JULY 1979/$1

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

THE ELECTRONIC AIR FORCE

Air Force Power

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CF6-50-POWERED KC-10A ADVANCED TANKER/CARGO AIRCRAFT

CF6-50-POWERED E-4A ADVANCED AIRBORNE COMMAND POST

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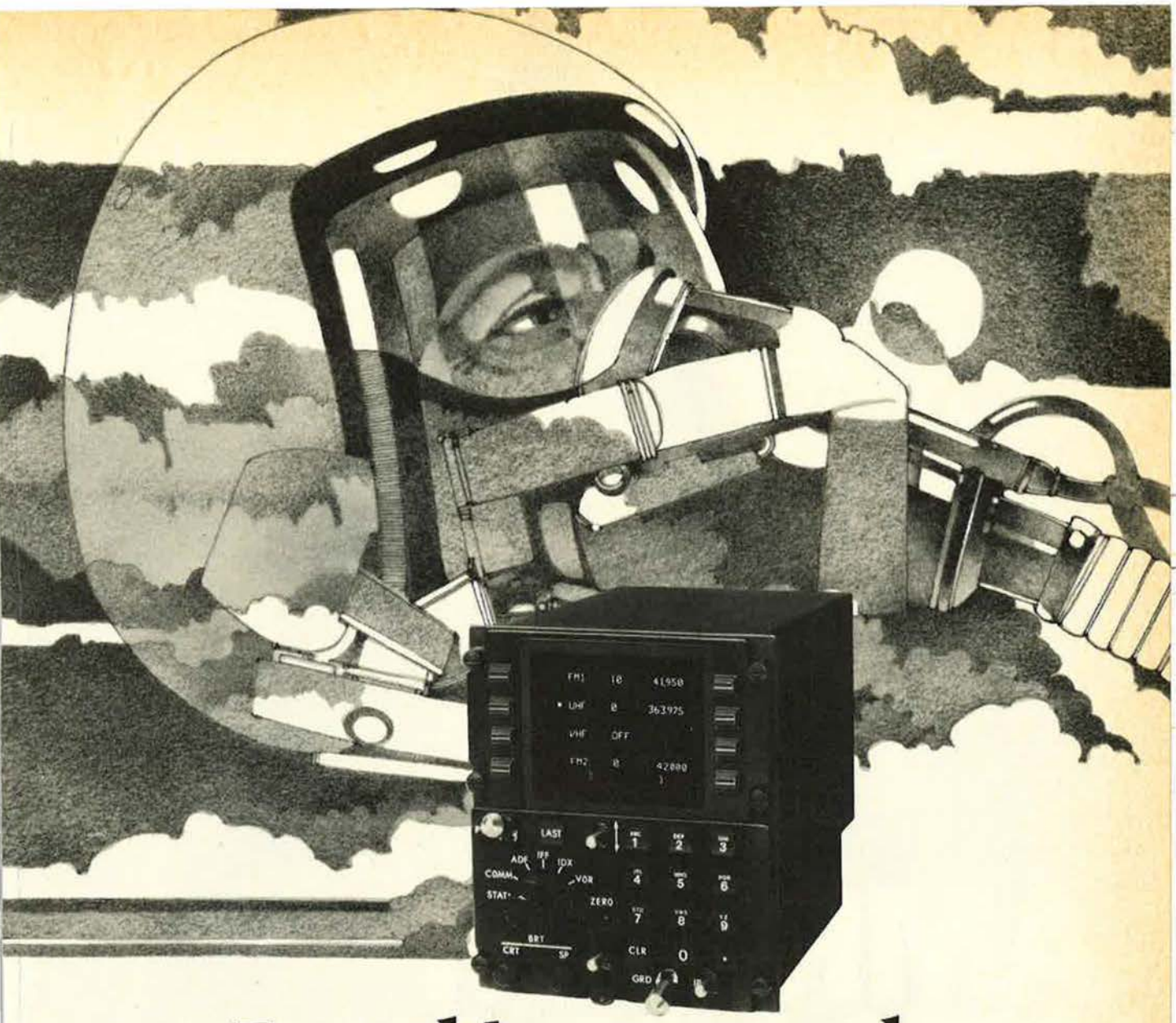
GENERAL ELECTRIC



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For details, contact Collins Government Avionics Division, Rockwell International, Cedar Rapids, Iowa 52406. 319/395-4412.

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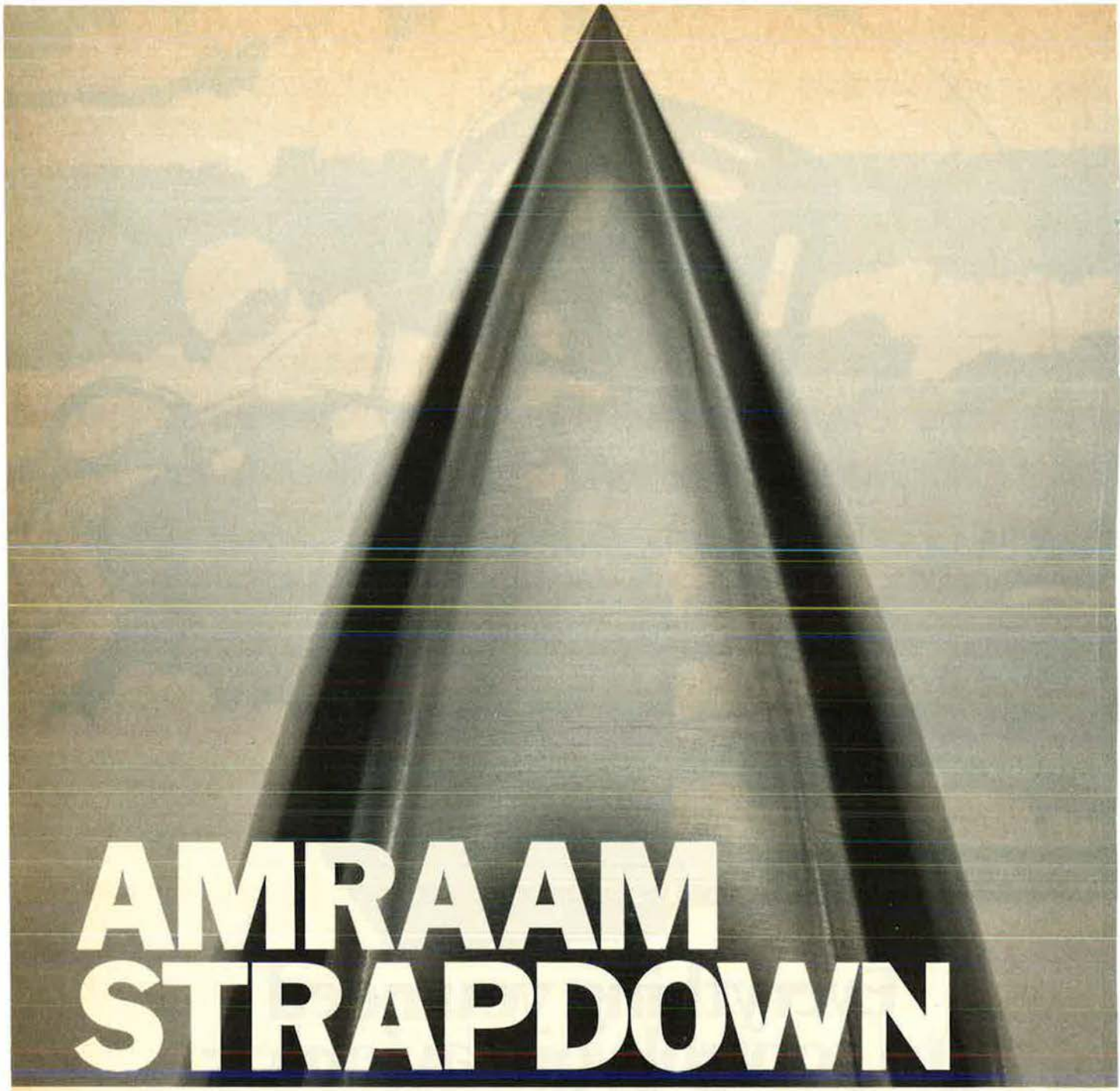

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Northrop Corporation, Precision Products Division, 100 Morse Street, Norwood, Mass. 02062.

NORTHROP

Making advanced technology work

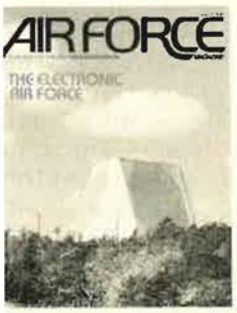
AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

JULY 1979
VOLUME 62, NUMBER 7

This Month

THE ELECTRONIC AIR FORCE

ABOUT THE COVER



The PAVE PAWS phased-array radar at Otis AFB, Mass., will soon be on guard against sea-launched ballistic missile attacks. It is illustrative of USAF's growing dependence on electronics, which, as in previous years, is the featured subject in the July issue. See section beginning on p. 36.

Departments

AIR FORCE Magazine (including SPACE DIGEST) is published monthly by the Air Force Association, Suite 400, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. **Phone:** (202) 637-3300. Second-class postage paid at Washington, D.C., and additional mailing offices. **Membership rate:** $13 per year (includes $9 for one-year subscription); $30 for three-year membership (includes $21 for subscription). **Life Membership:** $200. **Subscription rate:** $13 per year; $5 additional for foreign postage. Regular issues $1 each. Special issues (Soviet Aerospace Almanac, USAF Almanac issue, Anniversary issue, and "Military Balance" issue) $3 each. **Change of address** requires four weeks' notice. Please include mailing label. Publisher assumes no responsibility for unsolicited material.

(USPS 010-280)

BPA Circulation audited by Business Publication Audit

AN EDITORIAL

Detect, Project, Deter

MILITARY theory and practice in today's nuclear-armed, superpower world bears some striking similarities to the political use of military force as practiced by the city-states of the Italian peninsula during the fifteenth century. The period has been virtually ignored by military historians, probably because it contributed so little to the development of tactics and organization by other European armies of the day.

The armies of the Italian princes were designed around heavy cavalry, not particularly suited to combat in the peculiar environment of the peninsula and inordinately expensive by fifteenth century standards. At the same time, the small Italian states were almost constantly involved in disputes and conflicts of interest where force or the threat of force could provide persuasive political leverage.

Warfare in that time and place was relatively bloodless. Armies were too expensive to risk on anything but a sure bet; defeat in the field could mean bankruptcy or extinction, sometimes both. So military engagements tended to be somewhat like chess matches—intricate maneuvers that frequently ended in a draw without a shot fired, or in negotiations.

The target of a commander was as much his opponent's perception of relative abilities to detect a maneuver and project forces to block it as it was the opponent's troops themselves. Detection and projection were the keys to success at an affordable cost.

This risk-cost-gain calculus worked well enough so long as everyone played more or less by the same rules. But in 1494, Charles VIII of France invaded Naples with a professional army. The mercenary *condottièri* had no stomach to fight such a force to the finish. The city-state structure rapidly deteriorated, and Italy became a battleground for French, Spanish, and Austrian invaders. It was as much a failure of will as a failure of arms.

In a sense, the military environment of fifteenth century Italy was a microcosm of our nuclear-armed world. Military force remains the ultimate political weapon, but a weapon that, because of its destructive potential, can be used politically only with extreme caution, when the vital interests of either superpower are at stake. The intricate maneuvering of forces now is more likely to occur in a computer than in the field, but the result may be the same—a decision by one opponent or the other to continue what he is doing, to desist, or to negotiate.

Perceptions of the opponent's ability to detect a threat and project forces that are qualitatively or quantitatively superior probably kept the USSR from sending troops t Korea. Similar perceptions certainly dissuaded th NATO allies from intervening in the Hungarian revolt c 1956, the Soviets from continuing to place missiles i Cuba, and Russia from reinforcing the Arab armie during the Yom Kippur War.

The supreme test of our ability to continue using mil tary power successfully (that is, without actually figh ing) as an instrument of policy lies in the years ahead when we probably are destined to permanent numerica inferiority in military manpower and weapons. Deterrin either a direct threat to this country or infringement o our vital external interests will rest increasingly on hov the USSR perceives US technical capabilities i strategic and tactical intelligence and in the ability t project and control forces.

This is true both in the relatively simple field c strategic nuclear warfare and in the nightmarishly com plicated business of coalition theater warfare. For th latter arena, success (deterrence) depends on th Soviet Union's tacit acknowledgment of US superiorit in managing vast quantities of information intelligentl in near-real time, and in projecting and controllin forces during a conflict that would be characterized b unprecedented density of equipment and rapidity c movement.

Detection and projection, looked at in broad terms are totally dependent on electronics. The importance o that technology is reflected in the DoD budget, abou twenty percent of which goes for R&D, procurement, and operation of electronic equipment. And, fortunately, th US does have a significant lead over the USSR in elec tronic technology.

It is no exaggeration to say that the electronic industr of this country is a national asset of unsurpassed im portance. One of the major challenges facing the Ai Force, as pointed out by Col. Robert Ziernicki on p. 67 c this issue, is to help maintain US superiority by de veloping an electronic systems engineering capacit that will support and encourage the electronic industr in doing what it does best—"innovate, trade off, and de sign for production."

If we fail to hold our lead in electronics, it will be, as i the case of the Italian states, a failure of will—which is t say, a failure in the strength, wisdom, and quality of na tional leadership. It will not be for lack of technical com petence.

—JOHN L. FRISBEE, EDITOR

The U.S. Air Force asked for uncommonly high performance

and they got it.

Selected by the U.S. Air Force, Teledyne Ryan's AN/APN-218 Common Strategic Doppler Navigation System brings major advances in performance and reliability to the high, vast regions flown by SAC's B-52 and KC-135 aircraft.

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Built for the long haul, the Teledyne Ryan Common Strategic Doppler Navigation System will do all that is asked of it in the high, cold world that is SAC country.

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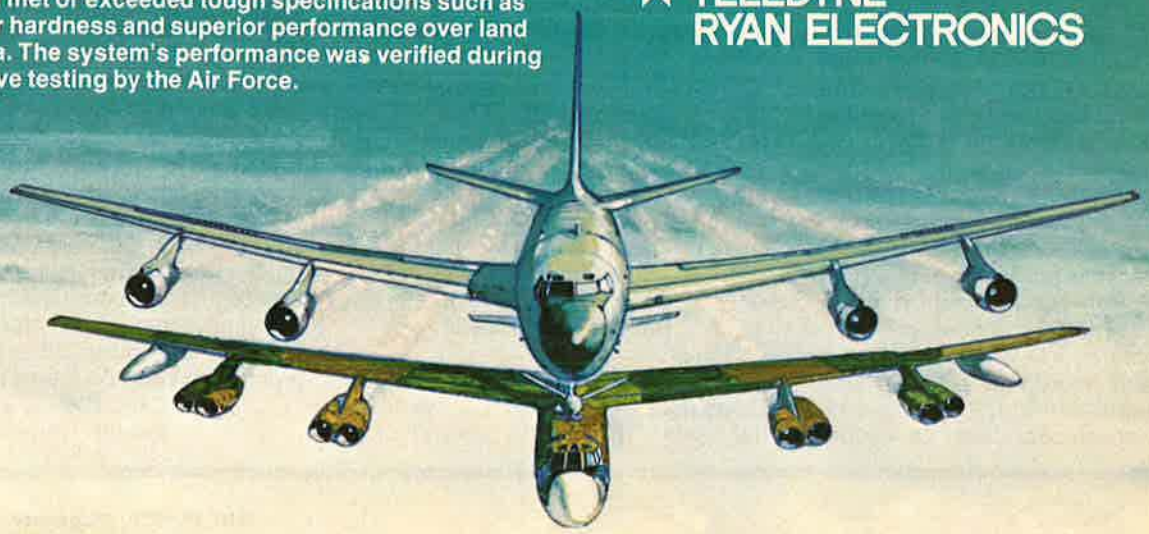

Airmail

Note of Thanks

Just a note to thank you for Edgar Ulsamer's excellent article ["No Substitutes for Military Preparedness"] in the AIR FORCE Magazine '79 Almanac. He did an outstanding job of capturing my thoughts and opinions.

As always, the Almanac is superb.

Gen. David C. Jones
Chairman
Joint Chiefs of Staff
Washington, D. C.

What's More Important?

JCS Chairman General Jones and General Milton (May issue) both discuss reinstitution of the draft without ever mentioning involuntary servitude. It would seem that when you consider sending out the modern equivalent of press gangs, at least you should admit that they *are* press gangs.

An alternative still open to the Congress is providing adequate pay to the military—pay which assures both quality and quantity. Since the DoD budget continues at well under a quarter of the federal budget, while budgeting for indirect purchase of votes exceeds fifty percent, transfer of a few billion dollars into DoD's budget should not be difficult. Unless, of course, a majority of Congress considers buying votes to be of more importance than national security. If that is the case, then we really *do* have a problem.

Maj. John H. O'Brien, USAF (Ret.)
Carthage, N. C.

More Ups-or-Outs

Ed Gates's article in the April issue, "Putting Up-Or-Out in Perspective," presents a very misleading statistic. To say "Even based on almost 1,000 such separations annually, the force-out rate is about one percent of the 95,000-member officer force, not the massive exodus some quarters would suggest," is to ignore the fact that the great majority of the 95,000 officers in the Air Force are not exposed to separation as a result of nonselection for promotion every year. It is senseless to compare a six-year captain or a twenty-four-year permanent lieutenant colonel, who have an attrition rate of zero as a result of nonselection, with an eleven-year captain, who can anticipate that ten to fifteen percent of his year group will be forced out because of nonselection for major.

A more meaningful formulation would be to determine what percentage the 1,000 who are forced out every year represent of the total who were considered for promotion in that year. This percentage will obviously be much greater than one percent.

Bernard H. Friedman
Riverside, Calif.

Having gone through the unpleasant experience of a promotion pass-over and involuntary separation myself, I found Ed Gates's article to be especially informative.

Mr. Gates touched too briefly on a valuable personnel resource that the Air Force is poorly managing; namely, dual-status members (enlisted and EAD who hold a Reserve commission).

Illogically, officers who were selected out in reductions in force are eligible to apply for the Reserve Recall program, but not those who were passed over for promotion and reenlisted. It is manifestly unfair to recall Reserve officers who were not even good enough to reach O-4 promotion consideration and exclude those who survived a select-out screening, but could not be promoted.

Recalling dual-status members in their commissioned grade would have many credible advantages:

1. Enlarge the pool of eligibles from which to draw.

2. Utilization of those with experience and training in multiple skills at both technical and managerial levels.

3. Effective use of those with proven loyalty and adaptability. The Air Force will continue approximately 100 selected officers who will be passed over by the forthcoming June 4 temporary majors' board. Would those selected for continuation have made the same choice if they had to serve until retirement as enlisted?

TSgt. James A. Bailey, USAF
(Captain, USAFR)
Hickam AFB, Hawaii

In the first few lines of his article, Ed Gates uses the phrase ". . . wide of the mark" to refer to several criticisms of the up-or-out system as presently stands. In fact, however, it i the article and not the comments tha miss the point.

Consider: If an officer is to serv thirty years on active duty, he mus achieve the rank of colonel. Curren proposed changes to retirement pro grams are being designed to encour age Air Force members to serve thirt years before retiring. Promotio quotas/actual percentages promote to captain, major, lieutenant colonel and colonel, are ninety-five percent eighty percent, seventy percent, an fifty percent respectively.

Now, to put Mr. Gates's commen ". . . the force-out rate is about on percent . . . not the massive exodu some quarters would suggest" int perspective, consider the percentag of new second lieutenants that will b able to serve the thirty years to retire ment under the up-or-out system: .9 × .80 × .70 × .50 = .266, or twenty seven percent of newly commis sioned officers will pass all screenin points to a thirty-year career. On th other hand, seventy-three percent wi be forced out of the service befor serving thirty years. Some will b forced out before they are even eligi ble for retirement.

The reason why the up-or-out sys tem is under fire is clear. The syster needs to be changed. But the Ai Force needs to retain some personne procedures to eliminate dead woo and keep promotion competitive. minimum standards can be de veloped, those who fail to meet thes standards can be eliminated. Perhap a limited-year contract with screenin to take place before continuation i possible.

To keep promotions competitive i might be feasible to allow individua officers the opportunity to decid when their records should go before promotion board, with some con straints established by the Air Force For promotion to major, captain could be given two board consid erations. The officers would deter mine when they felt their best promo tional chances existed and reques that their records be forwarded fo consideration.

The Air Force could impose re strictions such that consideration coul not be requested before the tenth year c service and both consideration request would have to be used before the twen tieth year of service. Other grade-leve promotions could be based similarly.

Capt. Wesley J. Johnsto
Dublin, Ohio

.ife at the Academy

recently read Gen. T. R. Milton's arti-le "The Air Force Academy: A Fine Twenty-five Years," in the April issue, and was touched, to say the least. Unlike the vast majority of articles appearing in periodicals (both pro and con), General Milton provided readers with a keen, unbiased, inside view that so few are able to do. At first reading I *knew* he was a recent USAFA graduate, like myself. When I learned that he was a '40 grad from the Point, I was even more impressed . . . both with his credentials (of course) and his research and insight. Academy life is unimaginable to the average outsider . . . but his article should enlighten all who read it.

2d Lt. Mark C. Ward
Luke AFB, Ariz.

just finished reading General Mil-on's article and would like to thank im for making my flight back from kinawa more enjoyable. I look for-ard to reading many more of his ar-cles and am sorry I've missed past nes.

The article was of particular inter-st due to the fact that this flight today arks my first leg of a trip which will erminate at Colorado Springs. I will e entering the June freshmen lass. . . .

I have just ended a wonderful and ducational seven-month tour serv-g as an F-4C crew chief in the 67th MV. My enlisted experiences were ery enlightening, and I wish that ore of the cadet wing could have ad a chance to experience a little of ose I have. I saw a lot of apathy in e low ranks of the enlisted force and ealize the great importance of having spiring individuals in the higher anks of enlisted personnel and in the fficer ranks. I just hope attendance t the Academy doesn't dampen my pirit, but will help create the blocks ith which my life's path will be aved.

A1C Francesca J. Nasjleti
Oak Park, Ill.

Doctors' Dilemma

t. Col. Vernon P. Wagner's letter in e April issue contains the most intel-gent idea in the history of military edicine—that of forming a distinct edical service separate from the mil-ary. In fact, this can be done by a imple expansion of the US Public lealth Service, which already cares or the US Coast Guard and the dying S Merchant Marines. In this way ere would be no need for a new overnment agency of any type, and think of the potential savings there!

Colonel Wagner's complaints are valid and I suffered similar frustrations and disappointments when serving as a flight surgeon. . . . I can remember being medical officer of the day on call for a major Air Force facility and noticing a regular surge of patients, both military and their dependents, at 2100 hours every evening. After asking these late patients why they were coming in at this hour, I was informed it was because the base PX closed at 2100 hours and they were coming in after doing their shopping! These patients would have been better off coming in during regular daytime hours because they would have had full staffing of the infirmary and would not be forced to be attended by personnel who were tired from having done a full day's work already. The military expected the physicians to work a thirty-six hour shift. However, if a pilot were asked to work beyond his twelve-hour duty time he would give a very negative response. . . .

This late-hour sick call, and other abuses of the medical personnel by the military personnel and their dependents is very demoralizing to the medical personnel, and for me there was very little hesitancy in deciding to leave the service when my two years' time was up. Each time a recruiting ad comes to me from one of the services I remember these abuses and throw the ad in the wastebasket, unopened and unread.

A separate medical service not subject to these abuses would go a long way in easing the current crisis of medical care in the services and would make this type of medical practice much more attractive to physicians and paramedical personnel. It would eliminate a lot of unnecessary aggravation and frustrations now being experienced by the medical personnel in the various armed forces.

Bruce D. Powell, M. D.
Spokane, Wash.

AFROTC's ADCOs

Initial reading of Capt. Charles G. Tucker's article, "AFROTC's New Look" (January '79), had me charged for one of those fire-breathin' replies. Second thoughts, and the fact that I'm no longer in that business, made me sit back and wait for indigenous types to fire back. Not only were none forthcoming (at least none was printed in your "Airmail" column), but now I have received a reprinted copy of that article via my Association as a Liaison Officer. The time has come to act!

The article presents a well-researched status report on the AFROTC's current situation. What's particularly galling is the notable omission—in this article as well as a similar earlier article (circa 1975) on AFROTC, plus the lauding of USAFA Liaison Officers (circa 1977) and AFROTC Liaison Officers (boxed article, p. 71, January '79)—of what I consider the "leading edge" of AFROTC recruiting efforts: AFROTC Admission Counselors. This small (approximately thirty-two) cadre of active-duty Air Force officers has been assigned the full-time primary duty of developing interest in and applicants for the national AFROTC program. A casual reference to any subject regarding AFROTC and its present situation is incomplete without acknowledging the Admission Counselors' existence and contributions.

Check with Lt. Col. Larry Lyon at AFROTC Headquarters on these personnel—he was an ADCO himself once. Better yet, find out where they're stationed and, with camera crew in hand, follow one around on a "typical" twelve-to-sixteen-hour day.

Maj. Victor J. Bliden
Abilene, Tex.

That Old-Time Crew Chief

Having read the letter in the April issue written by Lt. Col. Wallace H. Little . . . it is apparent to me that he has no concept of what an old-time crew chief was. (Note that I say *was*.) The crew chief of today, through no fault of his own, but because he is not trained to the degree of the old-time crew chief, cannot function as one should. The old-time crew chief could, and did, do any job required on his aircraft in a minimum of time with the maximum efficiency.

Please spare me and don't tell me how complicated aircraft have become. Communications and radar notwithstanding, aircraft systems have not changed. It's the same old hydraulic system, AC and DC electric system, autosyn instrument system, airplane general, etc. Flight controls are now electrohydraulically operated. But so what? Today the job that one old-time crew chief used to do requires half a dozen or more

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 interest of space or good taste. Names will be withheld on request, but unsigned letters are not acceptable.

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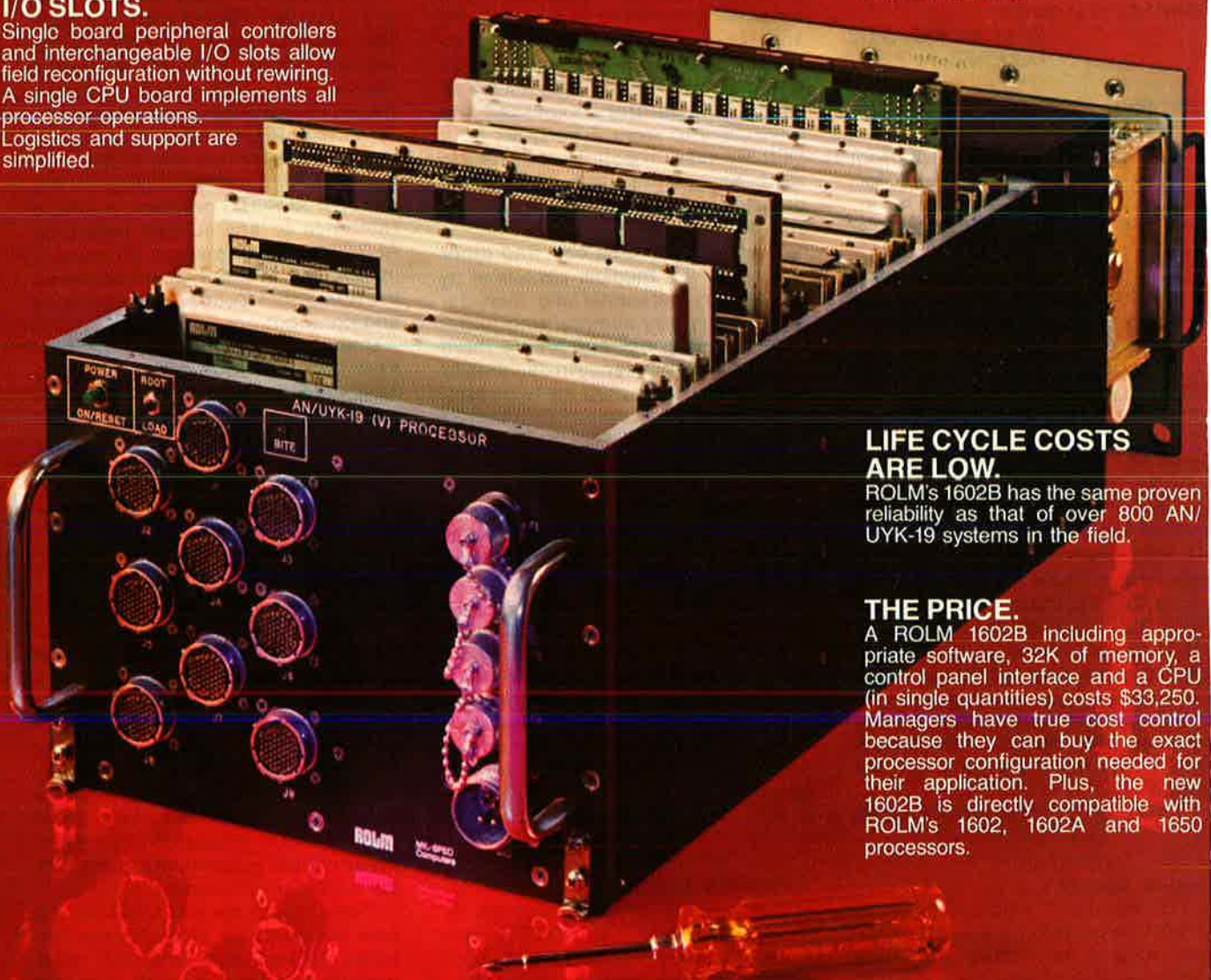

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Airmail

specialists over a longer period of ime. As an old-time crew chief, now n production control, with thirty-eight years of experience, I say bring back the crew-chief system, but first bring back the old-time crew chief.

SMSgt. William H. Jensen
Otis AFB, Mass.

