about it to any competent military correspondent.

With the heart of the battle only about thirty miles from Austin, the *American-Statesman* dispatched an advocate journalist named John Kelso to Camp Swift to cover the story. According to his report, in the paper of March 30, "Gallant Crew 77" was a "camping trip" that cost the taxpayers more than $6 million. He did not quote an authority for the figure. The price was high, according to Mr. Kelso, partly because it involved 800 flight missions by the Tactical Air Command and "fake" ground warfare complete with tanks. Money also was spent on roads, and tents to house some of the troops. There is no indication in Mr. Kelso's banal report that he had any interest in the purpose of the exercise or what it proved, but he did write that paychecks were distributed on payday and that there were beer-vending machines and evening movies in the chow hall.

The *American-Statesman* did use a photo with Mr. Kelso's story, a good shot of the interior of the Air Force Command Center, fully manned and in operation. The newspaper's readers were not told what the picture was all about. Considering the juvenile approach used by the reporter, a cartoon would have been more suitable to adorn his copy. The total result was that the Austin newspaper held the maneuvers up for ridicule only. There was no factual reporting or evaluation of the performance from the Readiness Command.

According to the masthead, the publisher of the *American-Statesman* is a man named Jim Fain. From the March 1976 issue of *Austin Magazine*, published by the Chamber of Commerce, we learn that he also can be correctly addressed as Brig. Gen. Jim Fain, United States Air Force Reserve (Ret.).

Presumably, he had fought to protect the Freedom of the Press, and now feels free to enjoy all its privileges. There is nothing in the Constitution about a publisher's responsibilities.

—CLAUDE WITZE

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IBM is also part of the Navy's newest countermeasures development program involving design-to-price concepts as well as being on board the Navy's newest carrier-based patrol aircraft, the S-3A, with the AN/ALR-47 System.

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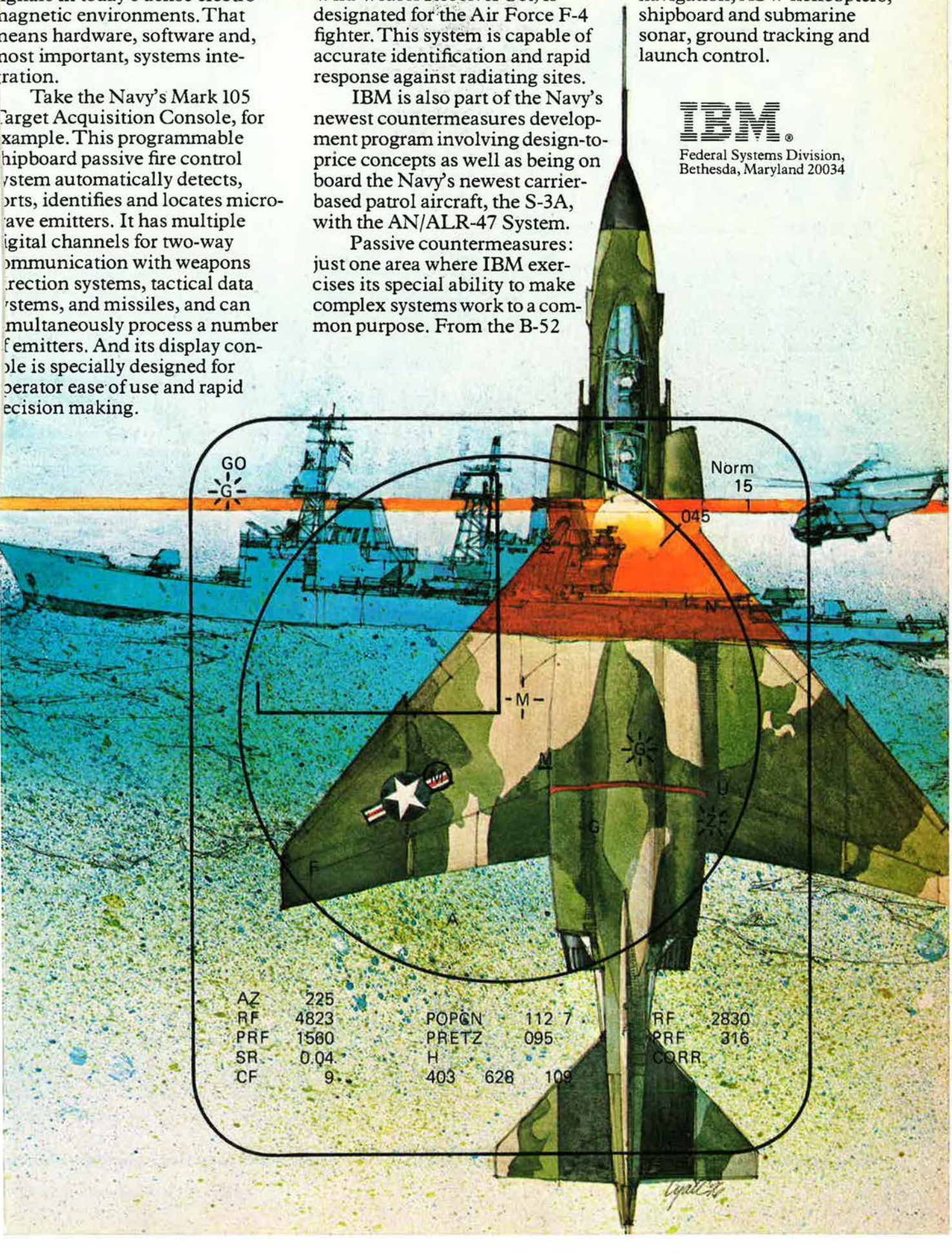


Aerospace World News, Views & Comments

By William P. Schlitz, ASSISTANT MANAGING EDITOR

Washington, D. C., June 6

★ In early May, NASA and the Soviet Union's Academy of Sciences formally agreed to further cooperation in manned spaceflight.

The move "is designed to provide continuity of the joint technical, scientific, and operational capability developed through the highly successful Apollo Soyuz" rendezvous in July 1975.

The agreement provides for three joint working groups to prepare recommendations for two new programs: one concerned with orbital manned flight and another with a possible international space station.

One group is to study potential programs that could be undertaken by the US Space Shuttle in conjunction with the Soviet Salyut space station. The emphasis, according to NASA, will be on "science first" programs. A second working group will undertake plans for these joint operations.

The third group is to explore the idea of a joint space station that might generate mutual economies and efficiencies, the space agency said.

★ Subject to Senate confirmation, President Carter in May named a physicist-oceanographer as the new NASA Administrator.

Dr. Robert A. Frosch, forty-nine, previously was associate director for applied oceanography at Woods Hole Oceanographic Institution, Mass. He succeeds Dr. James C. Fletcher, the fourth head of the space agency who resigned on May 1 to return to private life.

Dr. Frosch attended Columbia University, where he earned a B.A., M.A., and, in 1952, a Ph.D. in theoretical physics.

Joining Columbia's Hudson Laboratories in 1951, he became Director in 1956 and held the post until 1963.

Dr. Frosch served as Assistant Secretary of the Navy for R&D from 1966 to 1973, and as Assistant Executive Director of the United Nations Environment Program from 1973 to 1975.

In other staffing moves:

• Picked as Under Secretary of the Air Force is Hans M. Mark, forty-seven, previously Director of NASA's Ames Research Center, Calif. He replaces James W. Plummer.

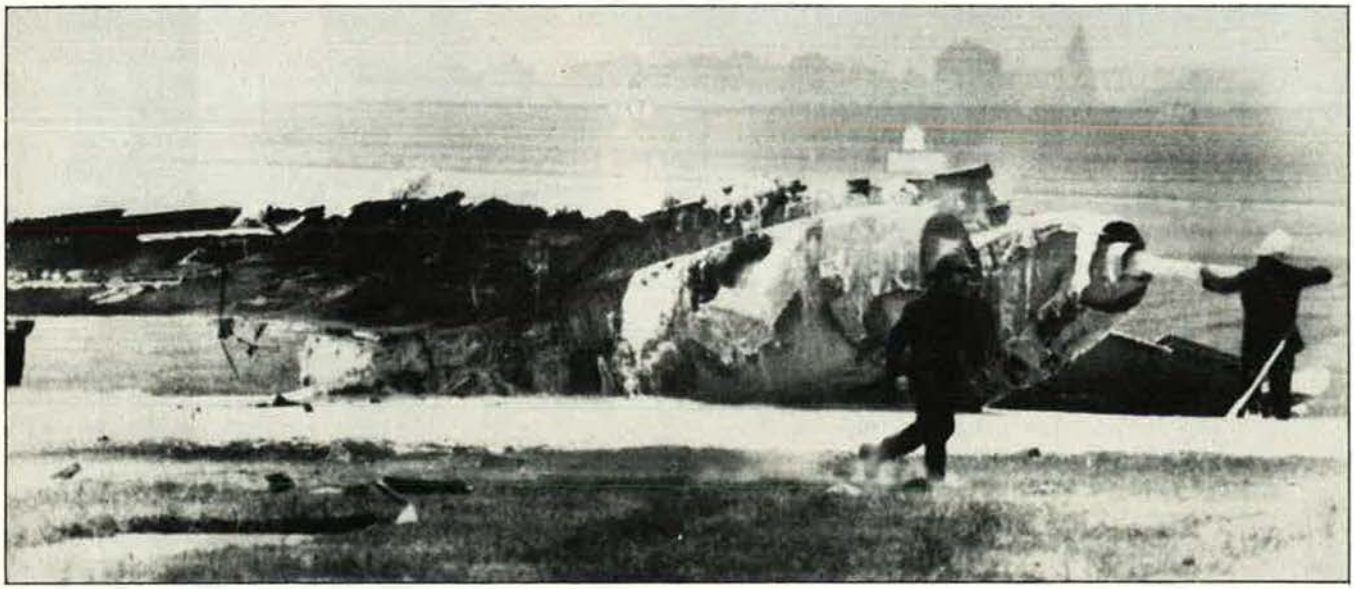
• Ms. Antonia Handler Chayes has been named as the new Assistant Secretary of the Air Force (Manpower and Reserve Affairs), replacing Mrs. Nita Ashcraft. Previously, Ms. Chayes was a partner with the law firm of Csaplar and Bok of Boston, Mass. Earlier a dean of Tufts University's Jackson College, Ms. Chayes attended Yale Law School 1949–51, and received a law degree from George Washington University in 1953.

A lecturer at Yale and Boston University Law Schools, she served on the White House staff in 1961–62.

Ms. Chayes's husband is the Hon. Abram Chayes, Felix Frankfurter Professor of Law at Harvard. They have five children.

★ Large-scale integrated circuits (LSIs) are complex and costly, but an Air Force engineer has designed a new type that eventually may be ordered routinely from supplier catalogs.

The integrated circuit, called a



At the Paris Air Show in early June, tragedy struck when a new USAF A-10 close-support aircraft engaging in aerobatics crashed. Howard W. "Sam" Nelson, the aircraft's pilot and director of flight operations for Fairchild, died.

digital phase lock loop (DPLL), ould find uses in a wide variety of nilitary and commercial electronics products, AFSC officials said.

Gary Gaugler, of the Electronic Technology Division of AFSC's Air Force Avionics Laboratory, invested about 450 hours in designing an intricate circuit technique called "universal gate array."

"We hope that within a year one military qualified digital phase lock loop chip will sell for about $3 to $4 as a standard catalog item," Mr. Gaugler said.

"In using the gate array technique for intricate circuit design, the starting point is a universal or standard chip with many components like transistors and resistors. Those parts, however, aren't connected to one another or anything else on the chip.

"It's how the designer connects them that determines the functions of jobs the intricate circuit will do. Hook up the components one way and the chip could do signal processing in radars. With parts connected differently, the chip might be an encrypted speech coder," the Air Force engineer said.

Functions the DPLL chip might perform in other military devices include frequency tracking, bit timing and data recovery in navigation equipment, and digital conversion in aircraft flight controls, AFSC said.

★ According to a March 31, 1977, DoD report to the Congress, the estimated cost of forty-five major military acquisitions rose $3.3 billion since December 1976. The estimated price tag on the weaponry now stands at $200.9 billion, up from December 1976's $197.6 billion (figures rounded).

The major Air Force-related acquisitions:

• **The B–1:** Cost of the program climbed $760.6 million from the previous estimate. According to the report, "The increase is based on the combined effects of reducing the production quantities in the early years, allowing for some changes in estimating costs, recomputing effects of inflation in later years, and adjusting the total production schedule." (It was cautioned that the B–1 program is under review and that the production schedule may change to align with a presidential decision.)

• **The F–15:** Program cost increased by $387.3 million "due primarily to revising the aircraft procurement schedule to seventy-eight aircraft per year beginning in FY '78 and the deletion of support for the follow-on interceptor program."

• **The E–3A:** Program cost decreased by $178.5 million due primarily to reducing the program by six aircraft—from thirty-four to twenty-eight—and the stretchout of the production deliveries to one aircraft every four months.

Among Navy programs:

• **The F–14A:** Increased $23.4 million due primarily to fund contractor claims settlement for FY '71 through FY '73.

• **Trident:** Up $22.7 million due to addition to development, test, and design program.

• **The E–2C:** Program cost in-

Simulators—Electronic Marvels With Great Potential

With budgetary constraints and climbing costs as motivating factors, the use of simulator training devices is mushrooming.

Simulators, in fact, have become big business and are carving out a major industry for themselves.

The devices have come a long way since the primitive Link Trainers of World War II fame, and now—harnessed to the latest in computer technology—are continuing to grow in sophistication and capability while providing economical learning in myriad endeavors.

They have earned a prominent place in training commercial airline pilots. For the military, especially USAF, simulators seem to have a vast potential across a broad spectrum. And, in the civilian sector, they may be admirably suited for such roles as driver training, to name but one example.

The commercial airline use of simulator training—which has yet to scratch the surface among smaller airlines and general aviation—is confined essentially to takeoffs, landings, and flying and navigation (and the emergencies encountered therein). The military, for its part, has brought a new challenge to firms manufacturing and marketing the devices, because of the difficulties in presenting realistic simulations of the complex tasks that military flyers are required to perform—as in dogfights.

Having already been applied to such activities as aerial refuelings and carrier-deck landings, simulators potentially could teach helicopter pilots to land in small clearings or atop buildings; tank and artillery crewmen to deliver ordnance; and submariners to attack enemy shipping tracked via periscope. The potential economies in all this are incalculable.

One leader in the field, Britain-based Redifon Co., alone is supplying a multimillion dollar buy of simulator visual systems to USAF for undergraduate pilot training at Williams AFB, Ariz., Vance AFB, Okla., and Reese AFB, Tex.

According to the company, "A typical visual system is made up of a giant 2,000-to-one scale model of a chosen area. A television camera mounted on a gantry roams over the model and simulates the aerial view from the cockpit when a pilot makes any maneuver. Dawn, day, dusk, and night flying can be reproduced as can any sort of emergency situation."

Redifon, which helped pioneer the commercial airline use of simulators with a sale of equipment to KLM, visualizes almost boundless use of the systems for both military and civil training. For example, in the commercial aviation arena, pilots could be taught on simulators to contend with specific airports. The simulation could contain ground features, hazards, and other items of pilot interest for, say, New York's Kennedy or London's Heathrow—by day or night and through fog or cloud cover.

Redifon has invested heavily in a technique called CGI (for Computer Generated Images). While this method does not approach the real world as seen through a cockpit's windscreen—or videotape images for that matter—CGI is remarkable for the detail it can present.

The firm's DAYNITE CGI visual system (developed in partnership with Salt Lake City's Evans & Sutherland Computer Corp.) uses a computer to electronically define a scene by points of light. In full color that can be shaded to depict even a glow on the horizon, one situation can feature an airport, with runways, markings, infrastructure, and surroundings including fields, forestry, roads, coastlines, etc., and even the skid marks on a runway.

Under contract to Boeing Co. and the Air Force, Redifon is currently producing the simulator system for USAF's new Airborne Warning and Control Aircraft (AWACS).

In any case, simulators, whose energy expenditures during operation are relatively small, can be expected to find ever-growing use as substitutes for fuel-costly and high-risk military aircraft maneuvers.

company's coming!

The U.S. Air Force EF-111A Tactical Jamming System (TJS) will be welcome company indeed, for tactical aircraft operations in tomorrow's ominous electronic warfare environment.

Vastly more powerful than any previous airborne jammer, the combat-proven ALQ-99 system will provide a safe "Highway In The Sky" by denying the enemy effective use of his surveillance capabilities and his radar-guided weapons.

Now flying at Grumman, the EF-111A will move U.S. tactical jamming into the supersonic era.

EF-111A TJS . . . will be known (and appreciated) by the company it keeps

GRUMMAN AEROSPACE CORPORATION

Aerospace World

crease of $21.2 million due primarily to steeper inflation.

★ A Lockheed-developed pilotless aircraft designed to harass enemy air defenses recently completed its initial flight-test program in Arizona.

A contender in USAF's Harassment Vehicle project, the seven-foot-long vehicle is powered by an eight-and-a-half horsepower Kolbo 274 engine that "is improved by Lockheed's capacitive discharge ignition system," officials said.

An important aspect of the craft is its low cost. Lockheed used a compression molding technique to form its body from fiberglass.

USAF visualizes its Harassment Vehicle as an expendable drone that would support manned aircraft missions by using its electronic countermeasures equipment to detect and deal with enemy radar.

Mission data would be stored in an on-board memory before flight to direct the vehicle's autopilot and other equipment.

In its recent flight demonstration, the Lockheed aircraft was operated as a remotely piloted vehicle and controlled by a manned ground station.

★ USAF has announced it will close Richards-Gebaur AFB, Mo. Headquarters of Air Force Communications Service will be shifted to Scott AFB, Ill.

The decision follows a two-and-a-half year battle by local residents to block the base closure.

According to USAF, the move will cut 1,500 manpower spaces (800 military and 700 civilian) and save $19 million annually.

At Richards-Gebaur, the C-130-equipped 442d Tactical Airlift Wing, an AFRES unit, will maintain the flight line and associated facilities with a cadre of about 200 people.

★ Initial operation test and evaluation (IOT&E) of the B-52/GBU-15 Modular Guided Weapon System was initiated this past spring at Carswell AFB, Tex.

The GBU-15 system is a family of guidance, control, warhead, and airframe modules that can be arranged in various configurations to perform specific missions.

The flight-test program calls for ten launches from a B-52D over either the test range at Eglin AFB, Fla., or White Sands, N. M. An additional twenty-two captive flights also will occur.

The GBU-15's midcourse guidance is provided through a data link from a B-52 radar/beacon combination or television.

Beside AFSC and Air Force Test and Evaluation Center personnel, also participating in the program are representatives from contractor firms, SAC, AFLC, and ATC.

The GBU-15's full-scale development program has been enlarged to include a B-52D antishipping and land-target role.

Other than suggesting production configuration changes and trade-offs, officials said, the test program will also judge such mundane items as the system's technical manuals and maintenance data.

★ USAF has moved into phase one of a program that, if successful, would sharply upgrade the capabilities of its strategic communications network.

Under a $36 million USAF Electronic Systems Division contract, ITT Defense Communications Division is heading up an industry team "to design and provide the system functional prototype of the Strategic Air Command Automated Total Information Network (SATIN IV)."

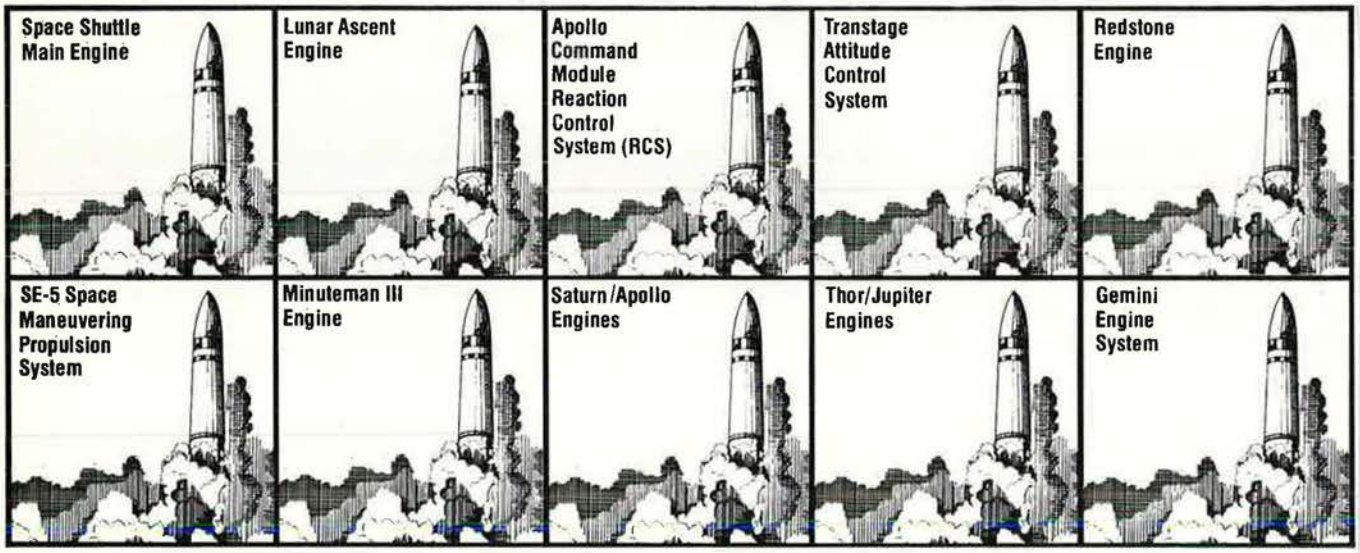
SATIN IV is visualized as providing "highly responsive, functionally survivable, and secure communica-

It's nice to be No. 1. Men of the 351st Strategic Missile Wing, Whiteman AFB, Mo., cheer their victory upon being awarded the coveted Blanchard Trophy. The 351st, commanded by Col. Clifford D. Cork, led the pack in SAC's 1977 Missile Combat Competition at Vandenberg AFB, Calif., this spring.

Together for the first time at Wright-Patterson AFB, Ohio, are the McDonnell Douglas YC-15 and Boeing's YC-14, contenders in USAF's Advanced Medium Short Takeoff and Landing (AMST) program. Both then headed for Europe.

AIR FORCE MX PBPS

IF IT'S HEADED FOR SPACE, ROCKETDYNE CAN BUILD A POST BOOST PROPULSION SYSTEM TO OPERATE THERE.



We've done it time after time, after time... From its earliest days, Rocketdyne has been a pioneer in rocket propulsion. Today, we're the leading developer and producer of reliable liquid propulsion systems.

You probably know us best for powering such history-making vehicles as Redstone, Jupiter, Atlas, Navaho, Thor, Gemini, Saturn/Apollo and Lance. We are also developing the Space Shuttle Main Engine.

A nice side benefit to all this work is the reputation we've established as being a highly reliable systems supplier—developing and then delivering low-cost, high-technology systems that can be produced in quantity, on schedule, with minimal risk.

We've delivered the Main Engine for the Minuteman III Post Boost Propulsion System. And now we're ready to go to work on the next big job: to develop and deliver the Post Boost Propulsion System for the U.S. Air Force MX Program. We have the experience, the technology and the resources to do the job right. Right now.

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Aerospace World

tions between the SAC commander in chief, the communications links of the National Command Authorities, and SAC missile and aircraft combat crew commanders." SATIN IV would replace the current data transmission subsystem—the SAC Automated Command and Control System.

Phase one's development of a prototype will determine whether or not SATIN IV "can be built in a cost-effective manner to meet operational requirements." If so, a full-scale system would presumably then be produced and installed.

Teamed with the ITT subsidiary in the project are IBM Federal Systems Division, Gaithersburg, Md.; BDM Corp., Vienna, Va.; and Leo A. Daly, Inc., Omaha, Neb.

Completion of SATIN IV under phase two would occur in the mid-1980s.

Tested successfully in the Baltic recently was this experimental X 114, a ground-effect craft developed by a VFW-Fokker subsidiary, Rhein-Flugzeugbau. The vehicle promises both civil and military applications.

★ This past spring at Ft. Irwin, Calif., was staged the largest Red Flag combined combat exercise thus far.

In support of 4,000 ground troops, Air Force, Navy, and Marine Corps aircraft flew some 2,000 sorties, including 1,000 direct-support missions.

At least twenty-two types of aircraft and helicopters participated in the event, operating from nearby Nellis AFB, Nev., and bases in other states including those as distant as Wurtsmith and Kincheloe in Michigan (from whence B-52 missions were flown).

Command and control of the Red Flag/Irwin II joint exercise included a Tactical Air Control Center based at Nellis, a C-130 Command and Control aircraft, a Forward Air Command Post, a Direct Air Support Center, and an Army Tactical Operations Center.

Close air support on what the Army termed a "massive" scale was provided, including on-call strikes by USAF's new A-10s of the 355th TFW, Davis-Monthan AFB, Ariz. It was aircraft from this unit that underwent a stringent sortie surge test in February, flying thirty-four simulated combat missions in eleven hours *(see April issue, p. 23).*

In mid-March, it was the A-7D Corsair II's turn, when at England AFB, La., a team of TAC and Ninth Air Force inspectors arrived unannounced. In two days of flight operations that followed, A-7Ds of the 23d TFW flew a total of 201 sorties.

Above, USAF Thunderbirds with photographer Ralph Amdursky, who photographed the team in flight, left, to create the world's largest color transparency. Sponsored by Eastman Kodak Co., the huge Colorama is on display in the Main Concourse of New York City's Grand Central Station.

★ This past May, various activities took place around the nation to commemorate the fiftieth anniversary of Charles Lindbergh's solo flight across the Atlantic.

To mark the event at the National Air and Space Museum in the nation's capital, a special exhibit was opened to the public.

Located near the *Spirit of St. Louis* and *Tingmissartoq*—the plane in which Lindbergh and his wife Anne explored the polar regions—are such memorabilia as flight clothing and photographs and a film clip of his departure and ticker-tape parade on his return to New York. Of particular interest is the barograph that Lindbergh carried aboard to prove he did not land en route.

Aerospace World

★ The Air Force is giving faculty members of the nation's institutions of higher learning the opportunity to conduct research in Air Force labs or to serve as research managers in the Air Force Office of Scientific Research (AFOSR).

Purpose of the University Resident Research Program, according to AFOSR Director Dr. William L. Lehmann, "is to provide an opportunity for qualified faculty members to direct their expertise toward Air Force research, as well as enhance their own professional development."

Assignments will be for one year, with the possibility of extension. In all, twenty-four positions will be available annually.

For information on USAF's laboratories and research programs, contact the Air Force Office of Scientific Research (AFOSR/XO), Attn: Lt. Col. Thurmon L. Deloney, AFSC University Resident Research Program, Building 410, Bolling AFB, D. C. 20332.

★ **NEWS NOTES**—In October, **ADCOM** will take over from the Army operation of the long-range **Parimeter Acquisition Radar** at the Safeguard antiballistic missile site at Concrete, N. D., near Grand Forks AFB, which will provide support.

Bardyl R. Tirana has been appointed as **Director of the Defense Civil Preparedness Agency,** succeeding John E. Davis. A practicing attorney since graduation from Columbia University Law School in 1962, Mr. Tirana in his new post will help coordinate civil-defense efforts among federal, state, and local authorities.

The military and civilian pioneers who developed the Atlas, Titan, and Minuteman ICBMs and Thor IRBM plan a **twenty-third anniversary reunion** in Los Angeles in August. For information, write: USAF ICBM Pioneers, P. O. Box 1260, Hawthorne St., Calif. 90250.

A team of USAF cameramen won first place in the 1976 Military Newsfilm Photographer of the Year competition for their "William Tell—76": SSgt. Nicholas A. **Alvarado,** TSgt. Jimmie L. **Box,** SSgt. Jerry W. **Hipley,** SSgt. James C. **Fitting,** SSgt. Daniel J. **Mahoney, Jr.,** Sgt. Paul M. **Norris,** and MSgt. William E. **Randall.** In fact, USAF took fifteen of the twenty-five awards. ■

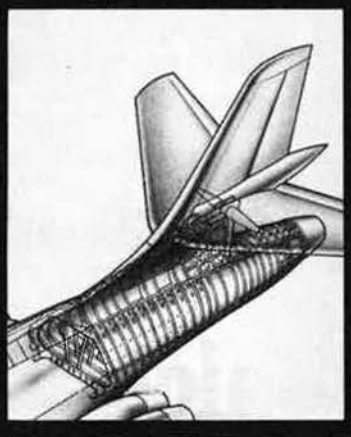
At the recent presentation of the 1976 Collier Trophy to representatives of the military/industry team that developed the B-1. From left, retired USAF Maj. Gen. John R. Alison, an AFA National Director and President of the National Aeronautic Association, the trophy's sponsor; USAF Chief of Staff Gen. David C. Jones; Rockwell International President and Chief Executive Robert Anderson; and Sen. Barry Goldwater, keynote speaker at the awards ceremony.

Index to Advertisers

ROCKWELL KNOWS WHATS BEST FOR THE B-1. THAT'S WHY WE'RE BUILDING THE AFT FUSELAGE.

If you've any doubts left about Vought's ability to handle major subcontracts in the field of aerospace, just read what Bastian (Buz) Hello, President of Rockwell's B-1 division had to say about us when we were tapped to build the aft fuselages for their B-1 bomber.

"Vought has long been recognized as a leader in the aerospace industry as specialists in producing both sophisticated aircraft and complex structural airframe assemblies. Their broad experience and proven techniques have been successfully used on such programs as the A-7, the 747 and DC-10 wide-bodied jet liners, the S-3A anti-submarine aircraft, and the Space Shuttle."



And that's from one of our toughest competitors. But we couldn't have said it better ourselves.

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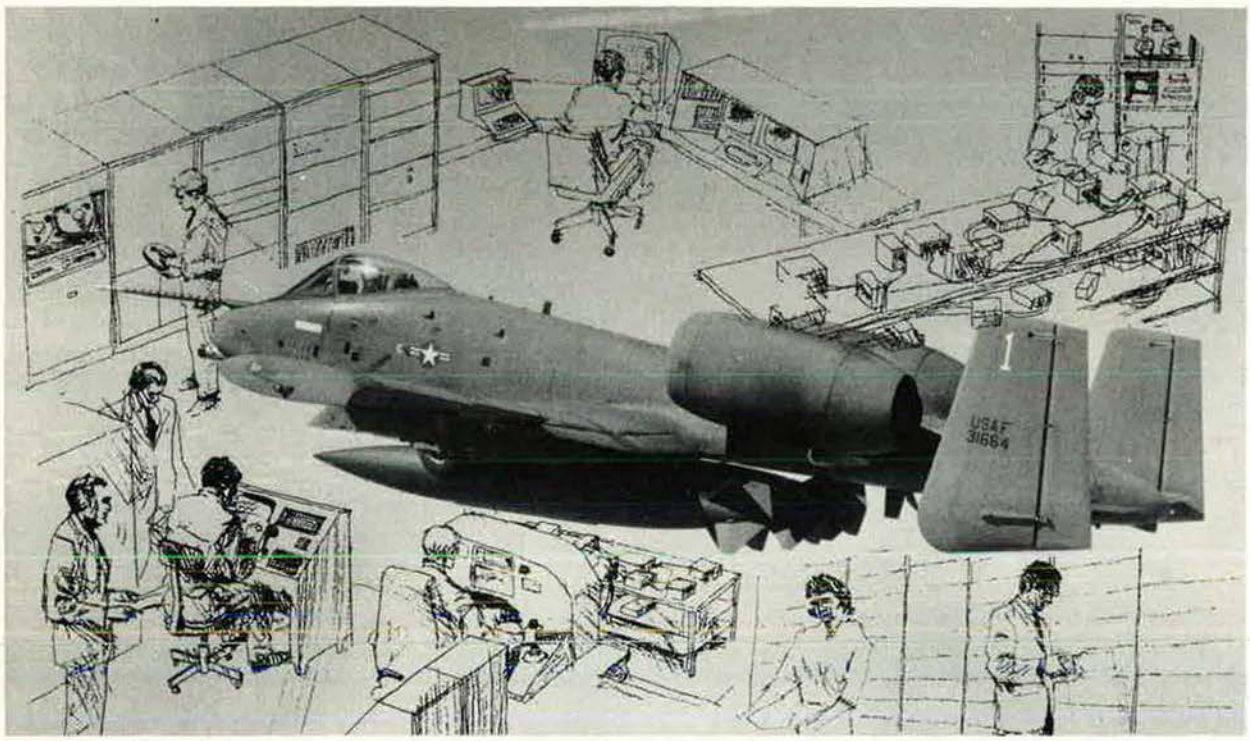
"DAIS" PUTS PILOTS ON TOP OF TECHNOLOGY



A modern, single-seat, attack pilot needs six pairs of eyes and a dozen hands in the heat of a dangerous mission. That's why airborne computers are vital to mission success and, for that matter, pilot survival. Digital computers, integrated in complex architectures, can control electronic countermeasures, do instant navigation, automate weapons delivery, monitor flight controls, and track engine parameters...simultaneously. By managing blizzards of data, the computer, and its companion avionics and software, gives the air crew time to react intelligently to fast-changing mission environments.

This means, however, that every possible mission function has to be thought out in advance and programmed into the computer. That's what DAIS, the Air Force's Digital Avionics Information System, is all about. It's the project for examining complex avionics and low-cost architectures which will enable future pilots to handle increasingly complicated weapon systems, effectively.

TRW supports the AF Avionics Laboratory in this effort with sophisticated simulation technology, support software, and avionics integration and analysis work. We are also part of the AF Logistics Command team that's developing integrated avionics test beds for the support of operational flight software.

TRW has more experience in developing and testing sophisticated real-time software than any other company. We've done it for manned and unmanned space systems and for both ballistic-missile and missile defense systems. The testing requirements for those kinds of missions are really rigorous. We've had to develop software test techniques that are versatile and comprehensive as well as capable of probing the lowest levels of detail.

For more information about TRW's capabilities in this area, contact Richard A. Maher, TRW Defense & Space Systems Group, One Space Park (90/2961), Redondo Beach, CA 90278. Phone: (213) 536-3238.

Digital Avionics Technology

FROM A COMPANY CALLED

TRW

AIR FORCE

JULY 1977

The strangely beautiful photo on the cover of AIR FORCE Magazine's seventh annual electronics issue symbolizes a fundamental Air Force concern that extends across the broad field of C^3 and avionics—the ability to operate reliably and without interruption in the face of interference by the enemy. Resistance to jamming and to nuclear-weapons effects are *the* watchwords of the military electronic systems designer. Phenomenal progress is being made.

Our cover subject is STRESS—an Air Force project involving the Air Force Avionics Laboratory, the Air Force Systems Command's Electronic Systems Division, and the Defense Nuclear Agency. STRESS created a barium cloud —one half ionized and the other half neutral—to simulate nuclear effects interposed between a Lincoln Experimental Satellite in orbit 25,000 miles above the Atlantic (a possible forerunner of the Air Force's new Strategic Satellite System) and a C-135 communications aircraft.

—THE EDITORS

THE ELECTRONIC AIR FORCE

An Air Force Avionics Policy

BY LT. GEN. ALTON D. SLAY, USAF, DEPUTY CHIEF OF STAFF/R&D

The author reviews what has been done in attempts to control the growing proliferation and cost of avionics and outlines the objectives, strategy, and tactics that are essential in defining and implementing guidelines for planning and managing avionics programs.

"AVI-ON-ICS"—Electronics for Aircraft. Why special emphasis? Simply (maybe simplistically) put, the answer lies in consideration of the three "C's" of the avionics business: Capability, Complexity, and Cost.

I won't spend much time on the first "C" because I'd be preaching to the choir. Certainly, none of us associated with the Air Force or the aerospace industry can rationally imagine an Air Force without the capabilities provided through avionics. We are totally and inextricably enmeshed in avionics. To a great extent, we are captives of avionics. This isn't a complaint. It's a statement of fact.

If that fact conjures up thoughts of the Air Force slavering over "new, more, and better" avionics equipment, thoughtfully and tantalizingly displayed by industry slavering over "new, more, and better" contracts, you're out of date. Perhaps it was the case a few years ago, but definitely not the norm these days.

We've become reacquainted with the old adage, "all good things in moderation." We are learning to keep a tight checkrein on our appetites for electronic goodies because of the latter two "C's"—complexity and cost—which, like the Bobbsey Twins, go together. And that's what I want to discuss.

I do want to emphasize that I'm going to concentrate on electronics for *aircraft.* By some other definitions, "avionics" may include electronics for missiles and spacecraft, but these applications have a set of problems and characteristics all their own, tied to their unique missions and operating environment. Aircraft avionics is where we have our major investment, our major problems, and our major potential for improvement.

Most of us can agree that avionics equipment is the most expensive part of an airplane, pound for pound. It's expensive to buy and it's expensive to support. The oft-quoted rule of thumb of $1,000 per pound is not far off the mark. A couple of years ago, before the price of gold was allowed to float upward, some considered "gold-plating" avionics to be a cost-reduction project. In some modern aircraft, the avionics equipment costs upwards of thirty percent of the total aircraft flyaway costs. Avionics support costs are equally high, approaching seventy-five percent of total support costs for some older aircraft with, in fact, avionics being the limiting factor on overall airplane reliability.

The high price of avionics is reflected in the fact that it, of all aircraft systems, has probably the highest ratio of "value added" in its manufacture and certainly has the highest complexity of any aircraft subsystem. Because of this complexity and sophistication, high-skill levels are required somewhere in the system to support the equipment. Depending on the support concept, these high-skill levels could be at the organization, intermediate, or depot level. In any case, a considerable burden is placed on the Air Force for initial and recurring training of these expensive people. Also, since avionics technology is evolving so rapidly, the technical knowledge and skills of our support people become essentially obsolete in relatively short periods of time. Add to this the generally poor reliability and maintainability track record of avionics, which generates a high workload for the maintenance troops in the field and at the depots, and you have a monumental logistics problem and a monumental logistics cost.

Consider the fact that the Air Force maintains an inventory of almost 10,000 active and Reserve aircraft, each with avionics equipment. Together, they have about 200,000 "black boxes" installed with perhaps another 60,000 al-

located to spares and war-reserve stocks. That's a quarter of a million black boxes that we have to maintain. Mind boggling! And it also represents an investment of about $12 billion.

We are currently spending about $400 million a year in research, development, test, and evaluation (RDT&E) funds to upgrade, replace, and improve this staggering black box inventory. That's about ten percent of the total Air Force RDT&E funds. It's also more than one-fourth of the total number of Air Force RDT&E programs. And this doesn't even include R&D dollars spent on avionics going into our major acquisition programs like the B-1, F-15, F-16, E-3A, and so on. If you add all of that up, we are spending about $550 million per year on avionics, which is fifteen percent of our total R&D budget.

This "front end" of the R&D effort will inevitably lead to very substantial future procurement programs as we modernize and upgrade our force. We are "turning over" our avionics inventory on about a fifteen- to twenty-year cycle, so that by 1990 we will have upgraded and modernized most of our 1970 systems. The question is: Are we collectively planning and managing this huge effort properly?

The Current Situation

In response to our requirements, industry has evolved a large and varied avionics development and production capability. This capability is partly reflected in the major capital expenditures made by most of the large aerospace corporations. But more importantly, it is reflected in the large body of knowledge and large numbers of highly skilled technical people employed by these corporations. Not surprisingly, almost all actual system design and production of avionics flow from the industrial resource. This poses a dilemma for the military manager. How is he to cope with this tremendously versatile, knowledgeable, powerful, and basically unstructured industrial base? How does he keep from being swept into the maelstrom? How does he sort things out in such a way that our military requirements are satisfied, but not oversatisfied? In other words, how does he ensure that we get the optimum return on the public dollar? Not easily!

The reason it's not easy is that there are many serious counterpressures—new threats, improved technology, high-risk designs, budget cuts. These counterpressures are usually diametrically opposed to the mandate under which we operate in regard to keeping tight control of costs.

Perhaps we have not understood these counterpressures as well as we might have. Most certainly, we have not always reacted to them well. This is reflected by the proliferation found in some of our critical subsystems such as inertials, TACAN, radar altimeters, and direction finders. Certainly, it is reflected in the high development, acquisition, and support costs for avionics equipment in general. To understand why we have this "proliferated" situation today, one must first understand the way we design, develop, and acquire avionics.

The "Avionics Process"

We buy avionics in the Air Force through two channels. For new systems and aircraft, Air Force Systems Command (AFSC) develops or, more often, contracts for development and procures avionics through its complex of Product Divisions (Aeronautical Systems, Electronics Systems), System Program Offices (*e.g.*, F-16 SPO) and Laboratories (Air Force Avionics Lab, Air Force Flight Dynamics Lab).

When avionics equipment is procured and installed in Air Force inventory aircraft through modification/retrofit programs, AFLC is the acquisition agency, through its network of Air Logistics Centers (ALCs). Again, the equipment is usually supplied by industrial vendors and is installed by a mixture of contractor and in-house modification teams. There are currently five major ALCs where this is carried out.

Figures 1 and 2 *(see next page)* portray the process by which an avionics design evolves for new systems and modifications. A design does not materialize spontaneously, in final form, but evolves in a series of steps from concept to the final, definitized hardware design. Some fundamental aspects of the final design are defined quite early in the process, even before the first schematic is drawn. It is in this process, when first

"... we are spending about $550 million per year on avionics, which is fifteen percent of our total R&D budget."

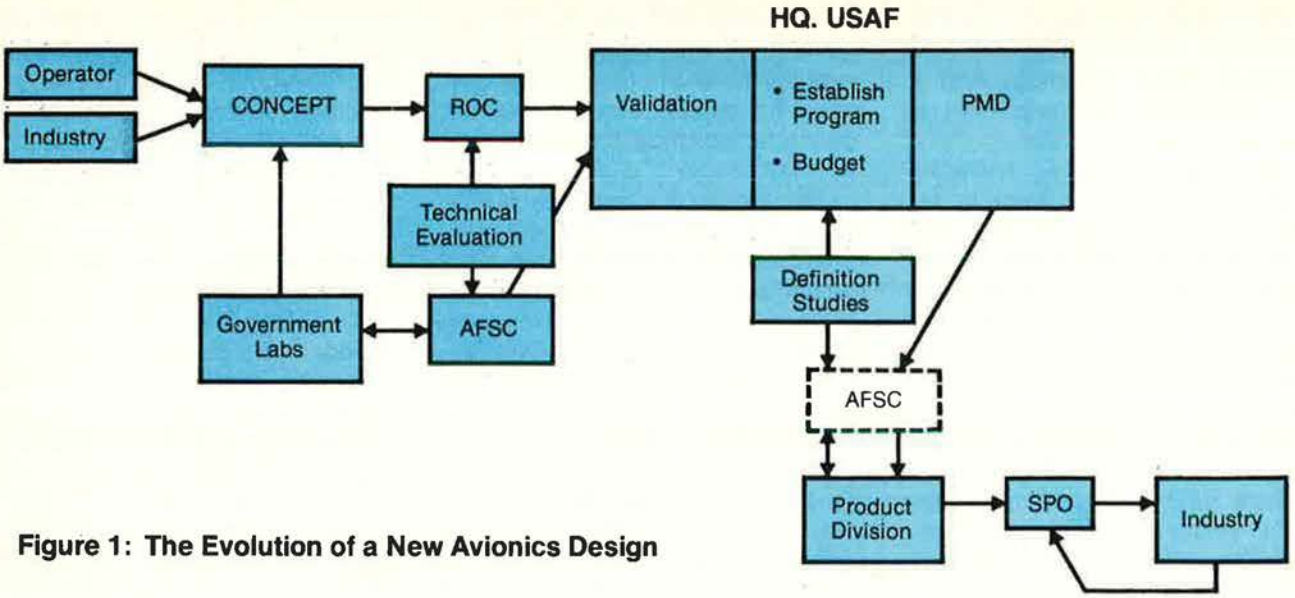


Figure 1: The Evolution of a New Avionics Design

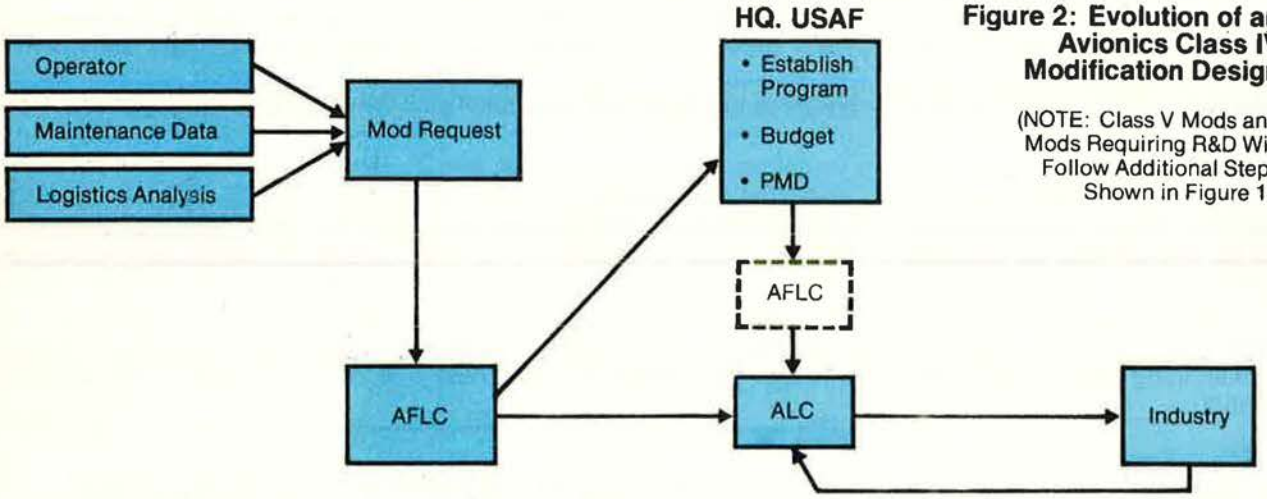


Figure 2: Evolution of an Avionics Class IV Modification Design

(NOTE: Class V Mods and Mods Requiring R&D Will Follow Additional Steps Shown in Figure 1.)

contact is made with the industrial contractors, that the Air Force often loses control of its overall standardization objectives.

The SPOs are the principal managers for development and production of avionics systems, working through their contractual relationships with industry. If the avionics system is complex, the early SPO cadre is no match for the large, technically competent, well-prepared industrial team if that team is oriented to introduction of a new or nonstandardized design. The problem with many of our corporate review processes is that they occur quite late, after these critical definition steps, so that the design becomes "locked into concrete" and very difficult to change substantially.

Of course, each SPO and ALC operates under the control of its respective headquarters and within the guidelines of Program Management Directives from Hq. USAF. However, the structure and management procedures that have been built up over the years give each SPO and ALC almost essential autonomy in initial selection of systems and subsystems as well as in total configuration control throughout the development and acquisition cycle. Higher headquarters control is exercised principally through the budgetary and programming processes. We tell the Program Director, for example, that he has "X" dollars to do "Y" work this year, and that we expect him to fulfill the "contract" that we have made for him with the Office of the Secretary of Defense (OSD) and Congress as related to cost, schedule, and performance.

Of necessity, detailed technical decisions that define the final production configuration of the

system are made by that SPO or ALC each day. The most important of these decisions come very early in the game when the initial selection is being made from among the competitors for the contract. In general, the Program Office accepts and evaluates designs and configurations from the competitors which reflect the unique designs advanced by the many hundreds of industrial vendors and sub-tier contractors used by the major system contractor.

Unless the Request for Proposal specifies a "standard" item of avionics or a "standard" system architecture, the offeror proposes the equipment/systems that best suit his particular scheme. This latter case has been the norm for most major weapon-system procurements. And there you have the roadmap for the proliferation of avionics equipment that has occurred in the past. There has been little guidance, direction, or policy to prevent it.

But this isn't news, or at least it should *not* be news to anyone who has spent some time in the avionics business. The question is:

Have We Tried Anything New?

Yes. We've all recognized the problem for some time and have made several starts (some false) and several moves (some backward) to do something about it.

First of all, we've studied the problem—perhaps too much. Since 1970, I know of at least ten major studies of the area by some very knowledgeable, and in some cases very powerful, groups and individuals.

Second, we've made organizational and procedural changes to increase the visibility of the avionics functional area and to improve its management. At Air Force Headquarters we've consolidated avionics programs into one office so that consistent guidance and application of standards could be set down in Program Management Directives (PMDs) as a basic source document.

General Slay has been USAF's Deputy Chief of Staff for Research and Development since August 1975, following assignments as Assistant DCS/R&D and as Director of Operational Requirements and Development Plans. He flew 181 combat missions in Southeast Asia, where he was DCS/Operations of Seventh Air Force and Deputy for Operations, MACV. He also has served as DCS/Operations of Air Force Systems Command, Commander of the Lowry Technical Training Center, and Vice Commander of Air Training Command.

We have instituted high-level Aircraft Configuration Steering Groups, which I chair. Under this arrangement, the Steering Group is a clearing house with authority. It provides for a USAF corporate review of standardization applications, the mix of Government Furnished Equipment (GFE) and Contractor Furnished Equipment (CFE), and any changes to baseline configuration of hardware or software. From my own experience, this procedure has proven effective in holding the line on Design-to-Cost (DTC) goals, design margins, etc. However, the number of systems that can be scrutinized at this level is limited by available manpower and time, so we use it for only a few major new systems. At present we have two such configuration steering groups: F-16 and AMST.

Air Force field units have made some changes, too—particularly at the Aeronautical Systems Division (ASD) of AFSC. An Avionics Standardization Office has been formed at ASD to investigate opportunities for commonality/standardization and to develop standards such as Form, Fit, and Function (F^3) specifications for specific pieces of hardware. An Avionics and Aircraft Accessories SPO has been formed with principal emphasis on acquiring GFE avionics equipment and making it available to other users. An Avionics Advisory Board was established to cut across all AFSC agencies doing avionics development and acquisition work, but it has fallen into disuse. The Air Force Avionics Laboratory represents a sizable resource of avionics technical capability, now devoting much of its time and energies to standardization approaches and life-cycle cost reduction as well as to its historic role of performance improvement.

But all of these field activities are "off line" to the SPOs and ALCs and depend for impact on "good will," direction by higher headquarters, and "making offers they can't refuse." This turns out to be an imprecise and inefficient process that often fails if it conflicts with the budget or schedule of the individual program office.

Finally, on the hardware side, we have started some major standardization efforts like the DAIS program (Digital Avionics Information System), the Standard Inertial Navigation Systems (INS) program (formerly known as Form, Fit, and Function—F^3), and the Standard Doppler program.

As we have followed this tortuous path, our intended destination has always been a better world of avionics where costs were low and a few good pieces of equipment satisfied our needs. Mecca!

But we aren't *nearly* there! In fact, we're scarcely out of the starting blocks! The question is:

Where Are We Today?

I still see very high costs to develop, buy, and support avionics. We still spend $50 million to $100 million to develop a relatively complex avionics subsystem, and we're still spending thirty-five to seventy-five percent of our support dollars for avionics on specific aircraft. Isn't there a cheaper way?

I still see avionics as the limiting factor in overall airplane reliability. Why must this be so? Some engines are just as complex and see harsh operational environments, yet, once matured, they operate for long periods before they need to be overhauled. Even commercial electronics, in very ordinary applications like garage door openers and calculators, see tough

vibration/temperature cycles and yet perform reliably. Why can't we do as well?

I still see us inventing new avionics solutions in large numbers for each new aircraft because, somehow, the older available equipment isn't "suitable" for the new requirement. Is this really always the case?

I still see a relatively low rate of acceptance by the airplane manufacturer of the standard avionics products of the laboratories—usually because of alleged risk, cost, and general unsuitability for the mission. Are these reasons or excuses?

In fact, I still see a substantial amount of resistance both from within the Air Force and from industry whenever some "vested interest" is perturbed by a new standardization initiative. I use the term "vested interest" with no general opprobrium because quite often it stems from a desire to accomplish the assigned mission with the highest possible degree of effectiveness. There is nothing wrong with that kind of vested interest. To the contrary, we cultivate it. Then there is the other kind that we all know about.

In any event, I still see us finding it very difficult to change traditional modes of thinking. It is difficult to break away from the "old way," particularly when the "new way" on the one hand may have some mission-related drawbacks and, on the other hand, some business-related drawbacks.

What I'm saying is that despite good intentions, together with some substantial management actions, I still see results that have been disappointing.

We have been going through a process that obviously has enabled us to understand the problem better, but, in my opinion, have paid insufficient attention to the institutional and cultural barriers to fundamental improvement.

I still do not have confidence that we're "in control." Why not? Let's look into it further.

The Gathering Storm

Analysis of our projected force structure shows that over the next fifteen to twenty years we will be developing at least a half dozen completely new combat aircraft that involve heavy use of avionics. We also will make many major modifications to our existing aircraft involving upgrading with new avionics suites. These new avionics equipments will most certainly be solid state, digital, highly integrated, and will feature extensive use of software.

That latter item—software—may be the proverbial alligator about to take a fifteen-pound bite out of our posterior while we swat at hardware gnats sitting on our nose. There are several reasons for saying this.

As best I can tell, we have spent more than $300 million on software support facilities for just a few major weapon systems. As I mentioned earlier, it is also apparent that our current "school solution" is to maintain these massive new programs uniquely each time, building a new, autonomous software support facility for each program. Why? I assert that unless we find a new way of doing software support, our eventual bill will be more than a billion dollars per year.

Software is expensive to buy and extremely difficult and expensive to support. Compared with the commercial automatic data processing world, where the burdened cost of writing a FORTRAN instruction appears to average about $25, we spend anywhere from $100 to $300 to write a comparable software line for some of our complex real-time digital systems. And, it's not unusual for a large military command and control or weapon delivery computer system to have programs of 500,000 instructions! You don't need a computer to figure the progression in terms of dollars and cents. The cost of just writing, debugging, and implementing a military software program can approach the staggering figure of $50 million per system.

Compounding the problem is the dimly perceived impact of the advent of microprocessors and their wide use in a distributed mode throughout our weapon systems. This makes me highly nervous. Again, unless we do something new and different, we face an era of "dispersed" microprocessors. Instead of having reasonably tidy software programs contained in "central" computers, we are likely to have software microprograms spread all over the airplane, with, for example, things like digital fuel controls needing special and unique software support.

What is the answer? Is the day of the "throwaway" avionics module approaching? We will certainly need to understand better and manage better the distinction between firmware and software and learn how to cope with the increasing use of Large-Scale Integrated (LSI) circuits by our industrial designers.

A very recent study by the Institute for Defense Analysis (IDA) estimates that we are already spending on the order of $400 million a year in direct support costs of integrated circuit (IC) assemblies, and that figure is projected to grow at the rate of twenty percent annually. There is also some indication that the indirect, or system support costs exceed, by a factor of six to eight, the direct costs.

An important point to note is that while the military is expanding its usage of LSI components, the commercial sector (TVs, automobiles, etc.) is expanding its usage even more rapidly. Because commercial volumes are much higher (and the operating environment less demanding), the military marketplace is becoming less and less attractive to the large IC manufacturers. This was forecast by the 1974 "Electronics X" study and verified by recent studies of the area. If we are not careful and do not take some decisive standardization actions, we in the military are liable to find ourselves without suppliers!

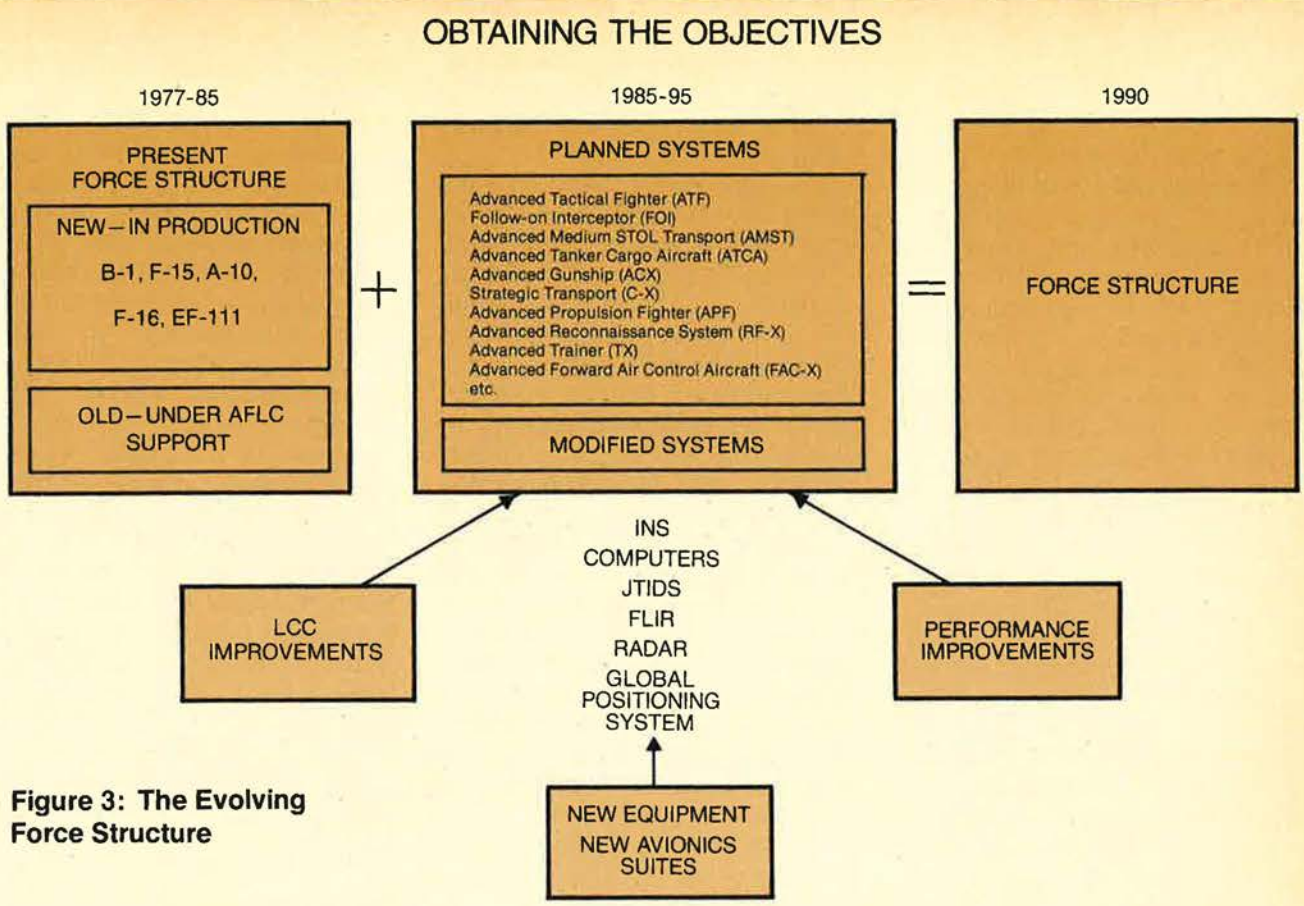


Figure 3: The Evolving Force Structure

Earlier in this article, I mentioned that we appear to "turn over" our equipment on about a fifteen- to twenty-year cycle. That implies that we are able to support this equipment for twenty years with adequate sources for spare parts. But now it appears that the average "lifetime" of a new LSI is about five years before it is overtaken by a "new, better" technology. So, how do you provide spares for twenty-year operation if your spare parts vendors have moved on to other products? This possibility is particularly serious if, in the meantime, the Air Force has been forced by software costs to move to a maintenance philosophy based on "throwaway" modules where the spare parts consumption rate may increase significantly, offset by a decreasing amount of repair-type maintenance.

More important in my mind than any other single facet of the "gathering storm" is the great impact that the growing complexity and "forced" integration of modern solid-state avionics has on the Air Force maintenance man. How do you troubleshoot this gear? We are getting a feel for the size, shape, and texture of this problem already. We have tried to avoid a lot of test equipment on the flight line, so we've gone to a Built-In Test Equipment (BITE) philosophy. On one of our newest operational aircraft we are experiencing a poor BITE effectiveness. If and when we can find the faulty equipment and get it off the aircraft, we have to resort to expensive, complex shop testers (which we have probably invented specially for the purpose). Again, on one of our most current combat aircraft we are experiencing a poor Cannot Duplicate (CND) rate. This means we are pulling the wrong equipment, for the wrong reasons, much of the time. This obviously drives logistics costs up rapidly and operators and maintenance people up the walls!

In addition to the urgency attached to these technical issues, there are real and serious operational pressures. Fighting an air war in the 1980s certainly isn't going to be easier than it was in Southeast Asia and the Middle East. The targets will be much more numerous, harder, and more mobile. The jamming environment will be much more severe. The threat to our aircraft from missiles and guns in both area and terminal defenses is growing rapidly.

All of these changes are driving our avionics requirements in the direction of greater capability in terms of accuracy/precision, countermeasures, and data handling. Figure 3 shows the combination of these technical and operational pressures on our current inventory. Combine this with the expected six to ten new major weapon systems and several mod programs projected over the next fifteen to twenty years and you have a synthesis that concerns me. We have an avionics "bow wave" forming in the development, ac-

quisition, operational, and support worlds.

What To Do?

Up to now this article has dealt largely with identification of the "avionics problem" and its current status. Now we have to get to the bottom line. We can't duck the issue of the importance of avionics; we can't duck the high acquisition and support cost of avionics; and we can't duck the impending bow wave of new avionics developments and procurements. Since we don't appear to be totally in control of this problem with the traditional technical and bureaucratic adjustments we have made —how do we attack the problem?

No single action will suffice; a combination of technical, managerial, and policy actions will be required. We certainly want to build on the starts that have already been made—the development of standard equipments and specifications, modular programs like DAIS, and the increased planning activities at all levels. These are changes in the right direction. But we need to focus on the institutional and cultural barriers to meaningful change. We need to attack—fundamentally—the basic attitudes and folklore in this business that have not changed much and probably will not change without some forcing.

I believe we understand the dynamics of the avionics problem and recognize the tremendous task facing us. If so, we ought to be able to find a relatively clear path to follow. I further believe that the first and most essential step along this path is the formulation and implementation of an avionics development and acquisition policy for the Air Force.

You say, "Well, why are you telling us? The ball is clearly in your court!" You're partly right. The mechanical side of the policy formulation has to be done here in the Air Staff and a draft regulation is currently in work. The coordination process will start this summer. But for any statement of policy to be effective, we must, from the outset, have wide agreement on the elements and nature of the policy as well as a clear understanding of its feasibility. Only this way can a real and long-lasting solution be found that will become institutionalized and independent of personalities. This is particularly true when the new policy involves considerable change from our normal way of doing business. Therefore, I've been seeking opportunities to explain, ahead of time, just exactly what we're up to. This article is one such effort.

The key task in forming a new policy such as required here (or any other broad management framework, such as Zero Base Budgeting) is to agree on an overlaying framework of clear and unequivocal objectives, the strategy to be used in attaining these objectives, and tactics that will be used to implement the strategy. Rather basic, but sometimes given short shrift. This overlaying framework can be used to keep the policy directed and in tune with current events.

Objectives

I believe our *objectives* in the avionics area can be stated simply:

- Provide required avionics for the total USAF mission.
- Achieve a twenty-four-hour-a-day, all-weather, all-threat, all-target capability across the full combat spectrum.
- Minimize development, acquisition, and support costs.
- Eliminate unneeded proliferation of avionics devices, equipment, and systems.

Strategy

The key word in a statement of strategy to attain our objectives is "coalesce."

- We should *coalesce* our proliferating and diverse avionics systems into a core architecture and a set of standardized sensors that are widely accepted and used as a baseline across all our systems.
- We should *coalesce* our management of avionics. In today's world of spiraling costs and restricted budgets, we can't afford to continue separate vertical management of individual avionics systems, each having its own hierarchy of management and its own unique logistics tail.
- We should *coalesce* our avionics technical capability and resources to focus on the problem. There are more than 1,500 technically trained and qualified Air Force avionics people at Wright-Patterson AFB alone. Many have advanced academic degrees. What a tremendous resource upon which to build!

Tactics

The decisions—some hard—that are required to make the strategy work are really our "tactics":

- Impose the standard core avionics architecture, standard sensors, and devices on *every* new or modification avionics program.
- Develop an in-house "systems-oriented" avionics engineering capability to provide the foresight that takes advantage of the hindsight. Mandate its use during the avionics development and acquisition cycle. Use this in-house capability to keep the architecture and standards vital.
- Change the avionics development and acquisition process to achieve *concurrent* development of standards, test equipment/methods, software, and mathematical models synchronized with the development of the end equipment.
- Structure, from the ground up, an avionics RDT&E and acquisition program based on the principles of Zero Base Budgeting to implement the strategy and achieve the objectives.

So there it is—our "straw man" set of Objectives, Strategies, and Tactics that can, in my opinion, form the framework for an effective Air Force Avionics Policy.

Obviously, this "straw man" leads to a concept of defining avionics systems and architecture as essentially GFE. We need to pursue what this fundamental change means in terms of specific things we might do in the relatively near future.

Progress and the Roadmap

I've already discussed the "policy formulation" work that is going on, and will result in a draft regulation being floated this summer.

In preparation for drafting these policy papers, we have been engaged for several months in determining our avionics baseline. Several months ago, I sent out a draft avionics baseline document to every agency in the Air Force that owned or operated an aircraft. We asked for a detailed review and check on *every* piece of avionics equipment installed on *every* aircraft in the Air Force, planned modifications, and mission requirements for new or modified avionics. As a result, we now know better than ever before what our present situation in avionics is. We have produced and compiled an accurate data base. We have published an Avionics Planning Baseline Document, which is a compendium of every force structure airplane, its present avionics configuration, planned modifications, requirements summary, and planned out-year force profile. This document is in the process of being computerized for analysis and will be available Air Force-wide.

"We need to attack — fundamentally — the basic attitudes . . . in this business that . . . probably will not change without some forcing."

Also, for the first time we analyzed functionally our total avionics budget this year, using the data just referred to, as well as the normal budget and program data. As a result, we now know exactly how our forty avionics programs play with respect to the rest of the RDT&E budget and the total USAF mission.

We also have started to publish some detailed planning documents within the broader avionics area, such as the Fifteen-Year Positioning and Navigation Plan, that will take another cut across our avionics programs to avoid unnecessary proliferation of navigation equipment. A similar plan for communications will be next.

All of these efforts help, from a headquarters perspective, to understand where we are and where we should be going, and are essential to formulating a sound statement of policy.

In the development and acquisition area, we will continue to pursue very aggressively the concept of avionics standardization—hardware and software. We will seek out new opportunities where they arise and push application of those we have already developed. We have a good start in programs like the Standard Doppler, Standard UHF radio, Standard TACAN, Standard F^3 INS, and DAIS.

This last-named program, the Digital Avionics Information System, sponsored by the Air Force Avionics Laboratory, is particularly appealing to me as it contains many elements I consider to be essential stepping-stones. The program approaches the total avionics suite architecture from an information transfer viewpoint. It treats as sensors normally distinct avionics gear, such as radars, inertials, and radio receivers, providing information to a distribution network called a "core" avionic architecture. This core consists of dual, redundant multiplex buses;

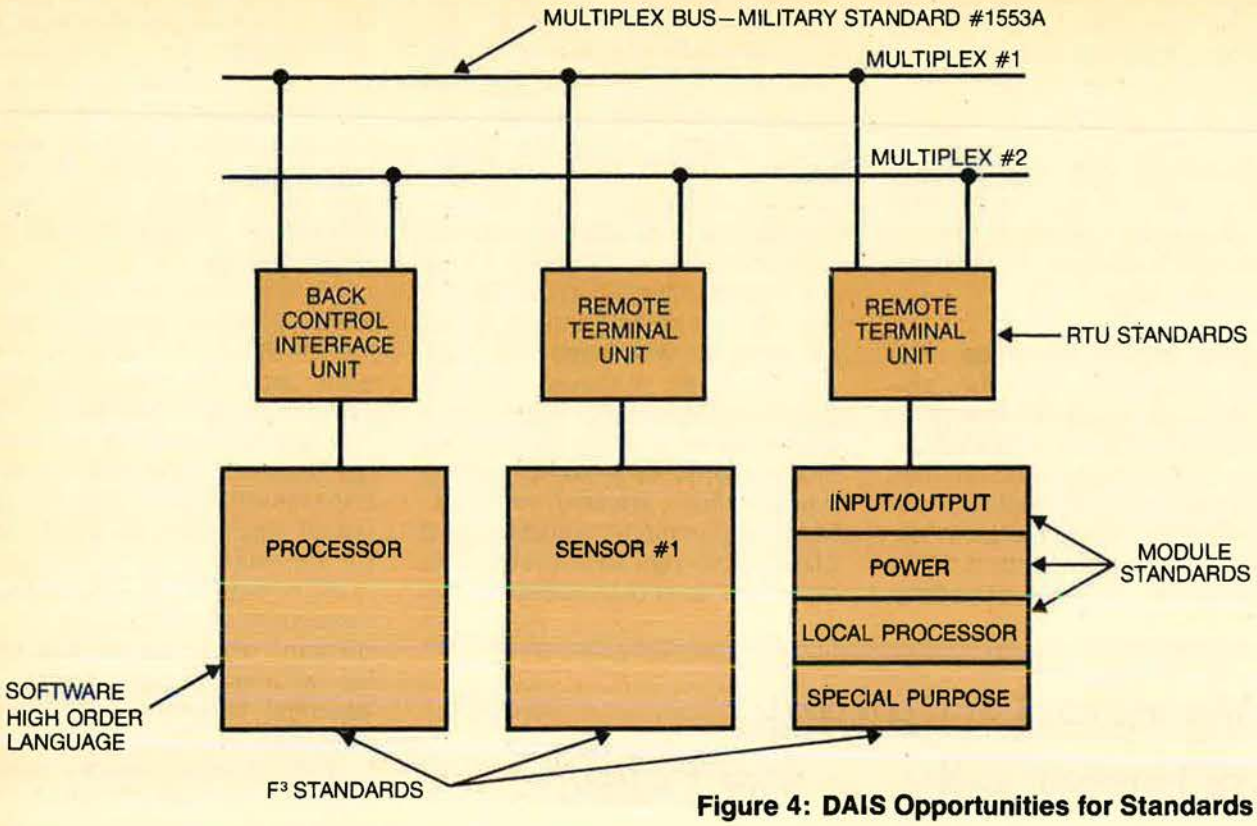


Figure 4: DAIS Opportunities for Standards

redundant computers; interface terminals; and top-down structured software.

This architecture has two key features. It is highly reliable at the total system level, because it is "fault tolerant." Today, you can walk up to the Laboratory's DAIS hot bench and introduce a catastrophic component failure—like cutting one of the multiplex bus lines or failing the prime computer—and watch the system reconfigure itself in milliseconds, under software control, without interruption to the crew members' displays or the ongoing weapon delivery computations. We want this capability in our combat aircraft.

The other key feature of DAIS is its highly structured, modular approach for both hardware and software. Figure 4 points out what this can mean for avionics standards. DAIS gives us *opportunities* for standards that can extend across every piece of hardware and software in the avionics suite and fosters the idea of multifunction/multipurpose equipment like universal controls and displays.

DAIS has also provided some extremely valuable fall-outs. It has provided an opportunity for in-house, hands-on, system level avionics design experience for our people.

But all of the foregoing is really prologue to the really major step—the creation of an in-house avionics systems engineering capability, and implementation of its function in the process of defining USAF avionics as I described earlier. This is where the primary cultural and institutional changes must occur.

Figure 5 shows how I envision the operation of such a function. it recognizes the evolutionary character of an avionics design and is inserted (as shown by the asterisked blocks) in crucial stages to provide a technical review/approval function. Note that it is inserted early enough in the process to affect the requirements definition. This crucial step, that in effect can serve to define a user-developer contract for the end product, places a severe demand on this in-house function.

It is widely held (but not widely implemented) that to define requirements, one must understand the nature of that which is to be described, the form of the description, and the process of analysis. This implies generic understanding of the technologies involved and becomes a forcing function on the types of characteristics you want your in-house system engineering capability to have. This

new entity—this new avionics "group"—should:

- Be large enough and technically sound enough to handle all avionics programs, new and modification.
- Have full spectrum engineering capability, *i.e.:*
  - design qualified engineering, at least to industry standards,
  - full avionics simulation/emulation capability,
  - full computer/software competency,
  - full awareness of support requirements,
  - full knowledge of aircraft interface requirements.
- Have responsibility and authority to:
  - review *all* avionics program architecture and design,
  - hold/release industrial contracts,
  - force changes when required,
  - recommend cancellation/initiation of programs,
  - have technical cognizance over all weapon system/avionics interface groups.

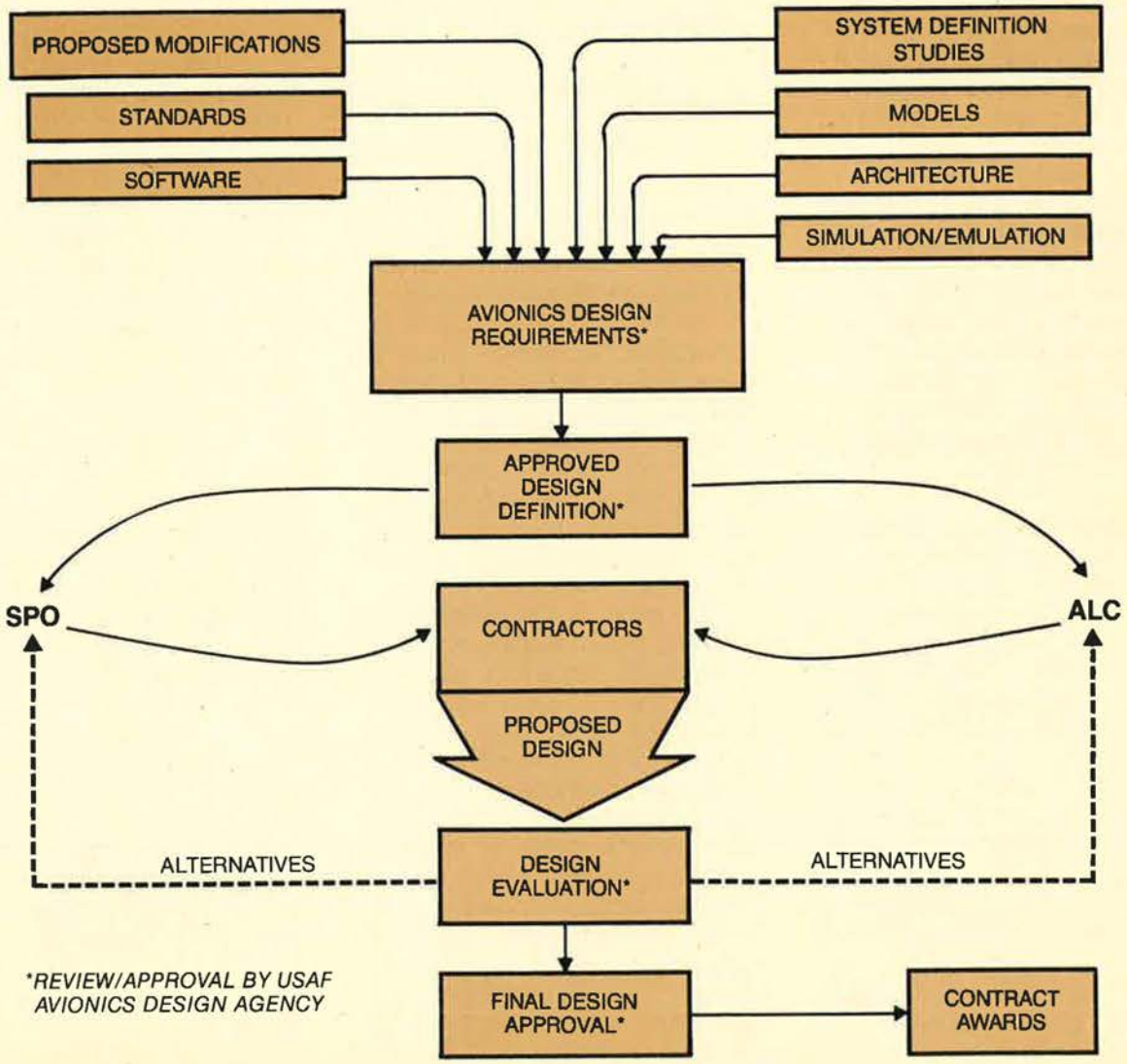
So this in-house function becomes a key element—the way we carry out the "tactics" I've outlined. It could use hundreds of technical people productively, providing a way to give massive support to our major weapon system SPOs, while retaining in detail a corporate memory that carries from system to system. This obviously will be the most difficult part of our task, but the payoff in terms of increased productivity and readiness can be substantial if we approach it in the right way.

I believe that the importance and nature of this complex subject warrant the emphasis I've given it here. I believe that there is a case, as I have indicated, for fundamental change. I believe that the principal problems in this area are managerial and institutional rather than strictly technical, so that is where I am directing my actions and where I've tried to focus your attention.

In my opinion, nibbling around the edges of this problem, as we've been doing, will not solve anything. As soon as we stop nibbling, any teeth marks magically disappear. That is the nature of the beast.

I invite your thoughts on this matter. ■

Figure 5: Disciplining the Design Process



THE ELECTRONIC AIR FORCE

How ESD Is Building USAF's Electronic Eyes and Ears

BY EDGAR ULSAMER, SENIOR EDITOR

One of the Defense Department's urgent concerns is getting the most from existing weapons and forces through "force-multipliers," meaning in the main techniques and systems that increase military effectiveness through better command control and communications. In the final analysis, that term boils down to information, from warning and intelligence to designating targets, obtained, transmitted, and processed by electronic means. Building this electronic "nervous system," for the Air Force as well as for other Defense Department components, is the job of Air Force Systems Command's Electronic Systems Division.

THE machinery and techniques to translate the posture of US military forces—ranging from routine readiness to force reconstitution after a nuclear attack—into controlled action are lumped together under the heading of command control and communications (C^3). It would be difficult to exaggerate how important this complex tool is to deterrence, crisis management, restrained show of force, and prosecution of war in accord with national objectives. Some analysts find that good C^3 capabilities can double or triple force effectiveness; conversely, ineffective C^3 is certain to jeopardize or deny the objectives sought.

In the context of C^3, effectiveness acquires broad meaning: These systems—or actually systems of systems that "interoperate"—must not only accumulate, sort, route, transmit, evaluate, and in other ways work on information and directives as rapidly as possible, but do so with extreme reliability in the face of hostile action and in response to changing requirements and conditions. Lastly, and possibly most important, they must be affordable.

In acquiring USAF and other Defense Department C^3 systems, the Electronic Systems Division of the Air Force Systems Command at Hanscom AFB, Mass., seeks all these traits in its products, but the "key word is the ability to be responsive to and meet wartime needs," according to its outgoing Commander (now USAF's Assistant Vice Chief of Staff) Lt. Gen. W. L. Creech. (ESD's new Commander is Lt. Gen. R. T. Marsh.)

ESD is a billion-dollar-a-year business that manages more than a thousand contracts annually. Like AFSC's other product divisions, "we don't build anything ourselves and depend, in terms of overall effectiveness, on our contractors and on how well we manage. We are catalysts, monitors, overseers, and advisors. We, therefore, emphasize our business function to hold down costs and to assure that the industrial managers of our programs are highly motivated and competent. I believe that this is paying off," General Creech told AIR FORCE Magazine.

Developing and acquiring C^3 systems, ESD's principal business, differs from other military R&D programs in several ways. ESD programs are usually one-of-a-kind systems, with no model to pattern after. They usually are to be coupled to—the vogue word is "interoperate" with—a relatively large number of other systems and subsystems, some of which may be older and not intrinsically capable of interaction, and others that are being developed concurrently or have not yet been defined. Col. Ed W. Milauckas, ESD's Deputy for AFWWMCCS (USAF's portion of the World Wide Military Command and Control System), rates the job of intersystem planning and engineering "the last frontier in systems management and acquisition." At the root of the problem is the fact that, in the past, systems concepts often were defined narrowly and without adequate concern for operational effectiveness within the nation's and its allies' total command and control capability. ESD's Vice Commander, Maj. Gen. Henry B. Stelling, Jr., defines the cause: "A program director had little latitude, insufficient resources, and too little time to devote to the broad type of planning that cuts across the entire mission area and into those things that were not part of his approved program."

General Creech cautions that "some circles see the Defense Department and the Air Force as not smart enough to design com-

mand control and communications that can interplay. This is a gross oversimplification. Sometimes the scope of the needed interplay among such systems is not clear at the outset, and, more often than not, by the time a firm requirement surfaces the necessary funding isn't there."

ESD is tackling the system-of-systems planning task with a new internal mechanism for development planning utilizing matrix management. System Program Offices (SPOs) assign personnel to a cen-

SOME OF THE ABC's OF ESD

For readers' ease of reference, the acronyms and abbreviations that appear in this article have been arranged here in the order in which they occur and by the subheadings they fall under.

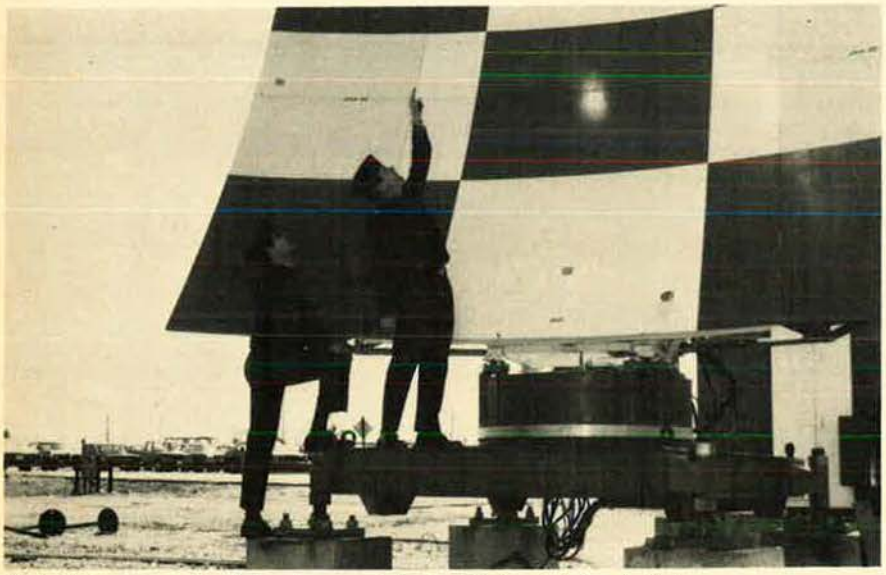
C^3	Command control and communications
AFWWMCCS	USAF portion of World Wide Military Command and Control System
SPO	System Program Office
Tactical C^3 Systems	
ELINT	Electronic intelligence
TIPI	Tactical Information Processing and Interpretation system
GAMO	Ground and Amphibious Military Operations Office
Joint Tactical Information Distribution System (JTIDS)	
TDMA	Time division multiple access
DTDMA	Distributed time division multiple access
AWACS	Airborne Warning and Control System (E–3A aircraft)
FOC	Full operational capability
ASIT	Adaptable Surface Interface Terminal
NADGE	NATO Air Defense Ground Environment system
NATO-Oriented ESD Systems	
412L	Joint US/German air weapons control system used by NATO
407L	Mobile US air tactical control system
Salty Net	Special data automation and communications equipment to interface NADGE/412L and 407L, and subsequently TACS, NADGE, and E–3A
TACS	Tactical Air Control System
TRI-TAC	Joint Tactical Communications program
478T	Combat theater communications program, a component of TRI–TAC
AJ	Antijam techniques and equipment
TACC	Tactical Air Control Center
TACSI	Tactical Air Control System Improvements program
OASIS	Operational Application of Special Intelligence program
COIC	Combat Operations Information Center program
Mobile Airborne Command Centers (ABCCs)	
CINC	Commander in Chief
Strategic C^3 Systems	
WWMCCS	World Wide Military Command and Control System
NCA	National Command Authorities
ELF	Extremely low frequency
DSCS	Defense Satellite Communications System
SAC's Automated Tactical Information Network (SATIN IV)	
DSARC	Defense Systems Acquisition Review Council
AFSATCOM (Air Force Satellite Communications System)	
UHF	Ultrahigh frequency
SAMSO	Air Force Systems Command's Space and Missile Systems Organization
SSS	Strategic Satellite System (formerly AFSATCOM II and III)
LES–8, –9	Lincoln Experimental Satellites
PAVE PAWS	
SLBM	Submarine-launched ballistic missile
NORAD	North American Air Defense Command
COBRA JUDY	Shipboard phased-array radar system
COBRA DANE	Phased-array radar on Shemya Island
COBRA BALL	Code name for a still-classified program
COBRA SHOE	A dormant, over-the-horizon radar program
BMD	Ballistic missile defense
GEODSS	Ground Electro-Optical Deep Space Surveillance system
LWIR	Long Wave Infrared detection system
OTH–B	Over-the-horizon backscatter radar
DEW	Distant Early Warning radar line
SEEK FROST	Robot radar sites for DEW Line modernization
SEEK IGLOO	Minimally attended radar sites to be built in Alaska

tral planning body whose purpose is to spot interface requirements so that they can be incorporated into individual programs while they are still in concept definition. This technique, General Stelling points out, "doesn't come for free because we have to draw top talent from the SPOs to work on intersystem problems for which neither manning nor funding was provided in our original budget. We have requested funds for this type of planning work in the FY '78 budget."