Endangered Species

The article titled "The Saga of *Shoo Shoo Baby*" [April issue] was interesting and yet a little sad. To think that an airplane that was produced by the thousands and that played such a big role in the winning of a war is now all but extinct does strike a sad note.

I grew up in Seattle and can remember the B-17s at the Boeing Co. during World War II. By the time I entered the Air Force the B-17s were gone and the B-47 was entering the inventory. But I do recall seeing a few B-17s in various places throughout the world during my active-duty years.

The article said that *Shoo Shoo Baby* may be the last existing G version. It seems to me that setting somewhere along US 99 in the Fresno, Calif., area is a G-model B-17. Can this be verified by any readers of AIR FORCE Magazine?

Col. William J. Schwehm, USAF (Ret.)
Tacoma, Wash.

Updating Alumni List

The Lewis C. Ellis, Jr., Squadron of the Arnold Air Society is preparing an updated list of alumni members. Please send us current information. If on active duty, please indicate rank, duty, and address. For others, occupation and home address would be appreciated, together with year of graduation.

Lewis C. Ellis, Jr., Sqdn.
Attn: Cadet Gary Fox
AFROTC Det. 820
Texas Tech. University
Lubbock, Tex. 79409

510th TFS Reactivated

The 510th Tactical Fighter Squadron was recently reactivated at RAF Bentwaters, United Kingdom. The squadron is now flying the A-10 Thunderbolt II close air support aircraft.

We, the latest members of the 510th TFS, are interested in learning more about our history. We would greatly appreciate pictures, memorabilia, etc., from previous members of the squadron.

Lt. Col. Howard T. Moss
Commander
510th TFS (USAFE)
APO New York 09755

TAPS

Readers will remember the poignant letter entitled "Final Fly-By" from MSgt. Pryor L. Fair, USAF (Ret.), which appeared in our June issue. While the issue was on press, our office received word from the Director of Communications, The Air Force Enlisted Widows Home Foundation, that Sergeant Fair passed away May 21.—THE EDITORS

106th Bomb Group

I am writing a human interest story on the 106th Bomb Group. Am particularly interested in locating Col. Eugene Rovegno, assigned to Bolling AFB after WW II. Rovegno was host to a reunion of members of this group in 1947, at which plans were made to formally organize an association of the group.

This was a history-making unit, so any information on the 106th would be most appreciated.

Mary Ella MacDonald
234 S. Water St.
Martinsburg, W. Va. 25401

SE-5E Logbook

I am most anxious to obtain logbook extracts for a service history of AS 22-296, the last airworthy SE-5E. Retired from the Army in 1927, 22-296 had quite an astonishing career in the motion-picture business. It received the civil registration N4488 in 1927 and, as far as I can tell, it is the oldest listing still current.

Any assistance will be greatly appreciated.

John Underwood
2054 W. Mountain
Glendale, Calif. 91201

UNIT REUNIONS

AACS
3d reunion of AACS (originally known as Army Airways Communications System, later becoming Airways and Air Communications Service), September 28–30, Colorado Springs, Colo. **Contact:** John H. Hoff, Jr., 2435 N. Meade, Colorado Springs, Colo. 80907.

CBI Hump Pilots
China-Burma-India Hump Pilots Association, 34th annual reunion, September 12–17, Arizona Biltmore, P. O. Box 2290, Phoenix, Ariz. 85002. **Contact:** Mrs. Jan Thies, Executive Secretary, 808 Lester St., Poplar Bluff, Mo. 63901. Phone: (314) 785-2420.

Eagle Squadrons
National reunion and book preview, August 16–19, Town and Country Hotel, San Diego, Calif. **Contact:** Reade Tilley, 921 Greenstar Dr., #702, Colorado Springs, Colo. 80906. Phone: (303) 635-5150.

Glider Pilots
9th annual reunion, National WW II Glider Pilots Association, September 20–22, Hotel Anatole, Dallas, Tex. **Contact:** Ginny Randolph, Reunion Secretary, 136 W. Main St., Freehold, N. J. 07728.

Liberal Army Air Field
September 21–23. Includes students; permanent party, commissioned and enlisted; civilian personnel. **Contact:** Eugene W. Slaymaker, Chairman Invitations, Box 1356, Liberal, Kan.

Sherman Field
2d reunion, all 3d Staff Squadron members stationed at Sherman Field, Fort Leavenworth, Kan., during WW II, and members of units stationed there after the war until its deactivation in 1953 invited. September 15–16, at Fort Leavenworth. **Contact:** Roscoe and Marilyn Swenson, 2053 Highland Ave., Salina, Kan. 67401.

4th Fighter Sqdn., 52d Fighter Gp.
September 14–15, Plaza Hotel, Buena Park, Calif. **Contact:** Fred K. Durni, 1641 S. Pomona Ave., Fullerton, Calif. 92632. Phone: (714) 879-9953.

13th Troop Carrier Squadron
AAC, South Pacific. August, in Columbus, Ohio. **Contact:** Dom Finelli, 1027 Bell Ave., Yeadon, Pa. 19050. Phone: (215) 259-6808.

28th Bomb Wing
September 6–9, Rapid City, S. D. First reunion in more than thirty years. Trying to locate all assigned and supporting units, Ellsworth AFB, S. D., such as Air Base Support Group, Civil Engineering, Hospital, AACS, AWS personnel, and members who were assigned from 1947 to 1957 to include B-29, B-36, and early B-52 conversion days. **Contact:** Albert A. Kopp, 914 Joy Ave., Rapid City, S. D. 57701, or Deane Curry, Rt. 8, Box 511, Rapid City, S. D. 57701.

Class 47-C
"Guinea Pigs," July 26–29, at Frontier Days, Cheyenne, Wyo. **Contact:** Bob Campion, P. O. Box 1830, Richardson, Tex. 75080.

64th Troop Carrier Group
September 28–30, Peach Tree Plaza Hotel,

CAN YOU SPO
(C) HAVE I

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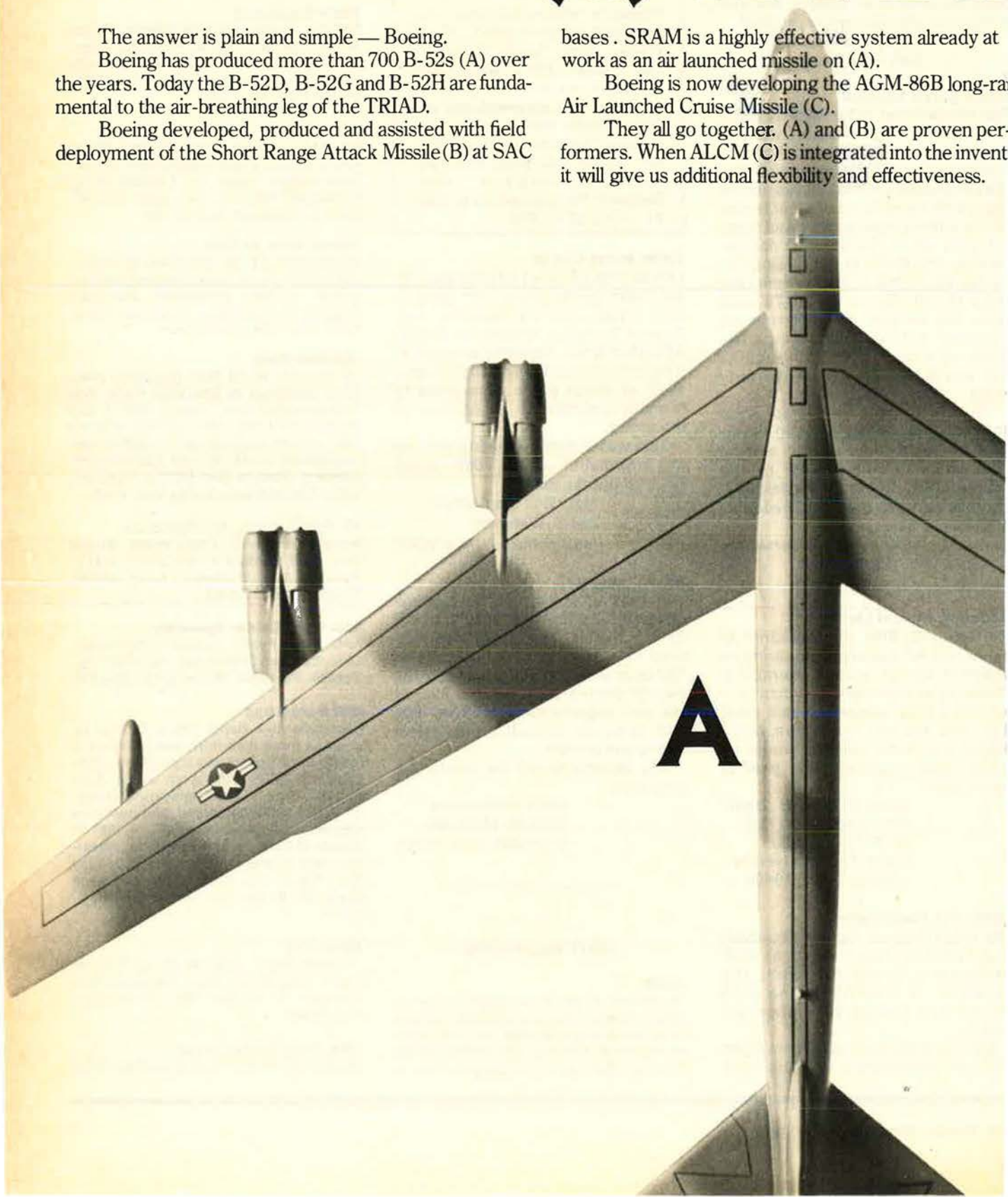
They all go together. (A) and (B) are proven per formers. When ALCM (C) is integrated into the invent it will give us additional flexibility and effectiveness.



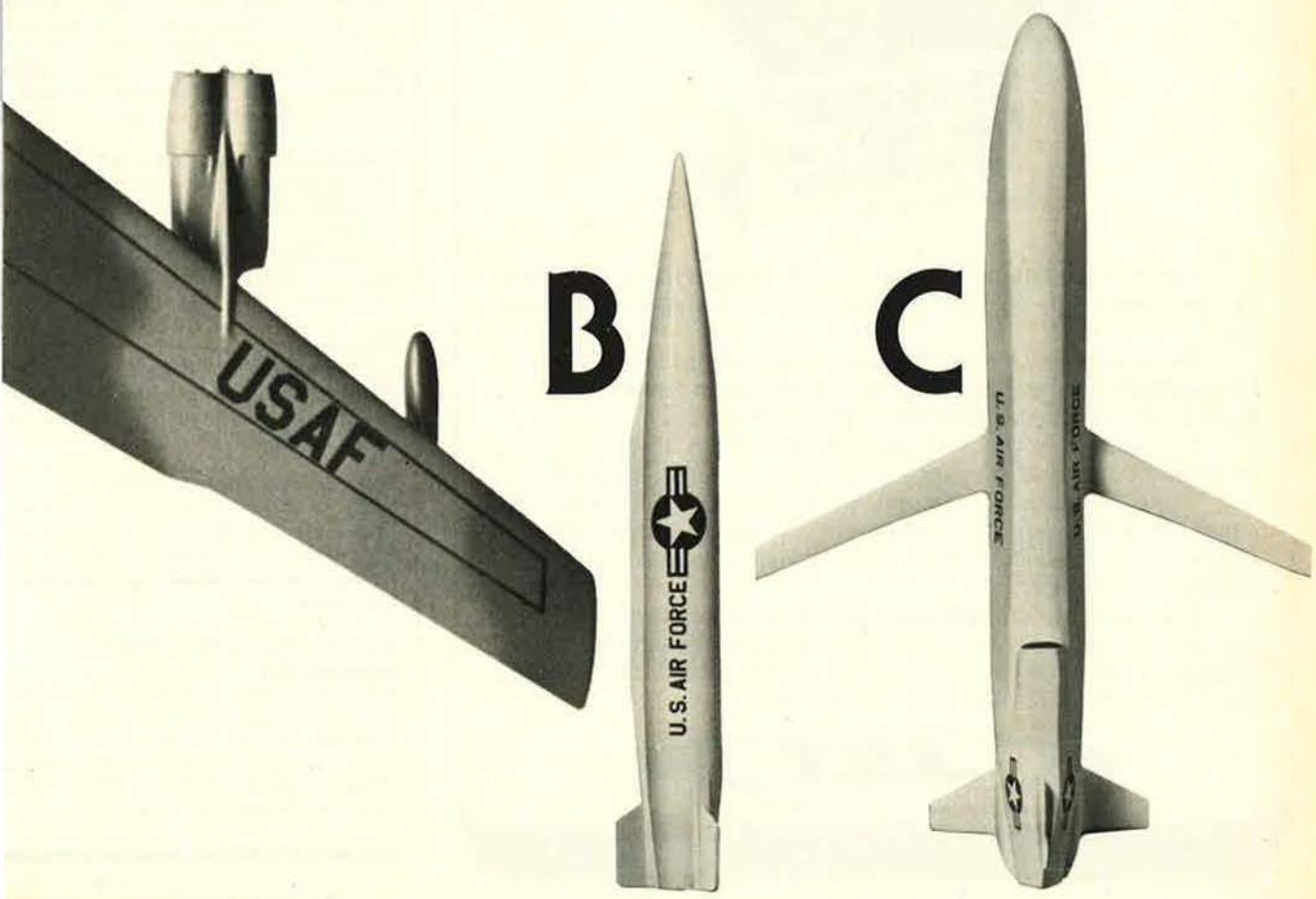
WHAT (A), (B) AND COMMON?

ALCM is more than an air launched missile that flies target with pinpoint accuracy. It's a system of aircraft, pport equipment, people, technical data and, of course, ssile, designed to help B-52s destroy a wide variety of rgets. All this has been tested in flights of the shorter-nge ALCM-A during the ALCM advanced development ogram.

Result: The specifications were met or bettered.

The experienced Boeing team now at work on the ALCM program is an unparalleled resource in the development and fabrication of air launched strategic missiles.

One thing for sure, if anybody is going to put it together right, (A), (B) and (C), it's Boeing.



Airmail

Atlanta, Ga. **Contact:** Roger Coleson, Box 205G, Nanjemoy, Md. 20662.

96th Bomb Group (H)
All former members, September 13–16, Marriott Hotel, O'Hare Field, Chicago, Ill. **Contact:** Robert W. Owens, 96th BG (H) Memorial Association, 900 S. Western Ave. 2-R, Chicago, Ill. 60612.

323d Bomb Gp. (M), 453d Bomb Sqdn.
"White-Tailed Marauders." The 453d's 11th reunion, September 28–30, Clearwater, Fla. All B-36ers invited. **Contact:** F. J. Mingus, 1806 East Drive, Clearwater, Fla. 33515, or Frank Brewer, P. O. Box 5973, Birmingham, Ala. 35209.

345th Bomb Group (M)
September 7–8. Former members of 500th Bomb Squadron, 345th Bomb Group **Contact:** Wm. J. Cavoli, 4314 Planters Court, Annandale, Va. 22003. Phone: (703) 790-1877 (office); (703) 978-3830 (home).

362d Fighter Group, 9th AF
10th reunion, September 17–22, Pittsburgh, Pa. **Contact:** Bill Marles, 2838 Blue Brick Dr., Nashville, Tenn. 37214. Phone: (615) 883-1208.

381st Bomb Group (H)
The 381st, based at Ridgewell, England 1943–45, has formed a Memorial Association. The 2d reunion, apart from the 8th AF will be September 21–23, Dayton, Ohio. **Contact:** T. Paxton Sherwood, 515 Woodland View Dr., York, Pa. 17402.

397th Bomb Group (M), 9th AF
"Bridge Buster" B-26 Marauders, including 596th, 597th, 598th, 599th Bomb Squadrons, 4th reunion, September 27–30, Colorado Springs, Colo. **Contact:** Nevin F. Price, P. O. Box 1786, Rockville, Md. 20853.

671st Bomb Sqdn. Ass'n
September 21–23, Howard Johnson's Hawaiian Village, Cincinnati, Ohio. **Contact:** George Marashian, 56 Highland St. Milford, Mass. 01757.

806th Medical Air Evac Sqdn.
ETO, 1943–45, on September 27–29 Charleston, S. C. All former members and friends invited. **Contact:** Mrs. R. W. Simpson, 2716 Pencoyd Lane, Charlotte N. C. 28210.

910th Tac Fighter Gp., 757th Tac Fighter Sqdn.
22d anniversary. September 8, Youngstown Air Reserve Base, Vienna, Ohio **Contact:** SMSgt. Ronald Aaron, 910th TFG, Youngstown MAP, Ohio 44473 Phone: (216) 856-1645, ext. 369, or TSgt Matthew Lawrence, ext. 250.

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In Focus...

BY EDGAR ULSAMER, SENIOR EDITOR

Washington, D. C., June 4

More Gyrations Over MX Decision

The Administration's zigzagging, foot-dragging policy on MX is causing intense concern and frustration in Congress. The view is widely held that the White House is engaging in a "technological filibuster" to gain leverage on SALT II ratification, even though its long-term intent may be discontinuance of the program after the Senate has voted on the treaty. Sen. John Glenn (D-Ohio), for instance, has charged that the Administration treats MX "as a bargaining chip to attract votes for the treaty."

While Congress is in no position to assure that the MX program will be completed—a process that would continue beyond 1986—both houses are attempting to force the Administration to enter a survivably based MX into full-scale development immediately. If the House and Senate can agree on joint language—considered likely at this writing—continued vacillation by the Administration would place its principals in a position of contempt of Congress.

While senior Defense officials claim the President's decision may be weeks or even more than a month away, it is likely, nevertheless, that at least a "token" decision will be announced before Mr. Carter signs SALT II in mid-June.

Secretary of Defense Harold Brown, speaking at the US Naval Academy on May 30, hinted that studies of several basing modes and of two different missile types are continuing. Other senior Defense officials who cannot be identified told this column that Secretary Brown will brief the President on the full range of options for MX, with the final selection up to Mr. Carter.

However, the President is known to oppose MPS, the MX basing mode favored by the Air Force and presumably the Joint Chiefs of Staff. MPS, or multiple protective structure, is a deployment technique whereby a single MX would be positioned in a complex of twenty or more hardened vertical shelters. Only one of the shelters would house an MX ICBM, but advanced technical means, such as simulation and decoys, would prevent a potential attacker from finding out which holds the MX at a given time.

The merits of MPS, in the Air Force view, extend from high survivability and great cost-effectiveness to strategic stability and compatibility with future SALT agreements that might limit further the permitted number of ICBMs. Opposition centers on three factors. One involves the belated recognition by the Administration that it accepted a SALT II provision that places the legality of MPS in question. Until recently, senior Administration officials asserted that the US SALT negotiators repeatedly had informed the Soviets that US considered MPS compatible with the treaty and that this country would not be swayed by a different interpretation on the part of the USSR (which was not long in coming).

Second, it is ironic that this "unilateral" US declaration concerning MPS cuts both ways and probably empowers the Soviet Union to deploy such a system even if the US decides on another basing mode. In light of this fact, which senior Defense officials accept, it becomes difficult to subscribe to the Administration's new logic that a Soviet MPS would increase Moscow's opportunities for "cheating" and that the US, therefore, should not deploy MX in the MPS basing mode. Defense officials claim the US would not permit the Soviets to base their ICBMs in a mode less verifiable than whatever basing the US picks. Whether this reasoning is amenable to the Soviets can be questioned.

The third case against MPS hinges on the hypothetical question of what happens if the Soviets breach US security and *do* find out which shelters house the MX missile. If that question deserves practical consideration—rigorous USAF studies rated the possibility as essentially inconceivable—a variant of the Air Force's often-studied trench-based MX becomes attractive. Known officially as the track-mobile trench concept, but usually called the "zippered," or "sun-roof" trench, this basing mode envisions each MX deployed in a covered trench between fifteen and twenty-three miles long, with hardened horizontal shelters every 3,000 feet. The missile would sit on a special erector/launcher, in effect a locomotive that moves on rails inside the trench at about thirty miles per hour to shunt the weapon between different hardened stations. The speed of the erector/launcher, a 1,200,000-pound vehicle, will take the missile about half the length of the trench in twenty-five minutes, or approximately the time between initial US detection of a Soviet ICBM launch, and detonation of the warheads in the US.

Because the missile's location changes *after* the Soviet ICBMs have been launched, the attacker would have to target each shelter. With the "baseline" trench system pegged at about 8,800 shelters, each hardened to about 800 psi (pounds per square inch of overpressure), a successful attack against the trench-based MX is thought to be infeasible.

Advocates of this concept point out that, in the case of the MPS system, a comprehensive breach of security would have grave consequences. It takes about one week to "reconfigure," that is, move all the missiles to different MPS shelters. Nevertheless, it is likely that work on MPS will continue, even if the trench concept is selected, in order to provide a fallback position or to permit a mix of these two basing modes.

The MX missiles proposed for both MPS and the zippered trench are identical, would weigh about 190,000 pounds, and carry up to ten reentry vehicles (RVs). "Baseline" warhead for the system is the MK 12A with a yield of 335 kilotons, but several other designs are under consideration.

SALT-related verification of the trench concept is clear-cut because an entire trench can be opened up within a few hours so that Soviet photographic satellites could establish that it indeed houses only one missile. Both the shelters and the individual trench segments between the shelters can be opened for inspection. The roof of the trench consists of a cement slab covered with dirt. Proposed location of the system, like MPS, is on public land in Utah and Nevada. Only the horizontal shelter sites would be fenced and withdrawn from public use. Total area withheld from public use would be about sixty-two square miles, which is about twice the area required for MPS.

Since the Defense Department

In Focus...

deals with strategic force modernization in an overall sense, all MX options are linked to specific, differing levels of associated strategic deterrent forces. The MPS/track-mobile trench option is "coupled" to a force of B-52s and/or hardened cruise missile carriers (STOL aircraft derived from the Air Force's Advanced Medium STOL, or AMST) carrying a total of 3,000 air-launched cruise missiles (ALCM) as well as a force of twenty Trident submarines. Under this option, the subs would carry *only* Trident II, also called C-4, SLBMs and plans for deploying longer-range, more accurate Trident II, or D-5, SLBMs would be abandoned. The total number of force loadings (ballistic missile warheads and nuclear bombs carried by strategic bombers) of this combined force would reach about 14,000, according to a senior defense official. Cost of the combined force in terms of investment (R&D, acquisition, and construction) is estimated to average about $7 billion annually over the next ten years, or a total of $70 billion. The current FYDP (Five-Year Defense Plan) includes funds for the development of the combined force. Price tags of other major options reportedly are about the same.

The second mix of strategic forces being considered is known as the enhanced dyad. The Joint Chiefs of Staff reportedly have recommended against this force configuration. Its key ingredients are a force of between twenty and twenty-five Trident SSBNs, each carrying twenty-four D-5 SLBMs; a fleet of between 160 and 170 cruise missile carriers, each carrying twenty-eight ALCMs, for a combined total of some 5,000 cruise missiles; and a force of about 400 D-5s deployed in Minuteman silos. (Minuteman would be phased out.) The D-5, a 110,000-pound "common" missile (land- as well as sea-based), would use the MK 12A warhead or an equivalent design and is to have a hard-target kill capability.

The Administration is aware that the second option has a "perception problem," meaning that many members of Congress see it as a gambit to let the land-based ICBM force atrophy—or at best relegate it to tokenism. In turn, Congress, as well as Moscow, is likely to construe the abandonment of the land-based force as a victory for the Soviet Union, whose burgeoning modern ICBM force is driving the US ICBMs into extinction.

Hence, a variant of the second option is under consideration. Involved here, in addition to the other elements of the "second" option, would be the deployment of between 100 and 150 modified D-5 "common missiles" on a like number of cruise missile carriers. *(See "In Focus" of April '79 for a detailed description of an airmobile MX system.)* Presumably, under this option, D-5 deployment in silos would be curtailed or eliminated entirely.

While a truck-mobile, "soft" D-5/MX concept nominally is still in the running, it is unlikely that this scheme will be given serious White House consideration because of strong congressional opposition.

ASAT Treaty Apparently Stalled

US efforts to rush toward a two-phased treaty with the Soviet Union to ban weapons and technologies that interfere with the other side's military satellites are being "stonewalled" by the Soviets.

The proposed accord not only sought to halt further Soviet deployment of satellite interceptors but also to prohibit both sides from permanently damaging, destroying, or displacing (taking over physically or by electronic means) each other's satellites or satellites of third countries that either side has a substantial interest in.

Bilateral talks concerning the proposed space-weapons ban came to a halt when the Soviets demanded a US pledge that the Space Shuttle would not rendezvous with spacecraft of any type. To do so, the Soviets claimed, would be tantamount to testing the system's capability to "kidnap" Soviet military satellites. Since the key purpose of the Shuttle is retrieval of US satellites for refurbishing and repair, the Soviet demand was rejected.

The Soviets also hinted darkly that they would reserve the right to "deal with" satellites serving the interests of such countries as the People's Republic of China. No early resolution of the impasse is in sight.

SALT Notes

• As SALT II enters its final phase, the debate is picking up in tempo and stridency. Congressional nose counters on both sides of the issue are in a rare state of harmony: They agree that, for the moment, the vote seems too close to call.

One senator deemed crucial to SALT II ratification is former astronaut John Glenn (D-Ohio), normally rated as a strong and loyal supporter of the Carter Administration. As of late, however, Senator Glenn has become a vocal critic of the treaty's verification provisions.

His avowal that "I very much want to be for the treaty" collides with his conviction that no treaty is better than a flawed one. He is troubled principally, "as are eighty percent of the American people, that the Russians might not adequately live up to their end of the bargain unless they know we have the means to detect violations."

The Ohio senator also is troubled that "we would sign a treaty knowing full well our ability to adequately verify Soviet ICBM tests has been seriously reduced by the loss of our monitoring sites in Iran, as stated by the Secretary of Defense."

The Administration, according to Senator Glenn, "is gambling that plans still on the drawing board work as predicted and in fact can replace recent losses in verification capability. . . . Where I part company with the Administration is its willingness to sign a treaty now, even before we know for sure how well the prospective systems work or if we even can work out the difficult political arrangements to permit monitoring systems to be put in place" overseas.

Senator Glenn also is concerned about the Administration's willingness to "trust the Soviets to act in *our* best interest as well as in their own." He cited the Soviet circumvention of the SALT II "fractionation limit"—which holds the maximum number of warheads permitted per ICBM to ten—that occurred while Secretary of State Cyrus Vance and Defense Secretary Harold Brown were meeting with the Soviet SALT negotiators last December. He pointed out that the USSR "tested the SS-18 with a capability for at least twelve warheads, ten actual and two simulated. This allows the Soviets to increase the number of warheads for that missile by almost a third if they wish to go 'live' with those simulations at a later date. The logic of the counting rules indicates we should presume that they will be in violation of SALT II from the day it is signed, but we apparently are going to maintain the fiction that ten is still the limit and trust the Soviets not to deploy the demonstrated MIRV capability."

Senator Glenn, like many other members of Congress, expressed

considerable chagrin about President Carter's use of the term "warmonger" to describe senators who plan to vote against SALT II in its present form: "I must admit that I am not at all pleased when those of us expressing reservations and concerns regarding the treaty are characterized by some as 'warmongers'; as senators willing to perpetrate a 'dark nightmare' that would follow SALT II modification or rejection. Such a charge is unfounded and does a disservice to the constitutional principle of 'advise and consent.' It is tantamount to giving the Senate an ultimatum to pass the treaty without amendments or face a barrage of criticism by the Administration's 'heavy hitters,' including the charge that the treaty's opponents are advocating war over peace."

• Another influential voice expressing reservations about SALT II terms is that of Dr. Fred C. Iklé, former Director of the US Arms Control and Disarmament Agency (ACDA), who warns that "without changes in the new . . . treaty, the follow-on negotiations on further strategic arms limitations are bound to fail."

Dr. Iklé charges that the Defense Department had to "slow down" the Air Force's ground-launched cruise missile (GLCM) and the Navy's sea-launched cruise missile (SLCM) programs in order to remain within one of SALT II's so-called Protocol provisions. During the period of the Protocol—the first three years of SALT II—cruise missiles of this type with a range of more than 600 km are banned.

As a result, he predicted, "the imbalance in nuclear arms between NATO and the Warsaw Pact, which already is from three-to-one to four-to-one in favor of the East, will get worse.

"As surely as night follows day," the former ACDA director warned, "the Russians will threaten, when the Protocol expires, to break up the SALT negotiations unless we agree to extend the deployment ban on our ground- and sea-launched cruise missiles. If they already have obliged us to leave out Backfire [strategic bombers] and to accept this cruise missile ban by threatening to walk away from the SALT negotiations, why can't they make the same threat even more effectively three years hence, when we may well be even more anxious to save the SALT treaty?"

Several senior Administration officials, this column has learned, favor extension of the Protocol.

• A bon mot by Amrom Katz, former Assistant Director of ACDA in charge of verification and analysis, has injected a thoughtful chuckle into the SALT II debate: "The US has never been able to find illegally deployed weapons that the Soviets have hidden successfully."

• Administration officials charged with selling SALT II continue to claim that one of its intrinsic virtues is that it assures continued Soviet noninterference with the US "national technical means of verification." This SALT circumlocution refers to both the tacit acceptance of the other side's spy satellites as well as other monitoring systems and the pledge not to conceal relevant information from those systems by such means as camouflage or obstruction of view.

This claim can be challenged since the provision governing noninterference is contained in the ABM treaty of SALT I, which is the only SALT accord that is permanent. Failure to enact SALT II would not affect the ABM treaty in any binding way. The assumption that the Soviets would abrogate the permanent treaty barring antiballistic missile defense in a fit of pique if the Senate rejects SALT II seems farfetched.

• The Republican National Committee, in a tightly reasoned analysis entitled "SALT II: The Best We Can Do?", terms the Administration's argument that without the treaty US/Soviet relations will degenerate beyond repair is "unreasonable and unrealistic. Relations can continue as they have for several years, with or without the Carter/Brezhnev SALT II agreements."