Further complications in C^3 system engineering can arise from changes in national policy, such as shifts from minimum assured destruction to flexible options and the use of counterforce. Formulation of such a change and its adoption by the National Security Council may take one or two years, but the corresponding C^3 hardware cycle would probably be considerably longer. The challenge to the systems designer, therefore, is to provide the flexibility needed to adapt C^3 systems to fluctuating requirements, a "quality that, by and large, we have been able to furnish so far," according to General Creech.

Another crucial question is how much survivability of C^3 systems is enough: "We do rigorous threat estimates to establish what needs to be done to the equipment we are designing. Yet there is *no* system that can't be jammed, interfered with, or interrupted if the enemy is willing to make a large enough investment. Also, there simply isn't enough money to build against the ultimate threat. So we need to make judgments about the degree of survivability that we want, key among which is that it obviously makes no sense to field a system that the enemy can wipe out in its totality with relative ease," General Creech said.

Two factors ease ESD's difficult job somewhat: The state of US electronics technology and production capability in general is superior to that of the Soviet Union; and the explosive growth and inverse decline in cost of microprocessors coupled to the transition from analog to digital C^3 systems facilitate interoperability, security, and jam resistance. In addition—and in part fostered by miniaturization of electronic circuitry—the strong trends toward modularity in system design and distributed command and control systems alleviate the chronic problem of users changing their original requirements during the five to seven years that the system is in gestation. Distributed systems are networks of small data processors, collocated with, for instance, radar sites that process data on the spot. C^3 systems, in the past, have tended toward centralization, which increases physical vulnerability and leads to relative inflexibility and high manning levels.



High Performance Precision Approach Control Radar is being built by Raytheon Co. for ESD.

Tactical C^3 Systems

Tactical or theater C^3 systems, General Creech points out, represent a special challenge, often even more difficult than that posed by strategic systems, because of the dynamics of tactical warfare, the larger number of sensors and other elements involved, and, especially in the case of NATO war scenarios, the intensity of hostile actions, such as jamming. But unlike strategic C^3, tactical systems, until recently, have not been looked at in the sense of rigorous intersystem planning.

The tactical commander often needs more information more rapidly in more understandable form, and, concomitantly, more capacity for executing orders that affect his own forces than does his strategic counterpart. Moreover, he operates under adverse C^3 conditions that range from electromagnetic jamming, spoofing, chaff, and hostile ELINT to homing missiles attacking his radars and communication sites.

ESD, working in concert with the Tactical Air Command and the Defense Department, is taking steps to create order out of relative chaos. ESD, General Stelling explained, is working on a "Tactical Air Forces Integrated Infor-

mation Systems Master Plan" and has set up an Interface Engineering Group to provide interoperability between tactical air control systems. That group currently is working on interfaces between the Precision Emitter Location Strike System, the Automated Tactical Air Control Center, and the Tactical Information Processing and Interpretation system (TIPI). Another similar engineering group is working on ways to couple the Air Force's tactical C^3 masterplan to GAMO, DoD's Ground and Amphibious Military Operations Office, responsible for linking the command and control systems of the three services.

The Joint Tactical Information Distribution System

The potentially largest tactical C^3 program in progress at ESD is JTIDS, or Joint Tactical Information Distribution System, to be used jointly by the Army, Navy, USAF, Marine Corps, NATO, and other allied forces. JTIDS will provide secure antijam transmission and reception of combat information, and according to Brig. Gen. J. T. Buck, ESD's Deputy for Control and Communications Systems, is expected to evolve into a $2 billion-plus program. The fact that it is a high-technology multiservice program makes JTIDS one of ESD's major management challenges, General Buck said.

JTIDS uses TDMA (time division multiple access) or an advanced variant of that technology DTDMA (distributed time division multiple access) to transmit digital data over jam-resistant broad bandwidths.

As the term denotes, TDMA divides time rather than frequency to communicate with individual participants on the net. Since it "frequency hops" across a wide spectrum, TDMA is highly jam-resistant. In the JTIDS application, each second is divided into 128 time slots. Through a sophisticated synchronization arrangement, these time slots are allocated to individual users for the transmission of short blocks of digital data—233 digital bits—called pulses. All participants have connectivity with all others, and there are no central nodes whose disruption or destruction could cause a system-wide failure. Messages are encoded so that each user can select only those categories of information that interest him.

DTDMA, according to JTIDS Program Director Col. B. Brentnall, is a newer, evolving technology that is more complex than TDMA. This technology permits users to transmit at the same time. "Instead of individual users transmitting complete messages in turn, with DTMA users *interleave* their transmissions on a pulse-by-pulse basis. Receivers sort out the pulses from the various users and reassemble them into messages. The inherent advantage is that this approach makes it possible to adjust the bit rate for different systems tapping data from the net," he said.

DTDMA is currently in the early stage of fabrication of Advanced Development Models, and downstream activities will be necessary to determine whether or not this technique offers economic or operational advantages over TDMA. Both approaches offer equally high antijam features, Colonel Brentnall said.

JTIDS is a multiphased program whose various elements are scheduled to achieve full operational capability between 1979 and 1984, according to General Buck. USAF's share of the RDT&E costs is pegged at $273.3 million. Hughes, ITT, and Singer-Kearfott are the key contractors.

JTIDS's so-called Class I phase involves development of equipment for large users, such as the E-3A AWACS. Flight testing of these terminals aboard the E-3A —several units have just been delivered to Boeing, the AWACS prime contractor—are scheduled for this summer, Colonel Brentnall said. Class I terminals are the size of a small refrigerator and weigh about 330 pounds.

Class II is being carried out under Navy auspices by Singer-Kearfott and involves the development of terminals—weighing about ninety pounds and occupying about two cubic feet of space—that are to be used by the F-14, F-15, and F-16. Of the initial twelve terminals, the Air Force will receive five for flight testing aboard the F-15. This element of the JTIDS program is scheduled to reach full operational capability (FOC) in 1983.

Class III centers on the development of a battery-powered backpack JTIDS terminal, weighing about twenty-five pounds, for use by Army personnel and Forward Air Controllers on the ground. Study contracts concerning this JTIDS element are about to be awarded. Full operational capability of Class III also is scheduled for 1983.

ASIT, for Adaptable Surface Interface Terminal, is yet another key element of JTIDS. Its purpose is to tie any of the three classes of JTIDS equipment to existing tactical C^3 systems, such as the NATO Air Defense Ground Environment (NADGE) system and Navy tactical control systems. ASIT will rely on interchangeable modules and software to achieve compatibility with various other systems.

Work is already under way on a JTIDS follow-on, called Phase II, that would use either an advanced form of the TDMA technology or DTDMA. Several NATO member nations have expressed "keen interest in adopting JTIDS as their standard system," Colonel Brentnall said. JTIDS's vulnerability to a tactical nuclear war environment is no greater than existing systems, according to Colonel Brentnall.

NATO-Oriented ESD Systems

For many years, one of the most rankling problems in NATO has been the inability of the two pre-

dominant C³ systems to interact —NATO's NADGE, including the affiliated joint US/German 412L air weapons control system, and the mobile US 407L tactical air control system—General Creech told AIR FORCE Magazine. ESD is establishing a temporary bridge between these systems through specialized data automation and communications equipment known as Salty Net. Program Manager Lt. Col. James E. DeZutter said acceptance testing of the interface equipment was completed early this year. About the size of a two-drawer file cabinet, the Salty Net equipment consists of a small microprocessor, a government-furnished avionics computer, electronic modules, and special circuitry.

The unit acts as a buffer, which matches up the different computer message formats and transmission speed rates used by the NATO and US command control systems, according to Colonel DeZutter. One now links a USAF tactical air control system with a German fixed air weapons control system radar site, and another connects the same USAF system with a NADGE radar site. Three additional buffers are now being installed in other locations. The second Salty Net task—to interface the 407L TACS with the E-3A Airborne Warning and Control System—is now being tested. Modified message-processing center software has been delivered to Germany this month for testing and is scheduled to become operational in September, according to Colonel DeZutter.

The final task of the Salty Net program will provide a lasting solution to the problem. Called Salty Net III, it provides for the modification of the TACS message processing centers so that they can interface directly with both the NADGE system and the E-3A software. This conversion is expected to be completed by January 1979.

Lt. Col. James E. DeZutter, Salty Net Program Director, with electronic buffer that links different C³ systems.

The payoff, Colonel DeZutter said, will be that US and NATO systems are further integrated into the overall command and control structure of the European Central Region.

Another pivotal ESD program concerned with NATO is the Digital European Backbone System. According to General Buck, its purpose is to provide a wide-band, digital, bulk-encrypted, ground-based defense communications system stretching from the boot of Italy to the British Isles. Carried out in stages by ESD on behalf of the Defense Communications Agency, this system will provide digital voice communications of increased capacity, reliability, and high security.

Another major improvement effort of tactical C³ is the Combat Theater Communications program, slated for completion in the early 1980s at a cost of about $450 million. Known as 478T, this program is a component of DoD's Joint Tactical Communications (TRI-TAC) program. Both 478T and TRI-TAC begin the transition from analog to digital communications systems. This transition will be accomplished by hybrid analog/digital switches and by other analog/digital conversion hardware. The advantage of transitioning to digital communications is that digital communications allow more sophisticated encryption techniques to be employed.

The security of tactical communications, so woefully deficient during the Southeast Asian war, is being improved across the board. Highly secure communications, involving both voice and written information, become much more feasible, both technically and economically, as a result of the transition from analog to digital systems, according to General Creech. "On the other hand, I expect that it won't be possible to secure all military communications, simply because of cost. There will need to be tradeoffs. Also, we must draw a distinction between security and antijam capabilities. The latter is becoming imperative because of an evolving Soviet tactical jamming capability of considerable scope and sophistication," the outgoing ESD Commander asserted.

Another ESD program affecting tactical command and control communications is the Tactical Air Control System Improvements, or TACSI program. A major project within the program, TACC Automation boosts the effectiveness of the Tactical Air Control Center through the use of rapid access displays, automation, and digital communications. Other projects within the program that improve the TACS capabilities through automation and miniaturization include TACS/TADS, the AN/TYC-10 Message Processing Center, and Automatic Radar Tracking.

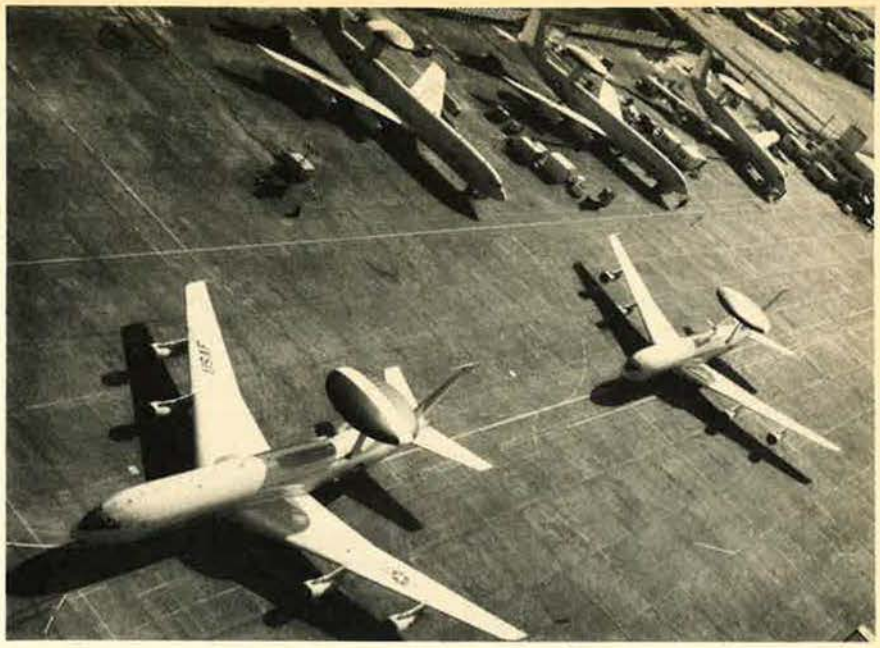
Closely coupled to TACS is TIPI, for Tactical Information Processing and Interpretation system, a $200-million-plus program to speed up the automatic processing and interpretation of tactical intelligence. Sorters and analyzers are being overwhelmed by the torrents of intelligence data generated by increasingly capable

sensors. TIPI and such affiliated programs as OASIS (Operational Application of Special Intelligence) and Combat Operations Information Center (COIC) are using machine intelligence to eliminate the bottlenecks and provide only essential information in understandable form to the decision-makers.

The long-term trends in tactical C³, ESD's Deputy for Development Plans Col. M. H. Alexander predicts, point toward transfer to unit level of some capabilities that at present are centralized. Current efforts to create a tactical C³ architecture (a term denoting the broad design philosophy underlying a system of systems), he said, deal with such concepts as reducing the time it takes to write frag orders from twenty-four hours to one hour by "doing more of this type of work at the unit level. Technology is here that would enable us to do this now through the netting of microcomputers," he said.

Dr. F. Robert Naka, USAF Chief Scientist, recently remarked that all available evidence points toward an age of "computational plenty," a term suggesting rapid, continued growth in computer hardware capacity that "should make it possible to achieve thousands—or even millions—of times the processing capacity per unit volume that we have today at a cost of between a tenth and a hundredth of today's. The resulting abundance of such powerful processing devices means that we will not have to concentrate our capability on a large collection of vulnerable vans.

ESD's "mini-TACAN" for USAF Combat Control Teams can be air-dropped and transmits to aircraft within a seventy-five-mile range.



E-3A AWACS, shown at a Boeing facility, will be able to interface directly with Salty Net III by 1979 to boost NATO's C³ capabilities.

"Users will be able to tap into the data stream through remote terminals and do their own processing. Targeting filtering processes, change detectors, and other human factor aids will be required so that less-skilled interpreters can be used. It is difficult training enough qualified people today for this job, and decentralization will fail completely unless we find ways to make their jobs easier. Not only will there be less reliance on large computers, there also will be less reliance on large computer programs and programmers. More and more, we will be looking to buy mass-produced standardized processing modules."

Mobile Airborne Command Centers

An ESD project of pervasive importance that encompasses tactical as well as strategic command and control capabilities is the CINC Mobile Airborne Command Center (ABCC), meant to enhance the C³ system of theater CINCs to manage conditions ranging from crises and conventional war to general nuclear war.

Purpose of these Airborne Command Centers, according to General Stelling, is to "provide theater commanders with highly mobile command facilities, permitting them to direct operations effectively in any contingency. A two-year concept definition study is being conducted to define requirements and operational concepts, conduct feasibility studies, and define a test plan for verifying the concept."

General Creech said ESD and the potential users have not yet arrived at any precise plans for the aircraft to be selected: "I would venture to say that the ultimate choice will probably turn out to be something smaller than the E-4, but as large or larger than the C-130." Meant to replace—or release for use as tankers—the EC-135s now in use which "aren't falling apart just yet but which, in a planning sense, should be replaced in the near future," the ABCC was recently defined as a

required operational capability by the WWMCCS Council. ESD was instructed to pinpoint the specific technological options in concert with the CINCs of the unified and specified commands. ABCC is to reach operational capability by 1985.

Strategic C³ Systems

At the center of all C³ systems is WWMCCS, the system of systems through which the National Command Authorities (NCA) control all US military forces and the unified and specified command structure (*see page 66*). The Air Force acquires and operates about seventy percent of WWMCCS. ESD plays a central role in the WWMCCS architecture, intersystems engineering, and acquisition.

In planning the WWMCCS architecture for the mid-1980s and beyond, the Defense Department has initiated a number of baseline programs and, in addition, programs in the WWMCCS Selected Architecture. These are expected to cost on the order of $12 billion by 1985. Key elements include various communications and warning satellites and associated ground stations and processing systems; several airborne and ground-based command posts; new secure voice and message networks; sophisticated information display systems; and the ELF (extremely low frequency—needed to communicate with submarines at depth) communications system.

The Air Force manages about three-fourths of the new investments. ESD is responsible for the development of many of the warning, communications, command facilities, and computer components of the WWMCCS architecture and participates in the development of the overall architecture for the next generation of Defense Satellite Communications System. Overriding concerns are specific USAF requirements and ground system design for the Defense Satellite Communications System, the General Purpose Satellite Communications System, and the Strategic Satellite System.

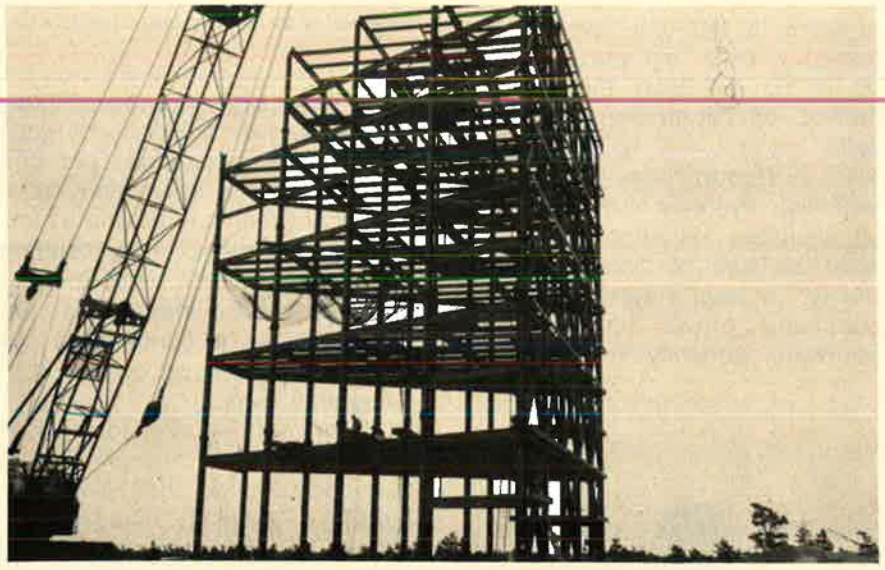
To date, the ESD Deputate for AFWWMCCS, augmented through technical assistance and systems engineering by the MITRE Corp. and assistance from many SPOs and operational commands, has completed twelve intersystem engineering tasks, resulting in the allocation of about $300 million for implementation and acquisition. Among these tasks were concepts for linking Minuteman and Titan ICBM launch control centers to four WWMCCS components, for coupling the Defense Satellite Communications System (DSCS) to the Simplified Processing Stations of the Early Warning Satellites, and detailed technical recommendations for achieving greater efficiency and interoperability of WWMCCS subsystems under USAF control.

The AFWWMCCS Deputate is participating in comprehensive tradeoff analyses regarding strategic and tactical requirements for the next generation of defense satellite communications system and their ground and airborne segments and is drafting recommendations for a Communication Relay for Crisis Situations. The latter, Colonel Milauckas explained, seeks to define improved communications connectivity between forces at a remote crisis scene and the NCA and is related to the proposed theater airborne command center.

SAC's Automated Total Information Network

In March of this year, ESD awarded a $32 million contract to the Defense Communications Division of International Telephone & Telegraph Corp. to develop a prototype of a vital subsystem of WWMCCS known as the SAC Automated Total Information Network, or SATIN IV. This system, its program director, Col. Wesley D. Woodruff, said, is to upgrade a SAC portion of WWMCCS by "furnishing under transattack and postattack conditions highly responsive, functionally survivable and secure communications" between CINCSAC, the NCA communications facilities, and about 200 SAC missile and bomber/tanker command posts.

SATIN IV replaces communications equipment that was developed during the late 1950s. The objective of the initial thirty-eight-month contract, covering Phase I of the program, is to design a basic system and to prove out its ability to perform "those functions



Old Cape Cod has a new landmark, the 105-foot-tall steel frame of the nascent PAVE PAWS dual-faced radar that can provide early warning of SLBM attacks on the US.

hat our earlier risk studies indicated would be most taxing," Colonel Woodruff said.

Key elements of the initial contract are design, production, and test of a functional prototype system consisting of computers, keyboards, display units, communications line coding equipment, and cryptographic devices, and to demonstrate that the software, "a massive and highly critical task," can meet the operational requirements, he added.

Assuming a go-ahead decision by the Defense Systems Acquisition Review Council (DSARC I) upon completion of Phase I, a SATIN IV production contract would be let that could result in installation of the equipment, first at Whiteman AFB, Mo., and Offutt AFB, Neb., and subsequently at all sites. Completion of the entire program is envisioned by 1984.

SATIN IV consists of five principal nodes at four SAC bases—Offutt; March AFB, Calif.; Barksdale AFB, La.; and Grand Forks AFB, N. D.—and the alternate National Military Command Center at Fort Ritchie, Md., as well as less complex nodes at all SAC bomber/tanker and missile command posts and ICBM launch control centers. The latter permit key tie-ins with the Minuteman III's Command Data Buffer system. SATIN IV can act as a damage-assessment system since terminals that drop out can be presumed to have been destroyed. SATIN IV will be deployed in hardened sites and have protection against nuclear effects comparable to that of the Minuteman capsule. SATIN IV equipment at various locations in the US and abroad will be tied together by the AUTOVON redundant, worldwide government communications network.

AFSATCOM

In December 1976, ESD awarded a $74-million-plus contract to the Collins Radio Group of Rockwell International Corp. for production of airborne and ground terminals of AFSATCOM, the Air Force Satellite Communications System. AFSATCOM is to enable the NCA to exercise efficient, rapid command and control of SIOP forces through satellite-based UHF (ultrahigh frequency) communications capable of operating at a rate of 100 recorded words per minute. The three principal contractors are TRW, Hughes, and Rockwell. The space segment will be deployed on host satellites in equatorial, polar, and other orbits and is being managed by AFSC's Space and Missile Systems Organization (SAMSO).

ESD's task, involving expenditures of approximately $200 million, is to develop airborne terminals for B-52, EC-135, C-141, FB-111, E-4B, and Navy submarine communications relay aircraft as well as ground-based terminals for the Strategic Air Command, Air Force Communications Service, and USAF Security Service. The terminals, General Buck said, consist of specially designed solid-state transceivers—some of which can transmit and receive at the same time—that combined with ancillary equipment provide error-free teletype communications. A special microprocessor in the teletype control unit makes it possible to compose, edit, and store messages for subsequent transmission. Messages can also be sent "live" as they are being typed.

The units are modularly constructed to permit various configurations tailored to various terminals. The units range from a miniaturized teletype keyboard and printer for use in the B-52 and FB-111 to computer-equipped ground and airborne command posts using batteries of transceivers, modems, teletype units, and high-speed printers. AFSATCOM is expected to reach full operational status in the next decade.

A follow-on system to provide increased survivability and anti-jam capability while using some of AFSATCOM's terminal hardware is in concept formulation. Previously called AFSATCOM II and III, it is now known as the Strategic Satellite System (SSS). A first step toward SSS are the two Lincoln Experimental Satellites, LES-8 and LES-9, that were placed into "near-geosynchronous orbit" in the spring of 1976 and that "have been performing beautifully ever since," according to General Buck.

The two satellites, one standing off the West Coast and the other off the East Coast of North America, orbit in figure-eight patterns between the Tropic of Cancer and the Tropic of Capricorn. Their purpose is to test techniques that help satellites survive and continue dependable operation in a hostile environment. Their power sources are radioisotope thermoelectric generators, in fact atomic batteries, that are designed to produce more than 130 watts of power continuously for five years from plutonium-238 fuel. Each satellite uses two generators. A special stabilization system keeps one end of each satellite pointed at the earth and a crosslink antenna system trained on the other satellite. The satellites' jam-resistant UHF communications are now being used for operational purposes as well as for research.

PAVE PAWS

Within about three or four years, two sophisticated, dual-faced, phased-array radar systems, one located at Otis AFB, Mass., and the other at Beale AFB, Calif., will provide rapid detection, early warning, and attack characterization of SLBMs launched against the US, and also support the USAF SPACETRACK program in cataloging positional and velocity information about satellites in low earth orbits.

A high-priority addition to WWMCCS, PAVE PAWS is linked to the NCA and SAC to furnish

SLBM information, and to NORAD's Cheyenne Mountain Complex to provide space data. PAVE PAWS's nearly 3,600 antenna elements generate a search beam with a range of up to 3,000 miles, according to Col. H. J. McLoud, Jr., of ESD's Deputate for Surveillance and Navigation Systems. Raytheon Co.'s Equipment Div. is the prime contractor, while IBM is the software developer. PAVE PAWS software is being developed by means of a sophisticated systems engineering technique known as top-down or structured programming that "helps in finding and solving software problems early in the cycle," according to Colonel McLoud.

COBRA JUDY is a new ESD development involving a shipborne phased-array radar system scheduled to become operational in 1980. Its purpose, according to Brig. Gen. David M. Mullaney, USAF's Deputy Assistant Chief of Staff for Intelligence, is to "track multiple reentry targets through the endoatmosphere [all strata of the atmosphere]." Testifying before Congress, he said COBRA JUDY will benefit national and USAF intelligence as well as the Army's Ballistic Missile Defense R&D Program. "COBRA JUDY will extend the COBRA DANE [an ESD-developed phased-array radar at Alaska's Shemya Island that collects data outside of the atmosphere] and COBRA BALL [a classified program] collection capability. In this extended role, COBRA JUDY will provide a more complete picture of foreign missile development programs," he stated.

The system is to serve Army requirements in the following manner, according to General Mullaney: "The US BMD research and development depends heavily on full-scale field data, most of which is collected at Kwajalein [one of the Marshall Islands in the Central Pacific] on US offensive missile system tests. Dedicated BMD target programs have also been necessary to provide an adequate range of targets and trajectories. This Kwajalein testing does not provide the confidence that would be obtained from data on actual Soviet missiles. . . . COBRA JUDY will permit the Army to reduce certain future dedicated target requirements that in the past averaged $10 to $15 million annually while increasing the breadth, number, and relevance of events upon which BMD threat analysis is based." General Mullaney testified in connection with a request to reprogram $1.5 million for COBRA JUDY from another program, the over-the-horizon radar program COBRA SHOE that is presently stalled because of political ramifications.

GEODSS, or Ground Electro-Optical Deep Space Surveillance system, is ESD's key program for detecting and tracking satellites up to geosynchronous and higher altitudes. The GEODSS prototype at Stallion Range Center, White Sands, N. M., developed by MIT's Lincoln Laboratory "has proved the concept and found objects dimmer than called for by the system specifications. We are now doing limited operational work for NORAD," Colonel McLoud said.

GEODSS will be installed at five sites spaced along the equator to provide worldwide space surveillance and augment SPACETRACK. Eventually, GEODSS will work in conjunction with either a ground-based deep space radar detection system or a space-based Long Wave Infrared (LWIR) detection system.

An ESD program that is being restructured is the CONUS OTH-B backscatter radar system, which, if deployed at one East Coast and one West Coast site, could provide warning against aircraft at all altitudes out to a range of about 2,000 miles. "In order to keep costs down until the technical feasibility—including the ability to function during periods of aurora borealis activity—is established, we have deferred many of the operational suitability aspects of the program until later," according to General Creech. These changes are expected to stretch out the program about two years from the original schedule, assuming that there is DSARC approval to enter the system into production.

Other ESD surveillance programs or projects include the Joint Surveillance System for peacetime airspace surveillance that is currently in source selection; the planned development of robo radar sites for the Distant Early Warning (DEW) Line (SEEK FROST), and SEEK IGLOO, the acquisition of minimally attended radar sites in Alaska (*see p. 60, April '77 issue*).

After two and a half years a Commander, General Creech believes "ESD is in good shape; would like to think in better shape than when I came. As I leave, I am confident that the Command will be in good hands with General Marsh and that the importance of electronics and command control and communications systems to the Air Force and the Defense Department will continue to increase in the years ahead." ■

ESD is modernizing the Ballistic Missile Early Warning System (BMEWS) to improve attack assessment information involving missile attack via the Arctic.

What's Happening in Electronics at ESD

A CHECKLIST OF MAJOR ELECTRONICS PROJECTS

SYSTEM NO.	NAME AND MISSION	STATUS	CONTRACTOR
404L	**Traffic Control and Landing System (TRACALS)** TRACALS encompasses fixed and mobile ground facilities and equipment, with associated avionics, to update the USAF air traffic control function. Major systems being acquired include terminal navigation aids, radar approach control equipment, landing systems, and air traffic control simulators.	Continuing Acquisition	Many
411L	**E-3A Airborne Control and Warning System (AWACS)** This system provides survivable airborne air surveillance capability and command control and communications functions. Its distinguishing technical feature is the capability to detect and track aircraft operating at high and low altitudes over both land and water. Used by the Tactical Air Command with Tinker AFB, Okla., as the main operating base. Aircraft may deploy throughout the United States and overseas to provide surveillance, warning, and control in a variety of peacetime and wartime situations.	Acquisitional and Operational	Boeing Aerospace Co. (Westinghouse is radar subcontractor to Boeing)
414L	**Over-the-Horizon Backscatter Radar** The program will provide long-range detection of aircraft approaching North America as part of the NORAD air surveillance and warning capability. Distinguishing technical feature of OTH-B is its ability to detect targets at all altitudes and at extended ranges. The present program is to build and test a prototype radar.	Development/ Validation	General Electric
427M	**NORAD Cheyenne Mountain Complex Improvements** Involves acquisition of data-processing equipment, software, displays, and communications for the NORAD Cheyenne Mountain complex. The core processing segment, modular display segment, and the communications system segment will provide NORAD with an integrated, responsive capability and a growth potential over a projected ten-year life span without major changes to equipment or software.	Acquisition	Ford Aerospace and Communication Corp.
428A	**Tactical Information Processing and Interpretation System (TIPI)** The USAF TIPI/USMC MAGIS (Marine Air Ground Intelligence System) will provide more timely and accurate intelligence to USAF and USMC tactical commanders at various echelons. Air transportable and housed in mobile shelters, the various segments of the system employ automated aids to provide the capability for rapid processing, interpretation, and reporting of intelligence derived from airborne collected electronic reconnaissance and photographic and radar imagery.	Definition, Development, Acquisition, and Deployment	Texas Instruments, Systems Development Corp., Fairchild, General Electric
433L	**Weather Observing and Forecasting System** A system for modernization of the Air Force Weather Service to provide high quality and timely weather observations, information, studies, advice, and forecasts in support of military operations and command and control systems.	Acquisition and Operational	Many
450A	**Tactical LORAN** A program for development and acquisition of the AN/ARN-101 (V) Navigation/Weapon Delivery System for the RF-4C and F-4E aircraft. This modular digital avionics capability with LORAN will satisfy tactical requirements for the 1978–88 period. Development and acquisition of a Tactical LORAN C/D Ground Chain for worldwide tactical deployment to provide LORAN environment for joint service common grid positioning. Development of precise grid prediction and grid data management for joint service use.	Development and Acquisition	Sperry Gyroscope, Lear Siegler
451D	**COMBAT GRANDE** Upgrading, modernizing, semiautomating, and maintaining the Spanish Air Force aircraft control and warning network.	Acquisition	COMCO, General Dynamics
478T	**Combat Theater Communications** A program to acquire new hybrid analog/digital and digital communications equipment both for Air Force tactical requirements and for the DoD Joint Tactical Communications (TRI-TAC) Program. Within TRI-TAC the 478T Office carries out the development, test, and production of equipment assigned as Air Force responsibility and ensures that USAF requirements are met by all of the equipment procured through this joint service program. Also responsible for the interoperability of TRI-TAC equipment with other communications equipment within the tactical air force environment.	Definition, R&D, and Acquisition	Martin Marietta, Litton Industries, Raytheon
481B	**E-4 Airborne Command Post** Provides the National Military Command System (NMCS) and Strategic Air Command (SAC) with an airborne command and control system that will operate during the pre-, trans-, and postattack phases of a general war. As a survivable emergency extension of NMCS and SAC ground command control centers, it provides a capability to execute and control SIOP forces during nuclear war.	Acquisition	Boeing Aerospace Co., E-Systems
485L	**Tactical Air Control System Improvements (TACSI)** This program will give the Tactical Air Control System (TACS) increased operational capabilities for command and control of tactical aerospace operations. Improvements consist of mobile communications and electronic systems capable of modular worldwide deployment that are compatible with the TACS and interoperable with Army, Navy, and Marine Corps tactical data systems.	R&D and Acquisition	ITT, Hughes, Systems Development Corp., Goodyear, Applied Devices Corp.
496L	**SPACETRACK Augmentation** Mission of the SPACETRACK system is to detect, track, and identify man-made objects in space. Improvements are needed in areas of extended range, greater coverage, better accuracy, and more timely reporting. Several efforts are under way to determine future requirements for modifications to the sensor network, on-site data processing, operating procedures, and system communications. Large ground radars and electro-optical systems are being considered for deep-space surveillance. Initial improvement	Acquisition	TRW (for GEODSS)

SYSTEM NO.	NAME AND MISSION	STATUS	CONTRACTOR
	is the Ground Electro-Optical Deep Space Surveillance (GEODSS), which will extend SPACETRACK surveillance to synchronous altitudes. This will be a global network of five sites to optically detect, track, and identify satellites in earth orbit.		
616A	**Air Force Support of MEECN** Upgrade of the Air Force Survivable Low Frequency/Very Low Frequency (LF/VLF) System as part of the Minimum Essential Emergency Communications Network. The LF/VLF System is designed to meet the requirements of CINCSAC and the Joint Chiefs of Staff.	Development and Acquisition	Westinghouse
633A	**COBRA DANE** Installation of a phased-array radar on Shemya AFS, Aleutian Islands, Alaska, to collect intelligence data on Soviet missile development tests. Corollary missions are early warning and satellite tracking.	Acquisition and Operation	Raytheon
633B	**COBRA JUDY** Acquisition and deployment of an instrumentation ship.	Definition	None
634B	**Joint Tactical Information Distribution System (JTIDS)** A program to develop a high capacity, reliable, jam-protected, secure digital information distribution system that will provide an unprecedented degree of interoperability between data collection elements, combat elements, and command and control centers within a military theater of operations.	Engineering Development	ARINC, Hughes, ITT, Boeing Aerospace Co., Singer-Kearfott
681E/ 1823	**DoD Base and Installation Security System (BISS)** An evolutionary program for a DoD standard electronic security system for physical security of DoD resources worldwide. This system's major components include sensor, imaging, entry control, and command and control equipments. The system concept emphasizes maximum commonality of major items and a variety of supporting subsystems. It offers a choice of equipments that can be tailored to the physical characteristics of the location and to the threat.	Advanced Development and Engineering Development	Many
968H	**Joint Surveillance System (JSS)** The JSS program is to acquire and deploy a peacetime air surveillance and control system to replace the Semi-Automatic Ground Environment (SAGE) system for the US and Canada. For Canada, the mission is expanded to include support of wartime air defense functions, and in Alaska the mission includes tactical air control functions.	Validation and Acquisition	To be determined
1136	**SAC Automated Total Information Network (SATIN IV)** A program for an integrated SAC command-wide digital record communications system to meet, with updating, SAC requirements for command control and support data transmission into the 1990s.	Development	ECI (for line printers), ITT (for system prototype, with IBM and BDM)
1144	**Automated Technical Control (ATEC)** A coordinated Defense Communications Agency program which, when deployed, will provide computer-assisted performance assessment, fault isolation, and reporting on circuits, equipments, networks, and links of the Defense Communications System (DCS). It is a part of the Technical Control Improvement Program to increase reliability and maximize performance of the DCS. ATEC consists of development and production of computer-controlled equipment and sensing devices.	Engineering, Development, Production	Honeywell, GTE Sylvania, Computer Sciences Corp.
1205	**Air Force Satellite Communications System (AFSATCOM)** A program for acquisition of UHF airborne/ground force terminals, airborne/ground command post terminals, ancillary equipment for operational control, and communications transponders on selected Air Force satellites. The associated family of modular UHF transceivers will provide a command communications capability in the line-of-sight mode. The full-grown family of modular UHF radios will result in a common base to provide the transceiver for the satellite SIOP and force communications terminals.	Development and Acquisition	TRW, Hughes, Rockwell
2059	**PAVE PAWS** Two dual-faced phased-array radars, one to be deployed on the East Coast and one on the West Coast. This system will be operated by the Aerospace Defense Command and will provide warning to the National Command Authorities of a sea-launched ballistic missile attack against the continental US.	Development	Raytheon
2128	**Ground-Based Deep Space Surveillance Radar** A program to verify the feasibility of ground-based radars for use in deep space surveillance. Results of this investigation will provide inputs to an Air Force decision on the configuration of a deep space surveillance system.	Conceptual	General Electric
2167	**SPADATS Improvements** The Air Force Space Detection and Tracking System provides the primary national capability for surveillance, tracking, and identification of man-made objects. This includes cataloging space objects, precision tracking of high-interest payloads, intelligence support, space object identification, maneuver detection, satellite decay and impact prediction, weapon-systems support, and support for national space programs.	Advanced Development	Hewlett-Packard, Magnavox
2189	**Air Force Ground and Amphibious Military Operations (AF GAMO)** Intersystem planning, engineering, and testing of Air Force tactical command and control elements used in support of the JCS-directed joint interoperability program for Ground and Amphibious Military Operations (GAMO). Activities will focus on increased compatibility, interoperability, and operational effectiveness.	Conceptual, Development, and Validation	None
2206	**Digital European Backbone** A program to incrementally transition portions of the European Defense Communications System from an FDM multiplexed system (analog) to a time division mixed system (digital) with higher reliability components. This will provide an economic wideband digital bulk encrypted terrestrial backbone for interconnect and alternative routing capability between Defense Satellite Communications System's earth terminals and major commands.	Validation and Acquisition	Many

SYSTEM NO.	NAME AND MISSION	STATUS	CONTRACTOR
2294	**SEEK SAIL** Involves acquisition of radar sensor for SPACETRACK in the Western Pacific area. Implementation of this sensor will provide information to the Aerospace Defense Command on new satellites during the initial orbit. This sensor will extend the system coverage and provide data for updating the SPACETRACK catalog.	Development	None
2394	**Operational Application of Special Intelligence Systems (OASIS)** Improvement of tactical command control and communications capabilities through the application and interfacing of appropriate surveillance and special intelligence systems. Initially, improvements to the USAFE Tactical Fusion Center (TFC) in its support of Allied Air Forces Central Europe will be addressed. Although the OASIS program will initially concentrate on needs of the TFC, the program will, as required, develop operational applications of special intelligence systems for other commands.	Development and Acquisition	None
7820	**Communications Security (COMSEC)** A program to accomplish COMSEC RDT&E associated with protecting classified communications by electronic means. The program responds to validated requirements identified by the USAFSS.	Continuing	Many
11896F/ 27596F/ 41896F	**Air Force SAFE Programs** Includes acquisition and deployment to some 100 USAF bases and sites of physical security equipment that is commercially available or is developed under the DoD BISS Program. These systems will protect mission-critical and high-value resources such as weapons storage sites, alert aircraft areas, and command posts.	Acquisition and Deployment	Fourder Inc.
	Air Force World Wide Military Command and Control System (AFWWMCCS) Involves systems planning and engineering for Air Force elements of the World Wide Military Command and Control System. Activities will focus on intersystem engineering of selected AFWWMCCS existing and planned assets.	Conceptual, Validation, and Development	None
	BMEWS Tactical Operations Room Upgrade Modifications to the Tactical Operations Room (TOR) of the Ballistic Missile Early Warning System. At Site I (Greenland) and Site II (Alaska) new operator consoles will improve operating efficiency and reduce personnel required. A proposed follow-on will provide new computers, improve resolution capability of radar electronics, and upgrade the TOR at Site III (England).	Modification and Analysis	To be determined
	Air Force Data Element Dictionary and Message Catalog Provides the automated digital exchange of command management information among the elements of the tactical forces through data communications.	Continuing	None
	Defensive EW/ECCM Functional Area Improvements An electronic warfare (EW) office within ESD to act as the ECCM focal point, with the prime responsibilities of ensuring that electronic counter-countermeasures (ECCM) are fully considered during the conceptual and developmental phases of C^3 systems acquisition.	Continuing	None
	Enhancement of TACS Ground Target Strike Control Capability Development and maintenance of a time-phased plan for significant improvements in the capability of the Tactical Air Control System to provide real-time control of strike, defense suppression, electronic warfare, and air defense aircraft in support of the ground mission.	Continuing	None
	Enhancement of TACS Air Surveillance and Control Capability The development and maintenance of a time-phased plan for significant improvements in the capability of the Tactical Air Control System to provide real-time air surveillance of the tactical theater and control of air intercept resources.	Continuing	None
	Identification of Hostile Aircraft The objective of this program is to define system performance requirements, compare alternative identification systems, and perform a conceptual design of the optimum system selected. The study will focus on identification of hostiles in Central Europe and will rely on the integration of data from several sensors for positive identification.	Conceptual	None
	Modular C^3 Interface Analysis Involves the development of a preliminary design for a flexible interconnect to be used in Tactical C^3 centers.	Conceptual	None
	SEEK FROST A program to replace the existing Distant Early Warning (DEW) Line with a system of totally unattended short-range radars and supporting equipment and facilities to provide enhanced coverage with higher probability of detection of bomber attack in the northern approach regions to the North American Continent.	Conceptual	None
	Tactical Air Forces C^3 Architecture Description of the evolutionary development of command control and communications and intelligence capabilities for tactical forces. Contains current, programmed, and desired capabilities and shows a budget-constructed program to achieve improved tactical operations.	Continuing	None
	TACC AUTO The Tactical Air Control Center (TACC) is the senior element of the Tactical Air Control System (TACS) and operates as the facility through which the deputy for operations exercises control of the tactical forces. The objective of TACC AUTO is to provide levels of data automation capabilities to the TACC and other elements of TACS through the incremental introduction of digital data links, automated data base, and rapid access displays.	Development	General Dynamics, Computer Sciences Corp.

Electronic Warfare News From Westinghouse

Advanced programmable ECM system now in production for USAF

Following a successful series of flight and environmental tests, the new AN/ALQ-131 ECM system is now in production for the USAF. The AN/ALQ-131 is a modular, versatile ECM system designed to meet both present and future electronic warfare threats in a number of scenarios. A digital processor control system which can be readily reprogrammed by means of a preassembled mission tape—on the flightline or in the shop—provides the AN/ALQ-131 with a rapid, accurate means of optimizing system response on a mission-by-mission basis.

The pod configuration and modular construction of the AN/ALQ-131 provide a high degree of adaptability for a variety of mission requirements. This modular concept extends to the subassembly level with emphasis on accessibility for ease of maintenance and upgrading of the system without impact on the airframe. A centrally integrated test system (CITS) quickly isolates faults in the ECM pod.

The AN/ALQ-131 can be carried on the F-4, F-15, A-10 and is compatible with many other aircraft as well. With the experience gained from 44 consecutive months of on-time production and delivery of AN/ALQ-119 ECM pods, Westinghouse has the know-how to produce this tomorrow pod today.

Compact control panel provides better cockpit control of ECM

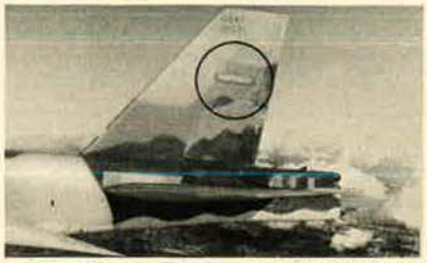
The C-9492-A/ALQ Control Indicator has been designed by Westinghouse for the USAF to satisfy the need for increased cockpit control of current ECM system capabilities. The unit features both digital and analog control to consolidate the required cockpit control and display and utilizes existing aircraft wiring for ease of installation and maintenance. The compact C-9492-A/ALQ weighs only 2.5 pounds and can be installed in the existing C-6175 panel space. The unit features status light/pushbutton function symbols which are easily replaceable to accommodate threat or equipment changes and has a calculated MTBF of more than 3500 hours.

Airborne Self-Protection Jammer—ASPJ

Over the past 10 years, Westinghouse has developed, produced, and delivered more than 2600 multi-band, threat programmable ECM systems. Now this practical experience is being combined with the new concepts and capabilities needed to satisfy the requirements for the U.S. Navy's next generation Defensive Electronic Countermeasures (DECM) system. The result will be ASPJ; an affordable and readily reproducible DECM system featuring designed-in reliability and ease of maintenance for high systems availability, yet field programmable for immediate threat response.

Westinghouse is making a major corporate commitment to this program in terms of manpower and facilities. The practical experience we have gained in the development of previous ECM systems coupled with the new system philosophy inherent in our ASPJ approach will ensure that the next generation DECM system provides the optimum in performance and reliability for "home safe" effectiveness against changing threats in a hostile environment.

Tail warning set keeps ahead by looking back



The Westinghouse AN/ALQ-153(V) Tail Warning Set keeps our aircraft ahead of the game by detecting various airborne threats. The radar system is designed for hardware commonality with B-52 and F-15 aircraft. It combines solid-state reliability with digital-processing performance to effectively and economically provide sufficient warning to the pilot for automatic dispensing countermeasures and/or aircraft evasive maneuvers at the optimum time.

The Tail Warning Set has emphasis on low false alarm rate, high reliability, and commonality between SAC and TAC hardware.

The system is currently undergoing flight tests on board a B-52 aircraft at Eglin AFB, Florida, flying from the home base in Wichita, Kansas. The flight test evaluation program for the B-52 will culminate in June 1977. AH-2-77

Westinghouse. A powerful part of defense

Electronic Warfare Development: A Look Ahead

BY COL. FRANCIS P. DUBÉ, USAF

The EW Systems Program Office at Aeronautical Systems Division is managing contracts with a value of more than $1 billion while developing improved procedures for assuring that USAF aircraft have the right EW systems to provide acceptable survivability in the future.

FOR many years, the "Old Crow"—the symbolic representation of electronic warfare (EW)—was underfunded and underestimated. But the Southeast Asia war demonstrated, and the Mideast's Yom Kippur War confirmed, the essentiality of EW. Against an increasingly sophisticated enemy electronic air defense system, countermeasures are required. Today, a wide range of aircraft are equipped with electronic warfare systems, representing an annual investment of hundreds of millions of dollars.

Economy and operational survivability demand that we find the right answers to some fundamental questions: Will the USAF be prepared to face a technically advanced air defense system? Are we taking the right steps to equip our aircraft with the right systems to provide acceptable survivability? These two questions are basic to planners, developers, and operators of Air Force combat forces.

The USAF has had four years since Vietnam and the Yom Kippur War to assess EW requirements, while observing a continuous upgrading of Soviet air defenses. It has become obvious that one way to counter an air defense system, that of evading it, is rapidly being removed from the bag of tricks. Historically, the strategic forces, because of their deep penetration mission, have needed a capability to degrade and destroy enemy air defenses in addition to avoiding them when possible. As the defenses became mobile, the tactical forces also recognized this need and began equipping their aircraft with systems to counter, degrade, and destroy electronic air defenses. Even low- and slow-flying aircraft, whose traditional role did not require them to penetrate electronically defended airspace, are being provided defensive avionics.

Applying QRC Lessons

One of the most rapid methods of equipping combat forces with EW systems has been the Quick Reaction Capability (QRC) acquisition process. It was a lifesaver during Vietnam; but QRC has its drawbacks. Inadequate testing leading to low reliability, poor maintainability, and faulty support equipment can be direct results.

The B-52 ALQ-127 Tail Warning System (TWS) development program points out QRC deficiencies. Normally, three or four years would have been allowed to design, fabricate, and test the system. But with the SEA conflict still in progress and optimism high, the program called for hardware being available nine months after contract award, and flight testing being completed twelve months after program go-ahead. Needless to say, schedules were not met, performance was marginal, and cost increased rapidly. This, and other similar experiences, have resulted in improved principles for developing, testing, producing, and deploying EW hardware.

The current ALQ-153/-154 programs to develop and acquire a tail warning system for the B-52 and F-15 have profited from lessons learned during the SEA era and from good "front-end" planning. Based on antenna technology developed in the Air Force Avionics Laboratory, an intensive aircraft configuration study was initiated. The Avionics Laboratory had developed a rather small antenna suitable for use with a tail warning radar. It was relatively easy to install on the B-52 vertical stabilizer. This antenna became the baseline for the two systems currently in development.

Business strategy panels were convened to lay out the program

and "murder" boards dissected the request for proposal prior to its issuance. Interest within the EW and radar industry was high, resulting in a number of proposals. Each proposer knew that *two* sources might be selected. Competition extended from the initial selection to a competitive production contract award. Also, because of the requirement for maximum commonality between the B-52 and F-15 system, industry was not seeking just the 300-plus unit B-52 production program but also the larger F-15 buy.

The award of the production contract will be based on both performance and life-cycle cost (LCC), a further incentive to put top managers, cost analysts, and logisticians on the program. The development contracts with the two winning contractors are structured around phases, with each phase having a number of priced options. Airborne Instruments Laboratory (AIL) and Westinghouse Electric Corp. were the two winners and were awarded initial contracts in May 1975.

Phase I of the development program concerned prototype equipment design, fabrication, and limited qualification testing. By structuring the contracts around options, the Air Force liability was limited until system performance was demonstrated, *i.e.,* if one of the systems failed the ground test phase, that company would pack up and go home.

Phase I also allowed the contractors to learn as they designed and fabricated hardware. System performance was the primary objective, with B-52/F-15 commonality and LCC not far behind. Both contractors completed the ground test phase successfully in August 1976.

Phase II consisted of a number of priced options, engineering services, and equipment spares to support a six-month flight test, and fabrication of four preproduction systems that would be subject to environmental qualification testing, reliability testing, and maintenance demonstrations. Design, fabrication, and testing support equipment for the intermediate level maintenance shop was a part of Phase II.

The flight-test portion of Phase II has been completed. However, much remains to be done. Reliability testing has yet to be accomplished, and so does a maintainability demonstration using a preproduction system in association with support equipment that was designed for Blue Suit operation.

Once the contractors complete their respective maintenance demonstrations, each can take a breather, for their production proposals will have been submitted. But the Air Force's work will continue; operational performance will be evaluated in minute detail as will reliability test results. Results of life-cycle costs analysis will be fed into the source selection process as will myriad other data. The plan is to make a production decision and contract award for the B-52 system in June 1978.

"...we must find out more about sorting, selecting and countering [EW] threats on a priority basis."

The program is not without its critics. The process may be a little slower in satisfying the user's requirements, but, when the system is deployed, it will have been thoroughly tested, the user will have been trained to use and maintain it, and the tools will be in his hands to do both jobs. It also is true that R&D costs are higher, but they are a one-time expenditure.

Another approach to reducing life-cycle costs is through maximum commonality. An example of that approach is the ALE-40, a chaff/flare countermeasures dispensing system selected for installation on F-4, F-5, F-16, A-7, A 10, and C-130 aircraft in either an internally or externally mounted configuration. This approach not only will avoid unnecessary proliferation of new dispensing systems; it also will ensure maximum use of common expendables and associated ground-support equipment. A high degree of commonality has been maintained in the electrical items even though there are sheet metal and dispenser block differences between aircraft. The biggest area of commonality of the ALE-40 will be the payload of chaff and flare cartridges. A family of payloads is being developed and procured that will reduce production costs and inventories of peculiar payloads.

These are some examples of how EW development is becoming a more orderly process. However, the ability to respond rapidly to emergency and crisis situations is being retained, should we have to resort to such measures.

Testing and Training

One problem is our inability to determine, short of combat, how an EW system will perform. To address this problem, testing and

training have been developed around simulations of adversary capabilities.

For flight testing, the electronic countermeasures equipment is installed in an aircraft and flown against simulations of the threat system. These flight-test simulators duplicate the threat as well as available intelligence permits. Computers use simulator data to calculate missile/AAA miss distances for comparing the presence and absence of countermeasures.

Flight testing serves as the dress rehearsal of any new electronic countermeasures technique or equipment. The less glamorous details and problems are worked out in laboratory simulators, where lower cost and high data rates are achievable. These qualities, coupled with the repeatability and flexibility inherent in the laboratory, have made this means of testing an integral part of every step of the development process. Laboratory simulations support feasibility testing, system integration, optimization, and the establishing of baseline system effectiveness.

The Air Force has two primary laboratory simulators for electronic warfare evaluation—the Air Force Electronic Warfare Evaluation Simulator (AF-EWES) in Fort Worth, Tex., and the Real-time Electromagnetic Digitally Controlled Analyzer Processor (REDCAP) in Buffalo, N. Y. REDCAP began in 1964 as a feasibility study for the Air Force Avionics Laboratory. It has grown into a $4.5 million facility dealing primarily with simulating enemy ground control intercept (GCI) systems and emitter environment.

AF-EWES had its origin in the B-58 program. From its inception in 1958, AF-EWES has grown into a $28 million facility comprising precise simulations of hostile air defense weapon systems. It deals primarily with engagements involving four to seven aircraft and one to four radars. AF-EWES is unique in that it utilizes actual radar circuitry that includes receivers, tracking circuits, displays, and controls, operated in real time by experienced radar operators. This method of simulation permits ECM equipment and techniques to be evaluated at real frequencies and in real time. AF-EWES measures the amount of degradation achieved against terminal threat systems.

This simulator permits comprehensive evaluation of a system from subassemblies and components during conceptual phases through operational testing and development of tactics for the resultant system. A typical sequence begins with feasibility testing of high-risk techniques and components against laboratory threat simulations. As risks are reduced and prototype systems developed, there is further laboratory testing to measure and improve system effectiveness against individual threats. In-flight verification of the EW system is the final phase of the development, test, and evaluation process. Rome Air Development Center (RADC) supports all these tests by measuring antenna patterns. Very accurate data, in fact standards of the industry, are achieved. The Air Force Electronic Warfare Center (AFEWC) library contains copies of all antenna patterns measured by RADC.

The Electronic Warfare Systems

"Finding the proper balance between 'do-it-right' and 'do-it-now' will not be easy."

Col. Francis P. Dubé has been Director of the Electronic Warfare Systems Program Office at AFSC's Aeronautical Systems Division since October 1975. Previously, he was Director of Avionics Standardization and Systems Architecture at ASD. A navigator, his career in electronic warfare operations and staff duty includes an Air Staff tour and a tour in Vietnam as ECM Division Chief. He is a graduate of the Armed Forces Staff College.

Program Office at ASD is managing 120 active contracts with a value of more than $1 billion. This does not include the EW acquisition activities of the F-15, EF-111, B-1, and A-10 SPOs. In the past year, the EW SPO initiated production programs on the F-4G Wild Weasel, ALQ-131 ECM Pod, and ALR-62 Radar Warning Receiver for the F/FB-111. It also accepted initial production deliveries on the ALE-38 Chaff Dispenser Pod, the ALQ-122 B-52 Jammer, and the ALE-40 Chaff Flare Dispenser for tactical aircraft.

Significant progress has been made in assuring acceptable survivability against advanced air defense systems. However, much still needs to be done if we are to remain ready to counter improved performance and new enemy capabilities. Aggressive steps must be taken in the following areas:

SYSTEMS

The mix of electronic warfare systems must be broadened to prevent technological surprise from degrading available options. The emphasis on developing equipment that is not sensitive to a particular threat needs to be expanded. The concept of power management has to improve so that countermeasures systems can cope better with new threats. A better balance between hardware and software flexibility must be achieved as we gain experience in the use of power-managed equipment. With this approach, systems can be designed to reduce the workload of the aircrew.

A dedicated aircraft for countermeasures support is definitely needed to replace the phased-out EB-66. The EF-111 is essential as a basic support element of the tactical forces. Another factor that will greatly improve capabilities is to consider electronic warfare requirements during aircraft design. Design must include not only space and antenna considerations, but also radar cross section and infrared signature reduction. Finally, commonality of airborne systems and support equipment needs to be a continuing goal. Critical components such as traveling wave tubes, power supplies, and other elements common to electronic warfare systems should be standardized. This might reduce life-cycle costs significantly.

TESTING

Test capability now consists primarily of facilities for evaluating the effectiveness of an EW system to counter the threats against which it was designed—primarily terminal threat systems. Looking ahead to the 1985 era, a more sophisticated generation of threat systems should be used, which will require major changes at test facilities. In view of financial and manpower constraints, modifying and integrating some facilities will be required. Little change is likely for component and subassembly testing; however, we must find out more about sorting, selecting, and countering threats on a priority basis. In the future, systems must be tested in the total environment they will face in operation.

Laboratory systems are being modified to include environment simulation. Schemes to economically realize dense flight test environments center on the use of numerous emitters. These emitters would not involve redundant receiving assemblies, but would all get pointing data from a common system. Embedded in this artificial environment would be a few realistic systems complete with normal receiver schemes from which countermeasures effectiveness could be determined.

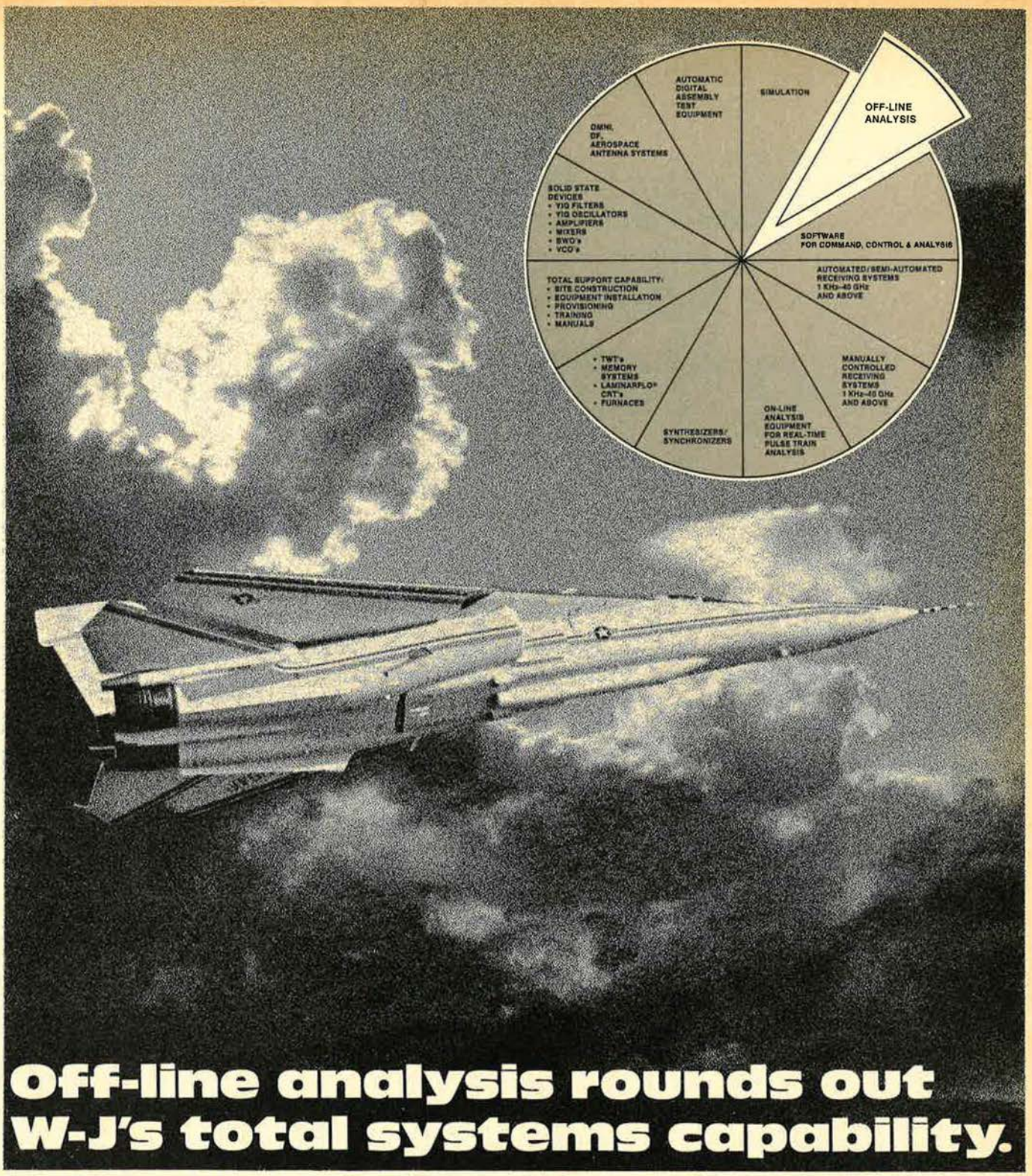
An adaptable threat simulator is planned, to be operational by the 1980s. It will be sufficiently modular and programmable to ultimately simulate an entire threat system. Such a system would make possible effectiveness studies of an existing system to counter a new threat. Taking the case one step further, generic jamming systems could investigate potential systems to counter the newly defined threat.

Future testing must consist of an integrated effort using laboratory simulators, flight test, and training exercises. Measures of merit must extend beyond the present standard probability of kill. DoD and USAF planning staffs need test results suitable for mission and force structure planning. Increasing emphasis on maintenance and reliability will continue in order to lower life-cycle costs. By 1985, test management will involve all operational commands as well as supporting agencies.

MANAGEMENT

Electronic warfare has become big business. It has also become an essential part of the Air Force operational forces. With that come responsibilities and obligations, including proving that systems are needed before committing the extensive resources required for production, and continuous considerations of trade-offs at all stages of the program. This process takes time.

The challenge to management is to conduct the electronic warfare business in a prudent and orderly manner and to remain responsive to rapidly changing threats from an ever-expanding enemy electronic air defense system. Finding the proper balance between "do-it-right" and "do-it-now" will not be easy. Pursued aggressively, with unswerving dedication and perseverence, the job can be done. ■



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THE ELECTRONIC AIR FORCE

How the E-3A Gives the Big Battle Picture

BY MAJ. GEN. LAWRENCE A. SKANTZE, USAF

From time immemorial, military commanders have dreamed of seeing beyond an adversary's borders and of viewing the battlefield itself from above, in order to control its myriad actions. USAF's remarkable E-3A is an all-seeing airborne radar system that "down-links" vital pictorial information to commanders on the ground.

THE first delivery of a production E-3A to the Tactical Air Command took place at Tinker AFB, Okla., on March 24, 1977. This event marked the beginning of a new era in our ability to manage and control tactical forces in massive, complex battle environments. Full development of the concept and tactics for most effectively exploiting this remarkable airborne warning and control system will be an exciting challenge to the Air Force over the next decade.

The focus of the E-3A system is the high-power, multimode airborne radar. Rotating at six revolutions a minute within the conspicuous black-and-white rotodome, while electronically scanning in elevation, it can be operated in either a pulse doppler (PD) mode or pulse mode, or both modes interleaved. The high pulse repetition frequency (PRF) pulse doppler mode provides the means to look down and detect low-flying targets against severe background clutter reflected from rugged terrain features. By a sophisticated filtering process, the ground clutter is removed from the return signals, leaving only valid target returns. In the pulse, or Beyond the Horizon (BTH) mode, the radar beam is pointed above the horizon, out of the ground clutter region, so a simple pulse mode can be used, extending the coverage well beyond the geometrical radar horizon of about 220 nautical miles.

The operation of the radar can be tailored to as many as thirty-two sectors within the 360-degree scan, utilizing the pulse doppler mode, with or without elevation scan, or BTH mode, or PD/BTH interleaved, or passive receiving as desired. The radar thus can provide a wide variety of target information across the interface to the data processor. This information is also supplemented by sensor data from the IFF, whose antenna is also located within the rotodome, on the back side of the radar antenna. Both streams of sensor data, correlated with inputs from the navigational functional group, flow through the interface adapter unit (IAU) to the IBM 4 Pi CC-1 data processor, which provides the high-speed, high-capacity digital processing that truly exploits the full radar potential. All sensor data are provided in digitized format, which gives great flexibility, and facilitates growth potential through software changes rather than hardware modifications.

The data-processing functional group executes the mission operational computer programs, maintenance programs, and utility computer programs in performing major system computational functions. It has a processing speed of 740,000 operations a second and a total memory of 917,000 words, expandable to 1,410,000 words by inserting additional memory storage units. The E-3A Airborne Operational Computer Program (AOCP) operates on a ten-second cycle and uses data received from all avionics subsystems. Processing this information enables the E-3A to detect, track, and identify aircraft; communicate with and relay messages to and from external sources; select, analyze, and display data; and perform onboard training. Almost all of this information provided by the computer is visually displayed to the crew on the multipurpose consoles of the Data Display and Control Functional Group (DDCFG), which is the heart of the man-machine interface on the E-3A system.

Two types of data display and control equipment, consisting of nine multipurpose consoles (MPCs) and two auxiliary display units (ADUs) are used directly by the mission crew to perform the

E-3A mission. The MPCs provide the mission crew with all display and control features required to carry out their surveillance, weapons direction, and battle staff functions. The ADUs support the communications, maintenance, and data-processing functions of the mission crew.

To accomplish their assigned surveillance and control tasks, the mission crew can configure the MPCs to serve as battle staff, surveillance, or weapons direction consoles. The MPC presents the appropriate pictorial representation of the situation required to support the function assigned the MPC by the operator. The pictorial representations of the available data range from individual symbols transmitting only sensor type and target position information, to a combination of symbols and tabular notes that display such information as target type, speed, direction of flight, bearing, friendly mission, and altitude. Supporting tabular data are presented in the lower portion of the display screen. From this data, and from such background pictorial information as maps and landmarks, the MPC operator can take actions in response to a developing situation. With the flexibility of configuring his nine MPCs to the appropriate mix of surveillance and weapons directors, the E-3A Mission Commander can optimize his ability to manage the air situation.

Display Remoting Equipment

A recent and dramatic capability added to the E-3A system is Display Remoting Equipment (DRE), using a conventional TV camera to transmit the picture on the MPC display directly, in real time, to high-level command authorities on the ground. Using commercial off-the-shelf equipment, a DRE set was installed and used during the three complex Initial Operational Test and Evaluation (IOT&E) exercises conducted during the last quarter of 1976. This demonstration equipment, with a single mobile ground station and microwave relays, provided commanders on the ground a constant overview of the total air situation as seen by the E-3A, including prehostility warning from long-range deep surveillance forming up and movement of hostile aircraft formations, positioning of friendly defensive and strike aircraft, location of in-flight refueling and SAR activity, and the overall ebb and flow of the air battle. Several ground-based IFF transponders were used to display the identification, location, and status of simulated key ground force units. A similar overview of critical maritime activity will be displayed when the maritime surveillance radar mode is installed.

In the massive tactical test (TACEX), the DRE capability

On the Brink of a Revolution

The United States Air Force has made no more important investment for national security than the commitment of resources to the development of the E-3A Airborne Warning and Control System (AWACS). The E-3A will have a revolutionary impact on command and control capability at both a national and international level.

The extension of surveillance horizons for warning and control with survivability, far beyond the limits of ground-based systems, through the employment of the E-3A, can provide civil and military leaders, as well as battle managers, with a never-before-available view of the battle area—potential or actual—and on a real-time basis. For the first time in history man can have an instant real, certain view of air and, if desired, ground and sea operations, before or during conflict.

With AWACS, our peacetime vision will extend far beyond the border. The knowledge we gain of our opponent's air activity will give us a higher level of understanding of preparations, and hence intent. This insight can enable national authorities to decide whether to mobilize or not to mobilize. The perfect vision of potentially hostile air activity will enable a commander to position his forces with economy and mass at the proper time and place to deter, or to fight. We will have time to think, reason, and act, rather than just react.

In the battle itself, the E-3A will enhance manyfold the capabilities of a commander's forces. This revolutionary technological edge will help us offset numerically greater hostile forces.

We have proven the E-3A's capability to see and to help manage in the largest, most complex peacetime test in the history of the Air Force. Last November, in the Southwestern United States, using the Nellis and Edwards AFB test ranges, an environment was simulated for the E-3A which permitted the time and space compression of opposing air operations of sufficient density to represent the threat environment potential in Central Europe. The purpose was to stress the system—both men and machine—to determine its operational capability.

From twenty-one bases in nine states, 413 Air Force, Navy, Air National Guard, and Air Force Reserve aircraft were employed, with an enemy/friend ratio of two-to-one. The Red Force was given ground control elements and extensive ECM capabilities to employ against the E-3A, which provided the Blue Force its only source of surveillance and control information. With the E-3A providing a real-time picture of more than 250,000 square miles—three million cubic miles of airspace—of prehostility Red Force activities, the Blue Force commander was able to make timely decisions and to concentrate his forces to meet the main threat. Despite intense ECM and intense operational activities, the E-3A enabled the air commander to achieve economic and effective battle management of a massive defensive/offensive air battle.

I am convinced that the E-3A, the most significant single tactical force improvement since the advent of radar, has us on the brink of a revolution in command and control.

—Gen. Robert J. Dixon, Commander, Tactical Air Command

Development of the E-3A underscores the US's ability to marshal its best talents to exploit technological know-how and management capability.

allowed the Blue Force commander on the ground to continuously monitor this intense, simulated NATO air war, beginning with early warning of massive air formations building deep behind the political border. This overview enabled him to most effectively use a numerically smaller force to counter more than twice as many attacking aircraft, despite intense airborne and ground-based jamming. If you project this scenario to the NATO Central Region, the same type of prehostility warning of developing air movements deep beyond the political borders, with all the unique intelligence features, could be displayed simultaneously in real time via downlink and microwave relays to all the political and military authorities in the NATO capitals.

The TV downlink has clearly demonstrated a dramatic potential for any crisis environment in which aggregated real-time intelligence is vital. As a result, the incorporation of DRE into the E-3A system will be accomplished rapidly. Although the basic development program is complete, engineering and test of the Block II enhancements already are under way to add a new high data rate, jam-resistant communications terminal and a maritime surveillance capability as the first block change to the E-3A. Over the expected thirty-year life of the E-3A, additional enhancements and increased capabilities will emerge, continually improving its flexibility and effectiveness.

The Development Program

The development of the basic E-3A has had a long and turbulent history, which, in retrospect, underscores the ability of the United States to marshal its best talents to exploit technological know-how and management capability and produce a system that provides a significant leap forward, multiplying battle management efficiency as a counter to numerically superior forces. Delivery of the first production aircraft within four months of the date laid down in July 1970, and within four percent of target cost, must certainly be characterized as the culmination of a highly successful development program, but one not without problems and difficulties that had to be met and resolved.

The initial Air Force requirement for an overland lookdown radar system was identified in 1963, culminating in a Specific Operational Requirement (SOR) jointly developed by the Tactical and Aerospace Defense Commands. Exploratory technology was conducted with small-scale radar models during the mid- and late 1960s to verify technical feasibility. Then, having established that technology, a development program was initiated in July 1970, following a formal Defense Systems Acquisition Review (DSARC). A philosophy of risk management was defined and the program was structured to verify early proof of radar performance and minimize large-scale fund commitments until success was assured. To do this, a brassboard flight-test program was defined in which two full-scale radars were flown competitively in two minimumly modified Boeing 707 commercial aircraft. Go-ahead on full-scale development was tied to demonstration that the radar could provide an operationally useful overland capability. That was accomplished in late 1972, and full-scale development go-ahead was approved by the DSARC in January 1973, following detailed review of the brassboard results. The original risk assessment criteria, which focused on the radar but also included those other critical elements associated with the full E-3A system, continued to be the critical criteria for decision milestones throughout the DSARC review of development program progress.

After some 900 flying hours with the brassboard aircraft, the next major step was the System Integration Development phase, commonly referred to as the SID Flight Test Program. An early prototype set of mission avionics—principally the IBM 4 Pi Computer, an IFF system, and four of the nine planned multipurpose consoles—was added to the Westinghouse brassboard radar in the Boeing 707 to provide an equivalent prototype E-3A system. Another 900 hours were then flown with the System Integration Demonstration (SID) aircraft, leading to a produc-

tion DSARC decision in December 1974. The primary risks to be resolved were successful operation of an integrated system, and demonstration of a complex airborne operational computer program that would manage and execute all of the mission avionics functions in flight.

Paralleling the SID Flight Test activity were the development, manufacture, and test of the repackaged radar, from brassboard into production configuration. It would be flown in the full-scale development Flight Test Program intended to complete the formal qualification of the complete E-3A system, including verification of reliability, maintainability, and operational suitability. Formal Initial Operational Test and Evaluation would also be conducted as it had been in the earlier brassboard and SID phases of the E-3A program. Therefore, since the production decision would be made prior to the Development Test and Engineering (DT&E) flight program, the final critical element in the DSARC risk assessment in December 1974 was evaluation of and confidence in the development status of the repackaged brassboard radar.

The degree of concurrency planned in the program's development and production phases was considered and assessed as reasonable and necessary for an efficient program during the initial program approval (DSARC I in July 1970) and reassessed at DSARC II (Development Go-ahead) and DSARC III (Production Go-ahead). Both the brassboard and SID Flight Test phases provided the performance checks on which to base confidence, and the degree of concurrency reduced the total program schedule and made possible delivery of the first operational aircraft a year early.

In actual execution of the program, the performance data amassed during the brassboard and SID flight phases allowed us to reassess the requirements of the full system DT&E Flight Program and reduce that phase by seven months, resulting in additional program savings. Nevertheless, the critical path in DT&E was clearly the development and successful flight test of the prototype radar. While the brassboard performance had provided high confidence in the design and performance of the radar, the repackaging challenge did entail schedule risk in terms of the amount of design refinement and qualification testing that would have to take place.

Repackaging the Radar

The primary task was to complete a repackaged design that would meet stringent weight and operability requirements. Extensive use of integrated circuits and multilayer printed circuit boards achieved much denser packaging in low power units. A complete redesign of the high-power transmitter was undertaken to reduce weight and to break it into a number of units, each capable of being manhandled, instead of the two large tanks used in the brassboard radar. The net result was to reduce the total weight from 14,000 pounds to 7,600 pounds. This one reduction increased the system's critical time-on-station by nearly forty minutes, thereby contributing significantly to the E-3A system effectiveness.

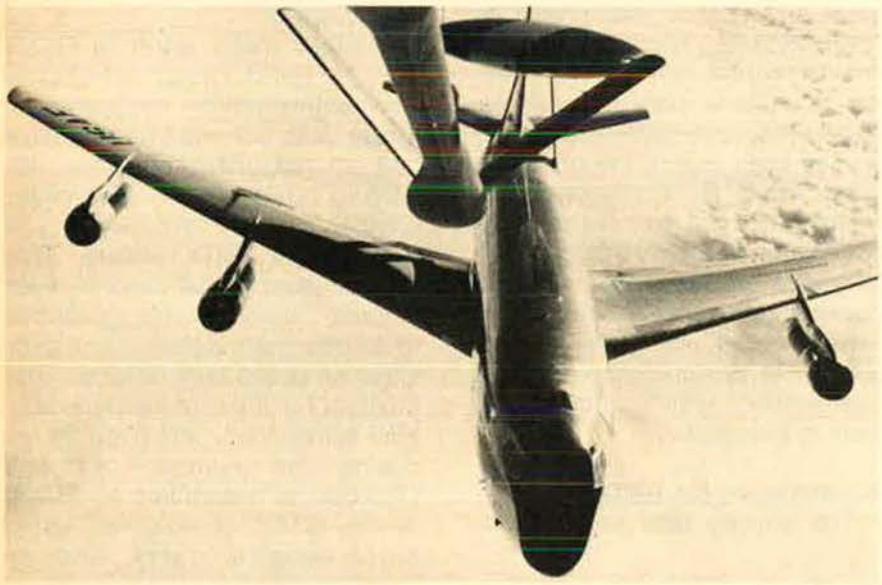
Another major effort in DT&E was to meet radar reliability and maintainability requirements. These were achieved by extensive use of redundant elements, including redundant transmitter chains, and by incorporating a Built-In-Test (BIT) system. This system detects and reports radar failures, automatically switches to a redundant element, and provides on-board fault isolation. The inherent reliability of the radar was also substantially improved by reducing the number of parts (100,000 on brassboard to 78,000 in the DT&E design), by using more reliable parts, and by stringent attention to environmental control and the effects of vibration and shock. Finally, in some selected areas we took advantage of advances in the state-of-the-art during the course of the brassboard program. Without changing the initial basic philosophy that only well-proven technology would be used, some minor design changes were made to improve performance and reliability, largely by changes in system timing and some other parameters.

In retrospect, there appeared to be ample time in the schedule during early manufacturing and testing of the prototype radars to accomplish all debugging and critical interface testing of the

AWACS's large surveillance radar allows the system to detect and track airborne targets at high and low altitudes over any terrain.

full radar system. However, it became evident during the first weeks of testing following full-scale radar assembly that we faced a considerable challenge in debugging the system. While it was clearly evident that the repackaged design was sound and would meet performance requirements, the process of isolating and eliminating the noise and instability contributors took much longer than anticipated.

By the end of 1975, it was clear that we would incur some minor schedule slippage to accommodate the design refinement process, which was compounded by a number of critical spares shortages in the development activity as well as a delay in completing the BIT/FIT (Fault Isolation Test) software. Fortunately, the problems were identified early enough so that the maximum slip in schedule was four months for the first production aircraft delivery, with a forecast back-on-schedule delivery by the fifth aircraft. A revised program plan was initiated and vigorously implemented by Boeing and Westinghouse during 1976. This plan met all commitments in an outstanding manner. Not only was a successful Flight Test Program completed on schedule but a series of three operational tests, including a severe high-density air battle environment test called TACEX, were completed with highly successful results.



Already capable of long "on-station" operation, AWACS can increase its loiter time even further through aerial refueling.

Countering Congressional Criticism

While the critical manufacturing, assembly, test, and refinement of the production prototype radar design was taking place, the first production budget for six aircraft was proceeding through the FY '75 congressional cycle. It came under strong criticism from the General Accounting Office, which published two reports raising serious questions about the system. These criticisms led to significant congressional concern. The major issues were the ability of the system to meet its performance requirements and the ability of an E-3A to survive in a hostile environment, characterized by intense jamming. Although the first issue was largely answered by the SID flight performance and the early DT&E radar testing, the survivability issue persisted.

In order to protect its oversight responsibility and avoid any premature decision, Congress wrote into the FY '75 Authorization Legislation requirements that a special ECCM Committee be formed by the Secretary of Defense to review the E-3A radar resistivity to jamming, and that the Secretary of Defense certify to the effectiveness of the E-3A in a high-density European environment prior to approval of the FY '75 production decision. The result was a period of intense activity during 1974 and early 1975, involving a significant amount of additional SID flight testing, including a special survivability test that featured dedicated attacking aircraft with airborne standoff and escort jamming. A significant number of engineering flight tests were flown against ground and airborne jammers at the request of the ECCM Committee. Although the originally planned SID Flight Program was completed by mid-1974, this expanded Flight Test Program continued through late 1974 and was not concluded until a final series of additional special tests were flown in May 1975, following a successful flight demonstration in Europe in April 1975.

The DSARC production decision was approved in December 1974, based on the final reports and data from the E-3A SID Flight Test Program, the Air Force Test and Evaluation Center assessment of IOT&E, and the report of the ECCM Committee. Go-ahead was held in abeyance, however, until the test results and the Secretary of Defense certification could be briefed to Congress. These results and conclusions were presented at special hearings before both the

Maj. Gen. Lawrence A. Skantze, for several years Deputy for Airborne Warning and Control Systems at AFSC's Electronics Systems Division, has recently been named Deputy Chief of Staff/Systems at Hq. AFSC. A US Naval Academy graduate, General Skantze has served as deputy and director of the SRAM program at AFSC's Aeronautical Systems Division, and as executive assistant to the Under Secretary of the Air Force.

SCIENCE/SCOPE

Survival odds have increased for US Army tank crews, thanks to a remarkable new fire-suppression system to be incorporated in the US Army's new XM1 main battle tank... scheduled for use during the 1980's. The system will detect and suppress a fuel explosion inside the tank, extinguishing it within 1/10 of a second which is less than half the time it takes to blink an eye.

Similar devices in the past have triggered false alarms due to signals as common as the energy reflected from colored shirts. So combat crews simply turned them off. In contrast, the Hughes dual-spectrum sensor can detect a mini-explosion even in direct sunlight. Yet, it will not false-alarm even when pointed directly at the sun or other light sources such as gunfire, rockets, lightning, matches or other vehicles. Infrared sensors and related electronics that are key elements in the fire-protection system will be built by Santa Barbara Research Center, a Hughes subsidiary, under contract to Chrysler Corporation, prime contractor for the XM1.

The first three production FLIR (forward-looking infrared) systems for the new B-1 strategic bomber are now in production at Hughes, which was recently awarded an incremental contract for the three by The Boeing Company. FLIR gives the crewmen a picture of the terrain ahead of them, day or night, and in nearly any weather.

FLIR detects thermo radiation, rather than visible light, radiated by objects. A video processor converts the temperature data into light-and-dark patterns. These patterns are assembled into the TV-like image of the ground ahead of the aircraft. The first three units are scheduled for completion in the second half of 1978.

The Navy's new Target Acquisition System (TAS) radar, developed by Hughes as part of the Improved Point Defense Surface Missile System, has successfully completed Navy Technical and Operational Evaluation tests at sea. TAS is a fully automatic radar system for detection, tracking, weapon evaluation, and target acquisition. The new system will provide individual ships with the quick reaction needed to counter low-flying cruise missiles that "pop-up" over the horizon or fast moving targets that dive in from very high angles.

The TAS lightweight antenna rotates at a 2-second scan rate on a roll-stabilized pedestal. The system scans two regions: the first covers more than 20 nautical miles for point defense target designation, and the other more than 90 nautical miles for air surveillance and control. TAS is planned for installation aboard the new Spruance class destroyers. Production go-ahead is expected to be given later this year.

Improved forecasting of major crop yields, a step in the battle against world famine, is among the benefits predicted from an advanced space instrument called Thematic Mapper. Scheduled for launch in early 1981, it will be installed on Landsat-D, fourth in the NASA Goddard Space Flight Center's series of Earth Resources Technology Satellites. Hughes, with its Santa Barbara Research Center subsidiary, will design and develop the instrument's basic structure, telescope, calibrating system, detector arrays and processing electronics.

The new sensing instrument, with a ground resolution expectation 2½ times greater than present sensors, should also contribute to improvements in agricultural land use, forest and water resource management, land use mapping and mineral exploration. Landsat satellites are launched in a low-altitude north-south orbit that carries them over both poles, providing complete coverage of the earth's surface.

MICRON IS READY.

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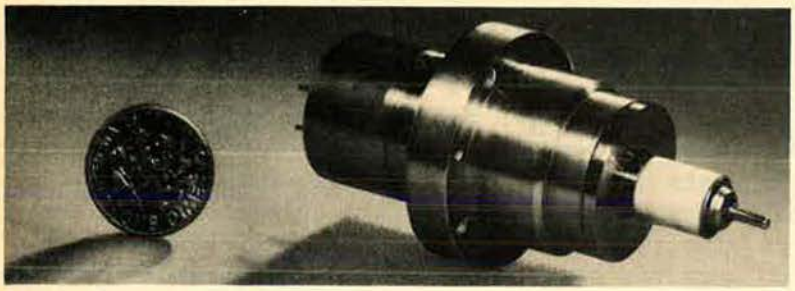

A Micro Electrostatically Suspended Gyro System utilizes a solid one-centimeter beryllium rotor spinning in a vacuum at 150,000 RPM.

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In addition, MICRON is capable of achieving high accuracy for strategic applications — such as the B-52 and special purpose missions — with software changes only.

Rockwell is proud to be part of the Air Force Standard Navigator Program which has as its goal the standardization of navigation systems to achieve low life cycle costs.

For more information, write: MICRON Program Manager, Autonetics Group, Rockwell International, 3370 Miraloma Avenue, Anaheim, CA 92803.

Rockwell International

Senate and House Armed Services Committees in March 1975. A production go-ahead was recommended and endorsed by both Committees in April 1975.

The net effect of GAO and congressional criticism was to force a large increase in testing in the SID Flight Program, which severely taxed program resources and management's ability to react rapidly to a steady stream of increasingly stringent test requirements from a variety of sources. The planning, execution, scope, and perception of these special tests were heavily influenced by the fact that survivability, and jamming resistivity in particular, are relative—not absolute—issues. No radar will ever be "jam proof," so the issue is really how much jamming resistivity is enough.

It was always clear that the E-3A radar design offered the most jam-resistant airborne radar ever built, and subsequent testing verified that. In fact, the depth of the E-3A radar sidelobes, the most important single measure of resistivity, far exceeded the design specification. The highest available jamming levels were used in these tests, including a specially built ground-based "Super Jammer" to thoroughly explore the radar's performance and limitations in intense jamming environments. Although accepted analytical techniques had been used to predict the expected radar performance in jamming environments, testing became the *sine qua non* and did in fact verify what had been predicted analytically.

A Unique Asset

Looking back on that period, recollections of trying to keep the development program on schedule and within cost are vivid. The continuous influx of special test requirements had to be handled with rapid identification and reallocation of test resources, as well as adjustment of internal budgets to cover costs. Nevertheless, in retrospect that hectic period and the additional testing can be viewed as a positive contribution. First, the additional testing clearly defused the criticisms of E-3A system performance. Second, the tests satisfied genuine concerns of the Congress which felt—and in retrospect rightly—that additional tests rather than analytical results were necessary to support the production decision. Third, we in both the DoD and the Air Force gained greater confidence and insight into the capabilities of this revolutionary airborne warning and control system. Finally, the findings and recommendations of the special ECCM panel, which found the E-3A to be a remarkable achievement and a highly effective system, set us on the road to early definition of a number of ECCM improvements that will enhance the E-3A's effectiveness well into the foreseeable future.