• One of the USSR's prominent experts on US military affairs, Rostislav Tumkovsky, a member of the US/Canadian Institute headed by Georgi Arbatov, recently gloated over Soviet "victory" and US "defeat" in past SALT accords.

Writing in the prestigious Soviet publication *Questions of History,* on March 5, 1979, Tumkovsky termed the SALT I Interim Agreement on offensive strategic arms a "victory of the Soviet Union in the arms race unleashed against it [that can] hardly be overestimated." Further, the Soviet analyst suggested, the Interim Agreement "affirmed the effectiveness of the USSR's reciprocal measures to strengthen its defenses and deter imperialist nuclear aggression."

The 1972 agreement, "like the [subsequent] Vladivostok Agreement [that provided the framework for SALT II]" marked "the defeat of the American strategic arms race policy," according to the Soviet analyst: "The reciprocal actions of the USSR destroyed all attempts by the USA to achieve nuclear superiority and to employ it in the interests of its imperialist policy. . . ."

The strident and gloating tone of the essay that came out on the eve of the signing of SALT II caused considerable concern in Congress.

• Some analysts find the SALT II definition of what constitutes a "new" ICBM and the prohibition against deploying more than one "new" ICBM over the life of the treaty so vague as to be meaningless. SALT II puts no constraints on the development and deployment of new SLBMs as long as there is no breach of the overall nuclear weapons ceiling. Since the US has opened the door to common SLBM/ICBM designs in connection with MX and Trident, the Soviets could develop and test an infinite number of new ICBMs simply by declaring that they ultimately would be deployed on submarines. SLBMs generally are first tested on land.

Washington Observations

• Recent SS-18 test flights involving encryption of twenty-nine out of a total of thirty-one data channels, disclosed in this space last month, may have been linked to new antisubmarine warfare technologies. The limited maneuvering of the single reentry vehicle was first thought to be a step toward terminal guidance. On further analysis, US experts believe now that the experiments served to demonstrate advanced Soviet ASW capabilities.

• Recent intelligence assessments have concluded that the Soviet Union will develop and deploy a modern intercontinental bomber force within the next few years. This force is expected to consist of strategic bombers larger and with greater range than the Backfire bombers now entering the inventory in quantity. There are no plans, however, to bolster the minuscule and obsolescent US air-defense capabilities.

• At least three types of warheads are being deployed on the huge Soviet SS-18 ICBMs (about seven times the throw-weight of Minuteman III). One type has a yield of more than one megaton. Another category has a yield of about 600 kilotons. The third category, a single RV, has a yield in excess of twenty megatons. The first two types of warheads usually are intermixed. ■

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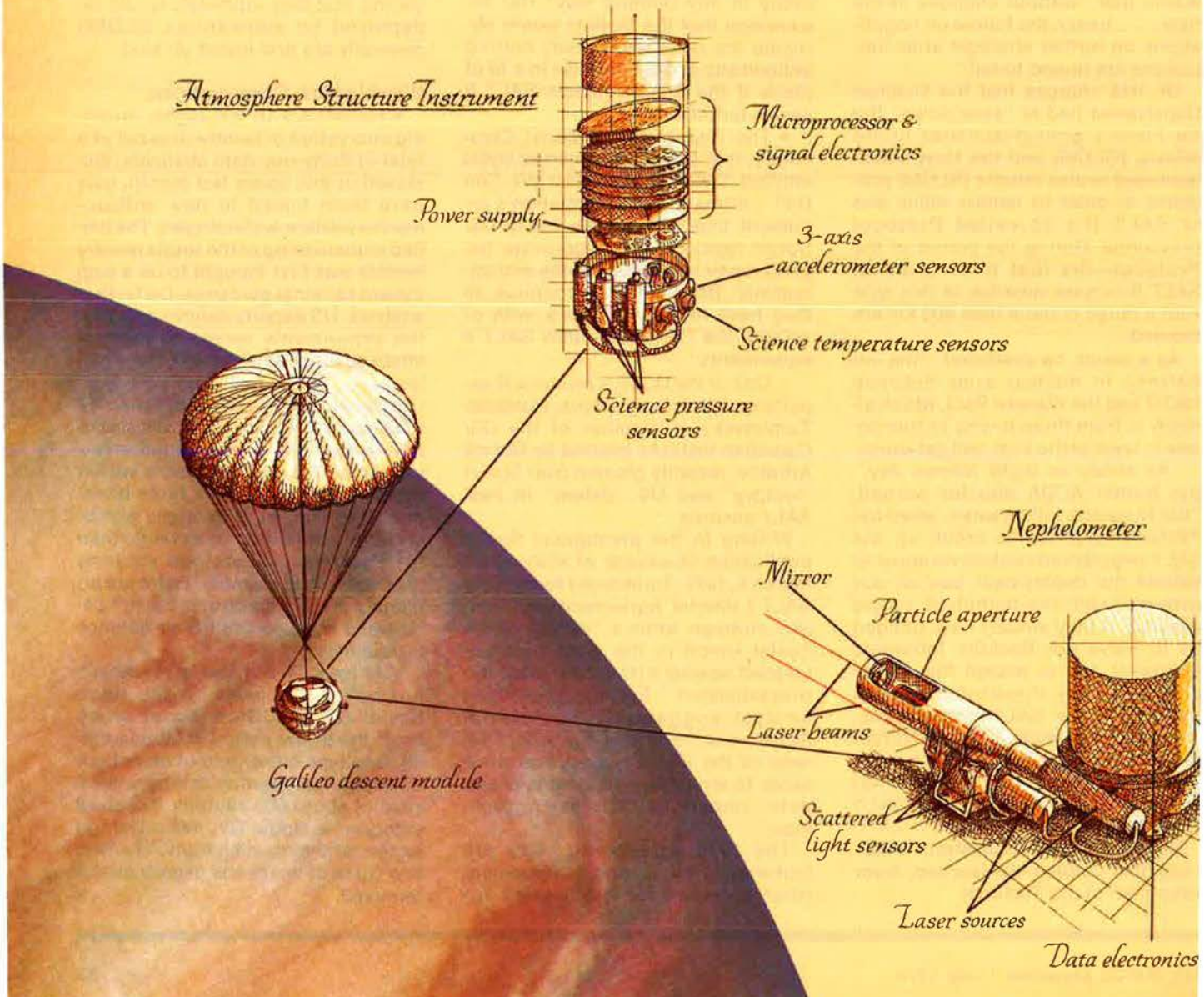

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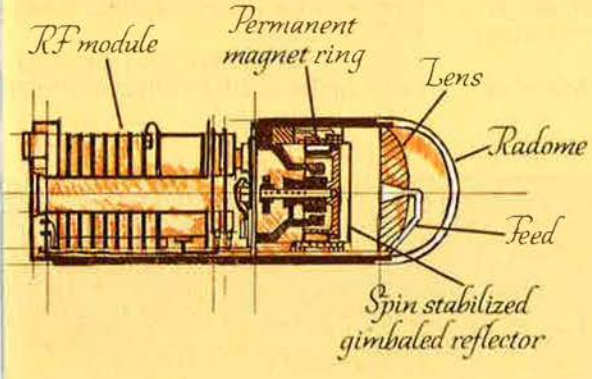
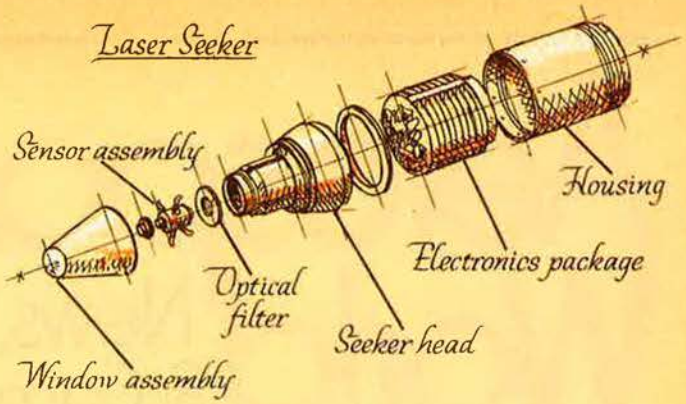
Our SCATHA satellite is crammed with 12 sensor instruments exploring the little understood phenomena of destructive electrical charge build up on Earth orbiting spacecraft. For the Galileo mission in 1983, we are designing instruments to take the measure of Jupiter's cloud particle density and atmospheric structure.



Millimeter-Wave Seeker



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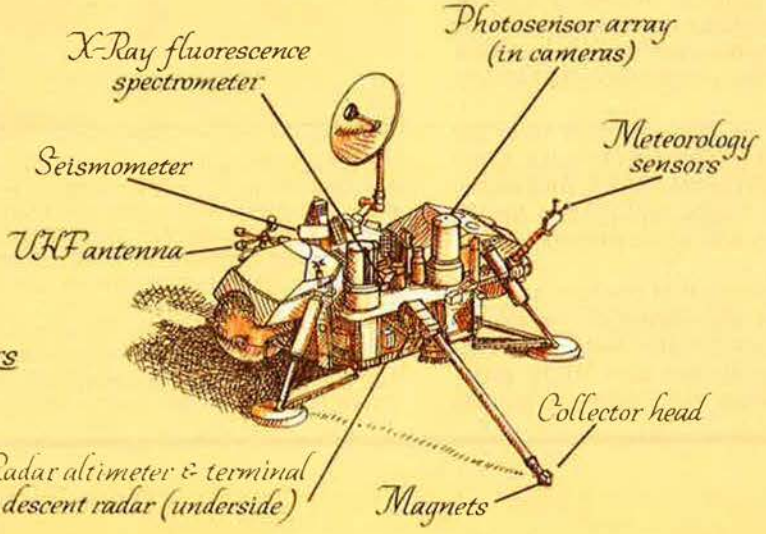


Viking Lander Sensors

Aerospace World News, Views & Comments

By William P. Schlitz, ASSISTANT MANAGING EDITOR

Washington, D. C., June 5

★ USAF's new fleet of twenty KC-10A tankers (the plane to be officially called the "Extender") is to be based at Barksdale AFB, La. The first of the advanced tanker-cargo aircraft—a militarized version of the McDonnell Douglas DC-10—should arrive at Barksdale in October 1980, with the full complement in place by late 1983.

Barksdale was picked, according to USAF, because it offers low daily training costs, requires minimal facility construction, and no unit relocations will be needed to perform the KC-10A mission.

Two air refueling squadrons will be activated at the base under an AFRES associate program similar to MAC's.

The AFRES associate squadron will consist of 160 members and the active squadron of 500, with crews flying the same active-force aircraft.

★ The US Army Corps of Engineers picked two contractors in mid-May to design and build two air bases in Israel's Negev Desert—implementation of the US commitment to peace in the Mideast under terms of the treaty between Israel and Egypt.

The contractor firms are consortiums of various US construction companies. The projects are to include runways and parking aprons, aircraft shelters and operational and support facilities including utilities, roads, and housing. The bases are to be initially operational in three years, and will cost a total of about $1 billion.

★ Based on tracking data from the North American Air Defense Command in Colorado, NASA officials believe that Skylab will reenter the atmosphere and be destroyed early in July.

They predict that perhaps as many as 400 to 500 pieces of the eighty-five-ton space station will survive frictional combustion and fall to earth. Among these will be two large sections weighing up to two tons apiece, officials declared.

While Skylab's positional status is being closely monitored, no prediction can be made as to where its debris will come down until twenty-four hours before it enters the atmosphere, a NASA spokesman said.

★ A new warhead for USAF's launch-and-leave Maverick air-to-surface missile is currently undergoing development testing at the Armament Development and Test Center, Eglin AFB, Fla.

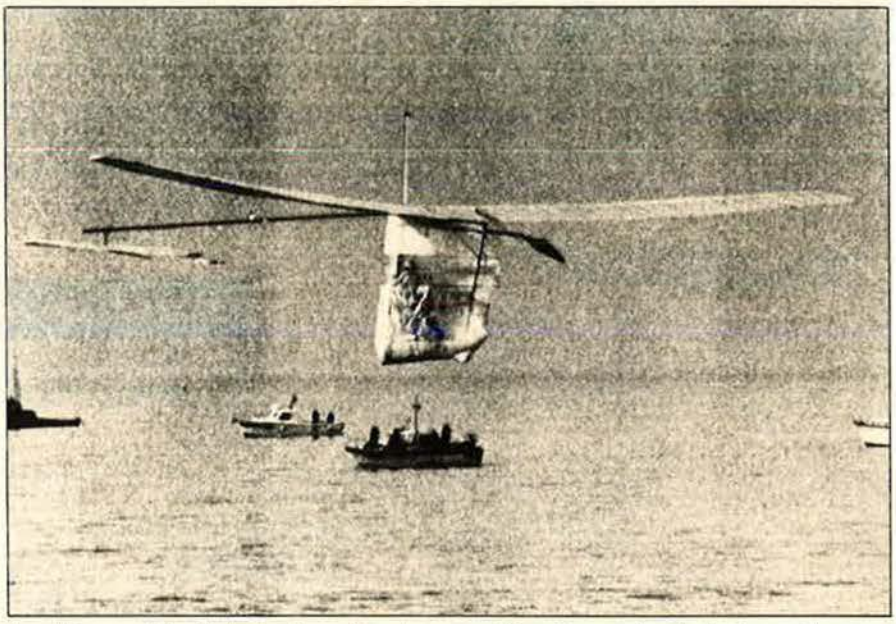
Warhead of the original Maverick, for use against armored targets, was designed with a forward-firing shaped charge. The new Maverick Alternate Warhead (MAW) is a kinetic energy penetrator whose blast and fragmentation effects should be lethal against a variety of targets such as ships, reinforced bunkers, and aircraft shelters, as well as armored vehicles, officials said.

Flight testing of the MAW, a heavyweight option to meet differing tactical requirements, is to begin at Eglin's ranges late in 1979.

★ USAF has given the nod for full-scale engineering development of the Combined Effects Bomblet (CEB).

The CEB, six inches long by two and a half inches in diameter (142 mm by 63 mm), is to have three damage-producing sections: an armor penetrating charge; a fragmenting body; and an incendiary capability. The bomblets would be carried in a spinning dispenser dropped from an aircraft over the target area. Released from the dispenser, the CEBs would form a large pattern against tanks, APCs, or troops.

Aerojet Ordnance Co., Downey, Calif., under a $10.5 million contract



In a history-making flight that lasted two hours and fifty minutes, America's Bryan Allen in June became the first to man-power an aircraft across the English Channel. Thus, the twenty-six-year-old Californian, who is about six feet tall and weighs 137 pounds, earned for himself and his sponsors the $200,000 prize offered by British industrialist Henry Kremer. Allen, a bicycle racer and hang-glider enthusiast, managed to keep the fifty-pound Gossamer Albatross *at some points just inches above the surface, in the face of increasingly troublesome winds. Allen, who stressed that he "was just the engine" during the flight, had high praise for the team of builders and organizers who made the event possible. Headed by Dr. Paul MacCready of Pasadena, the group is already designing a third-generation* Gossamer, *presumably to follow* Albatross *and its famous parent,* Condor, *into the record books with another amazing feat.*

Energy savings will be the primary benefit of a multiplex system to be installed by Hughes at Eglin Air Force Base in Florida. The energy monitoring and control system, which uses a single transmission line to carry thousands of different electrical signals on a time-shared basis, will link a central station to 1,528 field data sensors and control points in 44 buildings and 6 remote power sub-stations. It will regulate the heating, ventilating, and air conditioning throughout the facility. The system configuration also will allow security, emergency communication, and similar life-safety functions to be added.

Military pilots may get help in locating ground targets from far away with a new electronic process that examines TV-like imagery and selects potential targets. The technique, called automatic target cueing, is designed to enhance the performance of such imaging devices as forward-looking infrared (FLIR) systems. It would free pilots from having to study imagery and allow them to concentrate on planning evasive action or performing other tasks. The Hughes approach checks full-frame pictures for likely targets and then further analyzes these highlights for classification. Automatic target cueing has been made feasible by advances in microcircuitry and pattern-recognition techniques.

A laser device that lets U.S. Army troops mark enemy targets for laser-guided missiles, bombs, and artillery shells is now in production at Hughes. The tripod-mounted device, called a Ground Laser Locator Designator (GLLD), directs an invisible beam of coded laser pulses at any target the operator selects. These pulses are reflected from the target, providing a bull's-eye for laser-homing weapons. The wavelength and periodic pulsation of the laser beam allow weapons and special sensors in aircraft to differentiate the correct target from those designated by other GLLD units in the same battlefield. GLLD also can pinpoint the range and bearing of still or moving targets for conventional artillery.

Discriminating between closely spaced targets at long range will be one of the F/A-18 Hornet's unique capabilities made possible by its multimode radar. The Hughes-developed system is the first tactical airborne radar that can show when two or more aircraft are flying in tight formation in an attempt to appear as a single radar blip. The radar operates in this raid assessment mode through special processing of radar returns from the target cluster. The processing is done by a programmable signal processor -- a high-speed, special-purpose digital computer. The radar, officially designated the AN/APG-65, was developed under contract to McDonnell Douglas for the Navy and Marine F/A-18 Hornet.

Secure and nonsecure voice communications can be handled simultaneously by an advanced radio-telephone switching system that provides channel-to-channel crosstalk isolation above 100 dB. The system, developed by Hughes for U.S. Navy shipboard use, eliminates the need for separate equipment for plain and secure voice channels. Hughes' advanced microcircuit technology, including extensive use of large-scale integrated circuits, has given the system a high packaging density, high reliability, and low power consumption.

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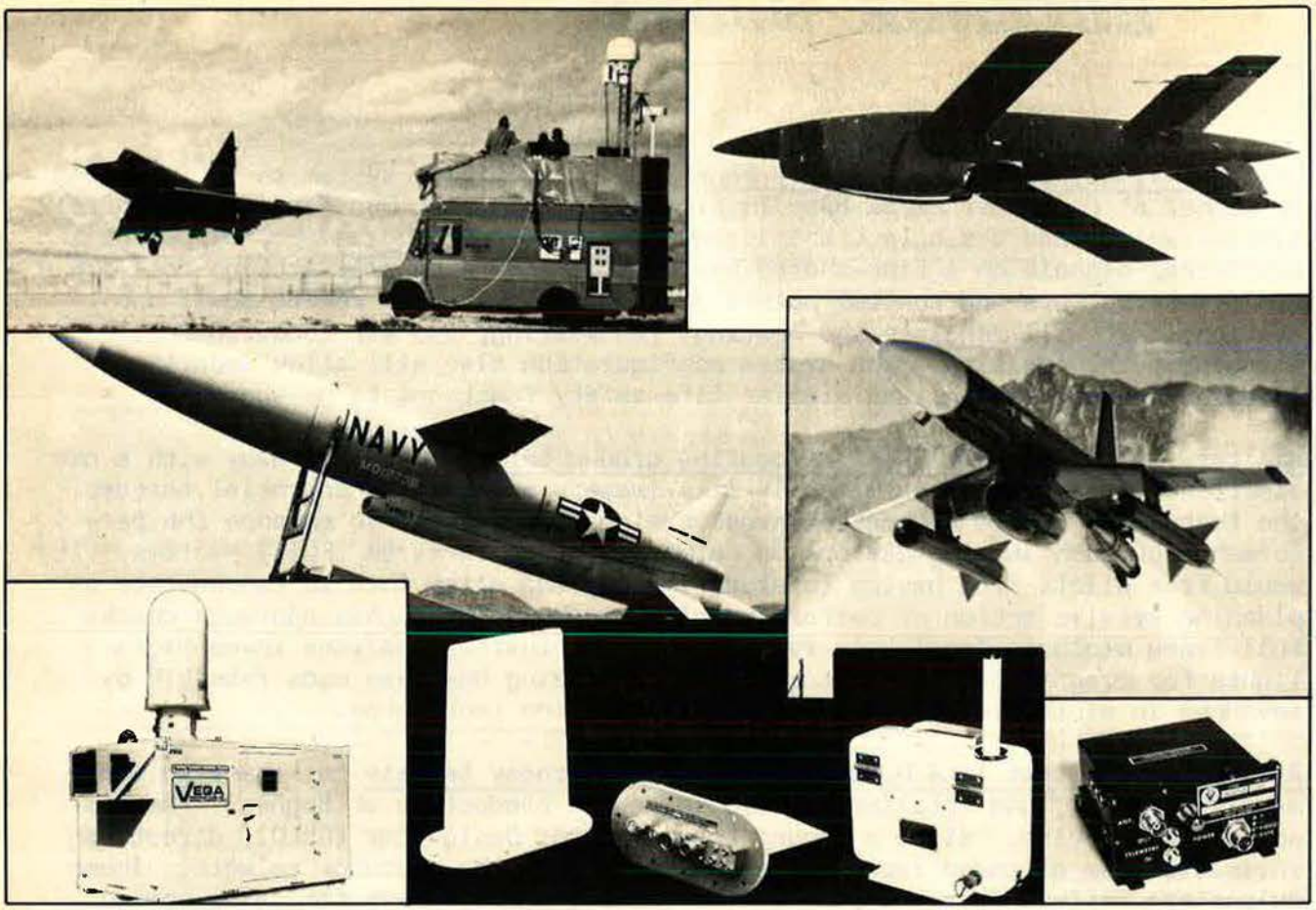

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let by the Armament Development and Test Center, Eglin AFB, Fla., is to produce 25,000 CEBs for test and evaluation at Eglin.

The CEB would be compatible with all USAF tactical and strategic aircraft, and, pending a production go-ahead, could enter the inventory by 1984.

★ Despite congressional recommendations for additional tests and design revisions, DoD announced that production of the initial batch of the nation's newest tank—the XM-1—would go forward.

Under the $9.8 billion program, 110 XM-1s are to be built between now and February 1980. The program calls for a total of 7,000 XM-1s to be produced over the next nine years, at an average unit cost of $1.4 million. After February 1980, output should hit ninety tanks a month, officials said. The XM-1 is being built at a Chrysler Corp. facility in Lima, Ohio.

DoD officials said, however, that the production schedule would depend on a continuing test program to resolve the tank's problems. If full-scale production is ordered, the first XM-1s are expected to be deployed to Europe in the early 1980s. Officials said that the sophisticated XM-1 "would be more than a match" for its Soviet opposite number—the T-72 tank that the USSR has in considerable numbers in Eastern Europe.

★ The Federal Republic of Germany plans to replace its air defense radar network installed in the early 1960s with a new computerized system known as GEADGE—for German Air Defense Ground Environment.

While Hughes Aircraft Co. of Fullerton, Calif., has been picked for management, design, software, installation, integration, and testing of the new system, "GEADGE will involve German and other NATO industry in a significant partnership both in terms of technology and employment," a company official said. The GEADGE program is valued in excess of $150 million.

Hughes headed the international consortium that produced NATO's NADGE computerized air defense system that stretches from northern Norway to eastern Turkey, and designed systems currently in use in Spain, Switzerland, and the Far East. Hughes also recently received an Air Force go-ahead to develop the Joint Surveillance System (JSS) to replace the twenty-year-old North American air defense system.

★ Air Force recruiters are hoping to sign up more than 400 computer scientists over the next eighteen months, officials said.

Qualified applicants will be commissioned as second lieutenants following completion of OTS at Lackland AFB, Tex.

Qualifications include either a computer science degree; degrees with a strong background in math, science, or a combination of the two; or nontechnical degrees with at least three computer courses and a strong math background. USAF will test college graduates who do not meet requirements to determine aptitude for computer technology or related fields for which they may be suited.

Air Force recruiters underline that computers are now integral to every aspect of USAF operations and thus technically challenging careers are available. See your Air Force recruiter.

★ A second Navy Fleet Satellite Communications (FLTSATCOM) spacecraft was launched into geosynchronous orbit early in May. It is positioned to expand the system's communications coverage across the Atlantic and into Europe and Africa.

FLTSATCOM-1, operational since its launch in February, is providing service for CONUS, Hawaii, and parts of the Atlantic.

The FLTSATCOM system, to eventually consist of five comsats, is designed to provide worldwide high-priority UHF communications among naval aircraft, ships, submarines, and ground stations, and SAC and the National Command Authorities Network.

★ The Rome Air Development Center, Griffiss AFB, N. Y., is currently de-

Intelligence Briefing...A Roundup

According to *Foreign Report*, published by London's *Economist*:

A training manual for senior army officers that was recently published by the official Hungarian military publishing house, Zrinyi, contains some unusually frank observations on (a) the need to borrow—or rather, steal—technology and military science from NATO, and (b) the desirability of trying to encourage dissidence inside NATO armed forces. Point (b) chimes in with the recent stepping-up of campaigns to promote soldiers' unions and radical conscripts' organizations throughout the NATO area. . . . The book, edited by Col. A. Fodor, is entitled "The Command and Management of Troops According to Western Views."

In more detail:

(i) The need to import NATO technology and "command and management techniques." Unlike standard Warsaw Pact military literature, the Hungarian text concedes the superiority of NATO's defense technology in certain key areas—laying particular stress on telecommunications and data-processing systems—and advises that it must be adopted by the Warsaw Pact. . . . "Western instruments and machinery must be thoroughly studied. Such studies will have a tremendous significance and will make it possible to apply the findings to our own armed forces." The book refers to the urgent need to master in depth the tactical decision-making processes of NATO units as well as to gain access to Western defense-related technology.

(ii) The need to promote "class struggle" inside NATO armies. The Hungarian manual is equally frank about Soviet-bloc interest in encouraging the breakdown of discipline within NATO armed forces. In a significant passage, it comments that "in many capitalist countries, junior officers serving in (or commanding) small units do allow their voices to be heard. In a few cases, their actions do have a political character. Although they are far from constituting left-wing political movements, dissatisfaction is reflected in collective criticisms of the decisions of superior officers."

The book continues: "We should not delude ourselves—as yet—that such events exercise any fundamental influence on the efficacy of Western military leadership. But under certain circumstances, they can demoralize the troops. . . . There is no doubt that the ideals of socialism, despite many obstacles, have penetrated Western barracks and have started a process of fermentation among both the soldiers who are led, and the officers who lead them."

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veloping the technology to make possible a long-range airborne radar system capable of pinpointing ground targets and providing guidance and control of weapons directed against them.

The concept calls for wide-area surveillance of moving targets and small-spot screening of fixed and moving targets, with information being processed immediately to provide an almost instantaneous response.

The system—dubbed PAVE MOVER—would employ side-looking X-band radar with an electronically scanned array and would be capable of conducting operations in all weather. PAVE MOVER's real-time feature is based on "advancements in moving target acquisition and digital processing techniques," officials said. *(See also p. 47.)*

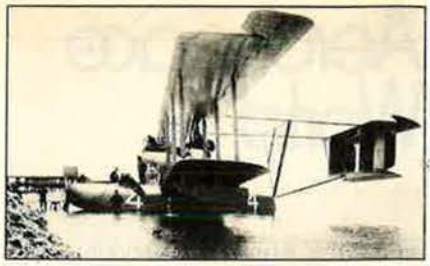
Under the sponsorship of USAF and DoD's Defense Advanced Research Projects Agency (DARPA), RADC is responsible for the system's hardware and software and their integration with an aircraft and ground-processing center. To this end, Hughes Aircraft Co. and Grumman Aerospace Corp. have been awarded contracts totaling some $23 million to design, build, and test advanced development models of the PAVE MOVER system. They are to be evaluated in 1981.

★ In another radar matter, USAF is replacing the systems used by military air traffic controllers in directing takeoffs and landings at forty-eight locations in CONUS and abroad. The surveillance radar systems being replaced are thirty years old. Twenty-three of these sites will receive new operations centers, as well.

The new radar complexes are fully transportable via surface vehicle or aircraft and can be relocated to meet such emergencies as military conflicts or natural disasters.

First models of these systems are already in use at Keesler AFB, Miss., to train maintenance personnel.

Under a $35 million contract, Texas Instruments Inc., Sherman, Tex., is building a total of fifty-three radars and twenty-eight operations centers. Their solid-state electronics eases maintenance problems considerably and provides USAF with a modern air traffic control system that is reliable, economical, and—with the transportability feature—flexible, officials said.



Left, Chief of Naval Operations Adm. Thomas V. Haywood and Walter Hinton at Pentagon ceremonies in May celebrating the sixtieth anniversary of the first flight across the Atlantic by a Navy Curtiss NC-4 seaplane (above). Ninety-year-old Mr. Hinton is the last survivor of the five-man crew. The restored plane is now at the Naval Aviation Museum, Pensacola, Fla., on loan from the Smithsonian Institution.

★ While the General Electric J79 jet engine is to be phased out of production, it is expected to power aircraft well into the twenty-first century.

What's remarkable is that the first J79 went into test in June 1954, a quarter century ago. Since, the J79 has established itself as the premier military jet engine and is in use by the air forces of seventeen nations.

While the engine was initially developed for USAF's B-58 supersonic bomber and also served as powerplant for the F-104A interceptor, its longest—and continuing—production run began in 1958 for the F-4 Phantom. In that span of twenty-one years, more than 11,700 J79s have been built to power ten different models of the F-4.

The J79 was originally rated at 14,350 pounds of thrust. Improvements have boosted today's version to 17,820 pounds of thrust, translating into aircraft speeds exceeding Mach 2. Through the years, the engine has powered aircraft to forty-six world records and has accumulated 26,000,000 hours of flight time.

★ A delegation of US space officials headed by NASA Administrator Dr. Robert A. Frosch recently spent sixteen days in China.

Purpose of the trip was twofold: to gain familiarity with Chinese space activities and to discuss further previously agreed-to cooperative space ventures. For openers, the Chinese are interested in acquiring a civil satellite communications system and a ground station for the reception of Landsat data.

Talks between US officials and a Chinese delegation visiting the US last year were formalized by an agreement on cooperation in science and technology signed by President Carter and Chinese Vice Premier Deng Xiaoping in January.

Following meetings with Chinese space officials, the American visitors toured several Chinese space installations.

★ The last airworthy B-17 Flying Fortress in Europe, and one of the very few flying anywhere, may have to be grounded at summer's end unless funds can be raised for an extensive overhaul.