In summary, there seems to have been a singular dichotomy in the E-3A development history. On the one hand, it was an unusually successful development program that has met performance, cost, and schedule goals. Yet, it has been highly controversial in terms of perceived effectiveness and unit cost. The effectiveness issue has now been resolved. Since development is completed, the remaining cost issue is really a function of how many systems are to be built and how efficiently they are produced. The original production rate was to be two per month at an estimated procurement cost of $42.5 million per E-3A. The current production rate for the first sixteen aircraft is one every two months at a procurement cost of $69.5 million per E-3A, including all trainers, ground support and depot repair equipment, and spare parts.

The E-3A has been a truly unique development that has produced an outstanding capability. It provides the US defense forces with a system demonstrably capable of providing deep-look prehostility warning, dramatically increasing force management effectiveness, and of becoming a genuine catalyst for improved communication and command and control of large tactical forces. ■

The E-3A Industrial Team

Prime Contractor:

Boeing Aerospace Co., Seattle, Wash.

Major E-3A Subcontractors:

Westinghouse Electric Corp., Baltimore, Md.—surveillance radar.

IBM Federal Systems Division, Owego, N. Y.—data processing.

Hazeltine Corp., Greenlawn, N. Y.—data display control.

Northrop Corp., Electronics Division, Palos Verdes Peninsula, Calif.—navigation and guidance.

Collins Avionics Division, Rockwell International, Cedar Rapids, Iowa—communications equipment.

AIL Division of Cutler-Hammer, Deer Park, N. Y.—identification, friend or foe equipment.

ECI Division of E-Systems, Inc., St. Petersburg, Fla.—communications equipment.

Keystone Manufacturing Co., Los Angeles, Calif.—rotodome turntable and bearing.

Redifon Flight Simulation Ltd., Crawley, England—flight simulator.

Hughes Aircraft Co., Fullerton, Calif.—audio distribution system.

AiResearch Manufacturing Co., Torrance, Calif.—environmental control.

Rohr Industries, Inc., Chula Vista, Calif.—struts, nacelles, and section of fuselage.

Cleveland Pneumatic Co., Cleveland, Ohio—landing gear.

Engine Contractor:

Pratt & Whitney Aircraft Group, United Technologies Corp., East Hartford, Conn.

THE ELECTRONIC AIR FORCE

Machine Intelligence Shapes Global C³ Nets

BY EDGAR ULSAMER, SENIOR EDITOR

Multitudes of mini- and soon even microcomputers on the ground, in the air, and in space revolutionize C³ systems and networks, and provide efficacy, survivability, and jam-resistance unthought of a few years ago.

IN ONE way or another, *all* operational actions by US military forces *anywhere* are initiated and managed through WWMCCS, the World Wide Military Command and Control System, and its various components. Like the electronics technology that supports and, to a degree, shapes it, this central network whose reach extends below the seas and deep into space is in a state of constant change. WWMCCS, naturally enough, is DoD's foremost trendsetter in electronics technology, from innovative computer usage and advanced sensors to creating the "architecture" of modern command control and communications (C³).

WWMCCS, in the view of its "manager," the WWMCCS Council—comprised of the Deputy Secretary of Defense, the Assistant Secretary of Defense for Communications, Command, Control, and Intelligence, and the Chairman of the Joint Chiefs of Staff—is in need of major improvements, especially in the area of crisis management. These improvements, known as the WWMCCS architecture, were incorporated in the Defense Department Five-Year Plan, and, over that period, will amount to about $10 billion in acquisition and $1.3 billion in R&D expenditures.

The Council, according to Lt. Gen. Lee M. Paschall, Director of the Defense Communications Agency as well as of the WWMCCS system engineering office and of the Military Satellite Communications Systems Office (MSO), channeled major R&D activities into two areas: research to establish the feasibility of superhard command posts buried at great depth, and evaluation of potential benefits to operational command and control functions from using advanced automatic data processing (ADP). At the same time, the Council deferred large investments in developing the so-called executive or decision aid technology and associated specialized computer techniques. This deferral is not a permanent reneging in a field that, over the long term, shows great promise and is being pursued at a modest level by the WWMCCS System Engineer and other elements of DoD, including USAF's Rome Air Development Center.

Executive aids, Dr. George Heilmeier, Director of the Defense Advanced Research Projects Agency (DARPA), points out, "help people think. They don't do your thinking for you, but they can legitimize the thinking process by what might be called 'walking back through the decision tree,' which is quite important: The human mind usually can't handle problems with more than seven variables; the computer can." A system of this type, built around an IBM 5100 desktop computer, is being tested with good results by the US European Command (EUCOM), he said.

In the context of WWMCCS, General Paschall said, executive aids might be used eventually to "synthesize" and display courses of actions—and their effects—in order to help decision-makers find the optimal solution as quickly as possible. The decision to proceed gingerly in adding such capabilities to WWMCCS and investing in the associated computer hardware and software was based mainly on as yet incomplete understanding of "how human beings reach decisions, which makes it very difficult to demonstrate this interaction," General Paschall said.

Secure Voice "Conferencing"

An overriding requirement for crisis management is secure voice

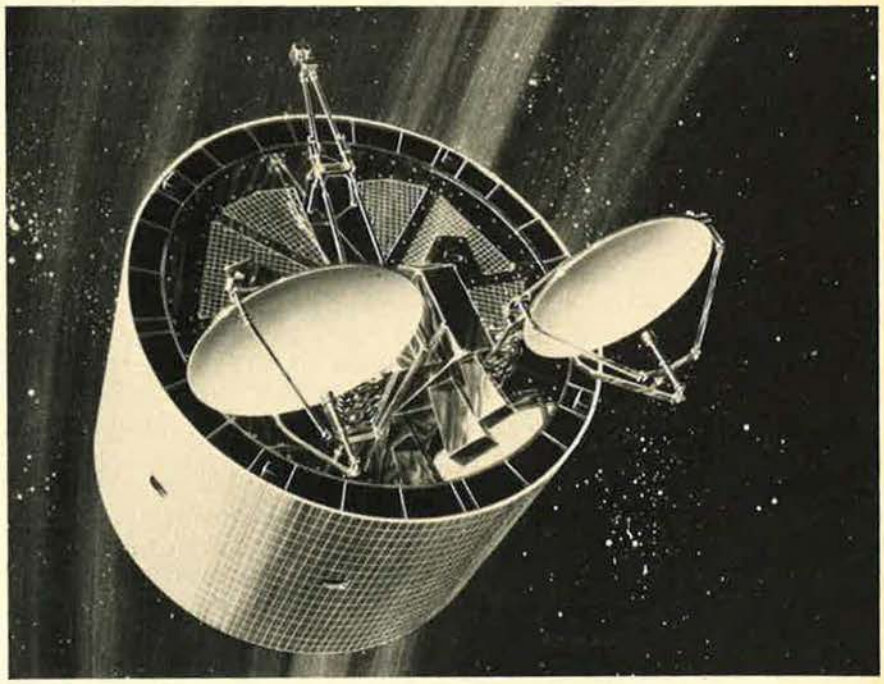
"conferencing," meaning, for instance, the ability "to set up within minutes a secure voice conference of high quality to link the key players—the National Command Authorities, the theater CINC, and the scene-of-action commander," General Paschall told AIR FORCE Magazine. The means for attaining this capability—a technological challenge only now entering the realm of the possible—is a combination of advances in digital data handling and such new networks as the Defense Satellite Communications System (DSCS). The latter is being developed in three stages by the Defense Communications Agency in concert with other Defense Department elements "in support of critical command, intelligence, warning, Presidential, and other special user requirements." It is meant to eventually reduce or eliminate aging and politically vulnerable terrestrial relay facilities as well as tropospheric-scatter radio links.

Now in Stage II, the geosynchronous DSCS, upon completion of its final phase, Stage III, is expected to "give us a three-to-one improvement in capacity, a six-to-one improvement in flexibility and, most importantly, a several-orders-of-magnitude improvement in AJ [jam-resisting]," General Paschall said. This satellite system is to consist of four operational satellites, positioned over the Atlantic, Indian, Eastern Pacific, and Western Pacific Oceans as well as two inactive on-orbit spares. The Stage II satellites will gradually be replaced as the Stage III system comes into being in the 1980s.

DSCS III's high AJ quality stems from the use of assorted advanced technologies, including the so-called multibeam or adaptive antenna null steering technique. Its principal function is to develop a null (a "dead" point blanking out reception) in the receiver antenna pattern and to point that null toward the jammer. Null steering can be used for analog and digital communications as well as radar systems and does not require special or modified waveforms; therefore, it does not interfere with voice quality, even when analog techniques are used. Other benefits of null steering are its passive character (hostile jammers can't tell that they are being blocked out), and the fact that canceling antenna gain in one direction increases performance elsewhere, which helps further in suppressing interference. Null steering exacts a price from the using system, however, because it requires auxiliary antennas that add weight and increase complexity.

A further feature of DSCS that reduces the risk of interference is use of the SHF (superhigh frequency) range. It is harder to jam than UHF (ultrahigh frequency) and far less vulnerable to nuclear effects. SHF signal propagation is disrupted primarily when the nuclear fireball occurs directly between the transmitter and receiver, and outages may last only a few minutes. UHF, by contrast, can be disrupted for significantly longer periods and over a wide area. The frequency range most affected by nuclear emissions—in the main X-rays, gamma rays, and the electromagnetic pulse (EMP)—is that used by (troposcatter) conventional radio. Since large nuclear blasts literally rip open the ionosphere—the outer part of the earth's atmosphere—that reflects radio signals, communications blackouts in that frequency range may last several hours. Extremely low frequencies (ELF), on the other hand, appear to be impervious to nuclear effects because they propagate deep underground and at a very slow rate.

The downlink of communications satellites (transmissions from space to earth) and the uplink (transmissions from earth to space) are affected differently by



DSCS Phase II satellites operate from synchronous equatorial orbit (at an altitude of about 23,000 statute miles) and handle voice, video, and digital data.

either jamming or nuclear effects. Usually the uplink is more vulnerable since the only requirement is to introduce more "noise," beamed at the satellite from a big-dish earth station, than the satellite's onboard system can filter out. Downlink jamming requires jammers relatively nearby, which suggests airborne platforms and, consequently, limited jamming power.

New Satellite Programs

The WWMCCS Council's concern with improved crisis management capability has led to the General Purpose Satellite Communications System (GPSCS) program, according to General Paschall. GPSCS is in early concept formulation at the DCA's Military Satellite Communications Systems Office (MSO) and is a follow-on to FLTSATCOM, the Navy's Fleet Satellite Communications System that eventually will consist of four equatorial synchronous satellites using both SHF and UHF bands. The proposed system's "general concept is likely to emerge by the end of this year," he said. A key requirement is high jam resistance, difficult to attain with UHF systems. But general-purpose, mobile, or easily transportable ground facilities dictate the use of UHF since SHF antennas are larger and heavier.

Early next year, the Defense System Acquisition Review Council (DSARC "Zero" or I—authorizing program go-ahead) is likely to examine MSO's proposed GPSCS configuration and, if satisfied, initiate the program and authorize formation of a joint program office, headquartered at SAMSO, but with a sizable liaison office in the Washington, D. C., area.

Another vital C^3 satellite system not yet defined is the Strategic Satellite System (SSS), previously known as SURVSATCOM and AFSATCOM II and III. MSO and various elements of the Air Force are assessing alternate approaches leading to recommendations that will be submitted to Assistant Secretary of Defense for Communications, Command, Control, and Intelligence Gerald P. Dinneen and, eventually, to a DSARC. The basic choice is between proliferation and highly survivable satellites, such as LES-8 and -9, with some presumably standing by in extremely high orbits. Proliferation would be achieved through a large number of system equipment packages on many host satellites. The objective is to deter attack on or interference with the system by providing more potential targets than an aggressor could cope with.

But the latter concept appears to suffer in a key area: two-way communications. In its FY '78 report to Congress, the Directorate of Defense Research and Engineering stated that preproduction models of SSS "have demonstrated the capability to provide two-way communications, via satellite, between a command center and aircraft," thereby suggesting that this proposed C^3 system should be able to furnish a strike-assessment capability. In a nuclear war, strategic reconnaissance and bomber aircraft should be able to report to the NCA, in real time, which targets were destroyed and which missed and, in case of the bomber, to get retargeting or restrike instructions. But a two-way communication capability is difficult to achieve with an agglomeration of communications packages "piggybacking" on many host satellites. Such a net is well suited for one-way transmissions, such as force execution orders, but ill-suited for feeding back data from small, mobile, and geographically scattered terminals. Whether or not national policy will require strike-assessment capabilities—and support the necessary investments—remains to be seen.

Advanced Airborne Command Post and ELF

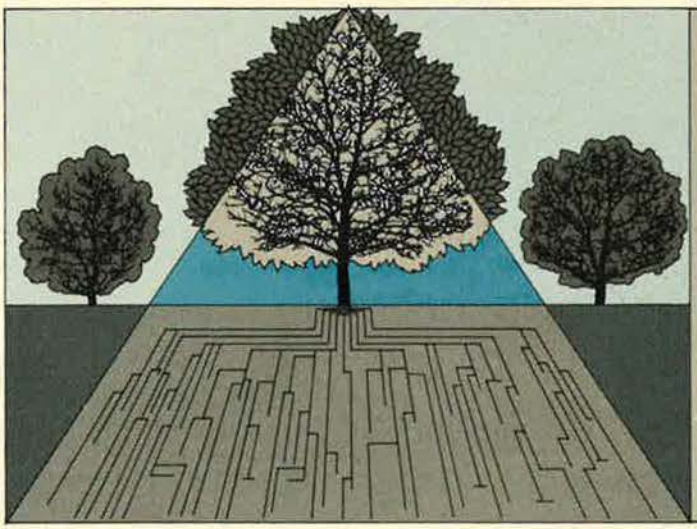
Two important components of WWMCCS are under critical review. The E-4 Advanced Airborne Command Post aircraft (modified Boeing 747s) that have begun to replace the older EC-135s in the National Emergency Airborne Command Post (NEACP) and SAC "Looking Glass" missions are basic to this nation's C^3 survivability. Purpose of these systems is to ensure continuing command and control of the strategic nuclear forces under transattack and postattack conditions. The initial phase of the E-4 program has been completed, and three E-4A aircraft are now performing the NEACP mission. Another aircraft is being converted to the E-4B configuration, involving development and installation of improved C^3 equipment by E-Systems at Greenville, Tex.

Following extensive flight testing of the E-4B version by the prime contractor, Boeing, and the Air Force, beginning late this year, the decision was to have been made whether an additional two aircraft—for a total fleet of six—should be acquired in FY '79. Following President Jimmy Carter's flight aboard an E-4 earlier this year, he directed that no additional E-4 aircraft be purchased during FY '78. "It is my understanding that Defense Secretary [Harold] Brown assured the President that indeed no additional aircraft would be acquired during FY '78, that Secretary Brown would reevaluate the need for any additional aircraft, and that he then would take the matter up with the President. As a result, we are holding the fleet to four aircraft," until further instructions, General Paschall said.

The nature and capacity of the E-4's future automatic data processing equipment—onboard computer, data storage, and link to WWMCCS—remain an open

MANAGING THE COURSE OF CHANGE

The roots of BDM capability in that complex art and science known as "C-Cubed" —Command/Control/Communications— go deep and spread wide. They extend through a whole alphabet of major programs, from SATIN IV and AWACS to WWMCCS, AFSATCOM, SURVSATCOM, AABNCP, TOS, EW, PREMPT, INCA, MEECN, NMCS, AUTOVON, and more than 30 others.



CUBE ROOTS

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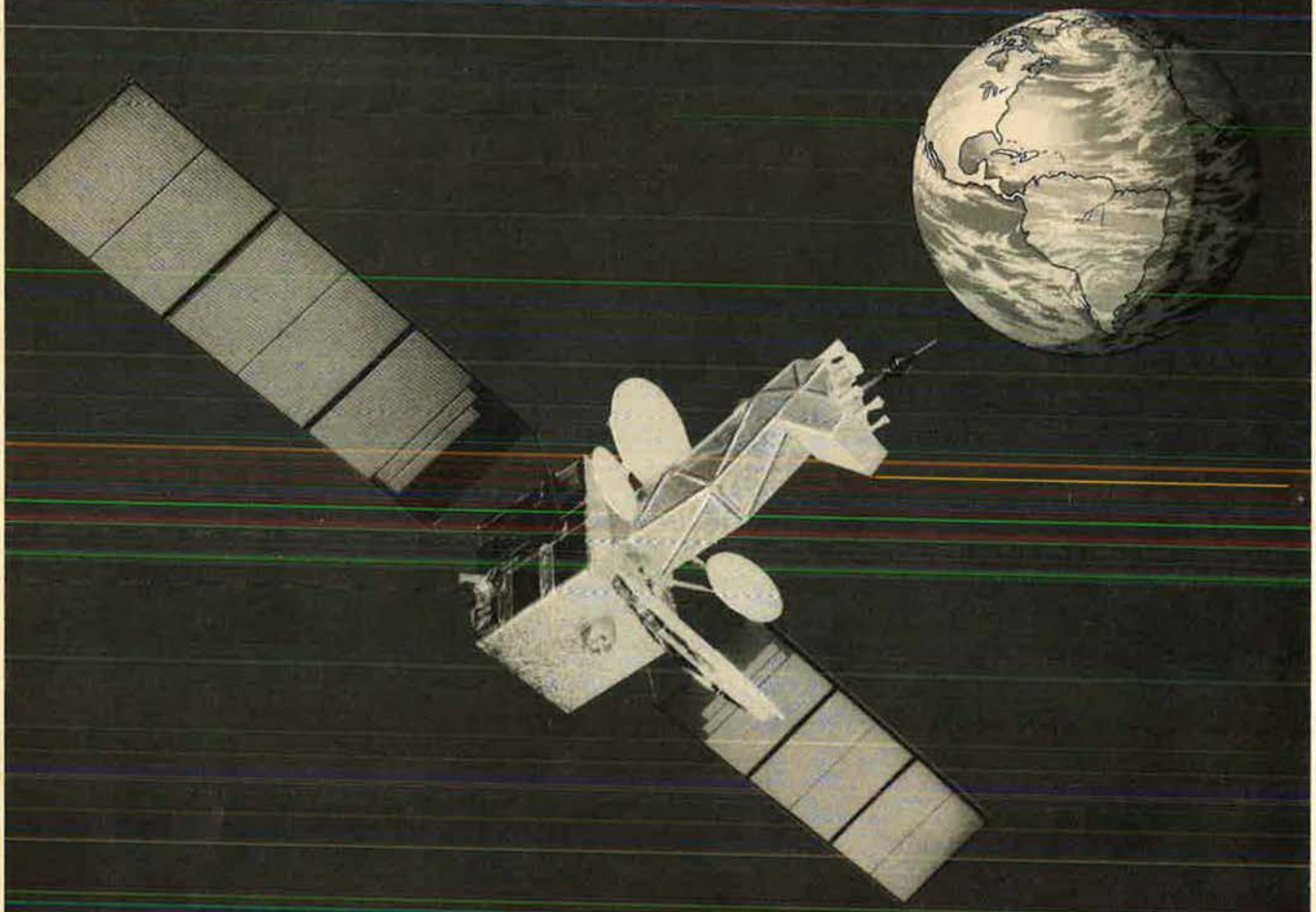

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question and continue to be the subject of high-level studies. The range of options under study extends "from doing as much as possible aboard the aircraft, which is almost as much as we do in the ground-based command centers, to the other extreme, which means performing only those things that are absolutely essential for pre-attack and transattack command and control," according to General Paschall.

Strategic Submarine C³

The ominous growth in Soviet offensive strategic capability places a premium on the security and survivability of the US Fleet Ballistic Missile Force at sea. Current communication means are deficient and could jeopardize the force. The subs have to slow down and place their antennas at or near the surface to receive communications, making them vulnerable to detection and attack. The technology to solve this problem is available in ELF, or extremely low frequency communications, whose signal travels deep in the ground but requires hundreds of miles of buried antenna wires in the United States. ELF is the *only* known means for communicating with subs operating at depth and cruising speed.

Congress, presumably because of political pressure by environmentalists, appears unwilling to fund ELF, or as it is known by its official program name, SEAFARER, in FY '78. The fact that careful research by DoD and the Navy failed to produce scientific evidence that SEAFARER would significantly harm the environment of the site has not stilled the opposition by some environmentalist organizations whose political influence threatens to scuttle the project.

In the absence of ELF and with Soviet sensor sophistication increasing, the role assigned to strategic submarines may have to be modified by curtailing their patrol area or using them as a highly survivable strategic reserve, instead of as part of the cutting edge of strategic deterrence.

New High-Level DoD Office

The importance the Pentagon's civilian leadership attaches to command control and communications support of strategic and general-purpose forces is evidenced by the creation of a new, high-level OSD office—that of Assistant Secretary of Defense for Communications, Command, Control, and Intelligence. The occupant of that office, Dr. Gerald P. Dinneen, told AIR FORCE Magazine that communications connectivity of C³ systems must be "assured through various levels of conflict, should deterrence fail," and must include a mix of space and terrestrial components.

Secretary Dinneen

Increased attention, he said, must be paid to the C³ needs "of the tactical forces." The trends, therefore, are toward applying to general-purpose forces, with special emphasis on cooperative arrangements with "our NATO allies," the technologies originally developed in response to strategic requirements.

One of Secretary Dinneen's first actions upon taking office was to participate in pertinent NATO committee meetings, a policy that he plans to continue in consonance with the Administration's commitment to interallied cooperation. Dr. Dinneen finds that the interest of various NATO members in sharing development and acquisition of tactical as well as strategic communications and command and control nets with the US is "very high."

The Defense Communications System

During normal day-to-day operations, the bulk of all DoD telecommunications is handled by the Defense Communications System (DCS) that provides high-volume command and control facilities throughout the United States, Europe, and the Pacific. Principal components are the Automatic Voice Network (AUTOVON); AUTOSEVOCOM II, a global secure voice network still in planning status; and the Automatic Digital Network (AUTODIN) for the secure transmission of message and other recorded data that is being upgraded (AUTODIN II). More than 1,500 AUTODIN and more than 17,000 AUTOVON terminals are in operation.

AUTODIN II, General Paschall said, is scheduled to get under way with the installation of some facilities in 1979 and to achieve operational status early in the 1980s. Its two distinguishing features are "packet-switching" and the internetting and interacting of different computers.

AUTODIN II is an outgrowth of the ARPANET, an existing computer network that stretches from Europe across the US to Hawaii. It was developed by ARPA and is being operated by the Defense Communications Agency. The ARPANET, according to Dr. Heilmeier, consists of more than sixty host computers of about twenty-six different types—and more than a thousand users employing thirty-four different types of terminals. Among the net's diverse users are Defense Department laboratories, federally funded research centers, universities, other

Our Satellites—How Vulnerable?

The debate continues—and some of it leans toward the sensational—about the ability of military satellites to survive attack and to resist interference without intolerable disruption of crucial tasks. Public awareness of these vulnerabilities was heightened when the Soviet Union last year resumed testing its antisatellite interceptor (ASAT), and by unconfirmed and probably erroneous reports of a Soviet ground-based laser "blinding" a satellite of the US Defense Support Satellite (Early Warning) System.

There is cause for concern as there is need for a balanced perspective. Some US satellites could indeed be attacked by ASAT, and these include vital ELINT and other crucial spacecraft in low earth or highly elliptic orbits. Other systems in geosynchronous or other high-altitude orbits seem to be out of reach of current Soviet space weapons. The Soviets lack a direct-ascent interceptor and are not likely to realize such a capability before the mid-1980s. Until they do, they must rely on staging ground-launched attacks against geosynchronous spacecraft via transfer orbits, which takes considerable time. It is possible to theorize that the USSR might look for shortcuts such as orbital mines or attacks from manned space stations in orbit, but few analysts consider either threat imminent or effective.

Further, the redundancy of US space sysems, in turn backed up by redundancies in terrestrial and airborne systems performing similar C^3 functions, probably precludes synchronized attack on all key elements of this system of systems. This condition is certain to obtain if a one-on-one (one interceptor per target) attack is mounted. The situation could change drastically if laser weapons were used, but that technology is years away from being able to concentrate thermal energy of lethal proportion on small targets many thousands of miles away. Conversely, it could obsolete ASAT.

Nuclear weapons detonated in space propagate destructive and disruptive effects over great distance, but offer the attacker no panacea if the other side's spacecraft are hardened or "invisible" because of extremely high orbits and for other reasons. It would seem essential, therefore, that the US continue to harden its military space systems and their ground terminals, and reject the notion that a shift to "soft" satellites would deter the Soviet Union from further development of space weapons.

The major short-term threat to US space systems seems to be jamming, but new technologies are becoming available to provide high jam resistance.

government installations, and a secure subnet that processes antisubmarine warfare (ASW) information.

The uniqueness of ARPANET stems from its ingenious use of standardized interfaces, actually small computers that serve as go-betweens among different computers and different programming formats, as well as its innovative packet-switching technique. The latter is a novel way of communicating that does away with dedicated circuits and breaks messages into blocks (packets of 1,000 bits) that include address information and take whatever route is available on the net. These packets are reassembled at the destination, and acknowledgment is transmitted to the sender. If it was not received correctly, the sender retransmits automatically so that errors correct themselves. Packets can travel by any available path, a technique called "fail softness," meaning that if a given link breaks down, messages are dynamically routed some other way.

AUTODIN II will use the ARPANET technology but add net-wide security and "priority preemption," that enables high-priority traffic to take precedence over less urgent communications, General Paschall said.

One of DCA's long-sought goals, multilevel security for shared computer systems and computer networks, continues to defy reliable solution and, therefore, is not likely to be used during the near term, he said. The underlying concept here is use of input-output devices going into a net that bar users with various levels of security clearance from obtaining unauthorized information.

Among the technologies being explored by ARPA for future C^3 systems is data fusion, a form of condensing, blending, and editing the rising data stream from increasingly prolific sensors through machine intelligence. This should include pictorial recognition by computers, such as the ability to identify such objects as SAM sites, airfields, or tanks under different illumination and camouflage conditions.

The only remaining major bargain in the defense marketplace, the steadily declining cost of computer memories and processing, Dr. Heilmeier believes, opens the door to the intelligent terminal that "remembers" the location of different types of information in different data bases, that can pursue specific tasks over extended periods of time, and can "act as an executive secretary by doing such things as filing, coordinating, alerting, teaching, and so on." Another direction in machine intelligence technology, about to be tested by ARPA, is to imbue computers with qualitative powers, the ability to infer and deduce, in contrast to numerical processing, a purely quantitative task. Included here are natural language computer interfaces that make it possible to work with data bases "using standard, literal English instead of computerese," Dr. Heilmeier told AIR FORCE Magazine.

Judicious exploitation of the electronics revolution over the coming years is likely to lead to three traits that General Paschall believes will be imperative for the next generation of C^3 systems: greater economy in money and manpower; increased security, survivability and reliability; and jam resistance. ■

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AFALD: Making Better Electronics Affordable

BY LT. GEN. BRYCE POE II, USAF

The "real world" of electronic equipment—its maintainability, reliability, and replaceability—is the focus of AFLC's Air Force Acquisition Logistics Division, which, in concert with other USAF elements and the aerospace industry, is coming up with highly reliable, affordable avionics.

AEROSPACE operations require extensive electronics, from target acquisition to post-strike bomb damage assessment. Electronic devices provide precise navigation for highly sophisticated aircraft and missiles, as well as command and control of air and ground forces. Electronic systems are the heart of satellites and underground command posts. Supply and maintenance depend on worldwide precision electronic links from forward area to State-side depot.

It is not enough, however, for these marvels of technology to work "most of the time." National defense is too critical. Although electronic systems must be complex to meet the threat, they must also be reliable, maintainable, and, above all, available to the commander with alert or combat responsibility. To see that they meet these criteria is the mission of the Air Force Acquisition Logistics Division (AFALD) of Air Force Logistics Command, working within the overall acquisition process.

In this day of diminishing resources, we must also add the word "affordable." Since increased performance is required to match the increasing threat, balancing complexity and maintainability, reliability and cost is a great challenge for both the Air Force and the electronics industry.

While I am proud of our Air Force/Industry team, which really does things exceedingly well, we have made mistakes. What is unforgivable is to repeat mistakes or fail to take advantage of successes. Feedback of information, good and bad, from the flight line and missile complex all the way to the design engineer is the AFALD's contribution to increased weapons effectiveness.

Nothing is more important to all three of our areas of responsibility—aircraft, missiles, and space systems—than electronics. Since its activation on July 1, 1976, the Division's bank of electronics "lessons learned" has grown steadily: the potting compound that melts when the aircraft operates in heat and humidity, cannon plugs that are too delicate for everyday flight-line use, black boxes that are insufficiently shock mounted, the radio located so that an ejection seat must be removed for minor repair, the relay that frequently must be reset but cannot be reached without dropping the engine, and many others.

There are few villains in all of this. Modern weapons are difficult to design and produce and, within them, space is at a premium. Wide variations in temperature, G-forces, vibration, power supply, and materials complicate even small, simple pieces of equipment. Often the potential problems evade even the experienced designer. Our business is to provide him with up-to-date information on mistakes and successes relating to his particular project.

We approach this in many ways. Recognizing that changes become more and more difficult as a system matures, we begin in the conceptual stage by challenging operational requirements. We press for the use of technology to improve reliability as well as performance. We insist on standardization or off-the-shelf and proven equipment whenever it makes sense. We include warranties, guarantees, and rewards or penalties in contracts to make the reliability and maintainability that is so vital to the Air Force also important to the contractor and his stockholders. All of this, of course, depends on that continuous feedback from the user to us and then, in turn, to the Air Force Systems Command (AFSC) and industry.

The AFALD mission is unique. Of its seven deputies, five are di-

rectly involved in reducing the ownership costs of future systems. (The other two—the Deputy for Advanced Tanker Cargo Aircraft and the Deputy for International Logistics—provide valuable experience in this area, and profit from it greatly.) We also share with AFSC's Aeronautical Systems Division responsibility for the Productivity, Reliability, Availability, and Maintainability (PRAM) Program Office.

Let's take a look at the way the Division approaches its task. Although most examples will be in the electronics area, a field that often provides the greatest opportunity for high payoff, similar efforts are under way in such diverse areas as aircraft structures, ground servicing equipment, munitions, business practices, maintenance and supply organization, and personnel training.

The PRAM office has a special importance to the AFALD. The best source of ideas for improving the reliability and maintainability of future systems is the combat command's flight line or missile mechanic. His enthusiasm in helping AFALD on future systems is greatly enhanced when he knows the PRAM engineer is also there to help solve his day-to-day problems. The basic PRAM organization and its project offices throughout AFLC and AFSC have initiated almost 300 improvement projects in the less than two years they have been in operation.

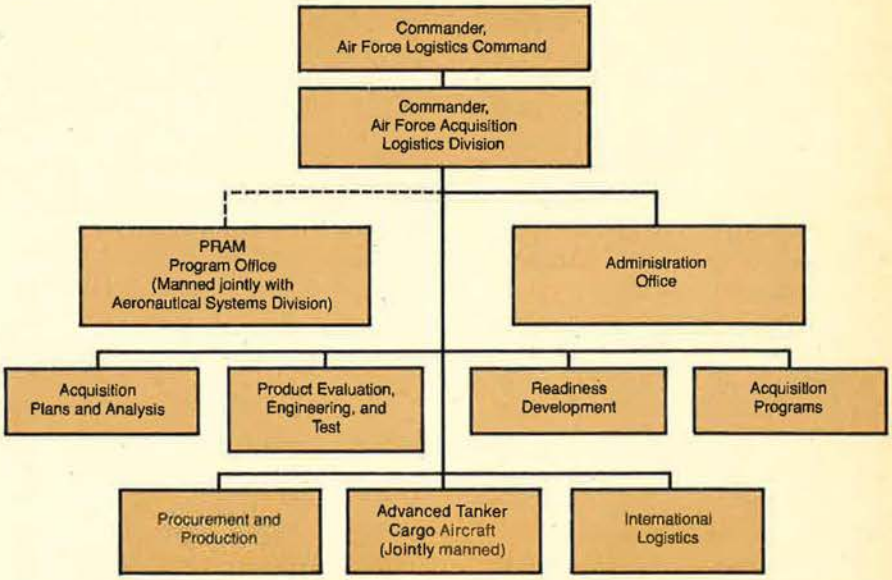
Currently approved PRAM projects include prototype test and evaluation of a technique of noncontract probing for fault isolation of printed circuit boards; and a study to determine the variances in the production process that cause a low yield rate for traveling wave tubes.

Rework of a single small module from the doppler radar used on airlift aircraft will bring $1.8 million in savings in five years. While significant savings result from such projects, the increased availability of the system is even more important. In the case of the radar module, an increase of mean time between failures from 180 hours to more than 1,000 hours means more C-141 and C-130 aircraft available in time of crisis—something that cannot be measured in dollars alone.

Analysis and Education

AFALD's Deputy for Acquisition Plans and Analysis has the tools to improve overall acquisition operations. His people have an impressive analytical capability, designed to help fill gaps in logistic support analysis so we can predict future costs more precisely. He leads the way in challenging operational requirements, chairing weekly meetings that review every Required Operational Capability (ROC) or modification ROC generated anywhere in the Air Force. Experts from Hq. AFLC and the Air Logistics Centers join him on these panels. Concepts of operation, training, maintenance and supply procedures, and overall management philosophy also are scrutinized closely.

The Acquisition Planners have another critically important job: improving the quality and expertise of logisticians, especially those in the acquisition business. Since duty with the line operational unit is essential to keep a "real world" perspective, they work with the Air Force Military Personnel System to provide combat command assignments for the acquisition-trained logistician and to ensure that he subsequently brings that experience back to the acquisition logistics process. The planners also play a part in improving professional education. Working with the Air Force Institute of Technology, they have established two new graduate programs in Logistics Management leading to a Master of Science degree—one with a major in Acquisition Management and a second with a major in International Logistics. The first students, military and civilian, should enter these courses in September of this year.



Feedback

The Deputy for Product Evaluation, Engineering and Test is responsible for improving the exchange of weapon systems design and performance information between the operational commands, AFLC, and AFSC. His job is "feedback" of lessons learned from past and current operating systems to give program managers a better perception of potential costs and savings when developing systems with similar characteristics or requirements.

AFALD engineers begin consulting with users and system program offices (SPOs) on proposed system design early in the conceptual phase. They act as the AFLC interface between using commands, AFLC's air logistics centers, Systems Command's product divisions and SPOs, and contractors. They assist SPOs in identifying components and materials that could cause safety hazards, reduce mission effectiveness, increase maintenance time, or create excessive operating costs. A satellite office at Edwards AFB, Calif., supports the myriad test and evaluation activities there.

Recent examples of the work done by this office include collecting reliability and maintainability data on aircraft navigation systems that will influence the way we buy similar systems, and preparing the statement of work and contractor instructions for developing a logistics support analysis system for a new aircraft.

This Deputate is also responsible for the Air Force Packaging and Evaluation Agency, an organization particularly important to electronics support. Proper packaging and handling techniques often can do more to extend the life and reduce the cost of a system than anything else. In one instance, repackaging a delicate guidance unit resulted in a multimillion-dollar saving in pipeline spares.

Less-Than-Major Systems

Our principal interface between AFLC and the SPOs for less-than-major systems is the Deputy for Readiness Development, whose people work in the field with the AFSC organizations that make daily program decisions. Our Directors for Logistics Planning at Space and Missile Systems Organization (SAMSO), Electronic Systems Division (ESD), and Armament Development and Test Center (ADTC) are assigned to this office.

Electronic systems form a large part of their work. For example, at ESD a depot support equipment team was established to determine the degree of commonality of support equipment for a high-performance precision approach radar and a transportable air traffic control system. The team found that we can save some $9 million by buying one contractor's general-purpose support equipment with adapters for the other, instead of procuring peculiar equipment and software for each system. The team analyzed concepts as well as hardware. Another $8 million will be saved by eliminating the need for a hot mockup of the radar.

In a new weather graphics system, we have an example of the close cooperation with industry that results in some of our best work. In this case, it originally was estimated that $1.5 million would be required for a piece of test equipment to meet a one-hour mean-time-to-repair requirement. The contractor suggested that if the time were extended to four hours, the test item would not be needed. The change was made and the money saved.

Readiness Development people also have been involved with ASD in a joint Air Force/Navy project to develop a common electronic countermeasures suite for the F-14, F-16, and F-18, and have worked closely with Air Force Avionics Laboratory personnel on design-to-cost goals, requests for proposal (RFP), and preliminary design reviews. On a related project—the Advanced Self-Protection Jammer—we found the contractor was designing components sized to completely fill the available space in the F-16 without considering connectors and cabling. While it sounds like a minor item, early identification of this problem eliminated expensive engineering changes.

Working with ASD, our people have been instrumental in writing a reliability improvement warranty (RIW) for the OMEGA Navigation Set. First, they decided on the correct type of RIW (spares guarantee vs. mean-time-between-failures [MTBF] guarantee). Next, a life-cycle cost analysis was performed to determine whether RIW or organic support would be more cost-effective. The MTBF guarantee approach was selected and a contract negotiated that included an RIW with MTBF guarantee of 1,150 hours at a cost of 4.5 percent per year of the acquisition cost, approximately thirty percent less than the Air Force's initial expectations.

Major Programs

The Deputy for Acquisition Programs is responsible for AFLC work in support of major programs at AFSC locations. He coordinates the efforts of the Deputy Program Managers for Logistics (DPMLs) located with SPOs, such as the B-1, MX, and E-3A, and develops the management tools, techniques, and expertise required to ensure that affordable and supportable systems are deployed.

For example, his staff participated in preparation of an integrated logistics support plan for the Global Positioning System. To provide the lowest practical maintenance man-hour expenditure per operating hour, the electronic line-replaceable units (LRUs) and shop-replaceable units (SRUs) were designed for removal and replacement without the requirement for calibration, alignment, and adjustment with the remainder of the system. An on-board, built-in test with the necessary software will provide rapid fault detection and repair verification.

When a major system, such as the F-16, is involved in Security Assistance, this office plans, budgets, and negotiates for all logistics support, including spares and training.

This Deputate also works with the manpower/personnel system to get the right numbers of people with the right skills into the logistics side of the SPOs so the DPML can do his job.

Procurement and Production

Recognizing that the AFALD requires a unique procurement function to incorporate Air Force procurement strategy effectively into production and support contracts, we established a Deputy for Procurement and Production.

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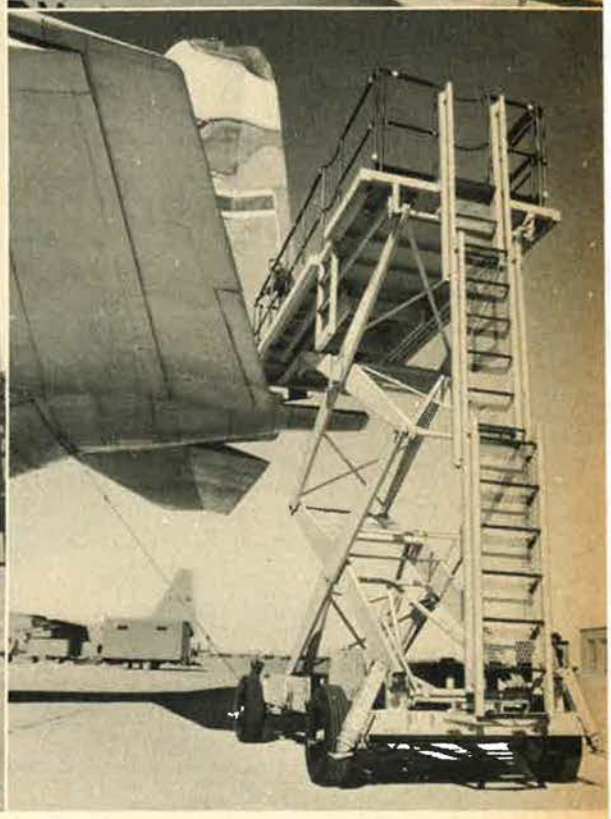

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The system is the solution.

Bell System

Lt. Gen. Bryce Poe II has been head of AFLC's Air Force Acquisition Logistics Division since July 1976. A 1946 graduate of USMA, he has spent much of his career in fighter and tactical recce operations, with combat tours in Korea and Vietnam. He also has served in Legislative Liaison, as USAFE DCS/Logistics, and as Commander of the Ogden ALC.

An example of the role we see for this Deputate is the case of the ARC-164 UHF radio, where, for the first time on a major subsystem, life-cycle costing was the principal basis for awarding the contract. The final agreement includes a specified acquisition cost-sharing ratio in which the contractor is rewarded for exceeding, or penalized for failure to attain, a specified reliability, based on the results of a verification test.

In short, the Procurement and Production Deputy's job is to find ways to reflect what is important to the Air Force (*i.e.*, maintainability, reliability, availability) in the contractor's profit and loss statement.

Reliability, Maintainability, Availability

In the final analysis, the AFALD is most concerned with the *availability* of weapon systems. Availability is tied directly to reliability and maintainability. Lack of either greatly increases costs. That's really what "life-cycle cost" is—the cost of designing reliability into a system vs. the cost of making it work if we don't.

What are some of the tools or techniques used to make our systems more reliable? The most effective tool is the attitude of the people who are working the problem—and I mean *all* the people—especially the program managers, the DPMLs, and the contractors. All our management tools are designed to motivate the contractors to provide us with field-reliable equipment, which they do with varying degrees of success.

We have learned some important lessons. One is to get into the program as early as possible, and have contractors sign support cost commitments while still in competition.

We also have learned the importance of improving our ability to analyze life-cycle costs. We've put analysts into our field directorates at the AFSC product divisions, and assigned them to the integrated logistics support offices of the larger programs. We have worked with the Air Force Institute of Technology to develop a short course in life-cycle cost analysis, and the Air Staff has sponsored a series of seminars on life-cycle cost/design-to-cost/reliability improvement warranties.

We're putting heavy emphasis on feedback so we do not repeat mistakes. And we exploit each success. We're learning from experts at the contractors' plants, the product divisions, the air logistics centers, and the professionals on the flight line.

At a higher policy level, we are beginning to see program management directives (PMDs) stressing life-cycle costing (LCC). A few years ago, PMDs usually were totally silent on LCC. Then there was at least a nod in the right direction by stating that "life-cycle costing will be considered." Now there is specific language such as "life-cycle costs will be estimated and methods for using reliability improvement warranties and support-cost guarantees will be investigated."

It's impossible to overemphasize the contractor's key role and full partnership in driving down the cost of ownership. It's through designing supportability into his products that we actually reap the benefits of LCC.

The defense industry is clearly getting more interested and involved. Perhaps the most significant signal from industry, however, has been the rise of logisticians in the corporate hierarchy. Boeing at Seattle, Rockwell at Los Angeles, and General Dynamics at Fort Worth have been among those who recently have recognized the increased importance of long-range operating costs by making their senior logistician a vice president.

Just as the entire Air Force is working this difficult problem, so are the other services and the Office of the Secretary of Defense. A DoD task group is trying to increase the visibility of support costs by weapon system. While we have voluminous data and cost systems, nearly all are oriented to a particular function, such as provisioning, transportation, or procurement, and none enables us to add up all the operating and support costs of a single weapon. Initial progress in finding a way to accumulate all costs for a given system is reported to be good.

Another action is the organization of a triservice working group to study reliability and support incentives. This group includes experts from the R&D, materiel acquisition, and maintenance communities of the three services and has been in existence for almost a year. One specific task for which the Air Force is lead service is the establishment of a triservice reliability improvement warranty data center to disseminate lessons learned in this area.

This, then, is the AFALD, just a year old but already deeply involved in the acquisition of new weapons. Electronics accounts for a large part of the acquisition and operating costs of new systems—from one-third to one-half the total dollar amount in many cases. It can be the "Achilles' heel" in many systems; hence, electronics is high on the Division's priority list.

These first few months have brought both successes and frustrations, but the overall pattern is one of optimism. Of one thing there should be no doubt: the establishment of the AFALD emphasizes Air Force determination, from the Chief of Staff to the man on the line, to cut the costs of owning and operating weapons. The reason is clear: Failure to do so will deny us the dollars needed to develop and acquire weapons desperately needed for national security. ■

IT IS a fact that the Hawker Hurricane provided the bulwark of the British Empire's air defenses in the early years of World War II, and, by struggling magnificently against staggering odds, turned the tide of the air war against the enemy. And the Hurricane continued to fight valiantly, on every front, until the final victory. Should you Spitfire pilots doubt it, ask any Hurricane pilot.

In January 1934, Sydney Camm, of Hawker Aircraft, Ltd., began a private company enterprise to design the first monoplane fighter for the Royal Air Force. At that time, RAF fighter squadrons were equipped with the Hawker Fury and Gloster Gladiator biplanes—both of which were obsolete. On November 4, 1935, Hawker's prototype aircraft, christened "Hurricane," was rolled out of the assembly hangar at the Brooklands factory airfield, and on November 6, piloted by Flight Lt. P. W. S. "George" Bulman, made its first successful test flight, reaching a top speed of 312 mph at 16,200 feet.

This original version was powered by a Rolls-Royce PV-12 Merlin C engine, rated at 900 hp, driving a fixed-pitch, two-bladed wooden propeller. The entire airframe, except for the engine cowlings, was fabric-covered. No armor plate was provided for the pilot and fuel tanks, nor did the aircraft have a bullet-proof windshield. Its design did, however, include landing flaps and a retractable undercarriage—but of most importance was its greatly increased firepower, a bank of four .303-caliber machine guns in each wing.

On June 3, 1936, the Air Ministry contracted for 600 Hurricane fighters. The Merlin C engine was replaced by the supercharged Rolls-Royce Merlin II, rated at 1,030 hp, which increased aircraft performance to a speed of 320 mph at 17,500 feet and the rate of climb to 2,450 feet a minute. Delivery of these aircraft, for service testing at RAF Station Martlesham Heath, began in October 1937. A change of propellers, from the two-bladed wooden type to the three-bladed, constant-speed type, further increased the Hurricane's speed to 328 mph.

In December 1937, the first production model, the Mark I, entered active service with No. 111 Fighter Squadron, based at RAF Station Northholt. Squadron Leader John "Downwind" Gillan, commanding 111 Squadron, proved the Hurricane's outstanding performance when he flew a distance of 327 miles at an average ground speed of 408.75 miles an hour.

By April 1939, the Hurricane design had been considerably modified to include metal-covered wings, protective armor plate for the pilot and fuel tanks, a ventral fin for better spin recovery, redesigned exhaust stacks to reduce night flying exhaust flash, and a faired-in tailwheel.

—IMPERIAL WAR MUSEUM PHOTO

Hurricane specifications did not change appreciably through the entire series from the first Mark I to the last Mark V. Wing span was 40 feet, length 31 feet 5 inches, height 13 feet 1½ inches, and wing area was 258 square feet with a wing loading of 24.1 pounds per square foot. Weight of the aircraft varied, by Mark, between 6,600 and 7,800 pounds loaded. Engine power, beginning with the Rolls-Royce Merlin C, increased from 900 hp to the 1,620-hp Merlin 24 and 27 engines over a period of four years, which, in turn, increased aircraft speed from 312 mph to 342 mph, climb to 30,000 feet in just over seventeen minutes, service ceiling to 34,200 feet, and maximum range to 525 miles.

Armament again varied with the Mark series: the Mark I and Mark IIA versions carried eight .303-caliber Browning machine guns capable of fourteen seconds of continuous fire; the Mark IIB was armed with twelve machine guns; the Mark IIC had four 20-mm Hispano cannons, and racks to carry two 250-pound or 500-pound bombs; the Mark IID had two wing machine guns, and two Vickers "S" 40-mm antitank cannons, with seventeen rounds per cannon, were mounted under the wings; and the Mark IV was armed with wing machine guns plus eight 60-pound high-explosive rockets. (There was no Mark III version, and only two Mark Vs were built.) Canadian-built Hurricanes were designated Mark X, XI, and XII; these were all similar to the British-built Mark IIBs.

In all, 14,233 Hurricanes were built. "The Last of the Many"—the wording painted on the fuselage of the last aircraft—was completed in September 1944. During the war, the Hawker Hurricane was flown in combat by pilots of every Allied air force and on every war front from Europe, Africa, the Middle East, the Balkans, and Russia, to the Far East. The Hurricane even operated from several Royal Navy aircraft carriers. It also served with the British Merchant Service Fighter Unit where—and this is almost unbelievable—it was catapulted from the deck of CAM (Catapult Armed Merchant) ships to provide air defense against German bombers searching for Allied shipping in the North Atlantic.

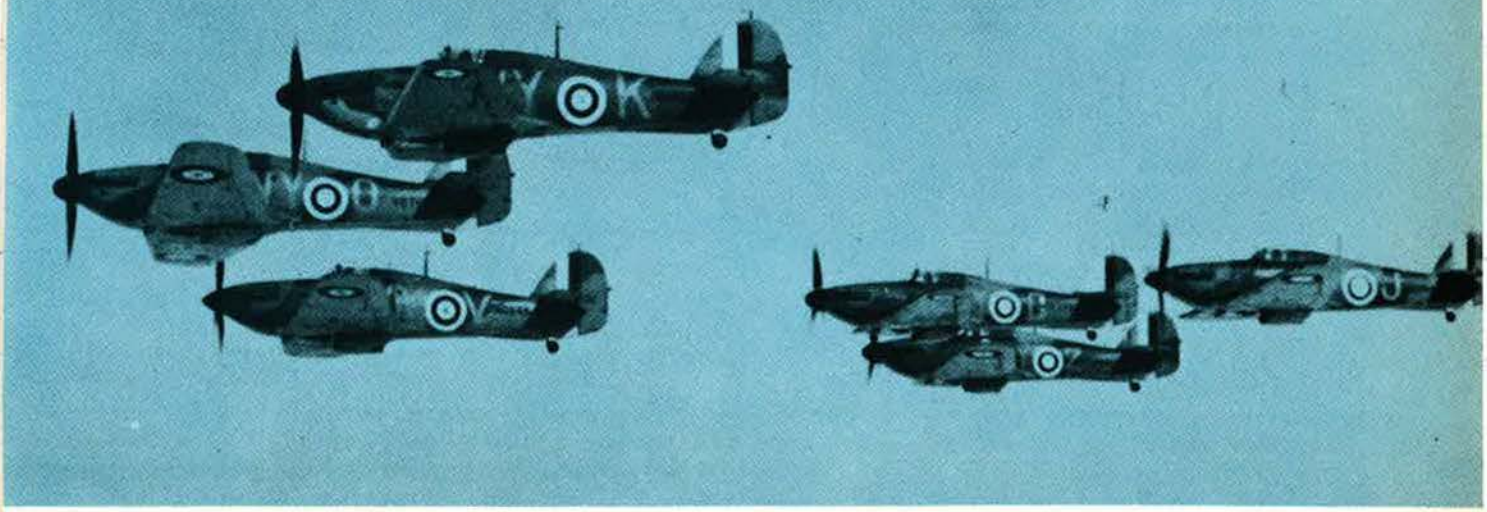
In this CAM ship operation, the idea was for the ship's sky-watch observer to spot an enemy bomber approaching his vessel, and then they'd catapult off the poor sod flying the Hurricane to make an intercept. After the flap was over, if the Hurricane could make it to a shore airfield, fine. If it couldn't reach land, the pilot ditched in the drink near the CAM ship and hoped he'd be picked up.

On September 3, 1939, the day Britain declared war on Germany, 497 Hurricane Mk Is were in service with eighteen Royal Air Force fighter

One of the Royal Air Force fighter pilot songs of World War II started out this way: "Here's to the Hurricane pilot, wherever he may be, aloft in lonely glory, at rest in eternity. . . ." Bill Dunn, who flew both Hurricanes and Spitfires for the RAF, is sure about one thing: The Hurricane turned the tide of the air war against the enemy. If there's a Spitfire pilot who doubts it, Author Dunn says, he should just . . .

ASK ANY HURRICANE PILOT

BY LT. COL. WILLIAM R. DUNN, USAF (RET.)

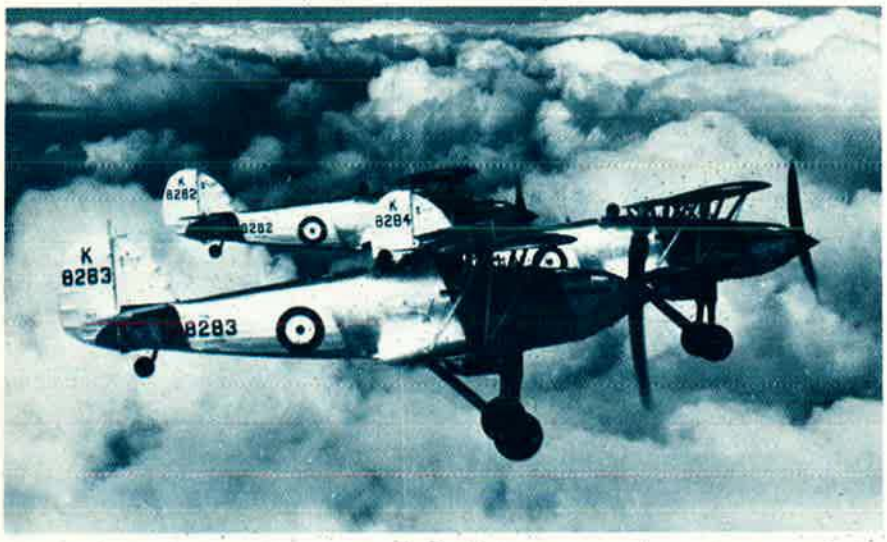


squadrons, fourteen of them operational. Four Hurricane squadrons (Nos. 1, 73, 85, and 87) and two Gladiator squadrons (Nos. 607 and 615) formed into the Advanced Air Striking Force (AASF) and went to war in support of the British Army's Expeditionary Force (BEF) in France.

The first few months, because of a lack of ground action, it was called the "Phony War." But there was nothing phony about the war in the air. Pilot Officer P. W. O. "Boy" Mould, of No. 1 Fighter Squadron, shot down a Dornier 17 bomber near Toul, France, on October 30, 1939—the first enemy aircraft of the war destroyed in air combat by an RAF pilot. In May 1940, the honor of becoming the first RAF ace was attained by Flying Officer E. J. "Cobber" Kain of No. 73 Fighter Squadron. Records of No. 1 Fighter Squadron, during the period of the "Phony War" (September 3, 1939, to May 9, 1940), listed twenty-six enemy aircraft destroyed in air combat and the loss of one RAF pilot.

On May 10, 1940, the real war began with the German surprise attack through Holland and Belgium into France. For the next two weeks, the Hurricane squadrons were almost continually engaged in providing fighter escort for the Fairey Battle and Bristol Blenheim bombers, and in fighting off the superior numbers of German Luftwaffe Me-109 and Me-110 fighters, Ju-87 Stuka dive bombers, and Heinkel III, Dornier 17, and Ju-88 bombers that were attacking the Allied armies. Six more fighter squadrons—Hurricanes, Defiants, and some Spitfires—were sent by the RAF Fighter Command to support the BEF and AASF, but the tide of the German advance into France could not be stopped. (The majority of the Spitfires were retained in England for home defense.)

On May 21, 1940, the withdrawal of all British forces from France and the abandonment of AASF forward airfields and unserviceable aircraft began, culminating in the miraculous evacuation of the BEF from the beaches of Dunkirk. By June 3, only sixty-six AASF Hurricanes and their battle-weary pilots had returned to the island fortress of England. The Advanced Air Striking Force had, however, destroyed more than 250 enemy aircraft in air combat, with a loss of twenty-two Hurricanes. About seventy-five Hurricanes were destroyed on the ground by enemy aircraft strafing and bombing RAF airfields, and some 120 unserviceable Hurricanes were burned by RAF ground crews to prevent their being captured by the German Army. In this three-week period of fighting, No. 1 Fighter Squadron was credited with destroying 114 enemy aircraft for the loss of three RAF pilots. The Battle of France was lost, but the Hawker Hurricane had proven itself to be an outstanding fighter—and



The obsolete Hawker Fury, left, and Gloster Gladiator, bottom left, were replaced by more up-to-date planes in RAF fighter squadrons beginning in the mid-1930s. Above, a Hurricane IIA of No. 605 Squadron. Right, a formation of Hurricane Mark Is, the first production model of the aircraft to enter service.

the Battle of Britain was yet to come.

The Battle of Britain

With the fall of France, Reichsmarschall Hermann Göring, the Commander in Chief of the Luftwaffe, began planning his great air assault against England—his *Adlerangriff*—the Attack of the Eagles. Two months later, on Thursday, August 8, 1940, on *Adler Tag*—Eagle Day—the Germans launched the first of their powerful air armadas and the Battle of Britain began.

During the brief breathing spell from June 3 to August 8 the RAF Fighter Command went flat out to reequip and reorganize its decimated fighter forces, which had lost an additional 198 Hurricanes and a few Gladiators in the unsuccessful defense of Norway against German invasion. Air Chief Marshal Sir Hugh Dowding had organized his Fighter Command forces into six groups, each responsible for the air defense of a designated geographical area of Great Britain. The total air defense force then available included twenty-nine Hurricane and nineteen Spitfire squadrons, which, on August 8, had a combined operational strength of 742 aircraft. The Luftwaffe had, on that same day, an operational offensive force of 2,550 aircraft.

There was no doubt that the newer Vickers-Supermarine Spitfire Mk I was superior to the Hurricane in speed, climb, and altitude, but not in firepower or maneuverability. Based on these aircraft capabilities, tactics were developed in which the Spitfires were to engage the German fighter escorts while the Hurricanes attacked the enemy bombers. No. 11 Group, commanded by Air Vice Marshal Keith Park, and No. 12 Group, commanded by Air Vice Marshal Tafford Leigh-Mallory, defending the areas within the radius of action of the German forces launched across the Channel from French bases, would take the full brunt of the enemy's air assault. Their combined forces totaled eighteen Hurricane and twelve Spitfire squadrons—some 540 fighters.

The Battle of Britain was fought with a fury unknown in the annals of air warfare until, on September 15, 1940, the Luftwaffe was defeated with terrible loss in aircraft and aircrews. Although German bombers dropped some 16,000 metric tons of

—IMPERIAL WAR MUSEUM PHOTO

The wreckage of a Dornier 17 downed during the Battle of Britain.

incendiary bombs and 11,000 metric tons of high-explosive bombs on British targets during the battle, the Luftwaffe lost 1,733 aircraft. Since the Germans were operating over British territory and the Channel waters, their aircrew losses were upwards of 3,500 men. The Royal Air Force lost 448 Hurricanes and 248 Spitfires. RAF aircrew combat casualties totaled 313 killed in action or missing and 287 wounded. Nearly three enemy aircraft were shot down for the loss of each RAF aircraft, and the aircrew loss reached a ten-to-one ratio. [Figures on both RAF and Luftwaffe losses during the Battle of Britain vary considerably, depending on the source.—The Editors]

It was to honor RAF airmen that Prime Minister Winston Churchill expressed a grateful nation's tribute in these words, following the Battle of Britain: "All the great struggles of history have been won by superior will-power wresting victory in the teeth of odds or upon the narrowest of margins. Never in the field of human conflict was so much owed by so many to so few."

There were five Americans whom I knew or knew of, who served with the RAF and who fought in the Battle of Britain: Flight Lt. Arthur G. Donahue, Flying Officer William M. L. Fiske, and Pilot Officers Eugene Q. "Red" Tobin, Andrew B. Mamedoff, and V. C. "Shorty" Keough. Tobin, Mamedoff, Keough, and I later served together in No. 71 Eagle Squadron, flying Hurricane Mk IIAs. Bill Fiske, Art Donahue, and Red Tobin were all killed in action, Andy Mamedoff was killed when he flew into a range of high hills in bad weather, and Shorty Keough was killed by a bomb during the London blitz.

Following the Battle of Britain, in October 1940, Fighter Command's strength was 1,326 Hurricanes and 957 Spitfires. Although the Hurricane continued in its primary role as a fighter for another year or so, the more advanced Spitfire was gradually replacing it in first-line squadrons. However, the Hurricane's combat career was far from ended. It was adapted successfully to other equally important wartime missions—the "Hurribomber," the "Tank Buster," the CAM catapult version, and as a night fighter.

This last bit was a "shaky do," to say the least. A DB-7, the British version of the American A-20, was equipped with a powerful searchlight in the nose and would patrol at night with a Hurricane in formation on each wing. When a bandit was located by ground radar, the DB-7 would be vectored onto the enemy aircraft, turn on its bloody great searchlight, and the Hurricanes were supposed to go in and make the kill. In actual practice everyone ended up nearly blinded.

Flying the Hurricane in Combat

My introduction to the Hurricane came after my transfer from the Seaforth Highlanders of the Canadian Army to the Royal Air Force in December 1940. Following five weeks at SFTS (Service Flying Training School) flying Miles Masters at RAF Station Tern Hill, I was sent to a Hurricane Operational Training Unit (OTU) at Duxford. Since the RAF urgently needed replacement fighter pilots, my OTU training was brief—seven hours and forty minutes of flying time in four days, including two "splash" firings of the Hurricane's guns into the Channel waters—then off to No. 71 Eagle Squadron for combat operations. I could just get the aircraft off the ground and land it again. My first landing brought the fitter's (crew chief) acid comment: "I've seen Hurricanes bounce before, but never to circuit height."

Actually the Hurricane was easy to fly, and like the Spitfire, had no bad habits. It was light and highly maneuverable; at 10,000 feet and with a true airspeed of about 300 mph, it had a turning radius of 800 feet—which the Me-109 and FW-190 couldn't match. As a gun platform, it was steady as a rock. Stalling speed, with flaps and gear down, was about sixty miles an hour, and before it reached a high-speed stall, it gave a long shuddering warning. Because of its low stalling speed and rugged, wide undercarriage, the Hurricane was ideally suited for small, unimproved advanced airfields.

Aerobatics with the Hurricane were a delight to perform, and she could do them all with equal grace. Takeoff distances were extremely short—throttle open, tail up, and she was in the air. Landing rolls seldom required more than a couple hundred yards. And she was rugged in construction, sometimes taking all the firepower the enemy had to offer and still making it safely to home base. I recall one pilot in particular who was shot up, belly landed, went through a stone fence and into a graveyard, knocking headstones in all directions—and then stepped out of the cockpit with only a black eye.

In No. 71 Eagle Squadron, which was composed of American volunteers in the RAF, we flew the Hurricane Mk IIAs on convoy patrols over the Channel coast of England, and on fighter sweeps and bomber escorts deep into enemy-held territory in France. My first victory in a Hurricane came on July 2, 1941, while we were escorting twelve Blenheims to bomb the Lille electric power station on Circus 29 (the raid code name). Just before we got to the target we were attacked by four Me-109Es and Fs. I saw a 109E beginning his dive on the bombers and engaged him from the port quarter at about 150 yards, firing one burst of four seconds and three bursts of two seconds each. After I chased this 109 from 12,000 feet down to 3,500 feet, it burst into flames and dove straight into the deck.

Four days later (July 6), on Circus 35, a fighter escort for six Sterlings bombing the Lille steel works, I saw a Hurricane from No. 306 (Polish) Squadron beating up a 109E that refused to go down. I gave the Polish pilot a hand with a couple of good bursts from about fifty yards, and, with heavy black smoke pouring from it, the Me-109 rolled over, headed for the deck, and went in just west of Mardyck. The Polish pilot, P/O Leon Jaugsch, and I shared this victory. Jaugsch now lives in Los Alamitos, Calif., and we correspond regularly.

On July 21, on Circus 54, again escorting Sterlings, I engaged two Me-109Fs that were making a stern attack on the bombers. One German saw me coming, took violent evasive action, and got away, but I put a long burst into the tail section of the second 109F at about fifty yards. His rudder and port elevator were blown off and his starboard elevator was shredded by the full blast of my Hurricane's eight machine guns. The pilot jettisoned his hood, bailed out, and the 109 went in.

One time I got an Me-109 on my tail and couldn't get rid of him. We were both turning as tight as we could. He couldn't get his deflection shot and I couldn't keep on turning forever. A vertical reversement would give him a squirt at me, so, to put an end to this fiasco, I yanked the stick back hard and kicked bottom rudder. I haven't the slightest idea what happened next, except it was bloody violent! My Hurricane's hood ripped off, banging me in the head, and taking my flying helmet, goggles, and oxygen mask with it. All the fabric on the left side of the fuselage tore loose and streamed out behind my aircraft. My face was cut up, and my left eye was swelling shut and filled with blood. Yes, I lost the 109 off my tail—the pilot probably figured I'd kill myself without his help—and, by the grace of God, I made it safely back to England, where the squadron doc sewed me back together again.

Pilot Officer Leon H. Jaugsch of No. 306 Squadron, a unit manned by Polish pilots, shares a victory and a friendship with Bill Dunn.

In the later part of July 1941, we were reequipped with Spitfire Mk IIAs, and my dependable old Hurricane warbird was sent to some other squadron. Some years after the war, in 1948, I was assigned as fighter advisor to the Imperial Iranian Air Force at Doshan Teppeh Airfield, just outside Tehran, to instruct on P-47 Thunderbolts. There I found the 1st Fighter Regiment, equipped with Hawker Hurricanes, and, much to my surprise and delight, since I had flown both the Hurricane and the Jug, I was directed to instruct Iranian pilots on both aircraft. My last flight in the Hurricane—the first fighter I had ever flown, and, consequently, my first love—was in September 1949.

The last operational Hurricane, as near as I can determine, remained on active service with the Portuguese Air Force until 1951. ■

Bill Dunn's byline last appeared in AIR FORCE in the September '76 issue, when he described how he became an ace (and the first American fighter ace of World War II) on August 27, 1941, while serving in the RAF with No. 71 Eagle Squadron. He later transferred to the AAF and added several more victories to his record, flying P-47s and P-51s in the ETO, Burma, and China. After the war, he was a military advisor to the Nationalist Chinese, the Iranian, and the Brazilian air forces. Retired since 1973, Colonel Dunn now lives in Colorado Springs, where he follows a second career as a painter and writer.

Pilot Officer William R. Dunn of No. 71 Eagle Squadron.

A gathering of the men who led World War II air armadas and built the postwar Air Force inevitably calls up . . .

Remembrance of Things Past

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

THE summer of 1943 was thirty-four years back in the ordinary way of measuring time, and light-years ago the way aviation reckons it. Thirty-four years ago the whole theory of airpower was being put to the test, with the answer still in question. The summer of 1943 would determine many things, including the future importance, and role, of airpower. Perhaps the very existence of an independent Air Force would depend on those few months.

We all know the story of that summer, how the success of the deep penetration precision bombing attacks was almost overshadowed by heavy losses of unescorted bombers. It took a precise blend of wisdom, diplomacy, and force to bring the UK-based Eighth Air Force through that hard time, and Lt. Gen. Ira Eaker had those qualities to spare. He also had the imaginative and inspired support of such combat commanders as Colonels Pat Partridge and Curtis LeMay.

My excuse for this backward look is that I had the good fortune recently to spend a day or so with these gentlemen, along with a few others who are already a part of aviation history. While recollections become the staple pastime as one grows older, and thus must be aired sparingly, this does seem one of those occasions.

We have all heard the stories of the legendary LeMay, the exacting taskmaster who built SAC. There was another side to him that comes to mind from that summer of '43. An attack against the dockyards at Bremen had failed dismally, with scarcely anyone hitting the target. VIII Bomber Command had attached great importance to that mission, attracting the London brass in strength for the 1st Air Division critique.

The first group leaders to speak were experienced enough to come up with good alibis, and so they sat down relatively unscathed. Finally, one of the new boys got up to explain his group's failure. In his innocence, he highlighted all his own mistakes. It was the moment the London contingent had been waiting for, and they went to work on the hapless light colonel. At that point Colonel LeMay of the 305th Group stood up, with absolutely everything to gain by remaining a spectator, to put an end to the harassment with a quiet word or two.

There are clearly more important things to remember than that, but in a way, maybe not. The fate of airpower was in some very inexperienced hands that summer of '43, with squadron commanders hardly dry behind the ears and aircrews fresh out of flying school. A little sensitivity at the right moment could do wonders toward building the confidence of that fledgling force, and, in fact, it did. That and the fact that the Pat Partridges, Curt LeMays, and the other older heads led in the air, not from offices.

The winter of 1944 saw Jimmy Doolittle take over the Eighth from Ira Eaker, who went on to the Mediterranean. Jimmy Doolittle, scarcely changed from those long ago days, was in that group the other day. There are so many stories about Jimmy in all his nine lives as test pilot, racer, scientist, combat leader, businessman, presidential advisor, and others know them better than I. The incident that sticks in my mind is really no story at all, just a little history.

In June of '44, General Marshall and General Arnold, accompanied by Maj. Gen. Fred Anderson, came to Bassingbourn in England. They arrived in a transport, and never had we seen so many stars. A few seconds later a P-51 made a sharp overhead break, touched down, and taxied in with the Eighth Air Force Commander, Lt. Gen. Jimmy Doolittle, in the cockpit. It was a great entrance, and we all loved it. The Eighth was a very big outfit, but somehow we all felt we knew its commander.

Pete Quesada turned up at the recent meeting, looking for all the world like the same Lt. Gen. Elwood Quesada featured in a June 1944 *Stars and Stripes.* He had, it seems, flown the Supreme Allied Commander, General Eisenhower, over Normandy in a piggyback P-51. Gen. Larry Norstad was there, quiet and introspective as always, but with enough memories of great events to fill several books. Then there was Gen. George Kenney, dapper and evidently indestructible, who can remember with great clarity almost everything that has taken place in military aviation. The main thing to remember about George Kenney was his relationship with Douglas MacArthur, a relationship that contributed immensely to the stature of the air forces in the Pacific and hence to the creation of the Air Force itself. It was fascinating to sit around after dinner one evening and hear Gen. Larry Kuter, an infallible oral historian, tell of the instant decision made by the mercurial Hap Arnold to dispatch Kenney to Australia as MacArthur's airman. Like so many of Arnold's decisions during those war years, it was the right one.

The modern Air Force that all of us were told about at that meeting the other day has little resemblance to the Air Force of the forties. There are not, for instance, many airplanes today. There will never be very many airplanes, in the 1943 sense, again. Never again will great air armadas lay contrails across an enemy sky.

The people in charge are different, as well. They have to be, for not only is theirs a more complicated technical world, but it is also immensely more complicated from a bureaucratic standpoint. Hap Arnold could not operate these days as he did then. He might, in fact, just explode in frustration. There is civilian control many layers deep, checks and counterchecks to the whole decision process. The military leader these days works under a microscope.

Still, it is easy to identify the new generation as lineal descendants of the best we had in the forties. They have the same dedication, the same basic interests, and if they don't have as much fun, at least they're better paid. ■

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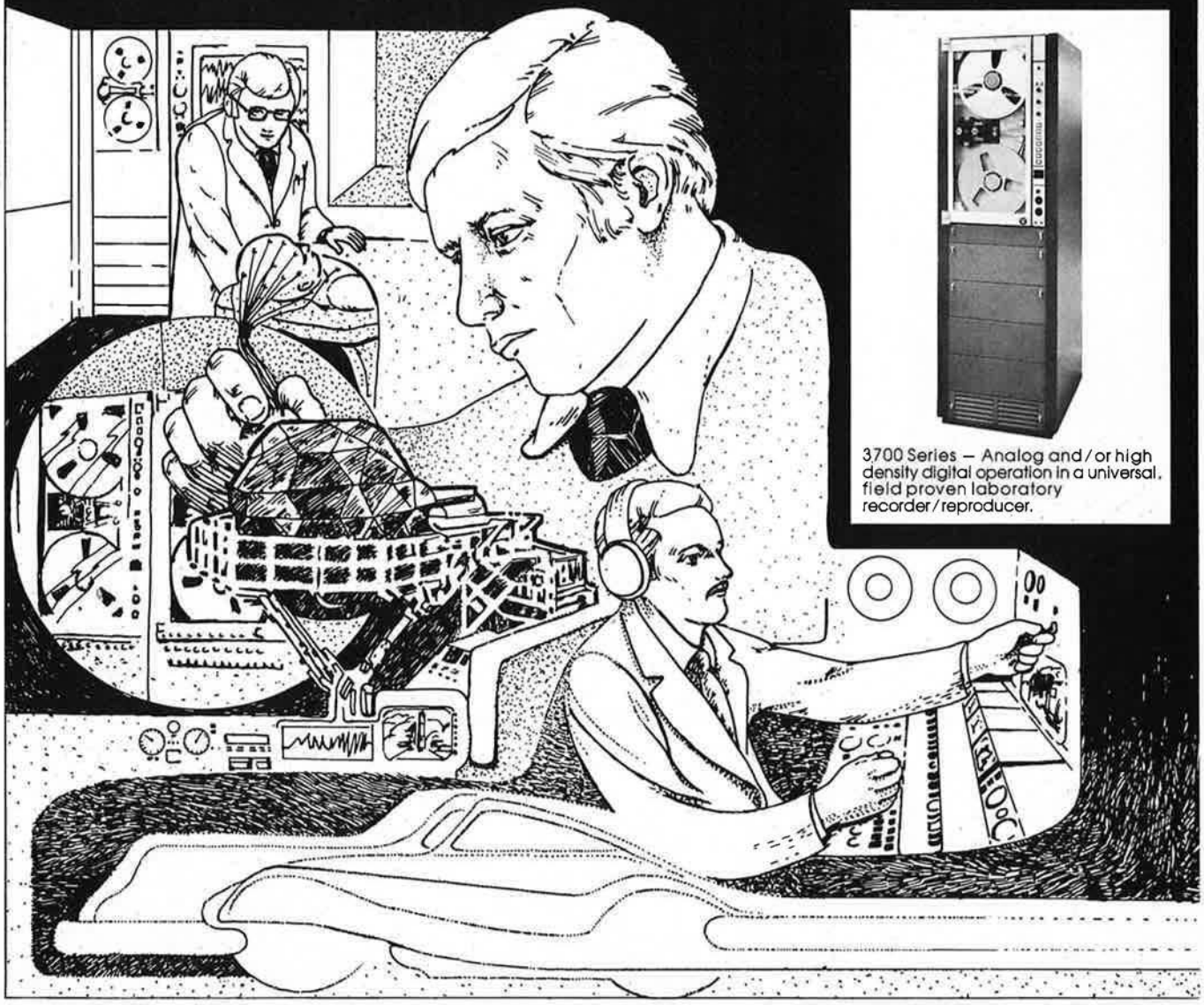

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Sperry Update 2

A timely report of Sperry Flight Systems activities in the airline, defense, space and general aviation markets.

Sperry multiplex units chosen for Hughes AH-64.

Hughes has awarded a development and preproduction contract to Sperry Flight Systems for multiplex remote terminal units to process data for the AH-64 fire control system. The MRTU, which utilizes high-density hybrid circuitry, is a direct application of technology developed by Sperry for the Space Shuttle orbiter and solid rocket boosters.

Army OH-58C's to get Sperry gyro horizons.

Sperry will provide a militarized version of its GH-14 gyro horizon to Bell Helicopter Textron as part of the U.S. Army OH-58C helicopter product improvement program.

The initial order is for 130 of the four-inch attitude indicators to be used in an OH-58C retrofit program.

The indicator has a built-in electric vertical gyro and a patented drive connection between the attitude indicator sphere and the gyro. The GH-14 for the OH-58 has a new, lower speed, higher mass gyro momentum wheel and electronics tailored to Army specifications.

Other features include electrical fast-erect circuitry, high resistance to shock and a built-in static inverter allowing the indicator to operate directly from DC aircraft power supplies.

Avionics Division formed; Challenger goes Sperry.

Sperry Flight Systems formed the Avionics Division to better serve the growing business aviation market, then promptly landed the major avionics package on the new Canadair Challenger.

"Creation of the Avionics Division of Sperry Flight Systems is a definite commitment to the business aviation marketplace," said Joseph J. Campanella, general manager. The new division will utilize Flight Systems' solid technological base to provide customers with the most cost effective design and production methods.

While the Avionics Division was being formed, Canadair selected Sperry's new SPZ-600 autopilot, flight director system, air data computer and instruments, vertical and directional gyros and digital V-NAV computer as part of the standard avionics package for the Challenger.

The SPZ-600 is a dual channel fail passive autopilot featuring a Sperry designed dual servo system to provide system redundancy and greater reliability. Protected from "hardover" control inputs by the dual servo design, the SPZ-600 can be certified with more control authority than systems requiring limited torque output to prevent "hardovers".

Have you heard about the ADT-222?

Sperry is now marketing an air data test system for precision avionic equipment . . . the ADT-222.

The ADT-222 operates as a pressure controller and a precision pressure standard, functioning in inches of mercury or millibars, altitude in feet, and airspeed in knots. A special digital processor is combined with two solid-state pressure control systems for accurate calibration and simple operation.

Packaged for bench top or relay rack mounting, the ADT-222 has been selected by more than 20 air frames and airlines. Messerschmitt-Bolkow-Blohm has placed an order for 10 systems.

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Airman's Bookshelf

Who's Ahead?

Strategic Power: Military Capabilities and Political Utility, by Edward N. Luttwak. Center for Strategic and International Studies, Georgetown University, Washington, D. C., 1976. 69 pages, including glossary. $3.

Who says good things don't come in small packages? In this latest addition to the Washington Papers series, Dr. Luttwak combines a very good description of the world's two major strategic nuclear arsenals with an excellent treatise on a most elusive subject—how to measure the strategic balance between the United States and the Soviet Union.

This tightly written book takes the reader through a philosophical discussion of the strengths and limitations of nuclear weapons, the hardware deployed by the two major nuclear forces, and, ultimately, an assessment of strategic force characteristics, qualities, and quantities that analysts traditionally use in trying to answer the omnipresent question: "Who's ahead?" While the answer to that question is essentially left to the reader, the important factors, as well as the misleading ones, are clearly outlined and analyzed.

But, as the author concedes, the more important and useful aspect of strategic power may not be found in the technological and, to a degree, quantifiable descriptions and measures of the hardware and tactics associated with the strategic balance. Rather, it is the realization that the most important measure lies with a nation's defense policy that these forces are designed to support—a political rather than technical consideration, all too often overlooked by many commentators. In this regard the author performs a most valuable service.

Packed into the first seventeen pages is one of the best and, as events are beginning to prove, most timely descriptions of the "whys" of strategic nuclear forces. In his lucid discussion of the political aspects of this controversial issue, Luttwak outlines the fundamental rationale that supports the current US policy of deterrence through a national strategy of flexible response and escalation control.

His approach to what he calls "extended deterrence" is strongly laced with the logic of why "a much greater capacity than that of a simple strike-back force is required in US strategic nuclear forces." In doing so, he makes several compelling arguments that support what he considers to be the futility of lesser strategies, such as minimum deterrence or mutual assured destruction.

No time is more appropriate for this résumé than now. As the new Administration grapples with SALT initiatives, such multibillion dollar strategic modernization programs as the B-1 bomber, MX, and Trident, and the buildup of Soviet political and military power, the debate on "how much is enough" is going to intensify. For those who intend to follow these proceedings, this primer is required reading.

—Reviewed by Maj. Kenneth Van Dillen, Hq. USAF, Office of the Deputy Chief of Staff for R&D.

Yes, Yes, *Nanette!*

Nanette, by Edwards Park. W. W. Norton & Co., New York, N. Y., 1977. 186 pages. $7.95.

It's easy to tell what Ted Park's book is about. It's about his experiences as a P-39 pilot in New Guinea during the early months of the Pacific War. The central character is his P-39, Nanette, an exceptional member of an unexceptional family of World War II fighters. Nanette was proof of the perversity of inanimate objects. She tried to kill every pilot other than Park who flew her.

Nanette also was a coward. Whenever a hairy mission was brewing—or when one that started out as a milk run was about to get hairy—Nanette sensed it and developed mechanical ailments, doubled her fuel consumption, or otherwise put herself and her pilot *hors de combat.* The only mission on which Park was clobbered was one the prescient Nanette decided to sit out on the ramp, forcing Park to fly another bird.

The book is also about the mixed bag of characters in Gopher Squadron—more or less typical of the hastily trained, inexperienced pilots that peopled every squadron in the early days of the war.

That's what the book is about, but telling about the book is something else. As the French chefs used to say of a powdered egg omelet during the European phase of the war, "It's all in the presentation." And it's a very good thing that Park didn't make his presentation right after the war. It probably would have come out like a hundred other war stories that were doomed to be soon forgotten. *Nanette* won't be.

Suffice it to say that *Nanette* has profited from the mellowing effects of time and from the author's postwar work as a writer and editor, now with *Smithsonian* Magazine. The humor (it's a very funny book) is understated, the heroics are downplayed, the people life size. Everything is there and, unlike Nanette and her kind, in perfect balance. It's the most thoroughly enjoyable World War II reminiscence we have seen, and it can be read purely for enjoyment, though there's a lot more depth here than first meets the eye.

In her own peculiar way, Nanette, the P-39, had style. So does *Nanette,* the book. It's one to buy.

—Reviewed by John Frisbee, Executive Editor.

New Books in Brief

Apollo-Soyuz, by Walter Froehlich. A veteran science and technology writer recreates the Apollo-

Airman's Bookshelf

Soyuz drama. Beginning with the exciting moments when the two nations "shook hands in space," the author discusses the delicate negotiations that led to the historic flight; the astronauts; their spacecraft; the experiments they performed jointly; and the social, psychological, and public affairs implications of the mission. On the book's canvas-like cover is a stunning reproduction of Apollo-Soyuz against the backdrop of the Volga River. Color photos, tables. National Aeronautics and Space Administration, 1977. Available at US Government Printing Office bookstores, the National Air and Space Museum, or by mail from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. 132 pages. $3.30.

Arms in the Indian Ocean: Interests and Challenges, by Dale R. Tahtinen. After examining the military capabilities of nations surrounding the Indian Ocean, the sources of potential conflict among them, the possibility of superpower intervention, and the regional interests of the superpowers, the author concludes that Washington and Moscow should immediately negotiate an agreement to sharply limit their presence in the area. Tables. The American Enterprise Institute for Public Policy Research, Washington, D. C., 1977. 84 pages. $3.

Asian Affairs: An American Review, edited by William Henderson. Published bimonthly, this periodical covers domestic politics, economics, and international relations of Asian countries extending from Japan to Afghanistan, but primarily concerns US Asian policy. American-Asian Educational Exchange, New York, N. Y., 1977. 208 pages. $12 for annual subscription; $2 for single copies.

Civil Defense: A Soviet View, by P. Yegorov, I. Shlyakhov, N. Alabin. This Soviet text for university-level students is tenth in the Soviet Military Thought series published under the auspices of USAF. It covers Soviet civil-defense doctrine, organization, and measures for the 1970s, giving the reader a good grasp of the scope of Soviet war survival plans. Charts, illustrations. 1976. 374 pages. $3.45. *Selected Soviet Military Writings, 1970–1975: A Soviet View.* Eleventh in the series, this work is an anthology of articles from the Soviet press and extracts from Soviet books on military-political topics published between 1970–1975. 1976. 295 pages. $3.40. Both volumes available from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

Civil-Military Relations, by Andrew Goodpaster, Samuel Huntington, Gene Sherrill, and Orville Menard. This is based on a symposium on the role of the military in American society. Several of the participants cite the importance of education in fostering understanding between military and civilian sectors. American Enterprise Institute for Public Policy Research, Washington, D. C., 1977. 84 pages. $2.50.

Cleared to Land! . . . The FAA Story, by Frank Burnham. Here is a look at the Federal Aviation Administration through profiles of its employees (from controllers to maintenance inspectors and engineering test pilots) who make the system work despite bureaucratic shortcomings. Photos, glossary, index. Aero Publishers, Inc., 329 W. Aviation Rd., Fallbrook, Calif. 92028, 1977. 254 pages. $11.95.

The Dauntless Dive Bomber of World War II, by Barrett Tillman. This is the first full-length book devoted to the "Dauntless," a Douglas dive bomber considered obsolete in its first day at war, but which left its mark on history through its success in the Pacific. Notes, bibliography, index, photos. US Naval Institute, Annapolis, Md., 1976. 252 pages. $14.50.

The de Havilland Mosquito, by M. J. Hardy. The author traces "Mosquito's" development, its operational career, and postwar service. It became one of WW II's most successful and cost-effective combat aircraft. Photos, bibliography, index. Arco Publishing Co., Inc., New York, N. Y., 1977. 128 pages. $11.95.