Sally B, a B-17G, came off the production line too late to see combat in WW II, and after a checkered military and civil career arrived in 1975 in England to become the flagship of the "USAAF World War II Memorial Flight," a group of volunteer Brits dedicated to the memory of the 79,000 US airmen killed in Europe during World War II. The Flight, which

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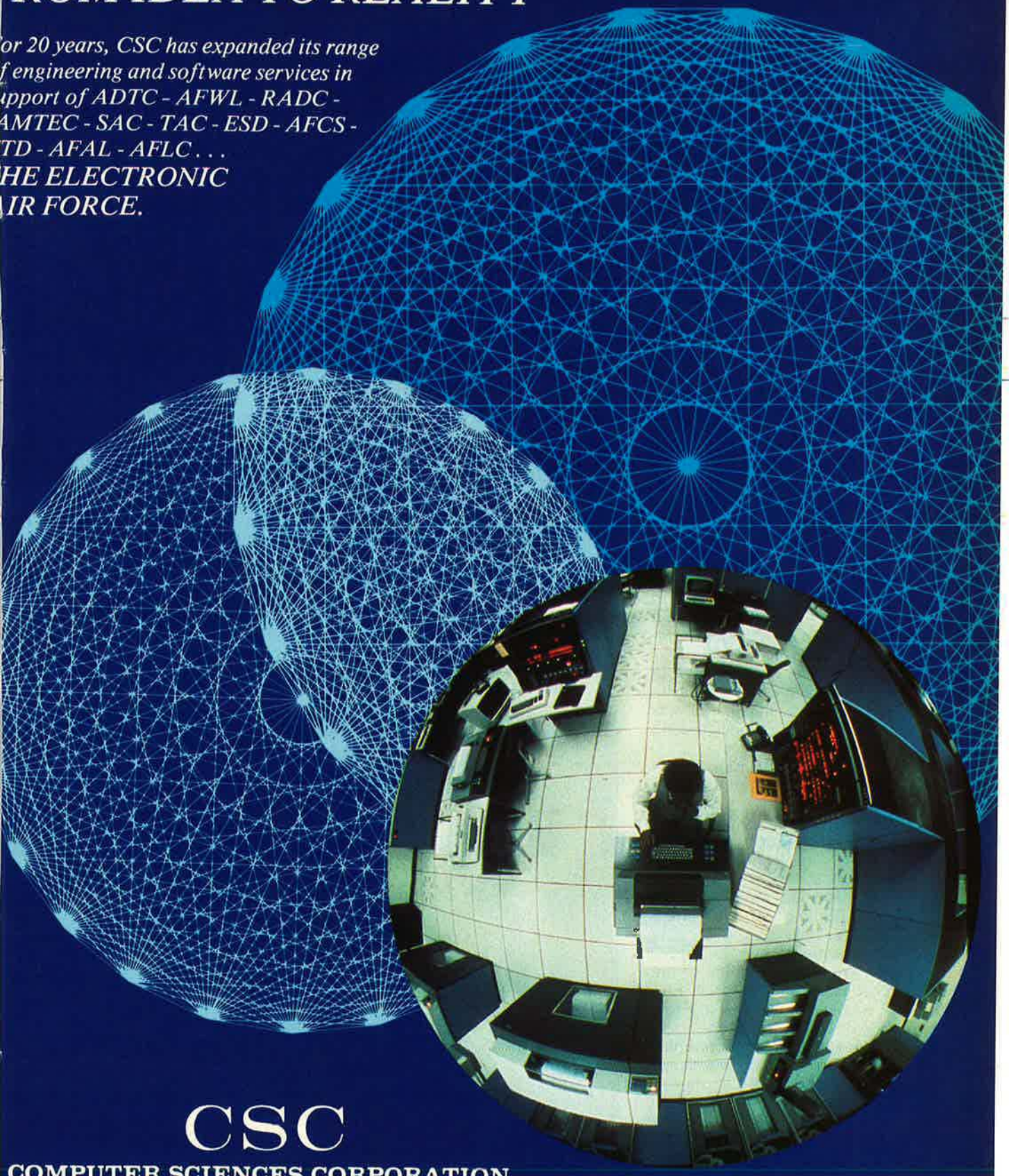

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includes an A-26 Invader, appears at air shows and the like. With no government subsidy, the group finances its operating expenses privately.

To raise cash, the Flight is selling prints of a painting of *Sally B* and plans a plaque to be engraved with the names of contributors. Donations and information about the prints: The B-17 Preservation Fund, c/o Euroworld, 277-279 Chiswick High Road, London W.4 4PU, England.

★ A memorial ceremony is scheduled for June 22 at Wright-Patterson AFB, Ohio, to honor six Air Force enlisted men killed in the Vietnam War.

Five enlisted dormitories and a dining hall are to be dedicated in their names.

The six:

- **Sgt. James D. Locker,** of the 37th Aerospace Rescue and Recovery Squadron, Danang AB, was killed March 7, 1966, while attempting to rescue a downed pilot.
- **SSgt. James R. Lute,** of the 774th Troop Carrier Squadron, died January 7, 1966, near Pleiku as a result of hostile action.
- **A1C William H. Pitsenbarger,** of the 38th Aerospace Rescue and Recovery Squadron, Bien Hoa AB, was killed April 11, 1966, while treating wounded troops in the field.
- **A1C James E. Pleiman,** of the 33d Aerospace Rescue and Recovery Squadron, was killed March 14, 1966, in the China Sea while attempting the amphibious rescue of two downed pilots.
- **TSgt. Roy D. Prater,** of the 37th Aerospace Rescue and Recovery Squadron, Danang AB, was killed April 6, 1972, near Quang Tri City while on a rescue mission.
- **SSgt. Frederick Wilhelm,** of the 537th Tactical Airlift Squadron, Phu Cat AB, was killed over Pleiku Province while on a mission.

Guest speakers at the ceremonies will be AFLC Commander Gen. Bryce Poe II and CMSAF Robert D. Gaylor. The families will attend.

★ Reflecting the excellence of the competing teams, only 245 points separated first from last in Olympic Arena '79, SAC's annual missile combat competition.

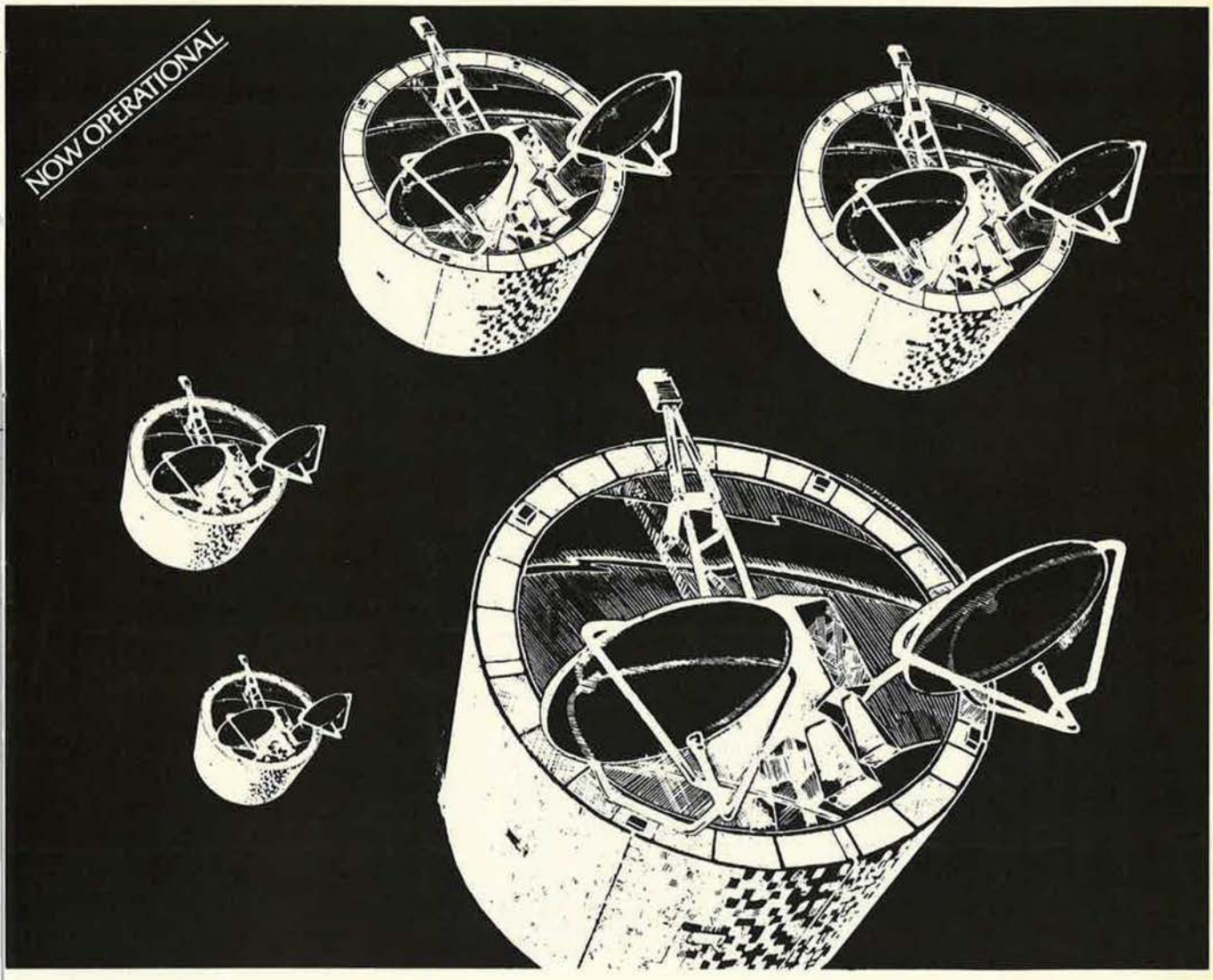
Members of the 390th Strategic Missile Wing, Davis-Monthan AFB, Ariz., signify their victory at SAC's twelfth missile combat competition recently held at Vandenberg AFB, Calif. The 390th dominated the meet. See item below.

The 390th Strategic Missile Wing, Davis-Monthan AFB, Ariz., amassed a total of 2,757 points of a possible 3,000 to capture top honors and the event's highest award, the Blanchard Trophy. In the lead from the outset, the Davis-Monthan missileers also were named Best Titan Wing, Best Operations Crew, and Best Titan Crew. They also were awarded trophies for Best Communications Team, Best Titan Communications Team, Best Titan Security Police Team, Best Titan Munitions Team, Best Titan Propulsion Team, and Best Titan Missile Maintenance Team. The Wing also received the AFA award for Best Titan Operations and AFLC's Best Titan Logistics trophy.

In second place was the 341st SMW, Malmstrom AFB, Mont., which trailed by only forty-two points and took Best Minuteman Wing honors. The Malmstrom unit garnered honors for Best Maintenance, Best Minuteman Power/Pro Electric Team,

SAC Commander in Chief Gen. Richard H. Ellis congratulates Dr. Charles S. Wehrer, Omaha, Neb., following the long-delayed presentation of medals Dr. Wehrer earned thirty-three years ago for, among other things, helping in the rescue of the crew of a downed B-24 in Italy. Dr. Wehrer, an AFA member, is currently a consultant in the Business Development Center of the University of Nebraska in Omaha.

TWO MORE PARTNERS IN NATIONAL DEFENSE



Two more spacecraft in the Defense Satellite Communications System (DSCS II) were successfully placed in orbit December 13, 1978. Joining those already in space, these TRW-built telecommunications satellites form the first high capacity, worldwide, military space communications system for command and control.

DSCS II greatly improves our capacity for keeping our worldwide forces in close touch with strategic commanders throughout the Department of Defense. DSCS II is being acquired by the U.S. Air Force Space and Missile Systems Organization for the Defense Communications Agency.

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The 321st SMW, Grand Forks, N. D., finished third, and was judged Best Operations, Best Minuteman Crew, Best Minuteman Missile Maintenance Team, and Best Minuteman Communications Team. It also received AFA's award for Best Minuteman Operations.

★ **NEWS NOTES**—USAF has authorized Lockheed Aircraft Corp. to gear up for **production of the TR-1 tactical reconnaissance aircraft,** designed for high-altitude surveillance of target areas. Some $10.2 million has been allocated in the current budget for start-up costs, while $43 million is being sought in the FY '80 budget for actual production. *(For a status report on the TR-1, see May issue, p. 120.)*

Reaching down into the ranks, President Carter selected **Lt. Gen. Edward C. Meyer as the next Army Chief of Staff,** to replace Gen. Bernard W. Rogers, who will head US forces in Europe. A 1951 West Point graduate, the fifty-year-old Meyer saw combat in Korea and Vietnam, and has served in Europe and in staff posts in the Pentagon. He'll be **the youngest Army C/S** since Douglas MacArthur.

In May, USAF awarded **Fairchild Industries** $413 million for production of **an additional 144 A-10 Thunderbolt II aircraft,** bringing the firm order to 483. In all, USAF plans to buy 733 of the close-support planes through January 1983.

The National Air and Space Museum, Washington, D. C., on October 26 will sponsor a **symposium to commemorate "Forty Years of Jet Aviation"** featuring, among others, **Sir Frank Whittle,** developer of Britain's first jet engine (whose work sparked early US efforts in the field) and **Hans Von Ohain,** inventor of Germany's first jet engine. Contact Walter J. Boyne, NASM, Smithsonian Institution, Washington, D. C. 20560; phone (202) 381-6244.

In the "largest demonstration of its kind" in DoD, Wright-Patterson AFB, Ohio, **has begun adding pelletized "refuse-derived fuel"** to its coal fuel in equal quantities and expects to save $7 million over the next ten years by so doing, AFLC officials said.

Died: Thomas Haywood, a former member of the American Volunteer Group in China and cofounder of Flying Tiger Line, of a long illness in Inglewood, Calif., in April. He was sixty-one.

Died: Col. Robert D. Heinl, Jr., USMC (Ret.), a combat veteran of two wars and journalist and historian, of a heart attack in early May while vacationing in the Caribbean. He was sixty-two. ■

VIC POWELL JOINS AFA STAFF

Victor Powell, formerly Executive Director of the National Aeronautic Association, became a member of AFA's Headquarters Staff on May 15. Prior to joining NAA in 1977, Mr. Powell served for eight years on the staff of Rep. G. William Whitehurst (R-Va.), a member of the House Armed Services Committee. Mr. Powell came to Washington from Norfolk, Va., where he was producer and anchorman of a local television news program. An active hang-gliding enthusiast, he is former President of the US Hang Gliding Association, and former editor of the organization's newsletter. He was the US representative to the first meeting of the International Hang Gliding Committee in Paris. With AFA, Mr. Powell will serve as Special Assistant to the Executive Director and is assigned at present to the Field Operations Department, reporting to Associate Executive Director Don Steele. A native of Parkersburg, W. Va., Mr. Powell served in the US Navy as an aviation electronic technician from 1954 to 1958. He was graduated from Marietta College, Marietta, Ohio, in 1962. He and his wife, the former Dianne Ferguson, live in Annandale, Va.

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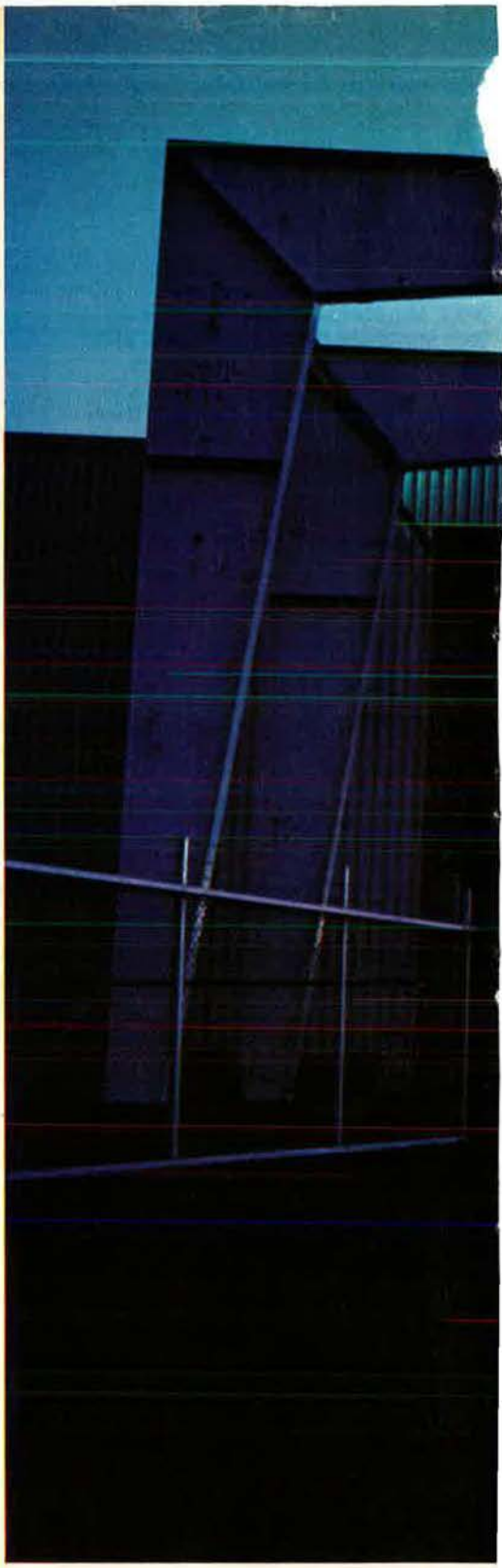

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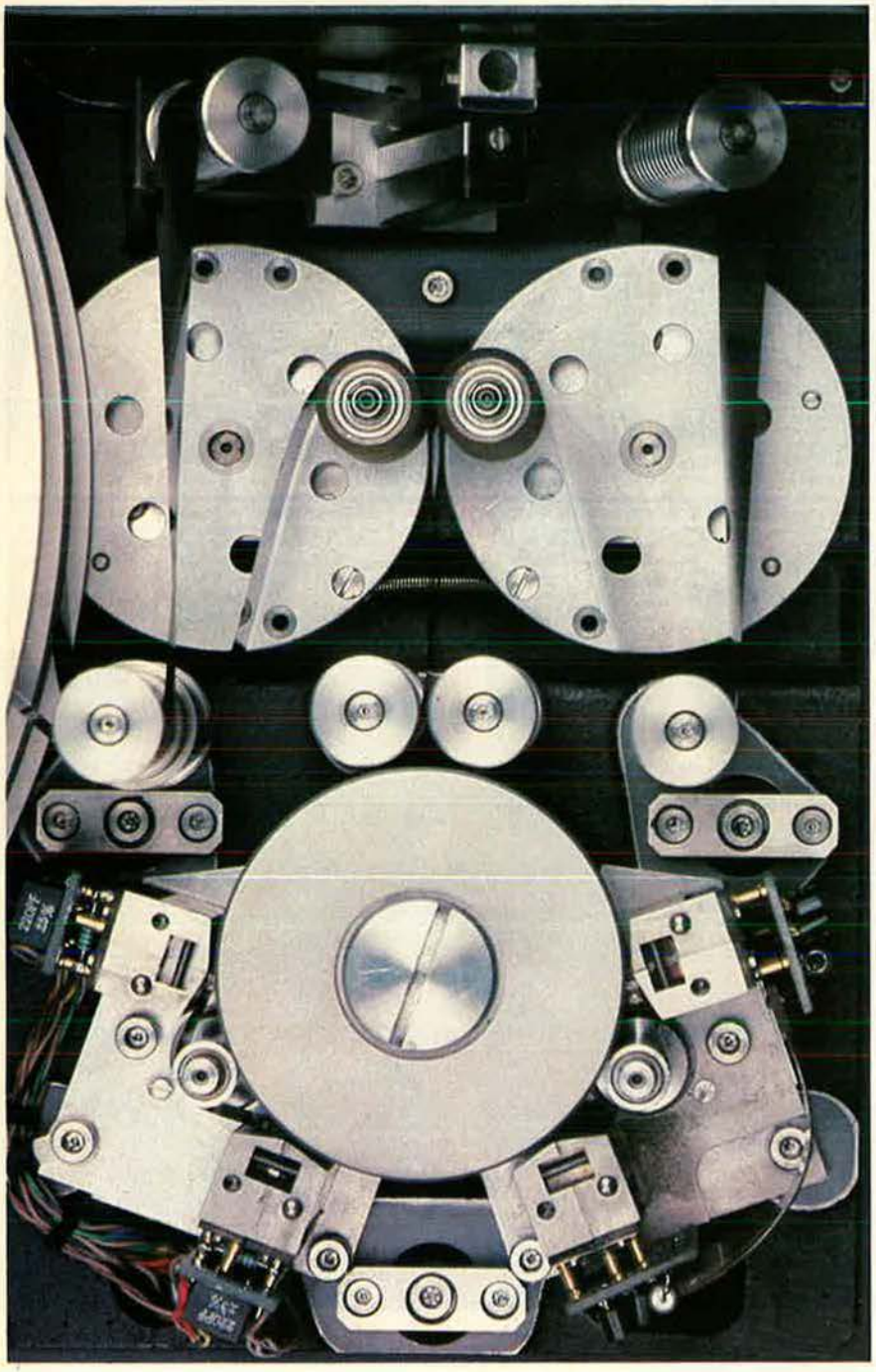

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Missing from the SALT II debate is a question that is basic to the concept of national security. In the next decade, will the US have . . .

A Strategy—Or a Capacity for Revenge?

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

FOR THE same reasons, I suppose, that the French at Crécy resented the longbow and old sailors detested the advent of steam, I have never wanted much to do with missiles. As is usually the case when there is a lack of motivation, I have never learned much about those menacing things either. They have always seemed to me a last-ditch sort of weapon, utterly impersonal machines that could not have, like airplanes, affectionate feminine names painted on their sides. They are simply what they are—devilishly ingenious, one-shot weapons of mass destruction. The idea behind them is also simple: If your missiles are big enough, accurate enough, secure enough, and you have enough of them to be convincing, the other fellow will not use his missiles. If one side has a clear and distinct advantage, then the game is over without a shot being fired. How To Win At War Without Actually Fighting, as Stephen Potter might have put it.

The great SALT II debate is now beginning, and that is roughly what it is all about. The people in favor of SALT say this treaty will level off both sides at approximate equality. Thus, goes the argument, the danger of a nuclear holocaust is lessened.

Those on the other side of the debate say this is misleading nonsense. The Soviets are now ahead, and this treaty will simply cement the disparity between us. In their judgment, SALT II increases the danger of nuclear war.

For those of us who don't really like to think about missiles, the arguments for and against SALT II become hard to follow. It is very easy to agree with the Administration's desire to hold down the growth of strategic nuclear weapons. They are nasty things, and the fewer in the world the better. But the opponents of this treaty say we are committing ourselves in SALT II to strategic inferiority and hence to an ever-more-vulnerable position on this increasingly dangerous planet.

The mail brings propaganda from both sides, to the point where a bemused citizen has great trouble arriving at a conviction. For, while any right-thinking defense-minded type would clearly rather see the money spent, say, on new fighters, there is this nagging worry that if the Soviets do emerge in the 1980s as the dominant strategic power, nothing else will really matter.

So far, the SALT debate has focused on verification—can we, or can't we, tell if they are cheating?—the ambiguous nature of the Soviet Backfire bomber, whether the cruise missile has been crippled in its infancy, and the more arcane arguments covering the whole miserable vocabulary of strategic weapon systems, MIRVs, "Slickems," "Glickems," and the rest. What seems to be missing from the debate is something basic to the whole concept of security in the next decade—SALT II or no SALT II.

Do we have any intention of redressing the growing Soviet superiority in strategic weaponry, or are we going to coast along as we have these past several years? They are years that have seen the cancellation of a new bomber; no new land-based, and hence truly accurate, missile; and no overriding concern about the increasing vulnerability of the Minuteman force. These could all be taken as signs of a declining national will to stay in the contest with the Soviets. The B-1 was not negotiated away, after all. It was given up freely and with no strings. The MX has been kicked around for some years now. There is some reason to believe it will follow the B-1 into oblivion, again with no strings attached. To be fair, the State Department sales pitch on SALT II does say we must improve our strategic forces during the life of the treaty, but this is a throwaway line in the script. The point is not pursued.

We hear a lot about slowing the arms race as one of the rationales behind SALT II. Well, a casual look at some defense spending figures gives reason to doubt there is any race. On strategic forces alone, according to some authoritative sources, the Soviets are currently spending about three times as much as we. The USSR total defense budget is estimated to be $104 billion above ours, or enough to fund the B-1, MX, Trident, XM-1 tank, the short-takeoff-and-landing tactical transport, and all of our fighter programs out to the end of the production runs. Soviet research and development money is, again, more than twice our own R&D budget, and the Soviet trend is on a comfortable rise while ours has only lately turned from a steady downward trend. We are not, in short, negotiating from any obvious position of strength.

SALT II may be a good treaty, as the Carter Administration avows, or it may be a very bad treaty, as some distinguished opponents declare it to be. Possibly, it may be neither—just something either barely acceptable, or barely not, with little room for choice. Whatever SALT II is, good, bad, or mediocre, one thing does stand out plainly in this confusing debate, and that is the desperate need for the United States to get moving on the improvement of its strategic forces. Our triad, the three-legged concept for strategic security that has worked so well these many years, is fast turning into a dyad as the old B-52s near the end of their useful life. The vulnerability of our land-based missiles may soon knock another leg off, leaving us dependent on the last and least accurate leg, the submarine-launched missiles. At that point, it will be fair to question whether we really have a strategy, or just the capacity for revenge. ■

Capitol Hill

By the Air Force Association Staff

Washington, D. C., May 25

The Changing Military Balance

Sen. Sam Nunn (D-Ga.) recently told the National Chamber of Commerce that in a little more than fifteen years US military superiority has declined to a position of "clinging parity" with the Soviet Union. "In strategic nuclear armaments, the [Soviets] have eliminated advantages once enjoyed by the US, and it appears [they are] embarked on a drive to obtain nuclear superiority."

Senator Nunn further said that "we must find an alternative to the All-Volunteer Force. Manpower costs, which consume sixty percent of the defense budget but cannot provide adequate mobilization . . . in a crisis . . . or sustain peacetime force levels or skill requirements, [make the All-Volunteer Force] a shaky foundation for America's national security. . . . We must address the dismal realities of the All-Volunteer Force and rekindle the obligation of every citizen to serve his nation, not just in fighting wars, but in preventing them."

Defense Supplemental

In approving the FY '79 Defense Supplemental Authorization Request, the Senate agreed to a supplemental bill totaling some $2.1 billion—a reduction of slightly more than $46 million from the President's revised request. Included in the bill were $265 million for MX, including $75 million for further study of various basing modes and $190 million for full-scale engineering development of the missile and multiple protective shelters.

A key issue in the debate was the disposition of four *Spruance*-class destroyers, originally planned for sale to Iran. The destroyers became available when Iran canceled its request for US arms. Sen. John C. Stennis (D-Miss.), Chairman of the Senate Armed Services Committee and one of the key senators in the upcoming SALT II debate, successfully led the fight to include the four destroyers for the US Navy in the supplemental bill. In a reversal of Administration position, Chairman Stennis encountered strong opposition to this proposal.

In a letter to Sen. Donald W. Riegle, Jr. (D-Mich.), the Office of Management and Budget stated that the Administration favored inclusion of two destroyers in FY '79 and two in FY '80. Chairman Stennis, who had not been informed of this new position, argued that in letters to the Senate Armed Services Committee, Secretary of Defense Harold Brown had indicated support for four destroyers in the FY '79 Supplemental bill.

Sen. Henry M. Jackson (D-Wash.) called the Administration's action on this matter "amateurish" and said that he had "never witnessed such discourtesy to the Chairman of a committee in the handling of committee business." When the final vote was taken, Senator Stennis won, fifty-six to thirty-two.

Griffiss to Receive ALCM

On May 10, the Air Force announced its selection of SAC's 416th Bomb Wing, Griffiss AFB, N. Y., as the first unit to receive the Air-Launched Cruise Missile (ALCM) now under development. Delivery of the first ALCM is scheduled for October 1980. Initial operational capability of the ALCM integrated with the B-52 is expected in December 1982. In support of the ALCM operation, Griffiss will receive some $14 million in FY '80 military construction funds and an additional 100 personnel to be assigned in 1981.

FY '80 Defense Authorization Bill

The House Armed Services Committee recently reported out its version of the FY '80 Defense Authorization Bill totaling just over $42 billion. This amount, an increase of some $2.1 billion over the Administration's request, includes a major provision requiring registration of all males who will be eighteen after December 31, 1980.

The committee approved $2.1 billion for a *Nimitz*-class nuclear-powered aircraft carrier (CVN) in place of the smaller, allegedly less costly, conventionally powered aircraft carrier (CVV) requested by the Administration. President Carter last year vetoed the FY '79 Defense Authorization bill because it contained funds for a nuclear carrier he had not requested.

The committee added $180 million for continued full-scale engineering development of the Marine Corps AV-8B Harrier and $30 million to initiate a competitive flight demonstration between the Strategic Weapons Launcher, a low-cost variant of the B-1, and the Advanced Medium STOL Transport (AMST) aircraft, as possible cruise missile carriers. Rep. Bob Carr (D-Mich.) offered an amendment to include wide-bodies in the competitive flyoff. The amendment was defeated.

In other action, the House Armed Services Committee recommended reduction of $17.4 million in requested Missile Surveillance Technology funding by terminating the Mosaic Sensor Project. Congressional sources report that in the absence of a specific requirement for a follow-on to the Defense Satellite Program, the committee could not support the Mosaic Sensor Project. The committee did, however, recommend full authorization for the Missile Surveillance Technology efforts under way by DoD and DARPA in the Mini-Halo program.

The Senate committee agreed to a total of some $40 billion, a decrease of just under $37 million.

The Slow-Moving Congress

Rep. Lee H. Hamilton (D-Ind.), in his May 16 *Washington Report*, commented on the "lack of legislative activity in both the Senate and House." As of the Easter recess, "the Senate had taken thirty-eight recorded votes and the House sixty-seven," a decline of sixty-two and forty-two percent respectively from the same period two years ago. The number of bills introduced had also fallen sharply "from 1,176 to 840 in the Senate and from 5,748 to 3,357 in the House."

Why the slow pace? Mr. Hamilton offered several reasons, including "more complex problems such as energy and inflation," the perception that hastily enacted legislation may be worse than none, the electorate's mandate to spend less and halt the proliferation of new programs, and the stricter view being taken by members with respect to congressional oversight responsibility.

The Ninety-sixth Congress "may make its mark less for what it does than for what it does not do" Representative Hamilton said. "It may be that [this] Congress is more representative and more responsive than most people think." ■

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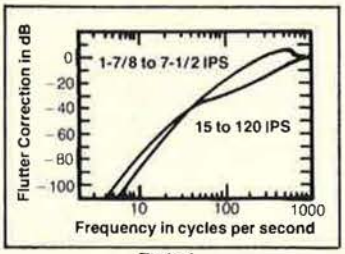

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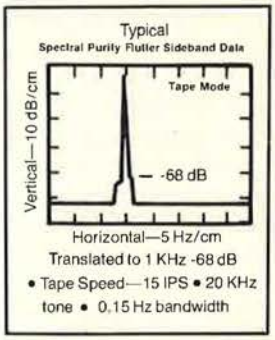

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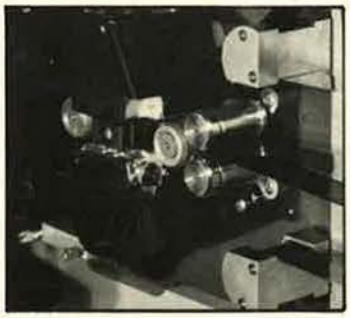

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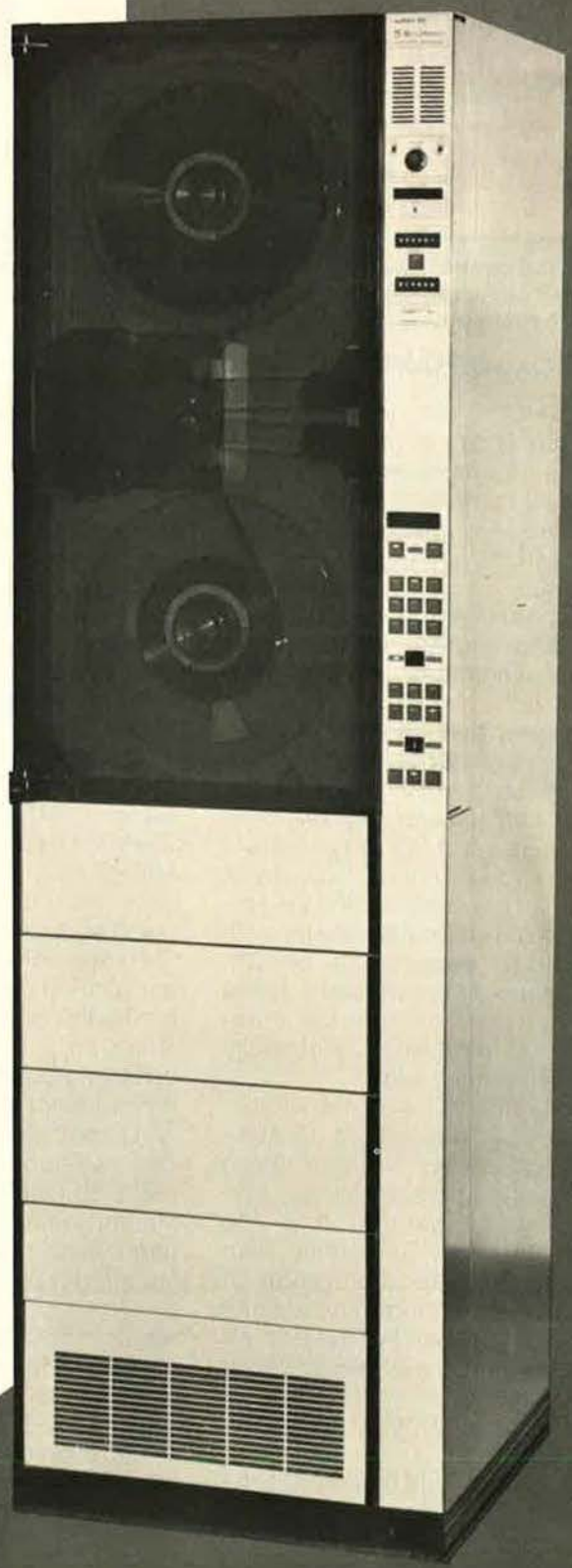

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The Growing, Changing Role of C³I

Command control and communications not only is growing in scope and importance to all military functions, but it is being reshaped as an "offensive" tool of warfare.

BY EDGAR ULSAMER, SENIOR EDITOR

WITHOUT the aggregation of complex, diverse, and intertwined techniques and systems known as command, control, communications, and intelligence (C³I), national defense would turn into chaos. From the deterrence of nuclear conflict to control of forces and employment of weapons, modern warfare is dependent totally on C³I.

It follows that defense of these vital military capabilities against destruction or disruption by the enemy and, conversely, offensive action against an adversary's command and control apparatus are military tasks whose importance has increased in step with both sides' dependence on C³I. The Defense Department's latest five-year plan reflects the paramountcy of improving C³I forcefully and comprehensively.

On the strategic side, the focus is on enduring survivability of command and control by the National Command Authorities (NCA) to extend beyond execution of the Single Integrated Operational Plan (SIOP) to the reconstitution of forces and contingency actions thereafter. Associated factors include adaptability of the country's military forces to future strategic threats and improved attack assessment.

As for theater and tactical C³I, the five-year plan stresses both the functional survivability as well as the ability to "interoperate" between the services and with the command and control systems of allied forces. There is noteworthy emphasis on what is variously termed as "counter-C³" or C²CM, for command and control countermeasures.

The Air Force's principal architect, systems manager, and coordinator of C³I is Air Force Systems Command's Electronic Systems Division (ESD) at Hanscom AFB, Mass. ESD, in concert with the affiliated Rome Air Development Center (RADC) and two Federal Contract Research Centers—the MITRE Corp. and the Massachusetts Institute of Technology's Lincoln Laboratory—is responsible for C³I research, development, and acquisition for USAF, other DoD elements, and allied forces. The Division's $1.6 billion annual operating budget accounts for fourteen percent of the Air Force's total R&D and mission-support funding. The development of C³ systems, ESD Commander Lt. Gen. Robert T. Marsh points out, historically has been burdened by "ad-hockery," meaning a proliferation of different systems, each tailored to a specific requirement, and without definitive provisions for their interaction. The paramount need now, applicable to all C³I systems, is more structure in terms of architecture, interoperability, standardization, and standard interfaces: "We can no longer afford to have individual systems going their independent ways. The penalty simply is too high, in dollars as well as inflexibility."

The incentive to "interface," or to orchestrate the operation and products of various systems so they can feed into common processing facilities, already is formidable. The payoff becomes prodigious as the Air Force moves closer toward the "fusion" of command and control information. This new coinage, General Marsh explains, encompasses a range of processes that culminates in unprecedented automation and, consequently, force effectiveness.

One phase of fusing, or correlating and synthesizing disparate information from different sensors, could involve taking the outputs from an electronic intelligence (ELINT) sensor and a SLAR (side-looking airborne radar) and comparing them while capitalizing on the best features of each. For example, one type of sensor might be intrinsically accurate in locating targets while another type is far better in identifying targets. Thus, fusion is meant to instill synergism into C³I by making the total product—the information that is presented to the decision-maker—better in accuracy, reliability, definition, and in other ways than is the output of the individual sensors without correlation.

Another facet of fusion, General Marsh points out, is the melding of intelligence and operational information. The military decision-maker, under the fusion concept, receives near-real-time information about the disposition of his forces in relation to those of the enemy, down to such practical factors as which weapons are available to deal with what targets.

Fusion also can mean a form of automated logic, or associative intelligence. A fused system might ingest information about the presence of certain categories of ground forces and, by drawing on its "memory," produce pertinent hierarchical data, such as which units can be presumed to have what types of surface-to-air missiles or other capabilities of concern to commanders.

As the C³I function reaches

deeper into and becomes more entwined with operational tasks, ESD's Vice Commander, Maj. Gen. Henry B. Stelling, Jr., told AIR FORCE Magazine, the Division is intensifying its contacts with the operational commands as well as the other product divisions of the Air Force Systems Command. The results are a series of MOAs (Memoranda of Agreement). In the case of USAFE, for instance, recently concluded MOAs cover the Tactical Air Intelligence System (UTAS), automation of TOC (Tactical Operations Centers), C^3 system support for the collocated operating bases (COB—a scheme to disperse augmentation forces from the CONUS to some fifty bases in NATO during crises), and the upgrading of USAFE's NATO command post at Sembach AB in Germany.

Other MOAs are in effect with TAC, PACAF, and ADCOM as well as with SAMSO, the Aeronautical Systems Division, and the Armament Development and Test Center. Systems covered by MOAs range from the C^3I architecture for the WAAM (wide-area antiarmor munitions) program to command and control support for the MX ICBM, according to General Stelling. □

Warning and Assessment Systems

The relentless, broad growth in the offensive strategic forces of the Soviet Union germinated comprehensive US C^3I responses in the areas of surveillance, communications, and force management. ESD's FY '80 RDT&E budget for strategic surveillance systems—a $205 million item—is up by almost one-fifth from the previous year.

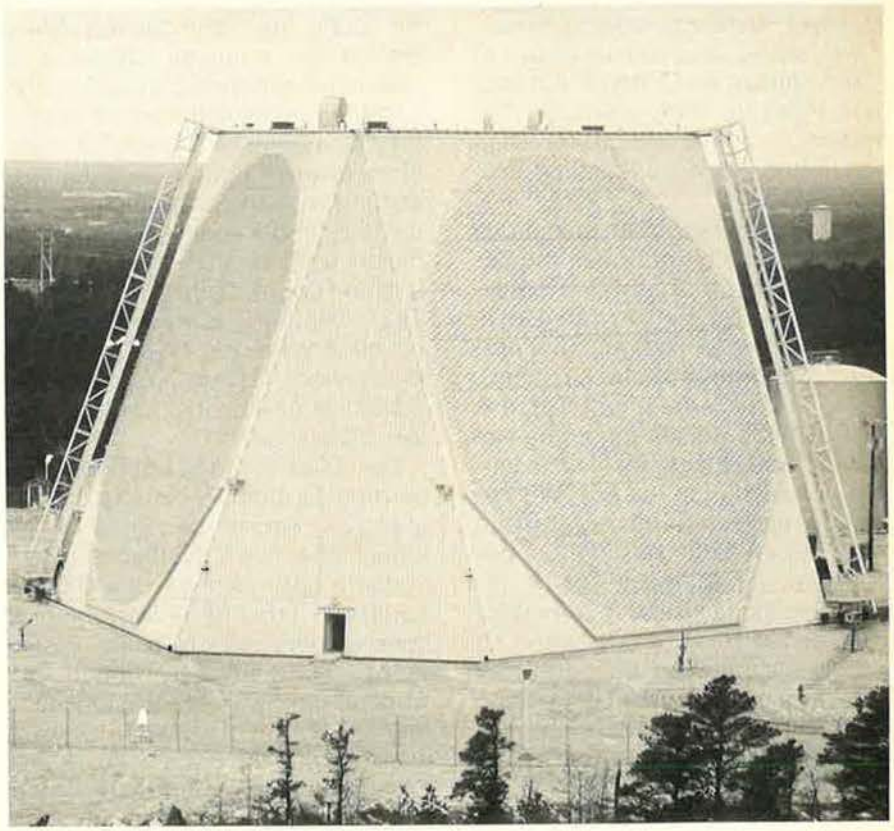
PAVE PAWS, a dual-faced phased-array radar system with a 3,000-nautical-mile range, provides rapid early warning of SLBM launches against the US and also catalogs positional and velocity information about satellites in low earth orbits. The first PAVE PAWS site at Otis AFB, Mass., was turned over to ADCOM earlier this year. A second site, at Beale AFB, Calif., according to Col. H. J. McLoud, Jr., ESD's Assistant Deputy for Surveillance and Control Systems, is expected to become operational late this year.

Additional PAVE PAWS radars are under consideration but have not been authorized or funded as yet. Surveys for sites three and four are planned by FY '81 and will involve locations in the Southeast—probably in Georgia—as well as in the Southwest—probably in southwest Texas.

The Soviet Union's changeover to a MIRVed SLBM force—the new SS-N-18s have been tested with up to seven RVs but under SALT II actually could go to fourteen warheads—obviously puts an additional load on PAVE PAWS. While the phased-array radar can be presumed capable of coping with MIRVs in terms of power management, this may not be completely valid so far as PAVE PAWS's data-processing capacity is concerned. However, if needed, additional data-processing capabilities could be incorporated into the system.

PAVE PAWS detects Soviet SLBMs flying minimum energy trajectories at a distance of about 2,200 nautical miles from the US coastline—or at about 3,000 miles in the case of "lofted," or high-altitude, trajectories that overfly other US sensor systems. While PAVE PAWS's detection range is below the range of the 5,000-mile-plus SS-N-18s, this is not considered crucial. Their trajectories pass through the detection fences in almost all cases, and other sensors would provide additional initial warning information. This is also true to some extent if the Soviets were to develop SLBMs flying depressed trajectories to take advantage of the line-of-sight handicap of PAVE PAWS or any other ground-based radar.

PAVE PAWS is a "soft" system that a potential adversary could attack or jam from standoff. Such an attack, however, would provide un-



The first PAVE PAWS site, at Otis AFB, Mass., was turned over to NORAD early in 1979. The second site, at Beale AFB, Calif., will become operational late this year.

ambiguous warning of impending strategic war and thus is not considered likely.

PAVE PAWS's prime contractor is Raytheon's Equipment Division, with IBM acting as the software developer. The system is linked to NORAD's Cheyenne Mountain Complex, the NCA, and SAC to provide SLBM launch and raid characterization information. Space surveillance information is furnished to NORAD.

The Enhanced Perimeter Acquisition Raid Characterization System (EPARCS) is another major ballistic missile warning and attack assessment program assigned to ESD. EPARCS's objective is to upgrade the US Army's Safeguard long-range radar—developed originally for ballistic missile defense—that the Defense Department turned over to USAF. The scanning pattern of the system is being changed to extend range and, hence, to provide earlier warning than is the case now.

EPARCS's location—at Grand Forks, N. D., some 1,000 miles south of the Ballistic Missile Early Warning System (BMEWS) sites—is well suited for characterization of ICBM attacks on CONUS, but less than ideal for early warning. The system also has unique capabilities in the space-surveillance mission.

Another ESD program to improve NORAD's ability to assess the nature and scope of pending ballistic-missile attacks on the US is BMEWS modernization. The program, according to Dr. William J. Perry, Under Secretary of Defense for Research and Engineering, involves the replacement, or extensive upgrading, of the BMEWS detection and tracking radars that were deployed in 1961. Initial operational capability (IOC), he reported to Congress, is planned for 1983 or 1984.

ESD's shipborne phased-array radar system (COBRA JUDY), while not a warning system as such, will provide the intelligence community with information about Soviet ballistic missile test flights and threat analyses. Raytheon, the prime contractor, is installing the radar on the USNS *Observation Island,* a naval ship previously mothballed.

A pivotal long-term ESD/SAMSO project in the field of tactical warning and attack assessment is WIC, or Warning Information Correlation. Purpose of the program is to define a technological base for integrating the data flow from various missile warning and nuclear detonation detection sensors and to standardize the display of this type of information.

ESD is developing an experimental "proof-of-concept technology" OTH-B (over-the-horizon-backscatter) radar near Bingham, Me., that could lead to operational development of such a system in the early 1980s. Radar of this type uses the ionosphere to refract radar waves around the earth's curvature to provide coverage of coastal approaches from 500 to 1,800 miles offshore and at all altitudes down to the earth's surface. Key question to be answered by OTH-B is the feasibility of signal propagation on the fringes of the auroral zone. Essential radar components and the antenna subsystem are expected to be ready for technical feasibility testing this summer. These tests should be completed by early 1981 and the results will then be examined by a Defense Systems Acquisition Review Council (DSARC). Assuming successful completion of the tests and a positive DSARC decision, authorization to deploy the system could come as early as 1981. General Electric is the OTH-B prime contractor. If cleared for production, OTH-B would be installed at one East Coast and one West Coast site.

The OTH-B radar concept, according to comprehensive USAF analyses, cannot be relied on to furnish effective surveillance of the northern approaches to the US because of lack of reliable ionospheric propagation in the Arctic areas. ESD, therefore, is continuing work on the SEEK FROST program that is complementary to OTH-B and will plug the gaps of the aging Distant Early Warning (DEW) Line radars. SEEK FROST is meant to either upgrade or replace the DEW Line, which is becoming more and more difficult and expensive to operate and maintain.

Unattended short-range and minimally attended radars are under consideration to reduce operation and maintenance costs.

In case of failure, the automated, unattended stations diagnose the fault and report the necessary information to a central maintenance depot. A repair crew would then be flown to the site by helicopter. Overlapping coverage by the robot radars would provide backstopping in case of failure by one.

Prototype development of the SEEK FROST radar is to be initiated during FY '80, according to Dr. Perry.

Related to SEEK FROST in terms of function and technology is ESD's SEEK IGLOO program. The latter involves replacing thirteen Alaskan Air Command radars with modern, minimally attended, 200-mile-range systems. SEEK IGLOO is expected to save about $30 million annually in operation and maintenance costs over the present system. A prototype is to be built in FY '80 for test and evaluation purposes.

SEEK IGLOO, in effect, is an extension of the Joint Surveillance System (JSS) that is intended to perform peacetime airspace surveillance for NORAD, the Alaskan Air Command, and Canadian Forces. The system will replace the aging and uneconomical SAGE network. JSS is to consist of between forty-four and forty-eight radar sites in the CONUS. Most of the radars will be operated by the Federal Aviation Administration (FAA). Information from the system's civilian and military radars feeds into seven ROCCs (Region Operations Control Centers), where data processing, display, and command control functions are carried out. To complement the "soft" JSS system in time of crisis, E-3A AWACS aircraft will augment the ROCCs to provide a limited wartime command and control capability. SEEK FROST, SEEK IGLOO, OTH-B, and JSS combined form the North American Surveillance System. The first ROCC is scheduled to be in operation late in FY '81. □

Space Surveillance Systems

NORAD personnel operate the new space data system developed by AFSC's Electronic Systems Division. The system records and permanently stores data on the orbits of all man-made objects circling the earth.

Two new ESD systems, one operational and the other in development, are to shore up the US space surveillance network, known as the Space Detection and Tracking System. COBRA DANE, a huge phased-array radar developed by ESD and located at Shemya Island, Alaska, near the end of the Aleutian chain, can detect an object the size of a basketball out to a distance of 2,000 miles. The system, now under NORAD operation, can track up to 200 space objects simultaneously.

GEODSS, for ground-based electro-optical deep-space surveillance, is designed to enhance clear-weather, nighttime monitoring of satellites out to geosynchronous (22,300 miles) altitudes and beyond. Scheduled to achieve full operational status in the 1980s, GEODSS will be deployed at five sites to provide full coverage of the so-called "geosynchronous belt." The first installation at White Sands, N. M., is in progress. Two other sites, one in Hawaii and the other in Korea, have been selected. Selection of the two remaining sites, one in the Middle East and the other in the Northern Atlantic region, is under way.

GEODSS can operate in one of two principal surveillance modes: It can move at a sidereal, or stellar, speed and thus detect satellites since they move at an anomalous rate; or it can filter out the stellar background by moving at the rate of a specific satellite whose orbital speed is known from previous sightings.

A follow-on program to GEODSS, TEAL AMBER, is under way at ESD's Rome Air Development Center. RADC's Commander, Col. Donald J. Stukel, said this DARPA-funded program is concerned with the development of a CCD (charged-coupled device) mosaic sensor operating at visible wave lengths and ancillary digital electronics to provide a wider field of view, greater sensitivity, and higher search rate than GEODSS. Rockwell International is conducting the TEAL AMBER program for which RADC has technical and managerial responsibility. The first TEAL AMBER mosaic staring sensor is scheduled to go to ESD for testing in the GEODSS system in FY '81. This advanced technology could be retrofitted into GEODSS.

ESD's Pacific Radar Barrier program concentrates on detecting foreign space launches in an early phase of their orbits. This capability is of special importance because the Soviet ASAT antisatellite weapon can intercept target satellites on its first orbital revolution. Two or three sites will be involved in this $60 million program. One element is the US Army/Lincoln Laboratory Altair Y-band radar in the Kwajalein atoll. Two additional island sites, one in the Western and the other in the Central Pacific, are under consideration. □

Strategic Command and Control

The E-4B Command Post, another pivotal ESD program, according to Dr. Perry, is "one of the best near-term prospects for achieving survivability of the key elements of command and control." The E-4B replaces the EC-135 National Emergency Airborne Command Post (NEACP) and is scheduled also to perform the SAC "Looking Glass" command post mission in the future. A fleet of six aircraft—converted Boeing 747s that incorporate extensive hardening against nuclear effects—is called for under DoD's consolidated guidance. The new Five-Year Defense Plan, however, holds the E-4B program to four aircraft. ESD's Deputy for E-4, Col. D. S. Hall, told this writer the Air Force's FY '81 Program Objectives Memorandum includes a six-aircraft fleet.

Communications for the E-4B include SHF and UHF airborne terminals, a high-powered LF-VLF terminal, and improved communications processing. The system is not operationally limited to air-to-air or air-to-ground line-of-sight communications, incorporates antijam features, and can operate in a nuclear environment over extended ranges.

The latter trait results in part from the aircraft's VLF (very low frequency) antenna system that can reel out a lower wire up to five miles in length and an upper wire up to one mile long.

Three E-4A aircraft serve presently in the NEACP role. These air-

The E-4B command post, a pivotal ESD program, is one of the best near-term prospects for achieving survivability of the key elements of command and control.

craft use the C³I system taken from decommissioned EC-135 NEACPs. One E-4 serves as the test-bed for the C³I improvements of the "B" version and, at this writing, is undergoing simulated EMP testing at Kirtland AFB, N. M. The Air Force expects to let contracts early in 1980 for retrofit of the three E-4As to the "B" configuration, to be completed in FY '84. Boeing, teamed with E-Systems, is competing against a Rockwell International/ Collins Radio team for the contract. Decisions about the E-4B's onboard automatic data-processing equipment have been deferred until completion of the retrofit. □

The AFSATCOM/SSS Program

The Air Force Satellite Communications (AFSATCOM) program provides reliable two-way command and control communications between the NCA and globally deployed nuclear-capable forces. The system is composed of satellites of the Navy's FLTSATCOM system, the Air Force Satellite Data System (SDS), UHF transponders integrated into selected DoD satellites, and UHF terminals in selected aircraft and ground installations. The program is managed jointly by SAMSO and ESD, with the latter responsible for the development, test, and acquisition of airborne and ground terminals.

Brig. Gen. W. E. Thurman, ESD's Deputy for Communications and Information Systems, told this writer that delivery of the terminals is "on time and on schedule." The AFSATCOM terminals are going on B-52, FB-111, EC/RC-135, and US Navy submarine relay TACAMO aircraft as well as into ICBM launch control centers. The AFSATCOM system reached initial operational capability (IOC) with the deployment of terminals on a B-52 squadron and four E-4 command and control aircraft as well as start up of a master control station at Offutt AFB, Neb. The system's space component, now in operation, includes transponders on FLTSATCOM and SDS satellites. The next component will consist of improved SDS satellites and single-channel transponders for the NAVSTAR GPS and Defense Satellite Communications System (DSCS) satellites.

The terminals aboard the bomber force are miniaturized teletype keyboard and printer units. The number of ground terminals, following consolidation of user requirements, has been cut from seventy-one to thirty-nine.

While AFSATCOM's one-way transponders on various host satellites enhance the survivability of the emergency action message dissemination system, additional improvements related to the system's electromagnetic and physical survivability will be needed. Hence, there are plans for a follow-on program, the Strategic Satellite System (SSS), whose development was authorized by the Defense System Acquisition Review Council (DSARC) in January of this year. Initial developmental contracts on SSS are to be awarded in FY '80.

Key for assuring the survivability of the system's space elements is very high orbital altitude. Improved spacecraft survivability has been demonstrated by LES-8/9, two Lincoln Laboratory experimental satellites that were launched into near-geosynchronous orbits several years ago. These technology testbeds for SSS use radioisotope thermoelectric power sources in place of the large solar panels—with corresponding radar cross sections—and a host of other technologies to minimize nuclear effects and maximize jam resistance. They also demonstrated the ability to communicate in a nuclear war environment reliably and directly with one another and with airborne terminals beyond the range of single satellite relay. This feature does away with intermediate ground terminals, which are among the most vulnerable elements of strategic communications.

While ESD seeks to incorporate AFSATCOM terminals into SSS, some new equipment is needed to assure survivability and antijam capabilities, according to General Thurman. The FY '80 budget includes $51.4 million for R&D associated with the SSS program. AFSATCOM and SSS are key components of the Defense Department's World-Wide Military Command and Control System (WWMCCS).

Another component of WWMCCS under ESD development is the SAC Digital Network (SACDIN). This communications network conveys two-way, hard-copy, secure command and control information between SAC Headquarters and subordinate SIOP elements, such as SAC missile and bomber/tanker

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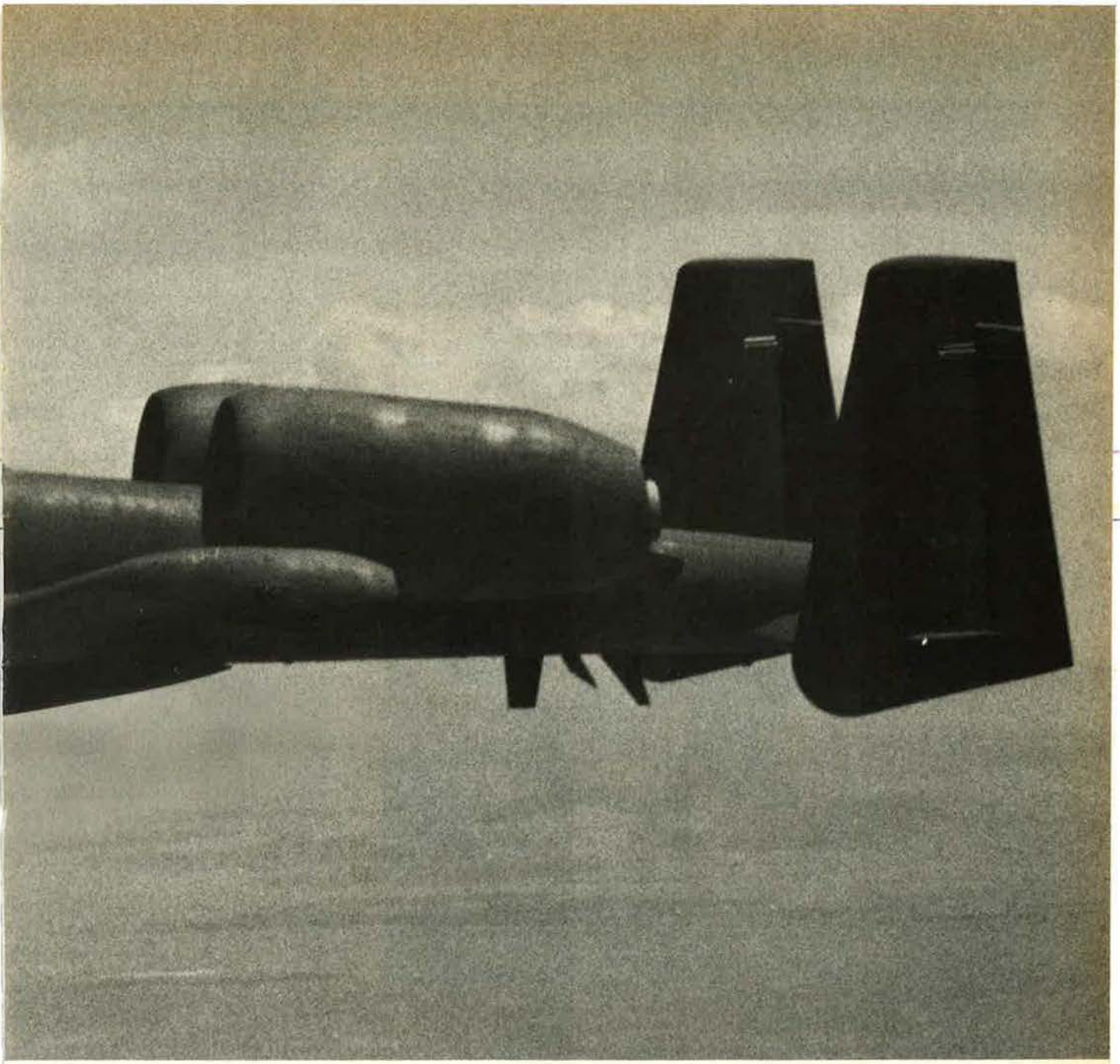

Response: The Two-Place Fairchild A-10

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command posts. The SACDIN program, following a scaling down caused by congressional concerns over rising costs, is now in the initial stages of development. SACDIN will utilize AUTODIN II, a common-use network, as the primary transmission segment, thus eliminating the need for the specialized transmission and switching subsystems envisioned originally.

SACDIN's prime contractor is the Defense Communications Division of ITT. Eventually, the system will link the alternate National Military Command Center at Fort Ritchie, Md., with various SAC command posts and ICBM launch control centers. The latter are tied in with Minuteman III's Command Data Buffer System that permits rapid retargeting. This segment of SACDIN will be hardened against nuclear effects to the same degree as the Minuteman capsule.

SACDIN makes allowance for the varying needs of different levels of users through a "hierarchical" structure and can diagnose and correct failures automatically. The system has backup links to AFSATCOM/SSS and the E-4B. □

Tactical intelligence equipment, developed by AFSC's Electronic Systems Division, is now being used by the Air Training Command at Lowry AFB, Colo.