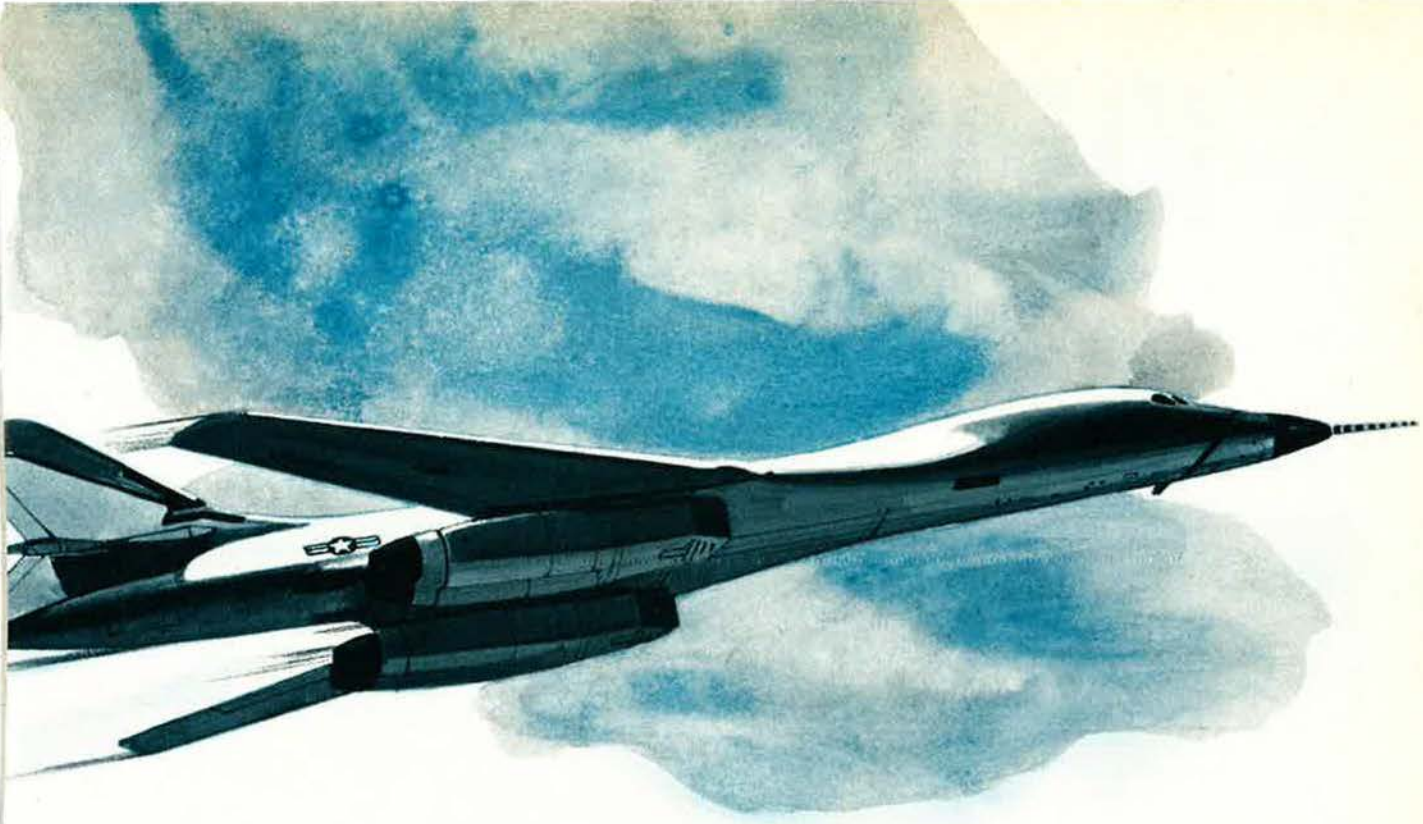
The Halder Diaries, Introduction by Col. T. N. Dupuy, USA (Ret.). Here in two volumes are the private war journals of Col. Gen. Franz Halder, Chief of the German General Staff, who kept a personal record of the important events between 1939–42—events leading to his own downfall, the ruination of the General Staff, and the destruction of Germany. His notes form one of the key documents of WW II. Westview Press, 1898 Flatiron Court, Boulder, Colo. 80301, 1977. 1,612 pages. $125.

Illusions of Choice: The F-111 and the Problem of Weapons Acquisition Reform, by Robert Coulam. The author analyzes what went wrong in the joint Navy-Air Force F-111 project. He draws on new theories of large-scale decision-making to show how the Air Force and Navy shaped program requirements despite Defense Secretary McNamara's determination to make the program succeed. Final chapter outlines prospects for reform. Bibliography, index, photos. Princeton University Press, Princeton, N. J., 1977. 433 pages. $21.50.

Jeppesen/Sanderson Aviation Yearbook, 1977. Developments in aviation fields from military/aerospace to sport flying are compiled from magazine accounts (including articles from AIR FORCE Magazine) and other sources in this annual volume. Period covered is from November 1975 to December 1976. Jeppesen/Sanderson, Inc., Denver, Colo., 1977. Index. 442 pages. $12.75, postpaid.

The Last Six Months, by Gen. S. M. Shtemenko. A former Chief of Staff of the United Soviet Armed Forces wrote this personal account of the Red Army's campaigns during the last six months of WW II. At the time the author was Deputy Chief of General Headquarters, working directly under Stalin and coordinating activities across the Soviet-German front. Photos, maps, index. Doubleday & Co., Inc., New York, N. Y., 1977. 436 pages. $10.

Mission to Earth: Landsat Views the World, by Nicholas Short, Paul Lowman, Jr., Stanley Freden, and William Finch, Jr. This is a large-sized compendium of outstanding Landsat scenes depicting the earth's surface from a perspective never



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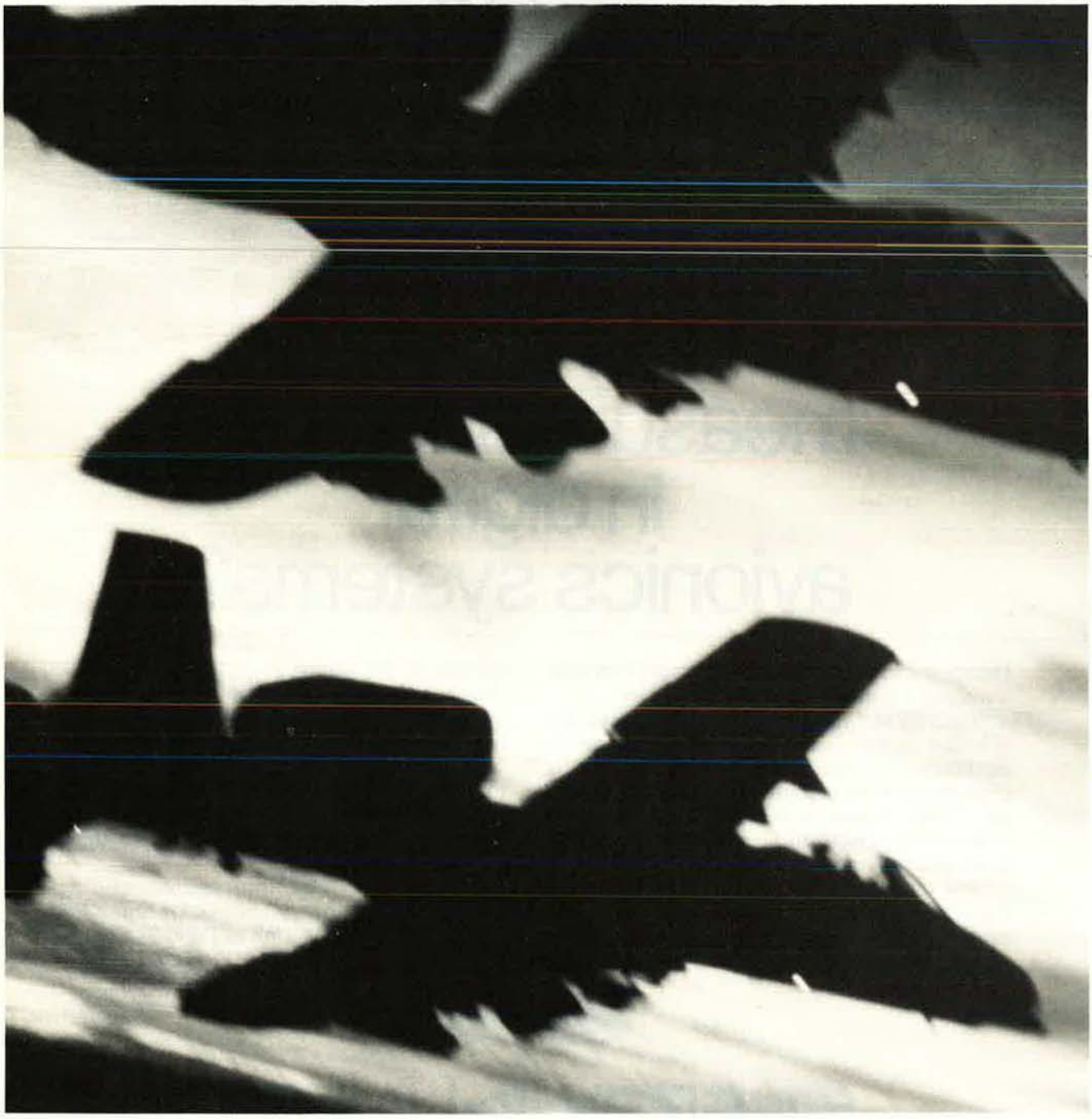

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before presented in such breadth and detail. Landsat images make it possible to see many natural and cultural features of the global land surface. Describes Landsat program, includes glossary of terms and index. Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. 459 pages. $14.

Nimitz, by C. B. Potter. The man who commanded thousands of ships, aircraft, and men came from a poor Texas family. Here is his remarkable biography from childhood to the Naval Academy, to husband and father, to a Naval career from ensign to flag rank, and to postwar appointments as Chief of Naval Operations and US representative on a United Nations commission. Notes, sources, index, photos. Naval Institute Press, Annapolis, Md., 1976. 507 pages. $16.95.

Preparing for the Next War: American Plans for Postwar Defense, 1941–45, by Michael J. Sherry. A Northwestern University assistant professor of history analyzes American military planning during WW II and its implications for postwar military policy. Theories about the origin of the cold war should be revised, he contends. It was Axis aggression in the 1930s and the experience of WW II that led Americans to an ideology of national preparedness, a war-conscious mentality, long before the cold war began. While this vision of a nation able to deter any aggression was innocently inspired, its potential for arrogance, misapplication, and misunderstanding by others proved tragic, the author says. Selected bibliography, index. Yale University Press, New Haven, Conn., 1977. 260 pages. $12.50.

The Roarin' 20's, A History of the 312th Bombardment Group, U.S. Army Air Forces, World War II, by Russell L. Sturzebecker. The 312th Light Bombardment Group came into being on March 15, 1942. Before reaching the Pacific in November of the following year, it had transitioned from A-31s to A-36s to A-24s to P-40s. Then at Port Moresby it changed to A-20s; hence the name of the unit and the title of the book. Dr. Sturzebecker, a wartime member, has spent thirty years collecting the material for this story of the 312th in the US and the Pacific. Several hundred photos. KNA Press, Kennett Square, Pa., 1976. 301 pages. $10. (Order from the author, 503 Owen Rd., West Chester, Pa. 19380.)

Sweden: Haven of Refuge, Aviation Historical Review. This is a special publication of the Swedish Historical Society detailing what occurred in neutral Sweden during WW II. Thousands of violations of Swedish neutrality were reported by Sweden's air defense forces. Most foreign aircraft were turned away, but many found refuge in the country. Here is the story. Photos. Swedish Aviation Historical Society, Box 308, Stockholm 1, Sweden, 1976. 84 pages. $6.50.

U.S. Navy and Marine Corps Fighters, by William Green and Gordon Swanborough. Here in text, specifications, photos, and three-view drawings are thirteen types of aircraft either in service or under development between 1941–45. Arco Publishing Co., Inc., New York, N. Y., 1977. 68 pages. $6.95.

The War in the Trenches, by Alan Lloyd. The trench war on the Western Front between 1914–18 was a hideous waste of human life. The trench soldier was like a rat in a ditch, defenseless prey to plagues and lethal gases unleashed by the enemy. In a single stunning day Britain lost more men than in the Crimean and Boer Wars combined. Selected bibliography, photos, drawings, index. David McKay Co., Inc., New York, N. Y., 1976. 200 pages. $12.50.

These recently published Adelphi Papers will interest students of military/political affairs: *Nuclear Power and Weapons Proliferation,* by Ted Greenwood, George W. Rathjens, and Jack Ruina, 51 pages. *The Soviet Union and the PLO,* by Galia Golan, 34 pages. Copies may be ordered from The International Institute for Strategic Studies, 18 Adam St., London WC2N 6AL, England. $1.50 each postpaid.

—Reviewed by Robin Whittle

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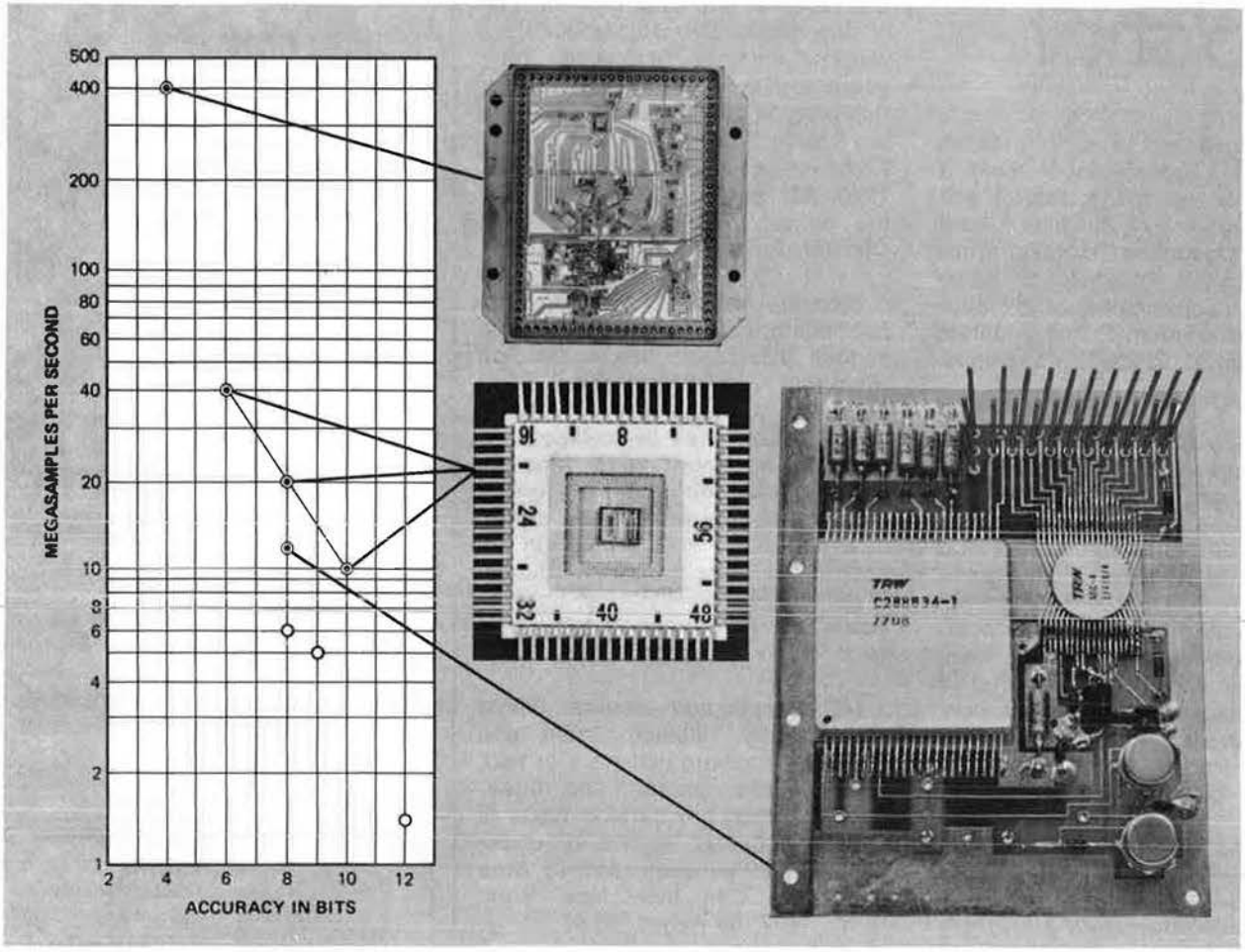

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The Bulletin Board

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

Dual Comp Curb Voted

The House Appropriations Defense Subcommittee in late May voted to prohibit second careers in the federal government for retired service people. The prohibition, which appears in the FY '78 Military Appropriations Bill, seems certain to dismay the military establishment. It comes at the height of a Pentagon campaign to place a moratorium on any actions that smack of benefits erosion.

The Committee action, if upheld by the full Congress, means that all military retirees hired by the government after October 1, 1977, must surrender their full retired pay. Few if any such persons would take employment under such conditions, of course.

Committee Chairman George H. Mahon (D-Tex.) cited the rising cost of retirement outlays and high unemployment as reasons for the curb. He estimated it would save the government $26 million next fiscal year.

It was pointed out by reporters, at a press conference on the FY '78 budget, that if a retiree were not hired by Uncle Sam, someone else would be. So where are the savings, Mr. Mahon was asked? No direct response was forthcoming, though he acknowledged that "in some cases" there would be no savings.

AFA and other military-oriented groups strongly oppose the Committee restriction. There are presently about 150,000 retired service members who work for the government. About five percent are retired regular officers who already must surrender part of their pay.

Chief Barnes Steps Down

Chief Master Sergeant of the Air Force Thomas N. Barnes will retire—"reluctantly"—August 1 after more than twenty-eight years in uniform. He plans to live in San Antonio where, he told AIR FORCE Magazine, he looks forward to "continuing to support the Air Force in whatever way I can."

The forty-six-year-old Barnes said he is joining the Texas Wildlife Commission as a conservationist, a position that will keep him moving throughout the big state. His nearly four years as the Air Force's top NCO have conditioned him to frequent travel. Since his appointment October 1, 1973, he has addressed hundreds of airmen groups, met with thousands more, conferred with commanders at all levels, and helped shape new NCO policies regarding promotions, military education, and career progression.

He described his association with the Air Force Chief of Staff as "excellent" and praised the latter's responsiveness to suggestions for improving life in the service. The main objective of Congress in establishing a top NCO post in each service was to assure that, through an articulate NCO spokesman, the service chief would be kept current and knowledgeable on all enlisted matters. Barnes and his four predecessors in the post have provided the "airman's voice" in the Chief of Staff's office.

Sergeant Barnes said he is gratified at the high personnel standards USAF has achieved and feels they must be maintained at all costs. He's also happy with the new three-tier alignment in the enlisted ranks, the new five-phase airmen educational program, and the new below-the-zone promotion opportunity for aspiring E-4s. BTZ quotas should be made standard for all airmen grades, as a "way to recognize new talent," he said.

Entering USAF in April 1949, Chief Barnes served for nearly two years in Japan as a flight engineer during the Korean War. Later Stateside tours found him performing as a crew chief, flight engineer, and senior controller in a variety of aircraft. In the late 1960s, he went to SEA with the 8th Tactical Fighter Wing. He moved to the top Air Force NCO slot following two years as the Senior Enlisted Advisor to the Commander of Air Training Command, Randolph AFB, Tex.

His successor at Hq. USAF, following what is described as an extremely tough screening process, is due to be announced this month.

More Woes on Health Care Front

Insufficient funding, a growing shortage of military physicians, and long delays in modernizing run-

Sergeant Barnes: High personnel standards must be maintained at all costs.

down medical facilities. These are just some of the problems Pentagon medical authorities, including USAF Surgeon General Lt. Gen. George E. Schafer, recently told Congress are responsible for curtailed health service at military hospitals. Their gloomy report follows on the heels of last month's "Bulletin Board" note that the Air Force medical service is short more than 300 doctors.

The Pentagon authorities delivered their tales of woe to a House subcommittee engaged in a probe of health care and other service personnel programs. Retirees and their dependents, particularly,

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are feeling the full impact of the physician shortage, Assistant Defense Secretary (Health Affairs) Dr. Robert N. Smith testified.

Dr. Schafer cited the uncertainties in financial planning created by the temporary nature of special medical pay programs as hurting doctor procurement and retention. Recent Defense-imposed cuts in medical officer promotion opportunity is another.

He said lack of money to modernize old facilities is hurting USAF's health program and acts to deny in-service care to many persons. Instead, they go the CHAMPUS route which, he declared, costs the government far more. Big savings could be achieved by building up the in-service care program and "decreasing CHAMPUS use to a minimum," General Schafer said.

USAF's Dental Surgeon, Brig. Gen. Robert L. Thompson, gave a grim report on dental officer manning, predicting that "without sufficient incentives" the shortage will grow. The already limited dependent dental service provided at certain remote and overseas bases may deteriorate, he indicated.

Dr. Thompson made a strong pitch for a contributory dental program for military families, with care provided by civilian dentists. He said the Defense Department and the services are studying the idea. He did not note, however, that family dental care proposals have been considered on and off in the Pentagon for the past two decades. The perennial roadblock: high cost.

Dr. Smith, the military's top medic, noted that under present law, the retired community has only "third priority" for in-service care (after active-duty people and their dependents). "Despite their limited entitlement," Dr. Smith said, retirees feel that, based on recruitment and retention pitches, they have an "absolute entitlement" to medical care. Thus the sparks fly.

He said the past five years have seen a decrease of 3,500 military physicians and 1,000 dentists. At the same time, the retiree population has soared, much of it has aged, and chronic illnesses and demand for care have multiplied.

As if to corroborate Dr. Smith's bad news for retirees, the large military hospital at Ft. Belvoir, in Northern Virginia, about the same time announced that it is closing its doors to most local retirees. Reason: a severe doctor shortage. Many USAF retirees and their families who used the Belvoir facility must look elsewhere.

Retirees should not expect much success at VA hospitals. These facilities are not staffed to accommodate any sudden surge of retiree referrals.

Anti-VA Benefits Drive Mounts

Influential lawmakers are joining in opposition to providing veterans' benefits to persons receiving upgraded discharges under the President's special discharge review program.

Veterans Administration officials

AFA Believes . . .

Views As Well As News

In this space, from here on, we will be commenting on various people-related issues reflecting, for the most part, AFA's current policy as affirmed by our National Convention. These policy positions are reported in AIR FORCE Magazine each year. But we feel our members should be reminded about our positions on current issues. This is particularly true of active-duty people.

It is more than "what have you done for me lately?" but a general lack of knowledge of AFA's long history of championing gut pocketbook issues.

More than half the Air Force has come on board during the 1970s. This in some ways parallels our membership experience. During this same period, the number of active-duty enlisted people in AFA has more than tripled. This is almost the same pattern as our young junior officer membership. So it is not surprising that the newcomers are not aware of our history. All the more reason to point out AFA's track record in behalf of Air Force people.

Who, for example, knows that back in 1965 (more than half a career ago for many Air Force people) AFA spearheaded the legislative drive that finally set the services on the road to pay comparability? In fact, in 1965, it was AFA's President who testified before Congress on behalf of a new and vastly improved pay bill. He did this not only on behalf of Air Force members, but, with the consent of both the Army and Navy military-oriented organizations, for *all* military members.

Who knows that it was AFA which—alone, it might be added—successfully fought for the establishment of a Chief Master Sergeant of the Air Force? This was not a popular idea then. In fact, it was a pretty lonely position. Now there are Senior Enlisted Advisors at many levels of command as well.

Who remembers that it was AFA's original efforts that eventually culminated in such now-well-accepted facts of Air Force life as the Air Force Community College; the up-to-date curriculum of the AFROTC program; the highly successful Air Force Junior ROTC program—and many other valuable programs?

We are not resting on past laurels. But these examples do point up the fact that unless we let you know more about where we currently stand, successes in these areas may go unrecognized.

Another reason for launching an editorial column in "Bulletin Board" is the fact that today, more than ever, personnel issues are closely scrutinized by the Air Force, Department of Defense, Congress, and the American public. In some cases we may agree with their criticisms or proposals. Often we will not.

Additionally, we will use this space to discuss some of the things our advisory councils do—our Enlisted Council, Junior Officer Advisory Council, Total Force Advisory Council, and so on. They identify or focus attention on those issues of interest to their particular constituents and recommend positions to AFA's President.

Occasionally, we may include a guest editorial, when we run across commentary on personnel issues that we feel deserves a wider audience.

Also, we'd like to encourage our members to be involved. That's *you*. If you think there is an issue that would benefit from a little sunshine, drop us a line. Yours might be the first voice to point up what is about to become the next hot topic of conversation in the Air Force community. Don't be bashful.

All in all, we believe there is a need to air views as well as news. We're interested in your reaction.

—James A. McDonnell, Jr.

told AIR FORCE Magazine that unless Congress enacts special curbs, persons getting cleansed discharges under the review will qualify for all veterans benefits. They emphasize that, under the law, they are not empowered to "look behind the discharge."

Legislators who oppose such handouts include Rep. Ray Roberts (D-Tex.), chairman of the House Veterans Committee; Olin E. Teague (D-Tex.); David E. Satterfield (D-Va.); John P. Hammerschmidt (R-Ark.); and Sen. Strom Thurmond (R-S. C.). Even liberal Sen. Alan Cranston (D-Calif.) has seriously questioned the award of VA benefits to those receiving upgraded papers. Cranston has asked Defense Secretary Harold Brown to answer questions on the subject before Congress acts on legislation to restrict the benefits.

More than 400,000 persons who received undesirable or dishonorable discharges (plus current service members in a deserter status, except from a combat zone) from August 1964 to March 1973, are eligible for the upgrade review program. Air Force in late May reported that the Joint Liaison Office in St. Louis had received more than 25,000 inquiries and 17,000 were found eligible for discharge review and probable upgrading. There were 320 deserter inquiries, of which 254 were held to be eligible.

Separate service review boards, meantime, are meeting and will stay in session throughout the year or until all cases have been handled. The government even provides toll-free inquiry phone service: (800) 325-4040 for those with general or undesirable papers; (800) 531-7500 for Air Force deserters.

VA News Briefs

Veterans Administration Administrator Max Cleland held the first of what he billed as "a continuing series of programs to update the Veterans' Association Community with what VA is doing." Along with an assemblage of his top staff people, he told AIR FORCE Magazine and other association representatives that he hopes to learn from them the areas they believe VA should be emphasizing.

In a spirited and candid exchange, he and his associates:

- Pointed out that VA is well aware of problems GI Bill attendees might face this fall under the new "post-pay" program and is working on several ways to ease the blow. (This revision allows students to collect VA benefits only as course work is completed rather than in advance.)
- Noted that VA would "be surprised if the 1989 termination date for current GI Bill benefits would be extended by Congress."
- Revealed that he is about to appoint a special assistant for "Outreach" that would allow VA to become more active in seeking out those veterans who are eligible for benefits but have not taken advantage of them.
- Indicated that plans are under way to expand the VA cemetery system, particularly in the Southeastern US.

The Military Personnel Center's Capt. Susan Fischer was recently named USAF's Outstanding Personnel Manager of 1976 and the Headquarters Level Junior Personnel Manager of 1976. Here she accepts the plaque in recognition of the latter honor from MPC Commander Maj. Gen. Walter D. Druen, Jr. Captain Fischer will receive AFA's Citation of Honor at the Association's National Convention in Washington, D. C., in September.

Personnel Legislation Lags

Delays—that's the story through late spring on military personnel legislation. The most delayed of all the key bills, the Defense Officer Personnel Management Act (DOPMA), was held up again as Congress and the Pentagon waited for a "position report" on the measure from the White House.

The House, at press time, was expected to finally approve liberalized changes to the Survivor Benefits Plan. But the alterations must then run the full gamut in the Senate.

Pentagon officials were getting edgy about the expiration of reenlistment and enlistment bonus payment authority on June 30. The extension bill had passed both Houses, but in different form, and the services couldn't promise bonuses for people weighing enlistment this summer. The deadlock was expected to be broken sometime in June, however.

On the retirement legislation front, all remained quiet. Pentagon and Capitol Hill authorities agreed that nothing could happen until well after the President appoints his Blue Ribbon Commission to study all military pays. And at press time the long official silence on the Commission continued.

The House Veterans Committee approved a bill giving a six percent increase in disability compensation and dependency indemnity compensation. And the Veterans Administration asked Congress to increase GI education payments by five percent, effective October 1. Individual lawmakers, meanwhile, continued to introduce scores of new bills affecting military personnel and veterans. Here are some samples:

H. R. 4894 (Rep. Charles E. Bennett, D-Fla.) provides that payments for military retired pay be made by the Civil Service Commission, not the Defense Department.

H. R. 5181 (Rep. Joseph L. Fisher, D-Va.) includes as creditable service for Civil Service retirement certain time spent as civilian employees in nonappropriated fund positions, *e.g.,* service clubs, library service, sports, and recreation.

H. R. 5655 (Rep. B. F. Sisk,

The Bulletin Board

D-Calif.) recomputes retired pay to reflect later active duty.

S. 1115 (Sen. Ted Stevens, R-Alaska) provides a Vietnam-era veterans bonus through tax credits of up to $500. For honorably discharged persons only.

S. 11129 (Sen. James B. Allen, D-Ala.) grants retired pay eligibility to certain reservists who did not perform active duty before August 16, 1945.

AFA Tying in With AFRAP

By September, AFA plans to fully support the Air Force Recruiter Assistance Program (AFRAP). Chapters will be aligned with specific recruiting detachments to help promote the intensified recruiting effort. Full details are now being furnished to Chapters and will be discussed at the new State Presidents Orientation in Washington next month.

AFRAP, designed to extend the service's recruiting "reach" and secure quality "leads," had generated almost 15,000 prospective leads by late May, according to the USAF Recruiting Service, Randolph AFB, Tex. But the overall recruiting climate remains difficult, and "continued help and support of every Air Force member is needed," a Recruiting Service spokesman said.

In other moves to meet the recruiting challenge, Air Force has:

- Increased from eight to sixteen the number of bases potential recruits in eleven tough-to-fill skills can choose.
- Reduced its FY '77 nonprior service recruiting goal by 2,000, because of lower requirements. The target is now 64,120.
- Placed forty-five recruiting advertisements in a wide variety of magazines between May and September 1977. Publications include *Career World, Ebony, Senior Scholastic, Jet, Sports Illustrated, Popular Mechanics, Reader's Digest, National Future Farmer, People, Air Progress,* and *Community and Junior College Journal.* The ad campaign stresses the "Golden Opportunities available through the Community College of the Air Force," now a degree-granting program.

Other recent steps under way to assure continued quality recruiting were reported in last month's "Bulletin Board."

Fund Drive Over the Top

The Air Force Aid Society has added nearly $1 million to its coffers, the lion's share of the recent Air Force Assistance Fund drive which brought in a whopping $1,794,946. That's more than double last year's take. Chief of Staff Gen. David C. Jones promptly wired congratulations throughout the service and declared that the "results help reaffirm the fact that Air Force people take care of their own. . . ."

The distribution of the donations went like this: Air Force Aid Society, $943,343; Air Force Enlisted Widows Home, $615,683; and Air Force Village, $235,920. The Enlisted Home has been sorely pressed for funds.

Sixty-three percent of the active members—about 365,400—participated, contributing an average $4.99, compared to a mere $1.86 last year. General Jones cited the perserverance and dedication of the project

Ed Gates . . . Speaking of People

Bachelor Housing: What's Happening

Except for a few previously approved projects now nearing completion, the Air Force dropped out of the family house-building business several years ago. Reason: the dwelling shortage for married members had all but disappeared. Where there were too few on-base quarters, the availability, quality, and price of private houses and apartments nearby—"community support"—were held to be adequate. The avalanche of base housing complaints from heads of households and wives, which resounded ten to fifteen years ago, has long subsided.

Bachelor housing, however, is a different story. Despite considerable Air Force action to improve living conditions for single members, particularly enlisted people, much more refurbishing and modernization is necessary. Also needed are policy changes to give bachelors equity with marrieds on quarters allowances, living area standards, and optional off-base residency.

Until the government comes to grips with these difficulties, bachelor enlisted housing is likely to remain a thorn in the side of many single service people. Retention and recruiting are not going to benefit. Bachelor officer housing, meanwhile, is in fairly good shape; Air Force is no longer overhauling old BOQs or erecting new ones.

For the enlisted force, Air Force in recent years has put up many new dorms and broken up open bay areas in old ones. Occupants enjoy more privacy. Space footage allowed occupants has increased somewhat, but the ninety square feet permitted E-4s, E-5s, and E-6s is nothing to cheer abo Critics note that it compares unfavorably with Defense-w standards for families of the same rank—they are allot 750 to 1,080 square feet.

Central latrines have not been replaced as rapidly USAF officials wished, due to dollar ceilings set by Defe and Congress. But new USAF dorm designs call for se private bathrooms, and base-renovation projects embra the same goals.

Maj. Gen. Robert C. Thompson, who as the Hq. US Director of Engineering and Services quarterbacks bachelor housing improvement effort, cites major impro ment in room decor and furnishings. In a recent *TIG B* article, he explained that color coordination—in drapes, c pets, wall paint, chair cushions, bedspreads, etc.—is "r a byword in all bachelor housing upgrade efforts."

He said noisy and unattractive metal lockers are be replaced by wooden wardrobes or built-in closets, patterned carpets that "add to the decor and reduce no levels" are SOP in all bachelor enlisted renovation projects.

With furniture, the shift is to modular-type pieces that attractive, functional, and less bulky. And small refrigerat now a standard item in each new dorm room, add a pleas touch.

Also improving dormitory life, General Thompson said, "the increased individual freedoms and reduced hara ment" occupants have enjoyed in recent years. The "A

officers, enlisted advisors, and commanders at all levels for the drive's smashing success.

Following the AFAF campaign, the annual US Savings Bond drive got under way Air Force-wide. It was to end June 15. Some 38.7 percent of Air Force members were already participating via bond payroll deductions. They were being urged to increase their allotments.

In a related move, Hq. USAF sent all base personnel offices a list of thirty-one agencies that have been approved to take part in the Fall 1977 Combined Federal Campaign. Newcomers to the list are the National Association for Sickle Cell Disease, Inc., and the National Hemophilia Foundation.

Lt. Gen. Kenneth L. Tallman and Chief Master Sergeant of the Air Force Thomas N. Barnes share a historical moment with new E-4 Sgts. Carrol E. Jerro, second from left, and Tracy M. Niksich during a Pentagon ceremony elevating them to NCO status. They are among the first airmen to become NCOs under the three-tier system and are assigned to Hq. USAF DCS/Personnel office, headed by the General before he became AF Academy Superintendent.

On the ROTC Front

The US Comptroller General has jumped on the services and Defense for not recouping ROTC scholarship money from participants who drop out of the advanced program. GAO declared, in a recent special report, that more than 2,000 scholarship holders and others in the advanced program (all services) drop out—after Uncle Sam "has invested heavily in their education and training." And the services are not forcing these dropouts to serve as enlisted members, as the law authorizes.

GAO has prodded the Pentagon to ask Congress for recoupment authority, but it has been tardy getting the proposal shaped up. Result: GAO has urged Congress to enact legislation on its own. It would "require reimbursement" for education and training costs "as an alternative to active duty." And so as not to single out the ROTC, the proposal—which has Defense's endorsement—would apply equally to participants in other officer acquisition and training programs.

tem of dorm inspections" many commanders employ—ere good marks on inspections reduce their frequency—w high standards of appearance to be maintained, he ded. Critics, of course, point out that married quarters are ost never inspected.

USAF's chief engineer acknowledged that "we still have ong way to go" to improve the entire bachelor housing entory of about 130,000 rooms. He also disclosed the velopment of a new project by his staff to "upgrade all chelor spaces to current standards, while pressing hard increase the standards to provide even more privacy and ace."

General Thompson's associates told AIR FORCE Magae that this is a bold seven-year refurbishing-construction-grading program carrying an estimated price tag of about billion. Repeat: $1 billion. It would mean major improvents in all rooms, latrines, furnishings, utilities systems, etc., have not already been elevated to top-notch condition.

Even if only half the $1 billion were made available, it uld represent a major breakthrough toward solution of a numental USAF personnel problem. A typical annual USAF helor housing outlay in recent years was about $20 ion, an official in the Engineering and Services office .

he living area "standards" is a touchy issue. Air Force cials are decidedly unhappy with Defense's ninety square allocation for most enlisted bachelors. What these offis seek, and what an internal USAF "working group" curly is trying to justify, is something closer to 135 square for E-4s and perhaps 180 square feet for E-5s and E-6s. uring Defense, White House, and congressional blessing such an ambitious program, of course, is something else. he Engineering and Services working group is also lookat other bachelor housing trouble spots, such as "optional residency." Air Force leaders favor letting bachelors live off base if they wish. But commanders, by law, must keep government bachelor spaces filled; since there are so many of them, most bachelors are so assigned and surrender their quarters allowance. Those who live in small, dreary, run-down facilities are stepping up their protests. Officials sympathize with them.

Air Force feels that if most of its bachelor quarters were in general A-1 condition, were comfortably and attractively furnished, and provided reasonable privacy, the attraction of living off base would fade. Adding to the unhappiness of low-ranking bachelors is the long-standing RHIP (rank has its privileges) practice, which permits single field graders to live off base and simultaneously collect quarters allowances.

A test pilot from Edwards AFB, Calif., meanwhile, has fanned the flames of the bachelor housing controversy with a stinging attack on Defense Department and Air Force bachelor housing policies. Maj. Gary W. Matthes hit the Pentagon leadership for short-changing bachelors while spending "their time and the taxpayers' dollars on family housing."

He charged discrimination against singles in the amount of allowable living space, off-base assignment policies, and quarters allowance rates. Matthes's attack appears in the March–April 1977 *Air University Review*, an official USAF publication. USAF officials acknowledge that much of his paper rings true and that they, too, endorse his solutions.

But launching them is no easy task. Many deserving maintenance-operational, construction, and personnel programs are competing for available dollars. Bachelor housing hasn't done too well in the past, but maybe its time has come. Otherwise, Major Matthes notes, the "dissatisfaction over housing among single members of the military make them an easy mark for unions." ■

The Bulletin Board

In related ROTC developments:

• Two more AFROTC units—Tulane in New Orleans and the University of Maryland's Eastern Shore facility at Princess Ann, Md.—will close next spring. Like the thirty-seven other units USAF has folded in the past three years, their "performance was substandard"; they didn't produce enough officers to justify the expense.

To take up the slack in New Orleans, USAF will establish a new unit at the University of New Orleans. Under a cross-training arrangement, Tulane students can participate in it. The one opening and two closings will leave USAF with 145 AFROTC units which, starting in FY '78, are programmed to produce about 2,800 new officers annually. The output this fiscal year, which ends September 30, 1977, is expected to hit 2,500. Only about 650 of them are slated to take flying training.

About 2,000 of the FY '77 output were commissioned in May and June. Texas A&M, with forty-nine grads, topped the list.

• AFROTC officials report that active-duty call-ups of new officers are going smoothly and the overproduction problems of past years have disappeared. Overall quality of graduates is increasing, and it is becoming tougher to enroll in many units, a Hq. USAF ROTC planner said.

• A group of thirty-eight airmen is contributing to that upsurge in quality. These are new AFROTC scholarship recipients from the active-duty force under the Airman Scholarship and Commissioning Program (ASCP). Chosen by an April board from 233 finalists, they carry grade point averages (for college courses they've already taken) of about 3.4. Most were chosen to pursue technical degrees.

They'll be discharged from active duty soon—and lose all such active-duty benefits as commissary and medical privileges in the process. But they will enroll in college this fall and, following eventual graduation, will be commissioned, return to active duty as lieutenants, and regain their benefits. The next ASCP

Senior Staff Changes

RETIREMENTS: B/G Thomas G. **Bee;** L/G Walter T. **Galligan;** M/G Lester T. **Kearney,** Jr.; M/G Charles F. **Minter,** Sr.; L/G Sanford K. **Moats;** M/G Otis C. **Moore;** B/G Robert F. **Titus.**

PROMOTIONS: To Brigadier General: Edward L. **Ellis;** Paul H. **Hodges;** Samuel K. **Lessey,** Jr. (AFRES); Russell E. **Mohney.**

CHANGES: M/G Ranald T. Adams, Jr., from Dep. Insp. Gen. for Insp. & Safety, and Cmdr., Hq. AFISC, Norton AFB, Calif., to Dir., Inter-American Def. College, Ft. McNair, Washington, D. C. . . . **M/G James H. Ahmann,** from Chief, US Mil. Tng. Mission, Riyadh, Saudi Arabia, to Dir. of Plans, DCS/P&O, Hq. USAF, Washington, D. C. . . . **B/G Bernard Ardisana,** from V/C, Hq. USAFSS, Kelly AFB, Tex., to Asst. Dep. for Ops., NSA, Ft. Meade, Md. . . . **Col. (B/G selectee) James I. Baginski,** from Asst. DCS/Ops., Hq. MAC, Scott AFB, Ill., to DCS/Pers., Hq. MAC, Scott AFB, Ill. . . . **Col. (B/G selectee) Tommy I. Bell,** from Cmdr., 4950th Test Wg., ASD, AFSC, Wright-Patterson AFB, Ohio, to Prin. Asst. Dir., Test & Eval., ODDR&E, OSD, Washington, D. C., replacing M/G Wayne E. Whitlatch . . . **M/G (L/G selectee) Benjamin N. Bellis,** from Cmdr., Seventeenth AF, USAFE, Sembach AB, Germany, to Cmdr., 6th ATAF, SHAPE, Ankara, Turkey, replacing L/G George G. Loving, Jr. . . . **B/G Emil N. Block, Jr.,** from Spec. Asst. to DCS/R&D, Hq. USAF, Washington, D. C., to Dep. Dir., Strategic Forces, DCS/R&D, Hq. USAF, Washington, D. C. . . . **L/G Devol Brett,** from US Rep. to Perm. Mil. Deputies Group, and Chief, US Element, Hq. CENTO, Izmir, Turkey, to Cmdr., Allied Air Forces Southern Europe, and Cmdr., Sixteenth AF, USAFE, Hq. Torrejon, Spain . . . **M/G James R. Brickel,** from Cmdt., AFROTC, AU, Maxwell AFB, Ala., to Dir. of Concepts, DCS/P&O, Hq. USAF, Washington, D. C., replacing M/G John S. Pustay . . . **B/ Bill V. Brown,** from Dep. Dir., J-3 (Strat. & Gen. Ops JCS, Washington, D. C., to Cmdr., 14th AD, SAC, Bea AFB, Calif. . . . **Col. (B/G selectee) Norma E. Brow** from Cmdr., 6940th Security Wg., USAFSS, Goodfell AFB, Tex., to DCS/Pers., Hq. AFLC, Wright-Patters AFB, Ohio, replacing B/G David B. Easson.