The E-3A AWACS

The Air Force's extremely versatile E-3A AWACS, an ingenious combination of jam-resistant radar and flying computer, performs CONUS air defense and various tactical missions. The system, a modified Boeing 707 jetliner equipped with an advanced "look-down" Westinghouse radar and sophisticated data processing, now consists of eighteen operational and one test aircraft. The total programmed USAF buy is thirty-four aircraft, the last of which is to enter the inventory in 1984. Total cost of the program, including a series of "enhancements" to meet changing requirements, is expected to come to about $4.2 billion in then-year dollars, according to Maj. Gen. G. W. Rutter, ESD's Deputy for AWACS.

In addition, NATO is acquiring eighteen E-3As at an estimated cost of $1.8 billion, or $2.3 billion if all ancillary costs are included. Some members of Congress want to reduce the programmed USAF buy, on the contention that the NATO acquisition makes some of the US aircraft unnecessary. This reasoning gains impetus from the fact that the US, as a NATO member, will help pay for the eighteen NATO AWACS systems. Up to six aircraft of the thirty-four USAF systems are in question at this time.

Because the E-3A has been planned to have a useful life of about thirty years, General Rutter pointed out, a comprehensive enhancement plan is being initiated. The NATO enhancement program seeks to roughly triple the number of target tracks—the specific number is classified—that the system can handle by installing a higher-speed computer and by increasing memory capability. The first NATO aircraft will be ferried by Boeing to Dornier, a German aerospace company, early in 1981, with delivery to NATO in early 1982. The German company, acting as a Boeing subcontractor, will install the mission equipment for all eighteen NATO E-3As.

Another element of the E-3A enhancement package will retrofit three additional situation display consoles for a total of twelve, and four additional radios. This boost in command and control capacity will strengthen the AWACS's "flying command post" feature, required especially for the CONUS air defense role. A "display remoting" capability—basically a secure and encrypted TV link to the ground—also is planned to provide commanders on the ground with the same information, in real time, that is displayed aboard the aircraft. Display remoting techniques are still being reviewed and probably won't reach operational status until 1984. Three E-3As have been equipped with conventional TV "downlinks" to demonstrate the feasibility of the concept, but lack security and jam-resistance.

A variety of features to enhance ECCM (electronic counter-countermeasures) is under consideration. The urgency of ECCM enhancements will depend on how rapidly Soviet ECM capabilities increase over the next few years. Before ESD undertakes modification of the E-3A radar—which even in its present form is considered highly jam-resistant—"we want to be very sure that there is such a requirement and that we have the best and most cost-effective solution in

hand," General Rutter pointed out.

The E-3A's maritime surface surveillance capability (MSC) modification, that is being carried out by Westinghouse, the system's radar contractor, adds a receiver to the pulse mode radar and incorporates a "land mass blanker" to filter out radar returns from land surfaces. This filtering is done by digital means in a special processor. Objective of the maritime surveillance feature is to enhance the E-3A's ability to augment naval surveillance systems. The last ten USAF and the NATO E-3A aircraft will be provided this capability.

The maritime surveillance capability, General Rutter said, is of special importance in the case of AWACS aircraft operating over the GIUK (Greenland-Iceland-UK) gap in support of the Atlantic Command "where there is a great deal of naval traffic of interest to NATO as well as the European coastal areas." The same applies to the E-3As that, beginning in the summer of next year, will be supporting PACOM/PACAF by operating over Korea. "With the maritime surveillance feature, these aircraft will be able to monitor both coasts at once. Since the North Koreans don't have a big-ship navy, we are concerned primarily with small vessels operating close to the shore," he said.

AWACS incorporates hardening against nuclear effects, mainly EMP (electromagnetic pulse), according to General Rutter. Comprehensive tests at Kirtland's special simulation facility verified the E-3A's EMP resistance. Nuclear hardening is of special importance to the CONUS air defense mission or in case of theater nuclear war in Europe.

Occasionally questions are raised about the E-3A's self-defense capability, which is limited to maneuvering at jet speeds, calling in interceptors, or directing friendly SAMs against airborne

The Air Force's extremely versatile E-3A AWACS, an ingenious combination of jam-resistant radar and flying computer, performs CONUS air defense and various tactical missions. The system is a modified 707 jetliner equipped with a look-down radar.

threats. (The fact that in the pulse mode, as opposed to pulse Doppler, the AWACS radar can detect aircraft operating at altitude over a distance of up to 350 miles probably precludes surprise attacks by hostile interceptors.)

ESD has looked at, but as yet has not seriously considered, the eventual need for an air-to-air missile, an antiradiation missile, or even a laser weapon. "For the time being, we are holding the E-3A's self-defense capabilities to hard-point provisions for a standard ECM pod on the NATO/USAF aircraft. This is needed because these systems have to operate over water where they could be surprised by SAMs," according to General Rutter. □

The Joint Tactical Information Distribution System

Possibly the most far-reaching E-3A enhancement is the addition of Joint Tactical Information Distribution System (JTIDS) terminals.

The Air Force is the lead agency of a joint service program—predicted by DoD to reach eventually a $5 billion plus scope—to develop a highly jam-resistant, secure data link that interconnects tactical elements of all US and, later on, allied services.

The JTIDS's many and varied USAF applications, according to General Marsh, include rapid reassignment of airborne aircraft, automatic transfer of improved all-weather target data into aircraft bombing and fire-control systems, threat warning, more effective control of interceptors and ground-attack aircraft, and positive identification and location of friendly JTIDS-equipped aircraft. Once JTIDS transponders have been placed on all US and allied fixed-wing combat aircraft, JTIDS, "by exception," will provide IFF (identification friend or foe) information.

NATO, which was offered JTIDS by the Defense Department as a means to increase interoperability, has not yet chosen between this system and two competing European systems. NATO has decided, however, that if one of the two European systems is selected, there must be interoperability with the US JTIDS system.

JTIDS exploits sophisticated time division multiple access (TDMA) and other even more advanced technologies to create multiservice jam-resistant networks that facilitate the correlation and manipulation of the data flow. As the term indicates, TDMA divides time rather than frequency to communicate with individual participants on a noninterference basis. Since it "frequency-hops" across a wide spectrum, JTIDS is highly jam-resistant. Each unit of time is divided into a large number of time slots, and a precise synchronization arrangement allocates the slots to individual users for the transmission of short bursts, or encoded pulses, of digital data. The combination of frequency hopping and coding not only leads to jam resistance and security but also makes it possible to create multiple nets within the JTIDS band. When a subscriber is not transmitting, the terminal monitors all transmissions but selects for further processing only those categories of information that interest him.

The Defense Department, General Thurman said, has committed all services to a joint digital language (basic data format) for use by all JTIDS subscribers. Deployment of JTIDS, General Marsh said, should yield immediate and dramatic benefits. Aircraft survivability will be increased, since relevant threat information will become available in real time. This will apply also to command and control data essential for executing specific missions. Further, applying this information to the common JTIDS navigational grid increases the probability of acquiring targets on the first pass so that a JTIDS-equipped force is likely to accomplish more, to sustain combat efficiency longer, and to experience fewer losses.

JTIDS, as General Thurman pointed out, will enable the E-3A to share its unique radar information in real time with combat aircraft that lack high-performance sensors.

Three classes of terminals are being developed under the JTIDS program. Class I is for large aircraft, such as AWACS, surface ships, and facilities that link JTIDS to ground-based networks. A production decision on this class of terminals is pending. These units weigh about 330 pounds and are the size of a small refrigerator. Flight tests of the Class I terminals were successful even in the face of severe jamming, according to General Thurman. Two terminals of this type have been accepted by ESD for test.

Class II terminals are designed for small aircraft, large RPVs, and ships with volume constraints. While similar to Class I in function, these units are smaller—about two cubic feet—and weigh only about 120 pounds. Class II terminals are about to enter full-scale development. Integration with avionics systems of the F-15 and F-16 is under way and about to start with the F-14.

The feasibility of Class III terminals—envisioned for use by some theater missiles, forward air controllers, small RPVs, and selected Army personnel—is being reexamined. The high-speed integrated circuitry technology needed to get these terminals down to a weight of about twenty-five pounds is not yet in hand, according to General Marsh.

ASIT, for Adaptable Surface Interface Terminal, is another JTIDS component currently in engineering development. Purpose of ASIT is to tie Class I terminals to existing C^3 systems, such as the NATO Air Defense Ground Environment (NADGE) system. ASIT testing is scheduled to start late in 1979.

The Federal Communications Commission has ruled that JTIDS does not interfere with FAA air traffic control systems. Key contractors of the JTIDS program are Hughes, ITT, and Singer-Kearfott. □

HAVE QUICK and SEEK TALK

Separate from JTIDS but performing a complementary role are ESD's HAVE QUICK and SEEK TALK programs. Impetus for both was the experience of the 1972 Yom Kippur War when the Israeli fighters were jammed by Egypt's Russian-made equipment from the moment they started their takeoff roll. Both programs provide jam-resistant, secure communications. HAVE QUICK will provide tactical aircraft with stopgap air-to-air and air-to-ground-to-air jam-resistant UHF communications. This interim system is limited to near-term EW threats. By about 1985, ESD's advanced jam-resistant and secure voice communications system, SEEK TALK, will take over from HAVE QUICK. This spread spectrum, random noise system will use adaptive array techniques to "null" a number of jammers at once. SEEK TALK will enable tactical aircraft to operate even in the most intense jamming environments that are being hypothesized for the coming decade.

The system will rely on advanced electronic circuitry to bring down costs sufficiently to permit installation on a large number of combat aircraft. SEEK TALK will provide a jam-resistant conferencing capability—meaning that a wingman can break into the traffic without delay to report SAM sightings, along with directional information, or other emergencies. A secondary SEEK TALK requirement is for security from enemy monitors. This feature need not be applied across the board, however, since much of the information carried by SEEK TALK—such as SAM firings—is known to the enemy anyway and is extremely perishable.

ESD is the Air Force's executive agent in working toward the integration of JTIDS, SEEK TALK, the Global Positioning system (NAVSTAR), and the Inertial Navigation System (INS-ARN101) of tactical fighters under a program called CNPI (communications, navigation, and positioning integration). CNPI's goal is to minimize cost and maximize operational advantages through avionics systems that have commonality, modularity, and compatibility. □

The PAVE MOVER Program

A fundamental requirement of long standing—the ability to scan large ground areas continuously under all weather conditions and from a standoff position—underlies the PAVE MOVER, or Target Acquisition Weapon Delivery Systems (TAWDS). A joint effort by DARPA and ESD's RADC, PAVE MOVER is to provide a wide-area surveillance, detection, and strike capability. Designed for low probability of intercept by enemy ELINT, PAVE MOVER is to make possible real-time weapon guidance data and cueing to other weapon systems. The system, in the view of General Marsh, is a key element toward DoD's ambitious Assault Breaker concept whose principal objective is to cope with the Warsaw Pact's armor in the second echelon.

PAVE MOVER's core technology is an all-weather airborne MTI (moving target indicator) radar along with associated ground processing and display equipment.

The system is to meet a number of operational requirements, including real-time surveillance of hostile activity beyond the forward edge of the battle area (FEBA) in order to detect abnormal trends and the ability to slow or stop hostile second-echelon movement. The latter presupposes the tracking of targets with sufficient accuracy to direct effective strikes by manned aircraft and air-to-surface weapons against them.

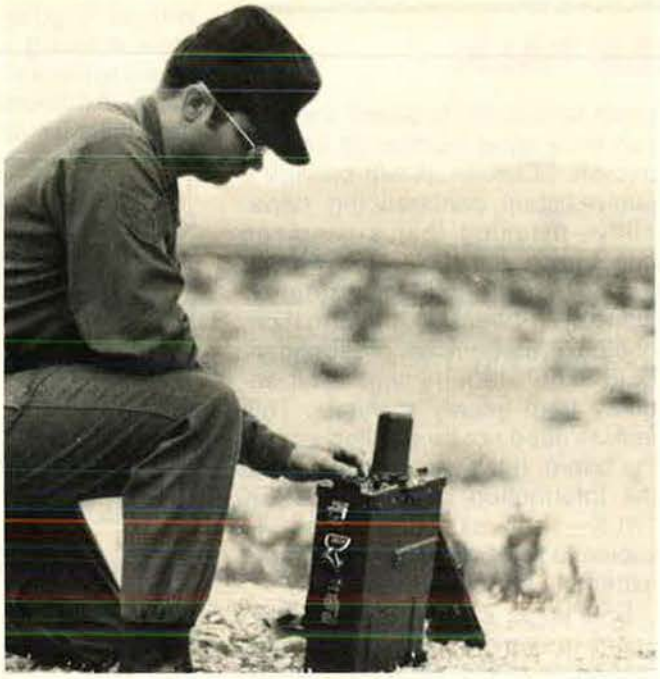
PAVE MOVER will be able to perform wide-area surveillance over a 120-degree arc (from the radar boresight) at long distances, as well as to guide weapons against slow-moving targets (such as tanks) within the area under surveillance. Additionally, it will provide data links for radar target information to ground processing centers. The system can operate in self-contained fashion or in concert with other navigation grids. Progenitor of the system is the Air Force Multiple Antenna Surveillance Radar, developed by Lincoln Laboratory. Two competing designs are under development by Grumman Aerospace Corp. and Hughes Aircraft Co. Development, fabrication, and preliminary evaluation of the designs are to be completed by August 1980. Full-scale testing of the system will then take place at Eglin AFB, Fla., over a six-month period.

Advances in sensor systems, and the availability of sensor information marked by what General Marsh termed "strike-type accuracy," are being hampered by inadequacies in exploiting such data rapidly and accurately as well as in getting the information to where it is needed.

Three ESD programs are concerned with this complex challenge. The TIPI, for tactical information processing and interpretation system, a $200 million program, uses computers to speed up the analysis of tactical intelligence to provide commanders only essential information in understandable form. Designed for USAF and Marine Corps use, TIPI processes and interprets mainly photographic and SLAR imagery.

The OASIS (operational applications of special intelligence systems) program "fuses" intelligence data with real-time operational information to aid Air Force and other commanders in NATO's Central Region in allocating available forces and assets. OASIS feeds into a Tactical Fusion Center. MITRE Corp. of Bedford, Mass., Martin Marietta of Denver, Colo., and Systems Development Corp. of Santa Monica, Calif., participate in this program.

The Battlefield Exploitation and Target Acquisition (BETA) project is a joint Army-Air Force effort to



ESD's new beacon radio-signal system helps ground troops direct air strikes.

demonstrate the near real-time integration of data from a wide range of Army and Air Force surveillance sensors. If successful, General Marsh said, BETA will be followed by development of a mobile, multisource correlation facility to provide targeting data for battlefield interdiction missions.

BETA equipment, according to Dr. Perry, will be located at Army Corps and Division Operations Centers and Air Force Tactical Air Control Centers. NATO-based demonstrations and evaluations are scheduled for 1980. The Navy and Marine Corps have joined the program on a trial basis. Principal objective behind BETA is not to develop and deploy an operational system but to furnish a realistic test-bed that can help point the way toward future "closed-loop" tactical C³I systems spanning the spectrum from target acquisition and establishing attack priorities to near real-time attacks by a variety of highly accurate weapons under all weather conditions and, whenever necessary, from standoff positions. The BETA Joint Project is being operated by the Army with close USAF participation. TRW is the system's prime contractor with support from Bunker-Ramo and BDM.

ESD's Tactical Air Battle Management System, a program that replaces TACC (tactical air control center) AUTO, will use off-the-shelf hardware to provide the same capability as its predecessor system but with increased growth for the future. It is planned to obtain this capability at an earlier date than would have been the case with TACC AUTO and at about half the cost, General Thurman said. Principal objective is to exploit fusion to the point where frag orders and their dissemination can be automated.

All of ESD's efforts in the tactical arena have coalesced, in the sense of systems architecture, into a recently completed master plan involving TAC, USAFE, and PACAF. Known as TAFIIS, for Tactical Air Forces Integrated Information System, it represents an integrated picture of where all C³ systems stand at present, how they work together, what their alternatives are, and where the Air Force intends to go in the near and far terms. □

EW: A Sword as Well as a Shield

Traditionally, EW has concentrated almost exclusively on defense suppression or countering enemy first-line missiles and guns with jamming, chaff, flares, antiradiation missiles, and strikes against his SAM sites. Conversely, antijam (AJ) and ECCM techniques have sought to protect USAF's own C³I from interference.

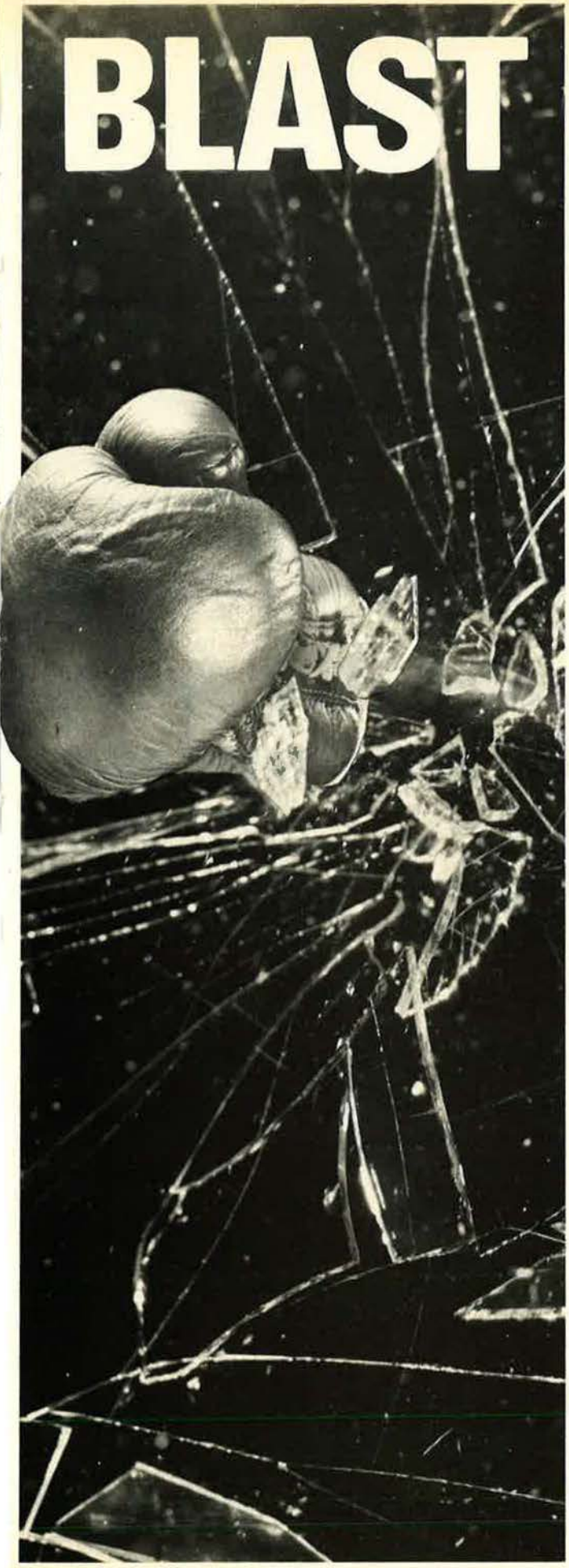
But as General Marsh pointed out, "we must look beyond defense suppression—and beyond defensive thinking—to use EW as a sword as well as a shield and to find ways to employ electronic warfare along with other capabilities and weapons to carry the war—offensively—to the enemy."

A new Air Force initiative, command and control countermeasures, or C²CM, was assigned to ESD last year, according to General Stelling. The objective is to "destroy, degrade, deceive, or exploit the enemy's C³I facilities, or—to use Warsaw Pact terminology—radio electronic combat capabilities," he said. The thrust of C²CM is purely offensive with the basic objectives of neutralizing or destroying the enemy's signal intelligence, command centers, data links, tactical air control system, artillery, armor, and other communications nets, and all other C³I nets and facilities, General Stelling explained.

"The job of drafting the C²CM plan has been assigned to ESD, the rationale being that we who design and develop C³ systems are most acutely aware of their vulnerabilities, and should therefore have a major role in planning how best to defeat the C³ capabilities of the other side," according to General Marsh. A dozen or so other Air Force and Army and Navy agencies will participate in the program.

The plan, the ESD Commander said, is to be completed in September. "It will outline incremental development of C²CM: an interim capability, using existing assets, operational in Europe by next year; a mid-term capability, incorporating some short-term improvements, by 1985; and full, advanced C²CM capability by 1995."

Electronics, it would seem, is on the offensive as never before. ■



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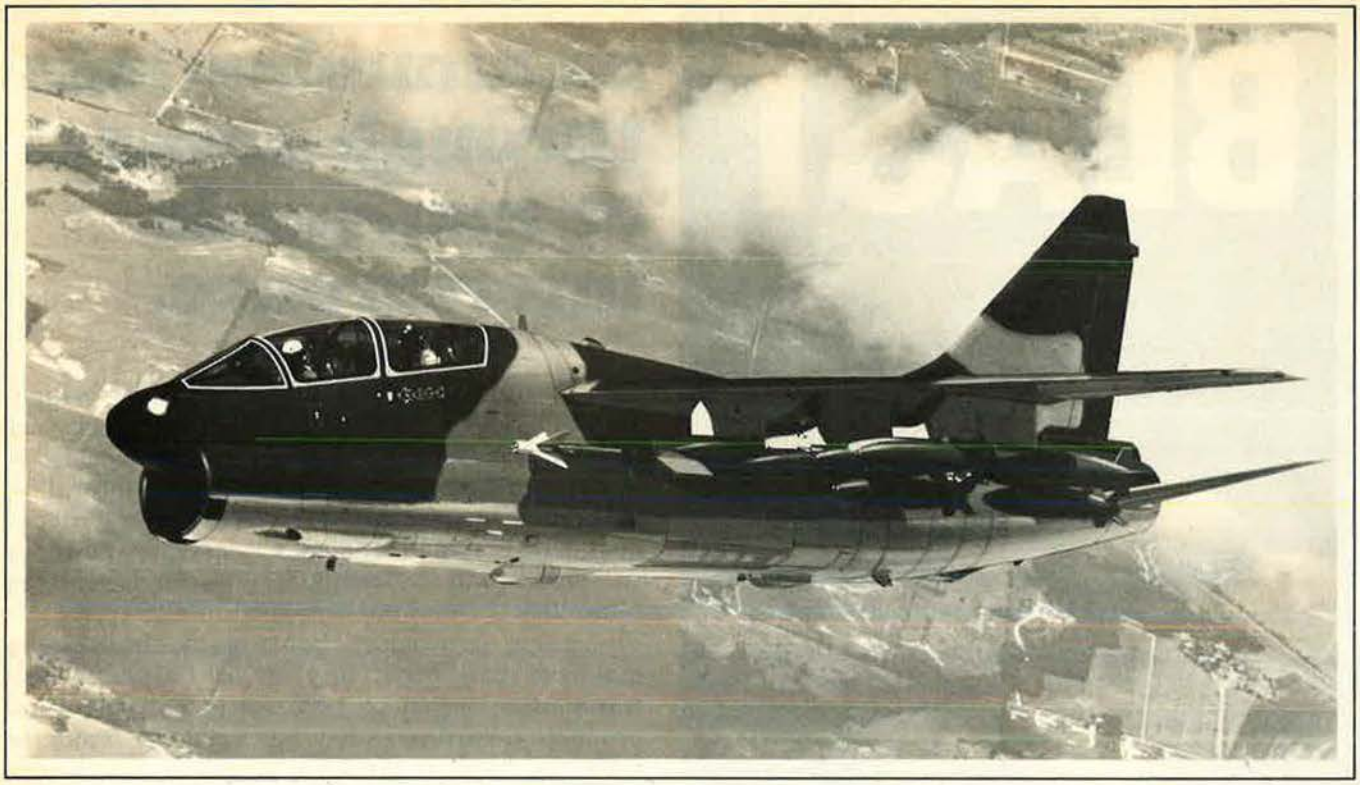

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What's Happening in Electronics at ESD

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, with associated avionics, to update the USAF air traffic control function. Major systems being acquired include navigation aids, radar approach control equipment, landing systems, and simulators.	Continuing Acquisition	Many
411L	**E-3A Airborne Warning and Control 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.	Acquisition and Operational	Boeing Aerospace Co. (Westinghouse is radar subcontractor to Boeing; Redifon for simulator)
414L	**CONUS Over-the-Horizon Backscatter Radar** The program provides 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 Communications Corp.
428A	**Tactical Information Processing and Interpretation System (TIPI)** The USAF TIPI/USMC MAGIS (Marine Air General Intelligence System)/USA MAGIIC (Mobile Army Ground Imagery Interpretation Center) will provide more timely and accurate intelligence to tactical commanders at various echelons. Air transportable and housed in mobile shelters, segments of the system use automated aids for rapid processing, interpretation, and reporting of intelligence from airborne electronic reconnaissance infrared, photographic, and radar sensors.	Development, Acquisition, and Deployment	Many
450A	**Tactical LORAN Digital Avionics Systems** Development and acquisition of the AN/ARN-101(V) Navigation, Weapons Delivery, and Reconnaissance System for the RF-4C and F-4E aircraft. This digital modular avionics system combines LORAN/inertial information and integrates radar, optical, infrared, and laser sensors to satisfy requirements for precision weapons delivery during the 1979–88 time frame.	Development and Acquisition	Sperry Gyroscope, Lear Siegler
451D	**COMBAT GRANDE** Maintenance of Spanish Air Force air defense system; provide additional communication links; and improve existing communications, command control, and weapons control.	Acquisition	COMCO (Hughes Aircraft and CECSA)
478T	**Combat Theater Communications** A program to acquire new hybrid analog/digital and digital communications equipment both for Air Force unique 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, ECI, 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 high-confidence capability to execute and control SIOP forces during nuclear war.	Development and 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 combat 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, Goodyear, Applied Devices Corp., General Dynamics
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.	Operational	Raytheon
633B	**COBRA JUDY** Acquisition and deployment of a shipborne phased-array radar supporting missile and space research and development activities.	Acquisition	Raytheon
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 flexible choice of equipments that must be tailored to the unique physical characteristics of the location and to the threat.	Advanced Development and Engineering Development	Many

SYSTEM NO.	NAME AND MISSION	STATUS	CONTRACTOR
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 the performance of tactical air control functions.	Implementation	Hughes Aircraft
1136	**SAC Digital Information Network (SACDIN)** A program for an integrated SAC command-wide digital record communications system to meet, with updating, requirements for command control and support data transmission into the 1990s.	Development	ECI, ITT, IBM
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 improve technical control, 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., Ford Aerospace and Communications 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	Rockwell, Linkabit Corp.
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.	Acquisition	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, 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 Program for Joint Interoperability of Tactical Command and Control Systems (AFJINTACCS)** Centralized analysis, planning, technical support, preliminary systems engineering, modification, and joint test support for Air Force command and control systems designed to participate in the JCS-directed JINTACCS program. Activities will focus on increased compatibility, interoperability, and operational effectiveness.	Planning, Test, and Demonstrations	None
2206	**Digital European Backbone (DEB)** A program to incrementally transition portions of the European Defense Communications System from an FDM multiplexed system (analog) to a time division multiplexed system (digital) with higher reliability components. This will provide an economic wide-band digital bulk-encrypted alternative routing capability between Defense Satellite Communications System's earth terminals and major commands.	Validation, Acquisition, and Deployment	Radiation Systems, Raytheon Service Co.
2283	**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	Hughes, ITT, IBM, Singer-Kearfott, McDonnell Douglas
2294/ 2467/ 2486	**Pacific Radar Barrier (PACBAR)** The PACBAR system will provide space surveillance coverage and early detection of new space launches in the Central and Western Pacific areas by placing improved radars at three sites.	Development and Acquisition	None
2295	**Ground Electro-Optical Deep Space Surveillance System (GEODSS)** The GEODSS system will extend the Aerospace Defense Command's spacetrack capabilities for detecting and cataloging space objects out to the 3,000–20,000 nautical mile range. This will be a global network of five sites to optically detect, track, and identify satellites in earth orbit.	Acquisition	TRW
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	Martin Marietta
2433	**SEEK IGLOO** Upgrading or replacing all thirteen USAF long-range radar sites in Alaska on a Minimally Attended Radar concept with maintenance by no more than three medium-skill radar technicians and no on-site radar operators. A major objective is a large-scale reduction in the life-cycle cost of Alaskan radar surveillance systems.	Development	None
63429F	**Warning Information Correlation (WIC)** Phased development of tactical warning and attack assessment software and display design. Through WIC, improved operational software will be developed for common display of information at the four command centers. Objective and independent evaluation will be performed of missile	Development	None

SYSTEM NO.	NAME AND MISSION	STATUS	CONTRACTOR
63429F	warning system and NUDET surveillance sensor capabilities to support tactical warning, attack assessment, strike assessment, and force management missions of NORAD and SAC. DT&E support for implementation of the improved software and displays will be provided.		
	Air Force SAFE Program Acquisition and deployment of commercially available and DoD BISS Program-developed physical security equipment to approximately 100 USAF bases and 130 sites worldwide. These systems will protect mission-critical/high-value resources such as weapons storage sites, strategic/tactical alert aircraft areas, special mission aircraft parking ramps, and specified command posts.	Acquisition and Deployment	Fourdee Inc., Honeywell, Dewey Electronics
	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).	Analysis	RCA
	BMEWS Modernization Improvement of the existing system by replacing the computers currently in operation and modifying the present radars to enhance range resolution and provide an attack assessment capability.	Development and Acquisition	None
	Air Force Data Element Dictionary 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 objectives in a given area.	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
	Improved Administration Capability Test (IMPACT) Design, implementation, test, and evaluation of a prototype automated office system for Air Force Systems Command. Objective is to introduce modern office technology to management and support functions for greater economy.	R&D	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 To replace the existing Distant Early Warning (DEW) Line with a system of minimally attended and unattended 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
	SEEK SCORE To develop and produce a radar bomb scoring system for SAC for training and evaluation of aircrews in a realistic operational environment.	Development	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-constrained program to achieve improved tactical operations.	Continuing	None
	Enhanced Perimeter Acquisition Radar Characterization System (EPARCS) The EPARCS program consists of hardware and software modification to the present PARCS system. It will include range extension of the radars, and increasing the accuracy and improving the traffic-handling capability in support of the launch-under-attack mission.	Conceptual	None
	SEEK TALK To reduce the vulnerability of tactical UHF radios to enemy jamming, by developing a long-term, jam-resistant capability that can be added to the present UHF radio system.	Development	Hazeltine, E-Systems, General Electric
	HAVE QUICK This program addresses the same need as the SEEK TALK program, but with a "quick-fix" emphasis, employing techniques that require neither advanced development nor extensive modifications.	Engineering Development	Magnavox

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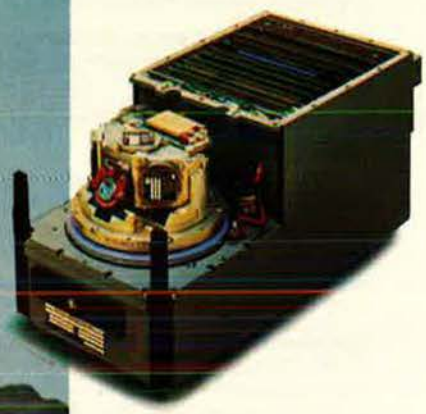

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The Imperatives of Electronic Superiority

The considerable cost of maintaining technical superiority in electronics is a far smaller burden on the US economy than attempting to match the USSR quantitatively in systems and manpower, but at a reduced level of US technological capability.