B/G Carl H. Cathey, Jr., from Dep. Dir., Dev. & Ac DCS/R&D, Hq. USAF, Washington, D. C., to Chief, Mil. Tng. Mission, Riyadh, Saudi Arabia, replaci M/G James H. Ahmann . . . **Col. (B/G selectee) Melv F. Chubb, Jr.,** from Asst. DCS/Systems, Hq. AFS Andrews AFB, Md., to Dep. Cmdr. for Acq., ADT AFSC, Eglin AFB, Fla. . . . **M/G Lynwood E. Cla** from DCS/Log., Hq. PACAF, Hickam AFB, Hawaii, Cmdr., San Antonio ALC, AFLC, Kelly AFB, Tex., repl ing M/G John R. Kelly, Jr. . . . **M/G James B. Curr** from Dep. Dir., Programs, DCS/P&R, Hq. USAF, Wa ington, D. C., to Dir., Programs, DCS/P&R, Hq. US Washington, D. C., replacing M/G (L/G select Abbott C. Greenleaf . . . **M/G Walter D. Druen,** from Asst. DCS/Pers. for Mil. Pers., and Cmdr., AFM Randolph AFB, Tex., to Cmdr., Seventeenth AF, USA Sembach AB, Germany, replacing M/G (L/G select Benjamin N. Bellis . . . **B/G David B. Easson,** fr DCS/Pers., Hq. AFLC, Wright-Patterson AFB, Ohio Cmdt., AFROTC, AU, Maxwell AFB, Ala., replac M/G James R. Brickel . . . **Col. (B/G selectee) Alo L. Ferguson,** from Cmdr., 355th TFW, TAC, Da Monthan AFB, Ariz., to Dep. Dir., J-3 (NMCC), OJ Washington, D. C., replacing B/G Eugene D. Sc

B/G (M/G selectee) Philip C. Gast, from Asst. Intl. Log., Hq. AFLC, Wright-Patterson AFB, Ohio C/S, Hq. AFLC, Wright-Patterson AFB, Ohio, replac M/G Gerald J. Post . . . **M/G James R. Hildreth,** f Dep. to Cmdr., USAFTFWC for Tests/Exerci USAFTFWC, TAC, Nellis AFB, Nev., to Cm

board for this highly selective project will meet next month to consider airmen for college entry next January.

Short Bursts

Maj. Karl F. Benkesser, USAF (Ret.), has been awarded a special $400 scholarship provided by AFA's Aerospace Education Foundation. It covers expenses incurred at the four-week Aerospace Education Leadership Development Course now under way at the Air University, Maxwell AFB, Ala. Major Benkesser is an instructor in the Junior AFROTC program at W. C. Hinkley High School, Aurora, Colo.

Many more NCOs than officers have taken advantage of **USAF's retirement waiver policy,** which allows E-7s through E-9s and O-4s through O-6s to retire with as little as six months time in grade. In FY '76, for example, USAF retired 6,293 E-7s, of whom 1,043 received the TIG waiver. During the same year, only thirty of the 1,011 majors who retired did so with under two years' TIG. The waiver authority, as reported here earlier, is being phased out.

The General Accounting Office has urged Congress to reduce sharply the **government-paid trips back home** some federal employees and their families in states, territories, and possessions outside CONUS have enjoyed for more than twenty years. Changed conditions often make these "specific benefits . . . no longer appropriate," the GAO says.

In a letter to the Secretary of Defense, the GAO said money can be saved by **further reducing the enlisted clothing allowances** that are paid each month. GAO, the government's watchdog on federal spending, noted that the life of initial issue uniform items varies from four months to ten years. Accordingly, some service people receive allowances for clothing items that won't require replacement during their active-duty service. The monthly stipends were cut this year. A male airmen, for example, receives $5.10 instead of the previous $6.30 in basic maintenance allowance.

USAF's new General Counsel—the service's top legal post—is thirty-year-old **Peter B. Hamilton,** a Yale Law School grad, class of '71. He was a Navy lieutenant (O-3) who later was with a Washington, D. C., law firm. ■

;AFTFWC, Nellis AFB, Nev., replacing M/G James A. ıight . . . **B/G Robert E. Kelley,** from Asst. for Gen. f. Matters, DCS/Pers., Hq. USAF, Washington, D. C., V/C, USAFTAWC, TAC, Eglin AFB, Fla., replacing G James N. Portis . . . **M/G John R. Kelly, Jr.,** from ndr., San Antonio ALC, AFLC, Kelly AFB, Tex., to st. DCS/S&L, Hq. USAF, Washington, D. C., replacg retiring M/G Charles F. Minter, Sr. . . . **M/G (L/G lectee) James A. Knight,** from Cmdr., USAFTFWC, ıC, Nellis AFB, Nev., to V/C, Hq. TAC, Langley AFB, ı., replacing retiring L/G Sanford K. Moats . . . **L/G eorge G. Loving, Jr.,** from Cmdr., 6th ATAF, SHAPE, ıkara, Turkey, to Cmdr., Fifth AF, PACAF, Yokota AB, pan, replacing retiring L/G Walter T. Galligan . . . **G William B. Maxson,** from Dep. Asst. to Sec. of ef. (AE), OSD, Washington, D. C., to Dep. Dir., Dev. & :q., DCS/R&D, Hq. USAF, Washington, D. C., replacg B/G Carl H. Cathey, Jr. . . . **M/G Richard E. erkling,** from Dir. of Aerosp. Safety, Hq. AFISC, Norn AFB, Calif., to Dep. Insp. Gen. for Insp. & Safety, d Cmdr., Hq. AFISC, Norton AFB, Calif., replacing G Ranald T. Adams, Jr.

B/G Leighton R. Palmerton, from V/C, Oklahoma y ALC, AFLC, Tinker AFB, Okla., to Dep. Dir., J-4, ICS, Washington, D. C. . . . **B/G James N. Portis,** m V/C, USAFTAWC, TAC, Eglin AFB, Fla., to Dep. :S/J-3, UNC/USF, Yongsan, Korea, replacing B/G ırry A. Willard, Jr. . . . **M/G Cuthbert A. Pattillo,** from :S/Ops. & Intel., and Senior US Rep., AFCENT, unssum, the Netherlands, to Dir., J-5, US Readiness ımmand, MacDill AFB, Fla. . . . **M/G Gerald J. Post,** ım C/S, Hq. AFLC, Wright-Patterson AFB, Ohio, to r., Log. Plans & Programs, DCS/S&L, Hq. USAF, ashington, D. C., replacing M/G (L/G selectee) omas M. Ryan, Jr. . . . **M/G John S. Pustay,** from . of Concepts, DCS/P&O, Hq. USAF, Washington, C., to Cmdr., Keesler TTC, ATC, Keesler AFB, Miss., olacing M/G Winfield W. Scott, Jr. . . . **B/G George Rutter,** from V/C, AF Acquisition Log. Div., AFLC, ight-Patterson AFB, Ohio, to Dep. for E-3A, ESD, SC, Hanscom AFB, Mass., replacing M/G Lawrence Skantze . . . **M/G (L/G selectee) Thomas M. Ryan,** , from Dir., Log. Plans & Programs, DCS/Systems & Log., Hq. USAF, Washington, D. C., to Dep. C/S, Systems & Log., Hq. USAF, Washington, D. C.

Col. (B/G selectee) Vernon H. Sandrock, from Cmdr., 51st Composite Wg. (Tactical), PACAF, Osan AB, Korea, to DCS/Log., Hq. PACAF, Hickam AFB, Hawaii, replacing M/G Lynwood E. Clark . . . **B/G Walter C. Schrupp,** from Dep. Dir. of Ops. & Readiness, DCS/P&O, Hq. USAF, Washington, D. C., to Chief, AF Sec., JUSMMAT, Ankara, Turkey, replacing B/G William R. Usher . . . **B/G Eugene D. Scott,** from Dep. Dir., J-3 (NMCC), OJCS, Washington, D. C., to Chief, Studies Analysis & Gaming Agency, JCS, Washington, D. C. . . . **M/G Winfield W. Scott, Jr.,** from Cmdr., Keesler TTC, ATC, Keesler AFB, Miss., to Asst. DCS/P&O, Hq. USAF, Washington, D. C., replacing retiring M/G Otis C. Moore . . . **M/G Lawrence A. Skantze,** from Dep. for E-3A, ESD, AFSC, Hanscom AFB, Mass., to DCS/Systems, Hq. AFSC, Andrews AFB, Md. . . . **Col. (B/G selectee) Casper T. Spangrud,** from Dir., Mgmt. Analysis, Comptroller's Office, Hq. USAF, Washington, D. C., to DCS/Comptroller, Hq. AFSC, Andrews AFB, Md., replacing retiring B/G Thomas G. Bee.

B/G Ewell D. Wainwright, Jr., from Cmdr., NORAD Combat Ops. Center, Cheyenne Mt. Complex, Colo., to Cmdr., Air Def. Weapons Center, ADCOM, Tyndall AFB, Fla. . . . **M/G Wayne E. Whitlatch,** from Prin. Asst. Dir., Test & Eval., ODDR&E, OSD, Washington, D. C., to DCS/Ops. & Intel., and Senior US Rep., AFCENT, Brunssum, Belgium, replacing M/G Cuthbert A. Pattillo . . . **B/G Garry A. Willard, Jr.,** from Dep. ACS/J-3, UNC/USF, Yongsan, Korea, to Dir. of Aerosp. Safety, Hq. AFISC, Norton AFB, Calif., replacing M/G Richard E. Merkling . . . **B/G David W. Winn,** from C/S, ADCOM, Peterson AFB, Colo., to Cmdr., NORAD Combat Ops. Center, Cheyenne Mt. Complex, Colo., replacing B/G Ewell D. Wainwright, Jr. . . . **B/G Charles E. Woods,** from Chief, Resources Div. Programs, DCS/P&R, Hq. USAF, Washington, D. C., to Dep. Dir., Programs, DCS/P&R, Hq. USAF, Washington, D. C., replacing M/G James B. Currie . . . **B/G William R. Usher,** from Chief, AF Sec., JUSMMAT, Ankara, Turkey, to Asst. DCS/Ops. & Intel. (IN), USAFE, Ramstein AB, Germany. ■

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The Association provides an organization through which free men may unite to fulfill the responsibilities imposed by the impact of aerospace technology on modern society; to support armed strength adequate to maintain the security and peace of the United States and the free world; to educate themselves and the public at large in the development of adequate aerospace power for the betterment of all mankind; and to help develop friendly relations among free nations, based on respect for the principle of freedom and equal rights to all mankind.

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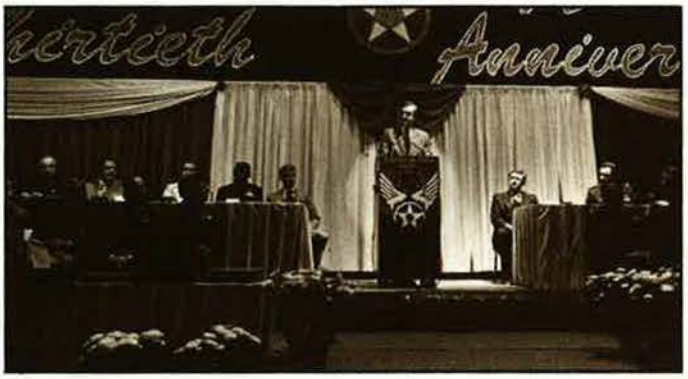
September 18-22 Washington, D.C.

AFA's 1977 National Convention and Aerospace Development Briefings and Displays will be held at the Sheraton-Park Hotel, Washington, D.C., September 18-22. Hotel accommodations are available at the Sheraton-Park, and a limited block is available at the nearby Shoreham-Americana Hotel.

All reservations requests for rooms and suites at the Sheraton-Park should be sent to: Reservations Office, Sheraton-Park Hotel, 2660 Woodley Road, N.W., Washington, D.C. 20008. The Shoreham-Americana Hotel's address is: 2500 Calvert St., N.W., Washington, D.C. 20008. We urge you to make your reservations as soon as possible. To assure acceptance of your reservation request, refer to the AFA National Convention.

Convention activities will include a Sunday



evening visit to the popular National Air and Space Museum, AFA business sessions, luncheons honoring the Secretary of the Air Force and the Air Force Chief of Staff, the annual Salute to Congress, and the Air Force Anniversary Reception and Dinner Dance, featuring a salute to the Air Force on its 30th Anniversary.

Again, we urge you to make your reservations at the Sheraton-Park or Shoreham-Americana as soon as possible to ensure obtaining your reservations. Arrivals after 6:00 p.m. require a one-night deposit or guarantee for the night of arrival.

Advance Registration Form

Air Force Association National Convention and Aerospace Development Briefings & Displays
September 18-22, 1977 ● Sheraton-Park Hotel ● Washington, D.C.

Type or print

Name _____

Title _____

Affiliation _____

Address _____

City & State _____

Make checks payable to AFA and mail to 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006

Reserve the following for me:

Advance Registrations
@ $60.00 per person ___ $_____

Current Registrations*
@ $70.00 per person ___ $_____

AF 30th Anniversary Reception & Dinner Dance Tickets
@ $35.00 per person ___ $_____

Amount enclosed $_____

*** Current Registration Fee (After Sept. 9): $70**

AFA News

By Don Steele, AFA AFFAIRS EDITOR

Unit of the Month

San Diego Chapter, California, cited for effective programming in support of AFA's mission.

Eight San Diego, Calif., civic organizations under the general leadership of AFA's San Diego Chapter recently cosponsored the San Diego Civic Awards Banquet to commemorate the golden anniversary of Charles A. Lindbergh's historic flight, and to recognize four outstanding contributions to aviation/aerospace. Award recipients were Gen. David C. Jones, USAF Chief of Staff; Lt. Gen. Ira C. Eaker, USAF (Ret.); the San Diego Chamber of Commerce; and Teledyne Ryan Electronics. General Jones was the guest speaker; Richard G. Capen, Jr., Senior Vice President, Copley Newspapers, and former Deputy Assistant Secretary of Defense, was the master of ceremonies; and the Hon. Bob Wilson, Representative from California, and AFA President George M. Douglas assisted in the presentation of awards. More than 700 members, guests, and civic leaders attended. In the photo, General Jones, right, assisted by Mr. Douglas, left, presents award to General Eaker. In recognition of the Chapter's contribution to AFA's mission through its outstanding public awareness program, AFA President Douglas names the San Diego Chapter as AFA's "Unit of the Month" for July.

—USAF PHOTO BY SSGT. DEEN JOHNSON

AFA President George M. Douglas was the guest speaker and awards presenter at the graduation of Class 77-5 of the ADCOM NCO Academy at Tyndall AFB, Fla. Following the graduation and awards ceremonies, Mr. Douglas posed with some of the award winners. They are, from left, MSgt. Millard Green, Americanism Award; TSgt. Melvin Turner, Class Speaker, Academic Achievement, and Honor Graduate; SSgt. Barry Dayhoff, Class President; Mr. Douglas; TSgt. Donald Stewart, Drill Master and Commandant Awards; and MSgt. Vincent Mayfield, Honor Flight Commander.

—VALSPAN AUDIO-VISUAL PHOTO

During the Lawrence D. Bell Chapter's Spring Dinner Meeting at the Executive Inn, Cheektowaga, N. Y., Chapter President Thomas Connett, left, presented the Hon. Jack Kemp, right, Representative from New York, a Chapter Citation in recognition of his consistent and effective contributions to the public understanding of national defense issues through his objective and comprehensive public speaking.

More than 350 members and guests of the San Mateo County and El Camino Real Chapters attended the dinner at which the San Mateo County Chapter's name was officially changed to the Tennessee Ernie Ford Chapter. Gen. Russell Dougherty, SAC Commander in Chief, was the speaker and Marlin M. Ostrow, an AFA National Director and a former AFA National President and Board Chairman, was the master of ceremonies. Shown are, from left, CMSgt. Fred Quinn, tail gunner on General Dougherty's WW II bomber crew; Chapter President Angie Anderson; General Dougherty; Tennessee Ernie Ford, popular radio and TV entertainer and recording star, and the bombardier on the General's WW II bomber crew; and California State AFA President Dwight Ewing.

chapter and state photo gallery

During a recent visit to NORAD Headquarters in Colorado Springs, Colo., to promote the AFA membership drive, Colorado Springs Chapter President Henry A. Kortemeyer, left, and Colorado State AFA President Ed Marriott, right, discussed the drive with Gen. Daniel James, Jr., center, Commander in Chief, NORAD.

During the change-of-command ceremonies for the 9010th Air Reserve Information Squadron at McGuire AFB, New Jersey State AFA President Leonard Schiff, right, presented the State AFA's Distinguished Service Trophy to Col. Jack Kruse, left, Commander of the 9010th, as well as organizer and President of the New Jersey AFA Information Chapter. Colonel Kruse's Reserve assignment has been changed to the Secretary of the Air Force's Office of Information at the Pentagon.

The Topeka Chapter's Spring Banquet was held in the Ramada Inn, Topeka, Kan., and featured a patriotic address by Thomas H. Wurtz of Denver, Colo. Shown following the meeting are, from left, Air Capital Chapter President "Clete" Pottebaum, Mrs. Pottebaum, Mr. Wurtz, Mrs. Wortham, and Topeka Chapter President Wilbur R. Wortham, Jr.

A recent meeting of the Robert H. Goddard Chapter at Vandenberg AFB, Calif., featured a presentation by Lt. Col. Don Madonna, center, Commander, 65th Tactical Weapons Squadron, Nellis AFB, Nev. After the presentation, Chapter President Bill Leary, right, assisted by Brig. Gen. Don M. Hartung, left, Commander, Space and Missile Test Center at Vandenberg, presented Colonel Madonna an artist's conception of the Space Shuttle in the landing pattern at Vandenberg AFB.

AFA News

Lt. Gen. George H. Sylvester, Commander, Aeronautical Systems Division (AFSC), was the guest speaker at a joint meeting of AFA's First Connecticut and Northern Connecticut Chapters at the Red Coach Grill in Windsor Locks, Conn. Visiting with General Sylvester, center, after the meeting are First Connecticut Chapter President James Holloway, left, and Northern Connecticut Chapter President Frank Wallace, right. More than 400 members and guests attended.

—OFFICIAL USAF PHOTO

John F. Loosbrock, Deputy Executive Director of AFA and Editor and Assistant Publisher of AIR FORCE Magazine, was the guest speaker at the annual "Bring Your Boss to Dinner" sponsored by the Junior Officer Council at Sheppard AFB, Tex. Following his presentation, Mr. Loosbrock, left, received a plaque commemorating the event from Capt. Lawrence A. Tomei, Council President.

CMSgt. Charles G. Sanders, 375th Air Base Group Senior Airman Advisor, Scott AFB, Ill., recently received an AFA Citation for initiating and supporting AFA programs benefiting the enlisted community. Scott Memorial Chapter President C. W. Scott, left, presented the citation during retirement ceremonies for Chief Sanders, center, shown being congratulated by Col. Hubert S. Diamond, right, Commander, 375th Aeromedical Airlift Wing.

CMSgt. Brian Bullen, right, Senior Enlisted Advisor to the Commander, Air Training Command, was the featured speaker at the Alamo Chapter's recent awards banquet. Following the Chief's speech, Chapter President Bill Roth, left, presented him a Chapter check for $1,000 for the Air Force Assistance Fund. Mr. Roth also presented awards to the Hon. Henry B. Gonzales, Representative from Texas; and Ed Cheviot, President and General Manager of San Antonio's KMOL-TV.

chapter and state photo gallery

William Demas, center, President, Thomas B. McGuire, Jr., Chapter, presents Maj. Gen. Thomas Sadler, second from left, Chief of the USAF Security Police, a Chapter check for $500 to be used for the new Security Police Museum at Lackland AFB, Tex. Looking on are Lt. Col. Francis Mazurkiewicz, McGuire AFB Security Police Commander; Amn. Cheryl Kostelac, second from right; and CMSgt. Lido Bertini, right.

A President George M. Douglas, the guest speaker at a recent dinner meeting the Wichita Falls Chapter, Tex., is shown presenting an AFA Medal of Merit Maj. Gen. Jerry D. Page, left, USAF (Ret.), Past President of the Chapter, Maj. Gen. Cecil E. Fox, right, Sheppard Technical Training Center mmander, looks on.

Pat Logan, Steel Valley Chapter President and Commander of the Pittsburgh Area Chapter of the American Ex-Prisoners of War, and Steel Valley Chapter Treasurer John Hickey visited the Veterans' Hospitals in Oakland and Aspinwall, Pa., during the "Salute to Veterans" sponsored by No Greater Love on February 14. Shown are, from left, Mr. Hickey; Col. Robert R. Sawhill, a prisoner in Vietnam for five years; Gordon Gravell, Pittsburgh Steelers offensive tackle; and Mr. Logan.

Outgoing Air Force Secretary Thomas C. Reed, center, the guest speaker at a March luncheon of AFA's Hawaii Chapter, visits with Gen. Louis L. Wilson, Jr., left, Commander In Chief, PACAF; and Chapter President James Dowling. More than 500 members and guests attended the meeting.

—USAF PHOTO BY BILL SETO

AFA News

Oklahoma State AFA Vice President Ted Allen, center, recently presented the State AFA's William R. Pogue Awards to Karen Sonder, left, and Janette Webb Moyer. The awards, presented during the Oklahoma State University School of Mathematical Sciences' Third Annual Awards Banquet, were in recognition of outstanding achievement in the mathematical sciences.

Anna Westbye Keeler, center, assistant to AIR FORCE Magazine's West Coast Sales Manager, was one of nine recipients of Judges' Special Award medallions at the Los Angeles YWCA's Leader Luncheon III, honoring the leadership role of women, which was held recently in the Los Angeles Bonaventure Hotel. Mrs. Keeler, shown in the photo with Mrs. Winifred R. Hessinger, right, Executive Director, YWCA of Los Angeles; and Mrs. Eloise Folley, left, was recognized for outstanding achievement in her role as Executive Coordinator of AFA's Annual Air Force Ball.

The winner of the L. G. Hanscom Chapter's annual essay contest was AFJROTC Cadet Michael Barrett, a student at North Quincy High School, Mass. Participants in the presentation ceremonies were, from left, Cadet Barrett; Col. Arthur E. Allen, USAF (Ret.), Aerospace Education Instructor at the school; Chapter Past President Joseph Scott; Chapter Photographer Felix Seligman; and the school's Headmaster, Peter Chrisom.

After presenting an AFA charter to the newly organized Airport #1 Chapter during its Charter Night Dinner, Pennsylvania State AFA President Lamar Schwartz, left, installed the Chapter's organizer and President Mike Lunardini, center, and Vice President Tony Monica, right.

chapter and state photo gallery

The Air Force Night Dinner Meeting, cosponsored annually by AFA's Tennessee Valley Chapter and the Huntsville Chapter of the Reserve Officers' Association, featured an address by Lt. Gen. Raymond B. Furlong, Commander, Air University at Maxwell AFB, Ala. Shown discussing the program are, from left, Lt. Col. James F. Patterson, Alabama ANG, President of the ROA's Huntsville Chapter and Alabama State AFA Treasurer; Col. Ralph Newman, USAF (Ret.), Aerospace Education Instructor at Butler High School; General Furlong; Tennessee Valley Chapter President Ralph Fleischman; and AFA National Director Jack Haire.

During a recent dinner sponsored by AFA's Rosendahl Chapter in the CPO Club at Lakehurst NAS, N. J., an AFA Life Membership was presented to Vice Adm. Charles E. Rosendahl, USN (Ret.), for whom the Chapter is named. Participating in the presentation are, from left, New Jersey State AFA President Len Schiff; AFA National Director Herb Fisher; Admiral Rosendahl; and Chapter President Ed O'Toole.

—PHOTO BY BOBBY CUYLER

Thirty-one trees, one for each of the Chanute AFB, Ill., Commanders from 1917 through 1977, were recently planted along a new troop walk at the base. The trees, a gift from AFA's Illini Chapter, mark the sixtieth anniversary of the base and will be dedicated following a June luncheon to be sponsored by the Chapter. Shown helping to plant one of the trees are, from left, Chapter President Kurt Schmidt; Col. Herbert Holmes, Deputy Base Commander; Chapter Treasurer Kyle Robeson; and Capt. James Alston of the Base Civil Engineering Office.

The Ak-Sar-Ben Chapter of Omaha, Neb., recently sponsored a dinner meeting at which Maj. George W. Larson, the Air Force's B-1 test pilot, was the guest speaker. During the program, a Chapter Citation of Appreciation was presented to Mrs. Anna May Mossman, personal secretary to SAC Directors of Information for twenty-eight years, on the occasion of her retirement after thirty-five years of federal service. Shown following the presentation are, from left, Col. John W. Walton, the current Director of Information; Mrs. Mossman; Chapter President Robert E. Runice, who made the presentation; and retired Maj. Gen. Alfred R. Kalberer, SAC's first Director of Information at Offutt AFB and Mrs. Mossman's first boss.

20% Dividend Declared for 1976! (To be paid June, 1977)

Dependable Protection from Y

Air Force Associatio

Important Benefits!

COVERAGE YOU CAN KEEP. Provided you apply for coverage under age 60 (see "ELIGIBILITY") your insurance may be retained at the same low group rates to age 75.

FULL TIME, WORLD WIDE PROTECTION. The policy contains no war clause, hazardous duty restriction, combat zone waiting period or geographical limitation.

DISABILITY WAIVER OF PREMIUM. If you become totally disabled at any time prior to age 60 for at least a 9-month period, your coverage will be continued in force without further payment of premiums as long as you remain disabled.

FULL CHOICE OF SETTLEMENT OPTIONS. All standard forms of settlement options, as well as special options agreed to by the insured and United of Omaha, are available to insured members.

CONVENIENT PAYMENT PLANS. Premium payments may be made by monthly government allotment (payable to Air Force Association), or direct to AFA in quarterly, annual or semi-annual installments.

DIVIDEND POLICY. AFA's primary policy is to provide maximum coverage at the lowest possible cost. Consistent with this policy, AFA has provided year end dividends (20% for 1976) to insured members in twelve of the past fifteen years, and has increased the basic amount of coverage on four separate occasions.

Additional Information

Effective Date of Your Coverage. All certificates are dated and take effect on the last day of the month in which your application for coverage is approved, and coverage runs concurrently with AFA membership. AFA Military Group Life Insurance is written in conformity with the insurance regulations of the State of Minnesota. The insurance will be provided under the group insurance policy issued by United of Omaha to the First National Bank of Minnesota as trustees of the Air Force Association Group Insurance Trust.

EXCEPTIONS: There are a few logical exceptions to this coverage. They are:
Group Life Insurance: Benefits for suicide or death from injuries intentionally self-inflicted while sane or insane will not be effective until your coverage has been in force for 12 months.

The Accidental Death Benefit and Aviation Death Benefit shall not be effective if death results: (1) From injuries intentionally self-inflicted while sane or insane, or (2) From injuries sustained while committing a felony, or (3) Either directly or indirectly from bodily or mental infirmity, poisoning or asphyxiation from carbon monoxide, or (4) During any period a member's coverage is being continued under the waiver of premium provision, or (5) From an aviation accident, either military or civilian, in which the insured was acting as pilot or crew member of the aircraft involved, except as provided under AVIATION DEATH BENEFIT.

Eligibility

All active duty personnel of the Armed Forces of the United States and members of the Ready Reserve* and National Guard* (under age 60), Armed Forces Academy cadets*, and college or university ROTC cadets* are eligible to apply for this coverage provided they are now, or become, members of the Air Force Association.

*Because of restrictions on the issuance of group insurance coverage, applications for coverage under the group program cannot be accepted from cadets or Reserve or Guard personnel residing in Florida, New York, Ohio or Texas. Members in these states may request special application forms from AFA for individual policies which provide coverage quite similar to the group program.

Please Retain This Medical Bureau Prenotification For Your Records

Information regarding your insurability will be treated as confidential. United Benefit Life Insurance Company may, however, make a brief report thereon to the Medical Information Bureau, a nonprofit membership organization of life insurance companies, which operates an information exchange on behalf of its members. If you apply to another bureau member company for life or health insurance coverage, or a claim for benefits is submitted to such a company, the Bureau, upon request, will supply such company with the information in its file.

Upon receipt of a request from you, the Bureau will arrange disclosure of any information it may have in your file. (Medical information will be disclosed only to your attending physician.) If you question the accuracy of information in the Bureau's file, you may contact the Bureau and seek a correction in accordance with the procedures set forth in the federal Fair Credit Reporting Act. The address of the Bureau's information office is P.O. Box 105, Essex Station, Boston, Mass. 02112. Phone (617) 426-3660.

United Benefit Life Insurance Company may also release information in its file to other life insurance companies to whom you may apply for life or health insurance, or to whom a claim for benefits may be submitted.

CURRENT BENEFIT TABLES

AFA Standard Plan

PREMIUM: $10 per month

Insured's Attained Age	Coverage*	Extra Accidental Death Benefit*	Total Benefit
20-24	$75,000	$12,500	$87,500
25-29	70,000	12,500	82,500
30-34	65,000	12,500	77,500
35-39	50,000	12,500	62,500
40-44	35,000	12,500	47,500
45-49	20,000	12,500	32,500
50-54	12,500	12,500	25,000
55-59	10,000	12,500	22,500
60-64	7,500	12,500	20,000
65-69	4,000	12,500	16,500
70-75	2,500	12,500	15,000

AFA High Option Plan

PREMIUM: $15 per month

Insured's Attained Age	Coverage*	Extra Accidental Death Benefit*	Total Benefit
20-24	$112,500	$12,500	$125,000
25-29	100,000	12,500	112,500
30-34	97,500	12,500	110,000
35-39	75,000	12,500	87,500
40-44	52,500	12,500	65,000
45-49	30,000	12,500	42,500
50-54	18,750	12,500	31,250
55-59	15,000	12,500	27,500
60-64	11,250	12,500	23,750
65-69	6,000	12,500	18,500
70-75	3,750	12,500	16,250

*If accidental death occurs within 13 weeks of the accident, your AFA plan pays a lump sum benefit of $12,500 *in addition to your plan's* regular coverage, *except* as noted under AVIATION DEATH BENEFIT below.

Coverage For Flyers — Aviation Death Benefit

Personnel on flying status pay the same low premium as all other insured persons. When death is caused by illness or ordinary accident, appropriate benefits shown in the table above are paid. However, when death is caused by an aviation accident *in which the insured is serving as pilot or crew member of the aircraft involved*, a total sum of $15,000 is paid under the Standard Plan, or $22,500 under the High Option Plan. Under this condition, the Aviation Death Benefit is paid in lieu of all other benefits of this coverage.

OPTIONAL FAMILY COVERAGE

(Add to either the Standard or High Option Plan)
PREMIUM: $2.50 per month

Insured's Attained Age	Coverage for Spouse	Coverage for Each Child **
20-24	$10,000	$2,000
25-29	10,000	2,000
30-34	10,000	2,000
35-39	10,000	2,000
40-44	7,500	2,000
45-49	5,000	2,000
50-54	4,000	2,000
55-59	3,000	2,000
60-64	2,500	2,000
65-69	1,500	2,000
70-75	750	2,000

**Each child, regardless of number, is provided $2,000 of coverage between the ages of six months and 21 years. Children under six months are provided with $250 protection once they are 15 days old and discharged from the hospital.

ofessional Association! Apply Now!

Military Group Life Insurance

APPLICATION FOR
AFA MILITARY GROUP LIFE INSURANCE

United of Omaha

Group Policy GLG-2625
United Benefit Life 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 Mo. Day Yr.	Height Weight	Social Security Number

Please indicate category of eligibility and branch of service.

☐ Extended Active Duty ☐ Air Force
☐ Ready Reserve or National Guard ☐ Other _____ (Branch of service)
☐ Air Force Academy ☐ _____ Academy
☐ ROTC Cadet _____
Name of college or university

Name and relationship of primary beneficiary

Name and relationship of contingent beneficiary

This insurance is available only to AFA members

☐ I enclose $10 for annual AFA membership dues (includes subscription ($9) to AIR FORCE Magazine).
☐ I am an AFA member.

Please indicate below the Mode of Payment and the Plan you elect.

HIGH OPTION PLAN		Mode of Payment	STANDARD PLAN	
Members Only	Members and Dependents		Members Only	Members and Dependents
☐ $ 15.00	☐ $ 17.50	**Monthly** government allotment. I enclose 2 months' premium to cover the period necessary for my allotment (payable to Air Force Association) to be established.	☐ $ 10.00	☐ $ 12.50
☐ $ 45.00	☐ $ 52.50	**Quarterly.** I enclose amount checked.	☐ $ 30.00	☐ $ 37.50
☐ $ 90.00	☐ $105.00	**Semiannually.** I enclose amount checked.	☐ $ 60.00	☐ $ 75.00
☐ $180.00	☐ $210.00	**Annually.** I enclose amount checked.	☐ $120.00	☐ $150.00

Names of Dependents To Be Insured	Relationship to Member	Dates of Birth Mo. Day Yr.	Height Weight

Have you or any dependents for whom you are requesting insurance ever had or received advice or treatment for: kidney disease, cancer, diabetes, respiratory disease, epilepsy, arteriosclerosis, high blood pressure, heart disease or disorder, stroke, venereal disease or tuberculosis? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance been confined to any hospital, sanitarium, asylum or similar institution in the past 5 years? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance received medical attention or surgical advice or treatment in the past 5 years or are now under treatment or using medications for any disease or disorder? Yes ☐ No ☐

IF YOU ANSWERED "YES" TO ANY OF THE ABOVE QUESTIONS, EXPLAIN FULLY including date, name, degree of recovery and name and address of doctor. (Use additional sheet of paper if necessary.)

I apply to United Benefit Life Insurance Company for insurance under the group plan issued to the First National Bank of Minneapolis as Trustee of the Air Force Association Group Insurance Trust. Information in this application, a copy of which shall be attached to and made a part of my certificate when issued, is given to obtain the plan requested and is true and complete to the best of my knowledge and belief. I agree that no insurance will be effective until a certificate has been issued and the initial premium paid.

I hereby authorize any licensed physician, medical practitioner, hospital, clinic or other medical or medically related facility, insurance company, the Medical Information Bureau or other organization, institution or person, that has any records or knowledge of me or my health, to give to the United Benefit Life Insurance Company any such information. A photographic copy of this authorization shall be as valid as the original. I hereby acknowledge that I have a copy of the Medical Information Bureau's prenotification information.

Date _____, 19 ___ _____
Member's Signature

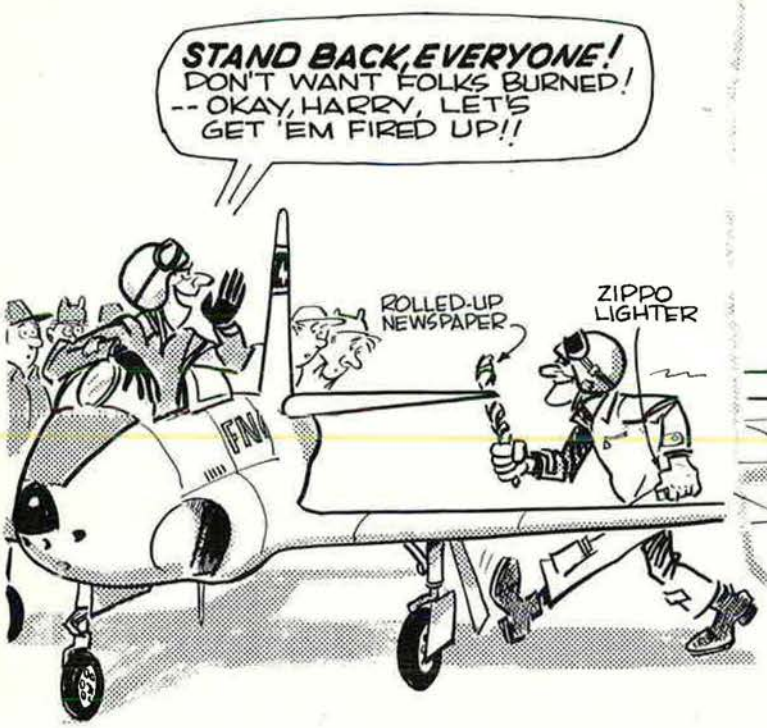
7/77
Form 3676GL App

Application must be accompanied by check or money order. Send remittance to: Insurance Division, AFA, 1750 Pennsylvania Avenue, NW, Washington, D.C. 20006

Bob Stevens'

"There I was..."

A COUPLE OF SMOLDERING BOULDERS USED TO PULL THIS ACT AT EVERY XC BASE WHERE THEY DREW A CROWD.



IN THE EARLY DAYS OF JET AIRCRAFT, THESE PROPELLERLESS MACHINES WERE VIEWED AS APPARITIONS FROM ANOTHER WORLD, and THEY STRUCK DOWNRIGHT TERROR IN THE HEARTS OF SOME TRANSIENT GROUNDCREWMEN. PILOTS, NOT UNMINDFUL OF THIS EFFECT, WERE PRONE TO TAKE CERTAIN "ADVANTAGES"...

BY "CRACKING" THE THROTTLE DURING WIND-UP, ONE COULD POOL FUEL IN THE PIPE and GET A ROARING START.

MANY THANKS TO BRG. GEN. CHUCK YEAGER, CEDAR RIDGE, CA.

Bob Stevens

ANOTHER CLOWN-WHO SHALL REMAIN NAMELESS-USED TO BEAT UP REMOTE XC REFUELING STOPS and THEN...

...AS THE TRANSIENT CREW VERY CAUTIOUSLY APPROACHED, HE'D SLIP A RUBBER HORROR MASK ON UNDER HIS P.I HELMET—

Who makes mini-RPV's that do everything in a big way?

Everybody knows the concept behind remotely-piloted vehicles: To avoid the loss of pilots and multi-million dollar aircraft.

But the trick is to make an RPV that can do the job consistently.

E-Systems has done it. And with a *mini*-RPV, no less. They don't look very fancy, but they fly very effectively. And our guidance systems are the next best thing to a pilot.

These RPV's have proven themselves with a high mission success rate. And they have a lot of flexibility with reconnaissance, jamming, deception, targeting or destructive punch.

And best of all, they're expendable.

For the systems answer to your problems, write: E-Systems, Inc., P.O. Box 6030, Dallas, Texas 75222.

E-Systems is the answer.

E-SYSTEMS

DC-10:

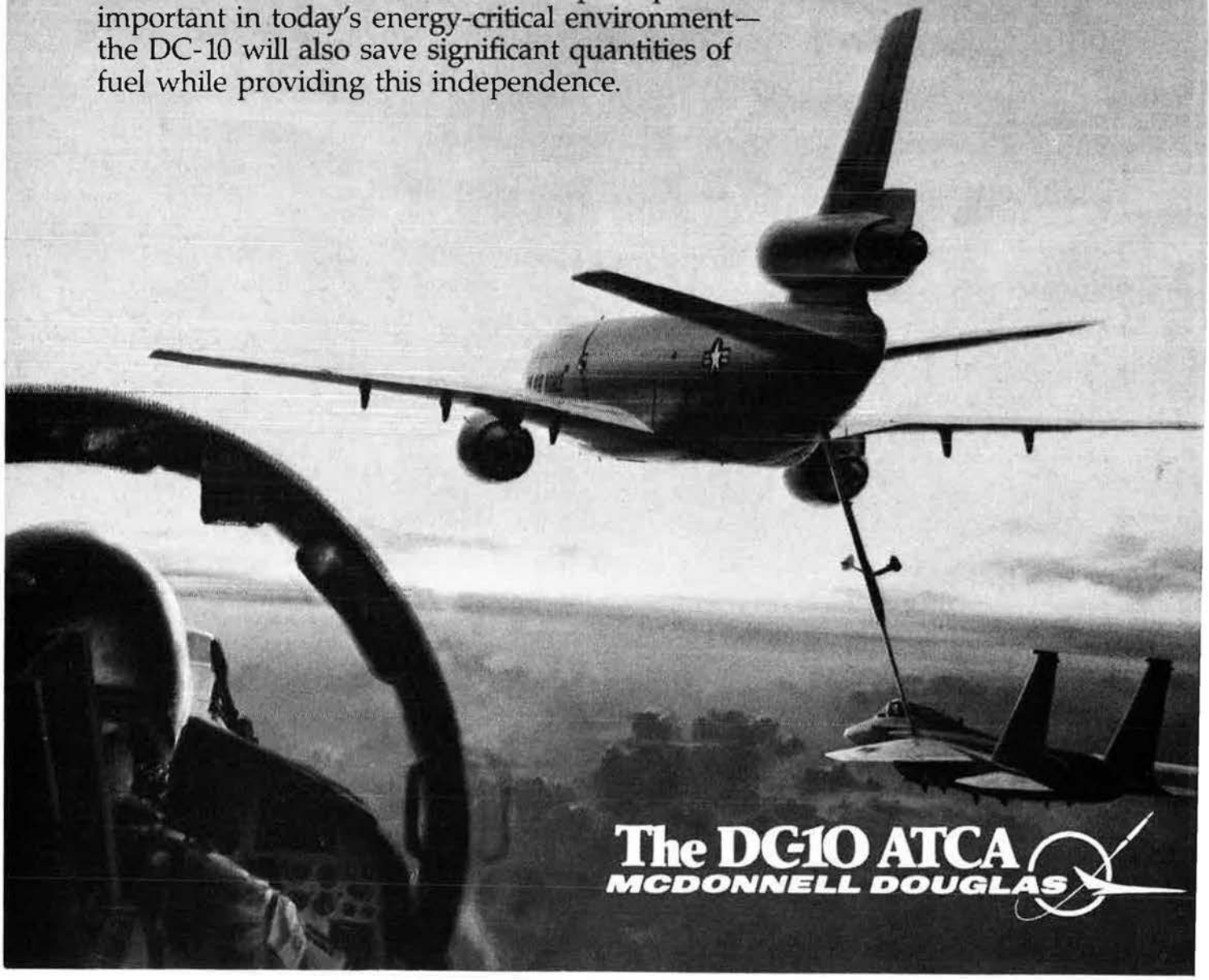
The economical way to win America's battle for "Independence."

America is faced with a challenge: to become independent of overseas refuelling bases that might be denied in time of crisis. It can't be done with today's smaller aerial tankers.

At huge savings to the taxpayer, the Air Force plans to select an existing commercial jetliner for its ATCA (Advanced Tanker/Cargo Aircraft). The research and development costs on these planes have already been paid for by private capital.

The McDonnell Douglas DC-10—the same aircraft that flies with 36 airlines around the world—is ideal for the ATCA mission.

Compared to alternative solutions, the 3-engine DC-10 offers obvious economic advantages. It costs less to buy than other wide-body jetliners. The DC-10's lower maintenance cost can yield additional savings during the service life of the aircraft. And—perhaps most important in today's energy-critical environment—the DC-10 will also save significant quantities of fuel while providing this independence.



The DC-10 ATCA
McDONNELL DOUGLAS