BY DR. RUTH M. DAVIS
DEPUTY UNDER SECRETARY OF DEFENSE
(RESEARCH AND ADVANCED TECHNOLOGY)

IN A direct sense, this nation's military superiority pivots on its ability to maintain unexcelled technological superiority in electronics. Such superiority in turn requires maintaining an unequivocal lead in electronics technology. This does not come cheaply. It demands steady—sometimes breakaway—advances in the many component technologies comprising electronics. It also demands knowledgeable vigilance in preventing the unintentional flow of critical electronic technology through the international commercial market into the ready arms of potential adversaries.

In a second important although indirect sense, our military superiority also is dependent on unexcelled electronics superiority. Military strength relies heavily on a vigorous domestic industry, and electronics technology is a kingpin of our industrial preeminence.

Kilogate integrated circuits, complex information networks, large focal plane arrays, and hypersensitive transducers integrated into systems that have a relationship of mutual dependency with their human companions is a national asset. It must be nurtured to preserve the existing US leadership in both defense and industry. Electronics technology thus viewed is not focused singly or simply on large-scale integrated circuits or advanced computers or sophisticated sensors, but is the composite of all of these and other capabilities that are integrated to serve national needs, including that of a strong military capability.

Two essential sources of military strength are manpower and science and technology. Their relative importance appears to be shifting, with science and technology seeming to be the more important now. This is certainly advantageous to the United States, for in terms of available force levels we would come out a poor third among the major nations.

Throughout history, military forces of all nations have learned to capitalize on advances in science and technology. In this era, perhaps the most significant technological advances are those associated with the myriad branches of the electronics field—advances that dramatically extend the senses, minds, and muscles of man. With these advances in electronic technology, we can maintain surveillance over virtually the entire earth, integrate and control the actions of men and systems in complex missions, deliver weapons with pinpoint accuracy to any target, and effectively contribute to countering the threats of opposing forces.

When we can perform these feats but do not, that is a conscious national decision, for we recognize that such capabilities may, at times, impose a burden on the nation's economy through their significant costs that steadily increase, because of constantly escalating requirements to maintain a clear-cut military advantage. Today, electronic technologies are essential in every modern military system. Ships, tanks, planes, or missiles become the platforms that respond to and transport the electronic systems and payloads, while men provide that essential measure of subjective input that cannot be emulated by machines.

The maturing of electronics in military systems has not occurred haphazardly. Sixty years ago, in World War I, radio was in its infancy; it was not until World War II, twenty-five years later, that radio, radar, sonar, and Loran became important tools of the military.

It was during World War II that the seeds of a military force based on electronics were sown. Then, the first rudimentary semiconductor diodes were developed for radar and the technology basis of the digital computer was established. In the two decades following World War II, computers, transistors, integrated circuits, microwave devices, and advanced detectors were developed, and the essential components for the new, sophisticated military electronics came into existence.

The development of these modern electronic components and the synthesis of both large and small systems that use them effectively were, in large measure, a direct result of military requirements. The first semiconductor devices and the first computers are examples of electronics advances, spawned by military needs, that have become, respectively, $4 billion and $30 billion US industries, of which the military share is small.

Growth of the electronics component of the defense budget is

shown in the graph below. The present role of electronics in military systems and operations is so pervasive as to almost defy precise description. The mission- and function-based discussion that follows is intended to provide a snapshot of the contributions of electronics to our current defense posture.

Electronics and the DoD Mission

The uniquely significant role of electronics in DoD planning is apparent in the statement by Dr. William J. Perry, Under Secretary of Defense for Research and Engineering, to the Congress on February 1, 1979. From it one may gain some measure of the importance of electronics to the mission of DoD. Some highlights and examples from his review follow.

Strategic Forces

The strategic component of US military forces is designed as a deterrent against nuclear attack. It consists of the strategic bomber now being strengthened with the air-breathing cruise missile, the ICBM for which various solutions to fixed-base vulnerability are being sought, and the submarine-launched ballistic missile (SLBM) now being upgraded with the quieter Trident submarine. Each of its component weapon systems consists of a payload, a vehicle with appropriate propulsion, and a complex electronic system. The B-52 bombers achieve survivability through an early detection and warning system that includes satellite systems and ground-based radars such as BMEWS, PARCS, PAVE PAWS, and DEW.

The cruise missile, the US answer to improved Soviet air defense capabilities, requires an advanced electronic terrain-following and target-recognition guidance system for precision payload delivery. The electronics for the manned strategic bomber fleet include a reliable command control and communications system; electronic countermeasures; precision navigation; and vehicle management systems.

The effectiveness of these US strategic forces depends on the onboard computers and other electronic equipment that employ the best available technology. First, the Minuteman, and later the SLBM programs, provided benchmarks in the development and application of the integrated-circuit technology.

Tactical Ground Forces

Precision-guided munitions, greater tactical missile capability, remotely piloted vehicles, and longer-range theater surveillance and reconnaissance capabilities are the electronics-based components of our modern tactical forces. The XM-1 tank will provide, among other advantages, a stealth capability for operation at night and in poor weather, a precision-guided gun with a high probability of first-round success, and advanced communication and fire-control radar capabilities. Twenty-five percent of the projected $1.4 million unit cost of the XM-1 is in its electronics.

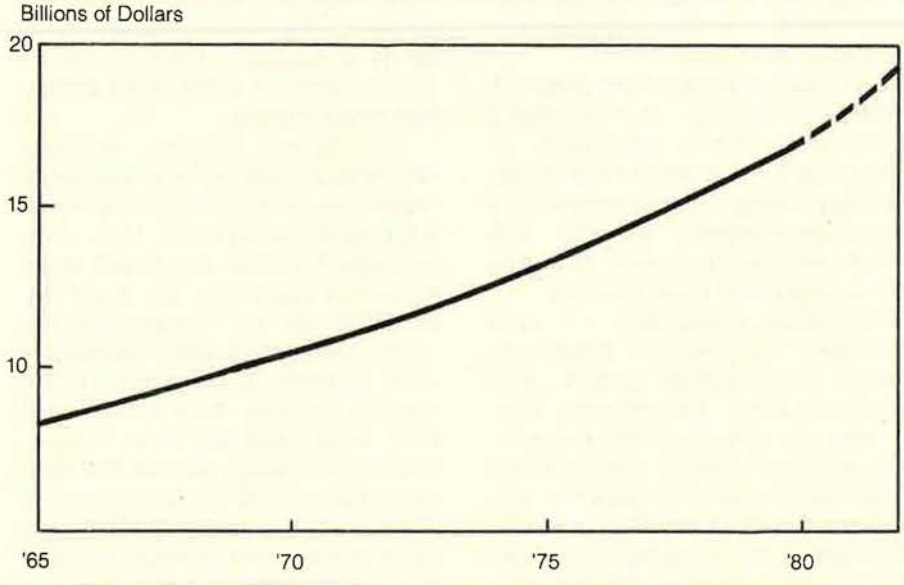
Antitank systems employing the Hellfire homing-seeking (laser, TV, IR, RF, or dual-mode RF/IR) antitank missile, the Copperhead laser-guided cannon-launched projectile, and the improved TOW antitank missile system provide a diversity of responses to the numerically superior Soviet tank forces. The Hellfire will be carried on an attack helicopter with a target acquisition and designation system consisting of an infrared imaging system for night operations, a TV system, and a laser designator/range finder. A separate pilot's night-vision system is included for night-flight operations.

Other electronics-oriented systems for our tactical forces include integrated sensor systems for detection of enemy activity, helicopter-borne radars that provide standoff target acquisition for battlefield control, battlefield short- and medium-range missiles, and field army air defense systems. The Patriot medium-altitude and high-altitude air defense system, for example, is designed to provide greatly increased electronic counter-countermeasures and a simultaneous engagement capability over the presently deployed Hawk system.

Air Warfare

The missions of the tactical air force are air superiority, interdiction, close support, and defense suppression. Air superiority is based on air-to-air missile systems carried by the F-16, F-15, F/A-18, and F-14 fighter aircraft. The F-16,

Defense Electronics Budget



for example, is equipped with a multimode radar that can acquire fixed surface targets as well as high- and low-flying aircraft in all weather, and the Sidewinder missile. The F-15 carries a longer-range radar and a suite of weapons for close-in and medium-range combat. It will have a programmable radar that through software changes provides for different mission types, weapon mixes, and operational environments. The F-14 fleet air defense fighter is to be similarly equipped.

The radar-guided Phoenix missile gives a beyond-visual-range air defense capability. For shorter ranges, the infrared-guided Sidewinder gives an all-aspects attack capability that is important in air combat. The TOW and the infrared-guided Maverick air-to-surface missile are designed to destroy armor or other small hard targets, including sea surface targets. An air-to-ground standoff missile system is currently being developed for high value, heavily defended land and sea targets.

Precision night-attack capability for fighter aircraft including terrain-following radar, millimeter wave fire-control technology, and precision attack capability is under development. High-speed anti-radiation missiles are being developed to destroy the radars of enemy surface-to-air missile systems and air defense artillery.

Sea Control

Sea warfare involves submarine and antisubmarine, air and antiair, surface ship and antisurface ship, and mine warfare systems. US sea-control strategy has involved the development and deployment of multimission systems that respond to multiple threats. Elements of this force comprise all of the electronics capabilities of land and air forces, but adapted to the marine environment. Precision munitions for the fleet include not only the terminally guided missile for both near-in and over-the-horizon surface and airborne targets but also sophisticated homing torpedoes with both short-range and standoff capabilities. The electromagnetic, optical, and seismic sensors of air and land warfare are complemented by underwater acoustic sensing in the form of sonobuoys and towed arrays. The command and control functions are equally demanding, calling for communication, signal processing, and data-reduction systems of increasing complexity. Aircraft carriers, frigates, destroyers, and aircraft of the modern Navy are almost overburdened with essential electronics to the point that electronics miniaturization has become nearly as critical to a ship as it is to an aircraft.

This Ballistic Missile Early Warning site at Clear, Alaska, is part of the US detection and warning complex.

Defense of the surface fleet against air attack is an area of high priority for the Navy. The strategy is based on a defense-in-depth concept wherein attacking aircraft and missiles will be engaged at both long and short range. An important part of this is the system that integrates and coordinates the airborne and shipboard systems comprising this defensive force. The Aegis system is being designed to provide the fast-reaction, high-tracking and engagement capacity, and improved weapon guidance required for this mission. It is an example of a complex computer-based electronics system that is so crucial to naval warfare as to warrant a special class of ships to carry it, the *Aegis* class of destroyers.

DoD Technology Thrusts for FY '80

Six technologies have been identified in the DoD FY '80 program submission as capable of introducing revolutionary advances in our military forces. These are precision-guided missiles, very-high-speed integrated circuits, directed-energy technology, low vulnerability munitions, advanced composite materials, and manufacturing technology. Three of these are primarily in the electronics area.

Additionally, the content of the FY '80 DoD Science and Technology Program consists of twenty-five areas, at least seven of them dominated by electronics. The majority are dependent upon electronics.

The Defense Advanced Research Projects Agency has identified eleven thrusts, nine of them dominated by electronics. They are cruise-missile technology, space defense, space surveillance, anti-submarine warfare, land combat, air vehicles and weapons, command control and communications, charged particle beams, and Assault Breaker.

There is a consensus that electronic technology is a key underpinning for mission-related systems, defense planning, and the future success of US defenses.

Electronics Technology

Status of Electronics Technology

We are fortunate that a strong domestic electronics technology base has been established and supported over the last three and one-half decades in the industrial, university, and government laboratories of this country. Since many of the concepts for and technological features of systems that will be operational in the next several decades are presently being conceived and developed in these laboratories, we must be familiar with this technology base.

Electronics technology has traditionally been identifiable in two general categories: electronic materials and devices, and electronic systems. Although with the development of more capable, complex devices this categorization has become somewhat hazy, it is still convenient for discussion.

The materials/devices technology base is dominated by integrated circuits (IC) and their advanced large-scale progeny, mi-

croprocessors and memory chips. More than any other single component of electronics technology, microelectronics has established electronics as key to advanced military systems. Integrated circuits form the basis of our computational capability, which, in turn, is the basis for much of our weapons superiority. The integrated-circuit developments of the 1960s are now entering the operational inventory, providing a positive impact on system capability and maintenance.

Almost every military system being developed calls for integrated circuits. The high-precision, terminal-guided weapons that provide one of the current important advantages of US forces would not be possible without these modern electronic devices.

It was defense requirements that fostered the development of the transistor and the integrated circuit, which were essential to the establishment of the $4 billion domestic integrated-circuit industry. Ironically, the industry is now largely dependent on and responding to rapidly expanding industrial and consumer markets. As a result, many current military programs must either use commercial integrated circuits or support the development of expensive custom integrated circuits. This technology becomes rapidly available through trade channels to the rest of the world.

There is a realm of integrated circuit technology, however, associated with high speeds and real-time signal processing that is unique to the military and provides a significant edge over competitors. The present DoD establishment of a major new initiative directed toward very-high-speed integrated circuits (VHSIC) will significantly strengthen this advantage in military integrated circuits while at the same time providing valuable technological fallout to the general semiconductor industry.

The VHSIC Program

The VHSIC Program was initiated for several reasons. First, the DoD market share of ICs has been gradually decreasing. Today, it is approximately seven percent. The result is that DoD needs for ICs are not being addressed adequately. Increasingly, the semiconductor industry has been reluctant to meet military specifications in their ICs. Additionally, to a large extent the signal processing needs of DoD have not received adequate attention.

Second, as the industry moves from large-scale integration (LSI) towards very-large-scale integration (VLSI), a new era is unfolding. It is the era of *integrated systems*, which results from the industry capability to fabricate very large numbers of (equivalent) gates on a single silicon chip. For maximum exploitation of this new era, we must develop new ways of thinking about silicon chips.

The management and efficient utilization of this complex functional capability is not easy, and the designer can no longer perform just the classical function of circuit configuration. He now must know and apply the principles of signal processing and computer system design.

Third, as the gate complexity levels continue to increase, military ICs are becoming increasingly custom designed, as mentioned above. In the preceding era, where medium-scale integration (MSI) predominated, the building-block concept was used to design systems. However, with increased complexity resulting in increasingly fewer ICs per system and a trend towards customization, VLSI is becoming more expensive.

The obvious counter to this trend has been the emergence of the microprocessor, which has developed into a phenomenal new commercial field with broad system applicability and affordable costs associated with the large market. In some systems, however, particularly DoD signal-processing systems, microprocessors have definite limitations. Therefore, without a signal-processing counterpart to the microprocessor, the costs, time delays, and logistics problems associated with a custom-design approach to LSI/VLSI have all worked against the broad use of this technology in military systems.

Further, when LSI/VLSI is used in military systems, it is often used in ways where its maximum advantage is not realized. The reasons for this were briefly discussed earlier. Principally, it is very expensive and the IC industry is reluctant to provide the specialized ICs that result in substantial delays in delivery. As a result, where LSI/VLSI is being used, it is used in a limited way, and its full advantage is not exploited. Full advantage will come about only when the ICs are available, affordable, easy to use, broadly applicable, and the systems and subsystems can be designed using integrated systems concepts.

The VHSIC Program has been structured to take advantage of the tremendous capability resident in our industrial and university facilities by focusing that capability specifically on DoD needs. It will find important applications that include the development and exploitation of new system concepts directed toward meeting future military needs and requirements.

Other Electronic Material and Device Technologies

Other material and device technologies, while perhaps less pervasive in their perceived effects, fulfill a variety of critical military needs and provide considerable exclusivity for US military forces. These include both visible and infrared sensors applicable to weapons guidance, reconnaissance, surveillance, and detection; microwave devices, both tubes and solid state, applicable to communications, guidance, electronic warfare, and radar; and other assorted technologies directed toward displays, sensors, and special applications.

Equally important to achieving progress in electronics materials, devices, and general electronics technology are the disciplines associated with the synthesis of complex systems. Concepts relating to adaptive, intelligent, and self-

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repairing systems are gaining credence. Our ability to organize and use these concepts in warfare systems, realizable through large-scale integration of large-scale microelectronics, is fundamental to interaction with and response to the multitude of environments, targets, and weapons that will characterize the future battlefield. Many of the military deficiencies of Vietnam stemmed from a less-than-perfect ability to deploy and utilize available resources. System technology provides the ability to operate strategic platforms of SAC, create precision-guided weapons, achieve stealth in warfare, protect sea forces from airborne threats, and locate and destroy enemy undersea vessels.

Clearly, electronic technologies that provide DoD the technical supremacy needed to develop, acquire, and maintain essential military capabilities are products of the partnerships of DoD and innovative American industry. This partnership must be protected and supported.

Economics and Military Electronics

Applying new electronic techniques to military systems has resulted in enormous performance increases while mean-time-between-failures (MTBF) has remained essentially constant. On the other hand, electronics has not resulted in the dramatic cost reductions for military users that have characterized the consumer and commercial areas. While calculator prices have decreased ten to 100 fold, the cost of tanks and tactical aircraft has been increasing at a similar rate. A good share of these cost increases is associated with electronics. A large percentage of the cost of the XM-1 tank is in its electronics fire-control system. The F-15 aircraft contains twenty-seven microprocessors, which is equivalent to an integrated-circuit version of a general-purpose computer.

A primary reason for these system cost increases, in the face of real component cost decreases, has resulted from the military tradition of using electronics technology advances to greatly expand operational performance capabilities rather than just to decrease costs. The US response to Soviet military posture is to emphasize quality, not quantity. In manpower and numbers of tanks, missiles, or guns, Soviet forces clearly exceed those of the US and NATO.

The US response to these larger forces is multifaceted, based on such capabilities as integrated command and control, precision-guided weapons that increase the probability of first-round kill, and better surveillance of enemy operations using electromagnetic and optical sensors. In the latter category are the focal plane arrays (FPAs) that permit nighttime imaging through infrared sensitive solid-state detector matrices. Such electronic capabilities make our military forces more efficient, and effectively serve as a force multiplier resulting in an equal or even larger capability than represented by a potential adversary. The associated costs of this technological superiority, while large, are a much smaller burden on the US economy than an effort to obtain numerical equivalence at a reduced level of technological capability.

Nevertheless, we must recognize that electronics can be used, if we so choose, to reduce costs, although in so doing the performance/cost tradeoff picture must be continually examined. Electronics can have a significant impact on improved reliability and maintainability through fault diagnostics, self-repair, and redundancy. Where performance can be traded off to achieve such life-cycle cost reductions, it probably should be done.

The thesis that electronics is the key technological ingredient of a strong DoD posture in the competitive realm of international military capability is compelling. Maintaining US preeminence in electronics is therefore a national necessity. The means for accomplishing this are receiving senior management attention with DoD. The previously cited establishment of a major thrust in very-high-speed integrated circuits (VHSIC) illustrates this attention.

Electronics technology, because of its wide-ranging importance to the United States, demands the best of management attention in industry, both large and small. Good industrial management, coupled with that of OSD where appropriate, will permit the individual creative talents of American scientists and engineers to be focused on strengthening both our domestic economy and national security. No better cause could be served. ■

At Sperry, older aircraf
get equal billing with th

For the B-52 . . . Sperry's controls and displays subsystem (CDS) will be the major control center for the offensive avionics system. The system, part of a B-52G and H updating, consists of two 10-inch cathode ray tube displays, a display electronics unit, digital scan converter, video recorder and two integrated control keyboards.

The display electronics unit is used for control and supervision of weapon delivery and navigation display processing and presentation. The two keyboards, located at the radar navigation and navigator stations will control the system in conjunction with the navigator's management and presentation panels.

Boeing B-52

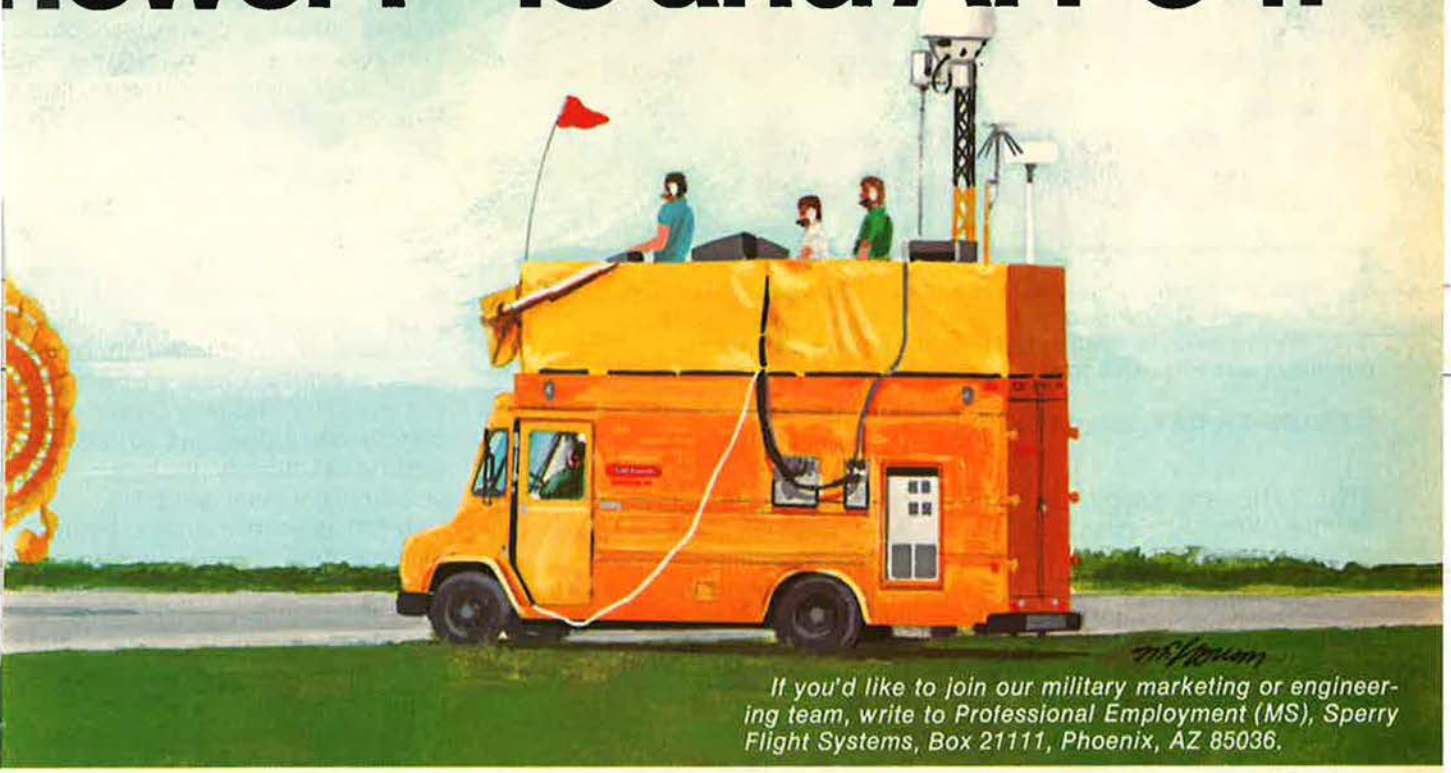
the F-102 . . . like the B-52, is also getting a new lease on life, thanks to Sperry Flight Systems. At our modification center near Phoenix we're changing the role of the fighter interceptor to that of a target drone — the PQM-102 (shown above). The Air Force contracted for the conversion of 145 aircraft, including options.

Capable of up to 8g maneuvers and operation through the full performance range of the F-102, the PQM-102 is a realistic afterburning target used in Air Force weapons system training.

Sperry has a long history of drone conversion work, from B-17s and B-47s to F-104s and T-33s.

the AH-64 . . . Hughes' advanced attack helicopter also counts on Sperry Flight Systems technology. We're providing the digital automatic stabilization system, including the digital backup fly-by-wire control system, a digital symbology generator for cockpit displays, and the entire multiplex data bus system, which integrates the TADS/PNVS with the aircraft fire control system.

ke the B-52 and F-102 newer F-15 and AH-64.



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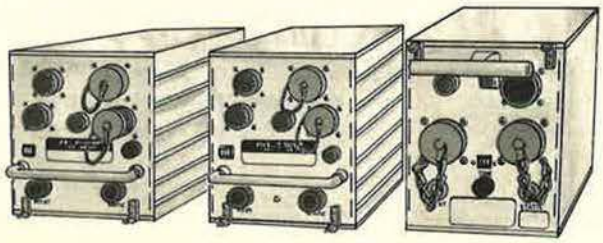
McDonnell Douglas F-15

the F-15 . . . is equipped with three major Sperry systems, including the attitude and heading reference system, an air navigation multiple indicator and digital air data computer.

the F-16 and F-18 . . . are also equipped with Sperry's digital air data computers. And for the F-18, Sperry builds the magnetic memory disc for the Hughes radar system.



F-15, F-16, and F-18 Digital Air Data Computers

the KC-10A . . . will have an advanced digital fly-by-wire refueling boom control system designed and built by Sperry. The system, proven in more than 1,400 hookups between a KC-135 and a variety of aircraft, allows the boom operator to "fly" the boom into optimum position for aerial refueling.

and for several fighters . . . Sperry is producing a three-inch threat warning indicator, incorporating a three-inch cathode ray tube display. It's one of three CRT systems in production for the military at Sperry.

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Progress on Energy Beam Weapons

Soviet scientists are considered ahead in energy beam research, but US experts are expanding work in this area. The weapons raise the prospect of shifting the balance between strategic defensive and offensive forces.

BY BONNER DAY, SENIOR EDITOR

DESPITE early reluctance within the Carter Administration and strong opposition in the science community, directed-energy programs—the so-called death rays—are being given a new emphasis in government research.

William J. Perry, Under Secretary of Defense for Research and Engineering, calls directed energy one of six technologies that "show promise for development in areas where we are in direct and serious competition with the Soviet Union." Soviet scientists, in fact, are considered ahead in directed-energy research.

The weapons—laser and particle beams—that might be developed from this research could provide defenses against missile attack and killer satellites. But US Defense officials say a good deal of research is required before any "death ray" becomes operational. Says Under Secretary Perry: "The major thrust in high-energy lasers continues to be verification that such weapons will be cost-effective compared with other more conventional means." Dr. Perry says particle-beam technology is in the "very early research and exploratory development phases."

Because these weapons potentially would affect the US-Soviet antiballistic missile treaty and negotiations with the Soviet Union for an antisatellite treaty, arms-control advocates have argued against such research as destabilizing to US-Soviet relations.

But advocates within the Administration have argued successfully that recent scientific breakthroughs in directed-energy research are too significant to ignore for diplomatic reasons. They warn that a Soviet monopoly of these weapons could be the most dangerous security threat to the US in the 1980s and beyond.

Scientists have learned to increase the energy of the laser systems, while cutting the physical size, so that they are growing more practical as ship, aircraft, and satellite systems. Researchers have learned more about the effect of lasers on target surfaces. Technicians have devised mirrors to improve the focus of lasers and back-up systems to facilitate the tracking of targets. Laboratories now are working on lasers that can penetrate the atmosphere, and even water, for longer distances. The effect of research has been to develop lasers that are small, have a high-energy beam, and are operated on a small, efficient power source. In a matter of a few years, in fact, some scientists see the possibility of developing weapons with one-shot, one-kill accuracy at millisecond speeds.

Already, tests in the secrecy-shrouded programs, particularly of lasers, have been impressive:

- In 1973, the Air Force used a low-power laser to shoot down a drone aircraft on the Sandia Optical Range at Kirtland AFB, N. M.
- In 1976, the Army, using a high-energy, low-power laser in a tracked vehicle, destroyed a number of airborne aircraft and helicopter drones at Redstone Arsenal, Ala.
- In March 1978, the Navy, using a chemical laser of moderate power, destroyed a TOW antitank missile in flight at the TRW test site at San Juan Capistrano, Calif.

US officials have been close-mouthed about these and other tests. But the success of the tests has given the Defense Department conclusive arguments to ask for additional money to begin development of laser weapons.

In the case of particle beams, there is now a consensus in the Pentagon that the Soviet Union is ahead in particle-beam research. A recent Defense report says: "The Soviet effort on particle beams is judged to be larger than ours, particularly in the area of accelerators for fusion applications." Defense Under Secretary Perry says that "in directed-energy technology, our efforts are directed to determining technical feasibility and preventing technological surprise, rather than protecting a lead."

Beam Funding

Particle-beam weapons differ from lasers in that they provide a stream of atomic or subatomic particles such as electrons, protons, and heavier ions, while a laser beam is a form of light. But in both cases the heat of the beams acts to destroy the target.

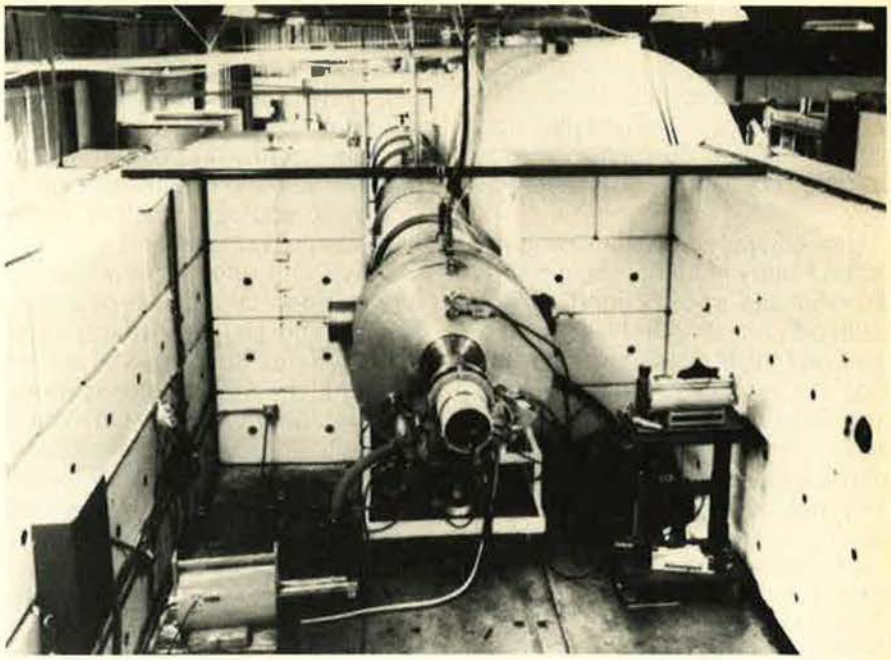
Laser research is the bigger program. For FY '80 laser research, the Defense Department has requested $209.5 million, including $101.4 million for the Air Force. The total Defense request for particle-beam research for the same period is $29.1 million, of which the bulk, $24 million, is for the Defense Advanced Research Projects Agency.

But the particle-beam program has experienced a dramatic growth, almost tripling in just four

years, and is expected to continue to rise in the '80s. In FY '77, the particle-beam program totaled just $10.2 million.

In both programs, in fact, the Defense Department is stepping up its efforts after a period when the Carter Administration had concluded that directed-energy research was counterproductive. Some opponents still argue that energy weapons will interfere with arms-control negotiations. Others insist that conventional arms can do the same things as directed-energy weapons, at a lower cost. A third argument has been advanced that even if practical directed-energy weapons could be produced, the nature of lasers and particle beams is such that they could be easily countered by defensive measures.

Based on these arguments, the programs were subjected to delays and cuts in spending. Speaking about the Soviet particle-beam program during this period, Defense Secretary Harold Brown said that "they can't expect to have such a weapon system in the foreseeable future." In subsequent months, there has been a quiet change in policy, and particle-beam research now is limited more by technology and money than policy restraints, and, according to one top Defense official, the new view "will be reflected in the FY '81 budget."



This experimental accelerator is being developed by Austin Research Associates, Austin, Tex., for the Army. It has the potential of a simpler and more compact method of generating high-energy, high-current, pulsed ion beams.

Particle Beams

The principle of particle-beam weapons is relatively simple, but the technology continues to be a major stumbling block. A particle beam is a stream of atomic- or subatomic-size particles such as electrons and protons. When these particles hit a target, a large number penetrate the target and travel through it, transferring energy to the electrons in the target. The energy lost in the material can generate enough heat to melt or crack the target.

Dr. Ruth Davis, Deputy Under Secretary of Defense for Research and Advanced Technology, told AIR FORCE Magazine that as part of the new emphasis on directed-energy research, she is setting up a government-wide advisory group on particle-beam programs.

Dr. Davis describes the particle-beam program this way: "What we are doing now is collecting the disparate bits and pieces of what has been done in the past and putting them in a package that can be managed with definable and understandable goals." This is a temporary procedure until the first coordinated program, now expected to be ready in time for the FY '81 budget, can be submitted to Congress.

The particle-beam review group will be similar to an existing High Laser Review and Advisory Group, which is also under the supervision of Dr. Davis. The particle-beam group is expected to have representatives of Defense, Energy, and other appropriate government agencies as members. As part of the reorganization, and in response to congressional direction, the Navy particle-beam program, "Chair Heritage," has been transferred to the Defense Department's Advanced Research Projects Agency.

The US particle-beam program is focused on basic research to determine whether or not particle-beam weapons can be developed in the next three or four years. Says Dr. Davis: "No work of any significance has been done in controlling beams of an achieved quality or in beam tracking or beam control. We have yet to propagate a particle beam through the atmosphere. No significant work has been done in switching technology, which is so important in

Particle-Beam Funding

(Millions of Dollars)

Fiscal Year	Cumulative*	'78	'79	'80 (Requested)
Navy	$14.1	$ 7.1	$ 0.0	$ 0.0
Army	4.4	3.8	4.3	4.1
Air Force	0.5	0.8	0.9	1.0
DARPA	0.0	0.0	12.0	24.0
Totals	$19.0	$11.7	$17.2	$29.1

*Breakdown of earlier years not available.

(Source: Defense Department)

providing power from the source to the accelerator to reach the speed and the repetition that are needed."

This lack of progress is the result of the conscious Defense decision, since changed, to place very low priority on particle-beam technology.

The US particle-beam program has a history of funding that began in 1958, but in 1972 funding was scuttled almost entirely when government policymakers decided that the technology needed was impossible to achieve at the time. Before 1978, Defense funding for particle-beam work totaled only $19 million, according to the Pentagon.

Dr. Davis now says: "I do not think it will be difficult to accelerate work in this area. It is just a problem of identifying the technical expertise and making available the resources."

There is no doubt that Soviet scientists, apparently considering directed energy a fruitful area of research, have given particle-beam research a high priority. Since at least 1976, US scientists have spotted the release of radioisotopes into the air over the Soviet Union that point to beam research. The speculation is that the isotopes came from tests of a particle beam being tested at Semipalatinsk. This site is where the Soviet Union also conducts underground nuclear weapons tests. Experts say the isotopes indicate that either a weapon using a particle beam is being tested, or a particle beam is being used in thermonuclear research to cause nuclear implosions.

There is general agreement that the Soviet Union is considerably ahead of the US. Says Dr. Davis: "We know they have been emphasizing accelerator technology for many years, which is useful in particle-beam work. We know that they are working on different kinds of power sources, another particle-beam requirement."

Now the Carter Administration has stepped up particle-beam research, and Defense officials say even greater funding will be requested for FY '81. Three weapons are considered real possibilities if the technology can be developed:

1. An antiballistic missile beam weapon on the ground to sweep the skies like a searchlight and destroy incoming missiles;
2. A beam weapon in a satellite to destroy enemy missiles shortly after they are fired from the Soviet Union, and to knock out enemy satellites;
3. A particle-beam weapon aboard ships to destroy attacking planes and missiles with a blinding speed not available today.

One of the major technical problems remaining, however, is to develop accelerators, the massive machines that produce particle beams, small enough to fit into ships, planes, and satellites. The type of accelerator required for weapons utilizes intermediate voltage and very high current, while nuclear physics research has concentrated on high-voltage, low-current accelerators.

Dr. Perry has announced that the Army is scheduled next year to complete tests of a collective accelerator in an effort to develop compact beam generators. He has also disclosed that an advanced high-current test accelerator is under construction at Lawrence Livermore Laboratory, Calif. The Aston machine already at the lab, though designed for fusion research, develops a high-current beam suitable for weapons research.

Laser Advances

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Since their discovery and development in 1960, lasers have been used in civilian and military applications, including medicine, communications, rangefinding, and target designation. US pilots used laser target designators in the last years of the Vietnam War.

To be lethal, however, lasers must propagate high-energy beams. The Defense Department defines a high-energy laser as one that has an average power output of at least twenty kilowatts or a pulsed power of at least thirty kilojoules. A high-energy laser destroys by focusing large amounts of energy on the target in the form of visible or invisible light. Because it is light, it travels at a speed of 186,000 miles per second, thus making possible almost instantaneous kills.

Laser-weapons research has gone beyond the research stage into exploratory development. The last three years have seen dramatic progress in laser-weapon development. Says Dr. Davis: "The key advances have been, first, the dramatic and absolutely necessary ability to shoot down weapons in an operational environment. Second has been obtaining the power levels in lasers of the level needed.

Laser Research Funding

(Millions of Dollars)

Fiscal Year	'71	'72	'73	'74	'75	'76	'77	'7T	'78	'79	'80*
Army	$ 4.8	$ 5.8	$11.9	$ 18.8	$ 24.8	$ 26.0	$ 21.0	$ 8.0	$ 13.7	$ 17.2	$ 20.5
Navy	4.7	11.7	18.2	29.5	38.6	50.6	44.1	11.0	33.2	33.8	40.8
Air Force	20.4	29.6	35.7	37.0	53.5	63.1	88.5	16.4	87.4	97.6	101.4
DARPA	16.8	20.9	20.1	19.6	20.2	19.7	20.5	2.7	23.3	30.5	46.8
Totals	$46.7	$68.0	$85.9	$104.9	$137.1	$159.4	$174.1	$38.1	$157.6	$179.1	$209.5

*As requested for appropriation by Congress.

(Source: Defense Department)

A new high-power, gas-dynamic laser, built by Pratt & Whitney, is under test aboard this NKC-135 Airborne Laser Laboratory at Kirtland AFB, N. M.

Third, we now understand enough about lasers sent through the atmosphere to determine the accuracy and the utility of using lasers against weapons that have managed to escape all other defenses."

Much of the progress in laser research has been the result of Air Force work with the Airborne Laser Laboratory, a Boeing NKC-135 equipped with a laser. A new high-power, gas-dynamic laser, built by the Pratt & Whitney Division of United Technologies, is being tested on the plane at the Air Force laser test facility at Kirtland AFB, N. M. The new laser is being integrated with an improved Hughes pointing-and-tracking system. Tests with an earlier low-power, electric-discharge carbon dioxide laser proved that a laser beam in a flying aircraft is not seriously degraded as it passes through the airstream, and that the laser system can operate under normal flight vibration.

Air Force scientists have developed a plan for a ground-based, high-energy laser weapon for antisatellite research, and have proposed to begin its construction in FY '83. The laser would be an advanced model of present deuterium fluoride chemical lasers that have shot down antitank missiles. Under the proposed plans, after the technology of the new laser is proven in tests, a second laser could be constructed, and the two used to examine the technology of shooting down objects in space.

The Air Force also has contracted with Rockwell International's Rocketdyne Division to deliver Sigma, a chemical laser, for testing this year.

For the Army, TRW is building an advanced laser using nitrogen trifluoride rather than deuterium fluoride.

The Navy is preparing for a series of laser tests this year at the new Defense High Energy Laser National Test Range at the White Sands Missile Range.

The Defense Advanced Research Projects Agency is funding research by the Lincoln Laboratory on carbon dioxide lasers that would use lasers to both track and destroy targets in a so-called "closed-loop." Present lasers use an "open-loop" system that exploits infrared sensor technology for tracking and limits the laser to "kill" missions.

Future Research

Dr. Davis says the Defense Department plans to spend $1 billion on high-energy laser technology between now and 1985. Some $1.27 billion was spent on laser technology through FY '79. Future funding for particle-beam research has not been publicly released. Defense officials say it is expected to total at least $300 million over the next five years.

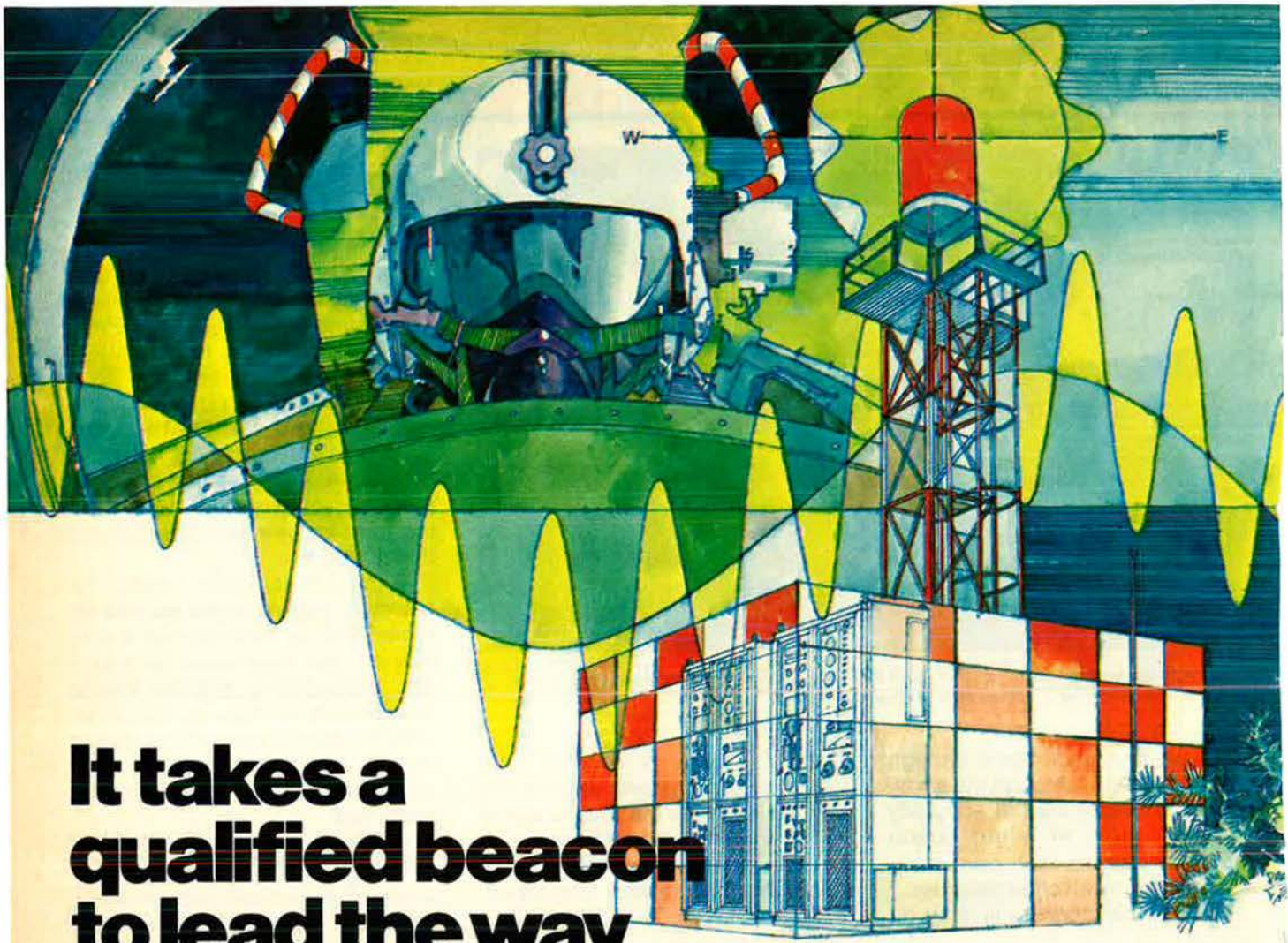
The upward trend in funding is expected to increase competition in the directed-energy field. Present leaders in the field include United Technologies, TRW Systems, Avco Corp., Rockwell International, and Bell Aerospace. Energy scientists say the history of directed-energy research has been that new leaders quickly move to the front as new technologies are developed.

Within the scientific community, however, many experts believe directed-energy weapons are a long way off, and may never be practical. Propagating particle beams long distances through the atmosphere and the effect of clouds and dust on laser beams are some of the problems that continue to vex researchers.

A Massachusetts Institute of Technology report recently concluded that charged-particle-beam weapons "do not appear to be appreciably more imminent than when they were first fictionally placed in the hands of Buck Rogers."

Dr. Anthony DeMaria, manager of the Electromagnetic and Physics Laboratory of United Technologies, and one of the nation's foremost laser experts, says the science of lasers and particle beams is known, but many engineering problems remain. "If someone wants to build a laser weapon, it could be done; the question is whether it would be small and efficient enough to be practical." Dr. DeMaria says energy weapons can be expected to face continued opposition from scientists on cost-effectiveness and other grounds.

But within the government, a consensus has been reached that this field must be explored, and that it should be a growing area of research and government spending. In the words of Dr. Davis: "Directed-energy technology, if proven to be technically feasible for weapons applications, could restore the balance between strategic defensive and offensive forces." ■



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Avionics: The Road Ahead

The task of improving avionics, under the pressures of financial restraints and the speed of technological advances, demands an even stronger partnership between the Air Force and industry.

BY COL. ROBERT S. ZIERNICKI, USAF (RET.)

COPING with the challenges and complexities of modern avionics, or electronics for aircraft, has dominated the thinking and demanded the best efforts of the Air Force's technical people and managers over the last few years. The effort has been worth it.

Substantial changes have been made in the way we now do business in the avionics world. New policies have been implemented. New mechanisms for planning, communicating, and controlling have been established. Perhaps most important, a new appreciation and awareness have developed of the need to consider avionics acquisition and support from a force-wide and life-cycle perspective. The Commander of Air Force Systems Command, Gen. Alton Slay, established the groundwork for these initiatives in his article, "An Air Force Avionics Policy," published in the July 1977 issue of AIR FORCE Magazine.

Yet, the game is not over. Policy statements and managerial initiatives alone are not enough to deal completely with a technically sophisticated area like avionics, which involves large segments of the industrial and Air Force technical communities.

I believe it is now time to examine the technical issues in more depth—to see if it is truly sensible for the Air Force to express its technical requirements, particularly with regard to avionics standardization, even more explicitly than it has in the past. Can we build on the progress achieved in the last few years by extending our standardization policies more deeply into avionics system design?

The range of answers to this question can have vast budgetary implications and can touch on fundamental questions of the roles and missions of public vs. private sectors of the avionics business. Some of the most difficult and contentious avionics issues facing both government and industry relate to the design and architecture of avionics systems and the extent to which each sector should participate in the technical issues relating to avionics integration.

The Main Influences

One of the principal trends in avionics has been, and continues to be, the shift from analog to digital electronics stimulated by the rapid growth of solid-state microelectronics and its general commercial availability. Applications have progressed from replacing "conventional" analog components such as vacuum tubes with solid-state equivalents, to replacing functions with solid-state logic arrays, and finally to total implementation of system functions by solid-state, integrated circuits, including full computer processing capability.

Another dominant trend has been to integrated systems architecture where digital subsystems are closely coupled under software control, exchanging digital data to perform a total weapon system function.

These trends have greatly increased the performance and capabilities of our weapon systems, although at the cost of increased system complexity. The gains we have achieved by the use of high-density solid-state microelectronics include improved system performance, decreased weight and volume, lower power consumption, increased reliability, and lower cost per function. However, these gains have been offset to some degree by penalties we now have to pay in longer and more complex system integration programs, software design and management, and generally more sophisticated logistical support. A relatively recent concern is the short "lifetime" of many microelectronic products, as technology continues to evolve rapidly and companies move on to broader, more profitable markets. A five-year product life cycle is not very compatible with a twenty-five-year weapon system life cycle.

The Issues

Most people will admit that avionics systems using modern microelectronics and real-time software carry their own unique class of problems. But system designers resist any attempt by the customer to specify system characteristics beyond a statement of required performance. That is why there has been some rocky going as we cautiously implemented a number of standardization concepts and actual standards. However, there has been steady progress.

Progress has been fastest and easiest when we have stayed in the domain of interface standards. Our understanding and use of these standards is moving through a series of discrete phases.

The implementation of the MIL-STD-1553 family of multiplex bus standards, as a first phase, apparently is becoming a success story. Major weapon system designs like the F-16 and the F-111A/E and individual subsystem designs like the Global Positioning System (GPS) and the USAF standard Inertial Navigation System (which itself uses an interface standard concept, called Form, Fit, and Function standardization) broadly use this

standard definition of multiplex signal interfaces and protocols. Even cross-service standardization is occurring, through the Navy's commitment to MIL-STD-1553 on its F-18 program and the Army's use in helicopter fire-control systems.

In the second phase, we are now implementing even more interfacing types of standards, such as the MIL-STD-1750 Instruction Set for avionics computers and the J-73 Higher Order Language (HOL), specified by MIL-STD-1589A, for avionics Operational Flight Programs (OFP). Note that these are not "pure" interface standards, but begin to impinge on the area of system architecture, in both a hardware and software sense. Similar efforts are going on in the area of microprocessors, an especially urgent task, since these devices will be so pervasive in all our systems in the near future.

But the fur really starts to fly when we move out of the area of simple interface standards into the murky world of system integration—when we talk not only of system interfaces, but of system topology. Included in this third phase of system architectural considerations are such concepts as mandating a total system design concept, developed by the USAF Digital Avionics Information System (DAIS); furnishing actual system software, such as the DAIS Executive, as Government-Furnished Equipment (GFE); and mandating that contractors demonstrate their system designs, at various evolutionary stages, on government-owned system engineering facilities/hot benches, "playing" against government-owned and installed system simulation and emulation models.

Are we moving too far in this last phase? Is the Air Force injecting itself too deeply into the design process and interfering instead of guiding? Certainly, an approach outlined in the previous paragraph raises the following questions and issues in the minds of some industry people:

- Is this resurrecting the "arsenal" concept, where the Air Force does the total in-house design, as it did in the pre-digital (PD) era?
- Is the Air Force trying to put contractors out of business?
- Is it suggesting that Air Force engineers are smarter than industry engineers?
- Is the Air Force going to constrain me so badly that I can't do my usual superior, innovative, efficient design work?
- Why don't you just tell us what you want and we'll build it for you?
- What about higher costs?
- Aren't you stifling technology?
- I won't accept Total System Performance Responsibility anymore.

These issues reflect legitimate concerns. They must be due to misunderstanding Air Force intent, to a particular perspective, to outright misinformation. Or, they may be right! In any event, these issues must be addressed. Perhaps the best way is to accurately describe the approach and its rationale.

Avionics "Alligators"

Most everyone is familiar with the analogy of "swatting at gnats while the alligator is about to eat you up." The alligators in the avionics case are:

- High development, acquisition, and support costs.
- Long development times, typically seven to nine years.
- Post-deployment reliability and maintenance—still generally poor.
- A history of change over the life cycle of an airplane.
- A limited budget, and continued pressure to reduce the budget.
- A developing critical shortage in technical people—engineers, maintenance technicians, computer programmers.
- "Computational plenty" from generally more powerful and available microcomputers that threatens to swamp the Air Force with software.
- An increasingly more capable and technically sophisticated enemy.

We cannot afford the luxury of gnat-swatting, while alligators of those magnitudes exist. Furthermore, our antialligator strategy better be pretty broad and flexible to be effective on several fronts, since the challenges I've just enumerated constitute just as serious a threat to our continued technological superiority as enemy action. Budget cuts can kill too! What do these threats and hostile environments mean to the technical aspects of avionics standards and architectures that we're discussing here?

- A history of avionics change over the life cycle of an airplane, due to technological pressures and/or operational requirements pressures, demands that avionics architectures be flexible. Flexibility may imply the heavy use of modularity concepts and clearly defined system interfaces that allow system upgrade without massive perturbation of the logistics system.
- High costs, budget constraints, and limited personnel availability dictate concepts like reusable hardware and software, avoiding the costs associated with "reinventing the wheel." If an avionics architecture can support the use of previously developed, satisfactory components like standard subsystems or standard software modules, item development time can be reduced by minimizing the number of completely new components and integrating those with the standards.
- The continued influx of digital systems into the Air Force inventory, compounded by the microprocessor explosion and the developing critical shortage of qualified software people, dictate the need for a focus on standardized software support concepts to minimize the capital investment required at our five Air Logistics Centers as well as minimizing the training needed to qualify support people on new software programs.
- None of us is satisfied with the performance, cost, or reliability of the bulk of our current avionics. The required improvements will principally come from technology; therefore, our standardization approach *must not* stifle this needed technological evolution, but should provide a framework of stan-

dardized interfaces that can support an occasional injection of new technology—again without necessitating a massive change in system support.

One point needs to be reemphasized because it is so important and because it's so typical of the problem facing us. I've mentioned two factors that can drive the evolutionary process in avionics—a history of changing requirements and technological evolution.

When the system is initially fielded, at year 0 in its operational life, an aircraft may have a relatively simple mission, with a relatively simple avionics suite comprising a dual multiplex bus, a single processor, and a few sensors and controls and displays on the bus. Within five years or so, we discover just how useful the airplane is and decide to augment the avionics suite with new sensors like FLIRS and radars and a new computer to take up the new applications workload. By year ten, those wonderful promises by the labs have materialized. An example might be an integrated communications-navigation system or a software-reconfigurable integrated display set. Or perhaps some new concepts of system architecture and topology have surfaced, like hierarchical multiple buses. Again, extensive software modifications result, hopefully in an upward compatible fashion.

Finally, quite late in the life cycle, a total system upgrade may be needed, either because of totally new operational roles and missions for the airplane or because new technology offers massive improvements. This may result in totally new architectural concepts like peer-coupled distributed multiprocessing systems. This evolutionary scenario emphasizes the fact that attention to front-end architecture is extremely important if the natural force of evolution is not to cause chaos in the logistics community.

The Approach

I believe that the goal of USAF-wide flexible, modular, reusable avionics and support systems can be attained by adhering basically to two operating principles. First, *in the eventual support of these systems, it should make no difference to the Air Force what vendor supplies our avionics systems.* Second, *the array of facilities involved in the development, test, and support of avionics should be fundamentally compatible in its hardware and software interfaces.* Let us examine these points further.

The Facilities

Figure 1 shows the array of avionics facilities generally in use by industry and the Air Force. The reasons I have categorized them into "Labs" and "Programs" will be apparent shortly. A spectrum of facilities is shown, basically proceeding from research-oriented facilities on the left to application-oriented facilities on the right. To dispose of the acronym problem, let me give you a few definitions:

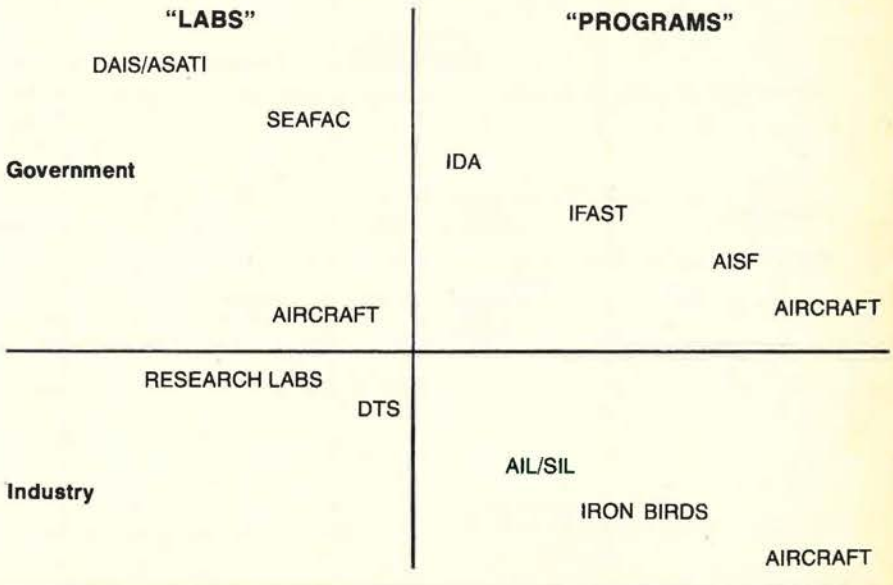
DAIS/ASATI are the Air Force programs at the Avionics Laboratory, the Digital Avionics Information System (DAIS) and its follow-on, the Advanced Systems Avionics Technology Integration (ASATI) program. The Systems Engineering Avionics Facility (SEAFAC) at the Aeronautical Systems Division (ASD) is an early and limited approach to a systems avionics facility by the engineering, as opposed to the scientific, community at Wright-Patterson AFB.

The Integrated Digital Avionics (IDA) program is a fully funded program to put ASD into the systems avionics business on a full scale, which I'll discuss shortly. The Integrated Facility for Avionics Systems Test (IFAST) is an emerging integrated test concept at Edwards AFB, Calif., where the bulk of our development testing and evaluation is performed. Avionics Integrated Support Facilities (AISFs) are the facilities being developed by AFLC at all of their major Air Logistics Centers (ALCs), one of the first being the F-16 AISF at Ogden ALC, Utah.

Recently, I have had the opportunity to review the avionics development approaches and facilities of many of our major avionics suppliers, including Boeing, General Dynamics, McDonnell Douglas (MacAir and Douglas), TRW, Lockheed, and Northrop. Much of what follows constitutes a composite view of those companies' processes.

On the contractor side, Integrated Test Beds (ITBs), sometimes called Dynamic Test Stations (DTSs) are used in early avionics definition efforts. Major avionics integration tasks are carried out in

FIGURE 1



facilities called Avionics Integration Laboratories (AILs) or Systems Integration Laboratories (SILs). Finally, Iron Birds describes full-scale ground mockups of total aircraft configurations, where perhaps integration of avionics systems with flight-control systems occurs.

The basic architecture of all of these facilities is quite similar. A total avionics suite can be developed, tested, or supported in such a facility, either in a simulated form or in varying degrees employing "real" equipment. Early systems definition work may well involve only simulations and emulations of both the hardware and software. Later, prototype hardware may be integrated, operating against various environmental models, hosted in the main facility computer.

Later still, actual production hardware is introduced and integrated on the Hot Bench in rigorous detail with other aircraft subsystems, with operational modes being tested in the cockpit mockup. The role of these facilities will become even clearer as we examine the contractor development process. This same type of facility is used by the Air Force in its system development programs and, in fact, the DAIS facilities follow this architecture.

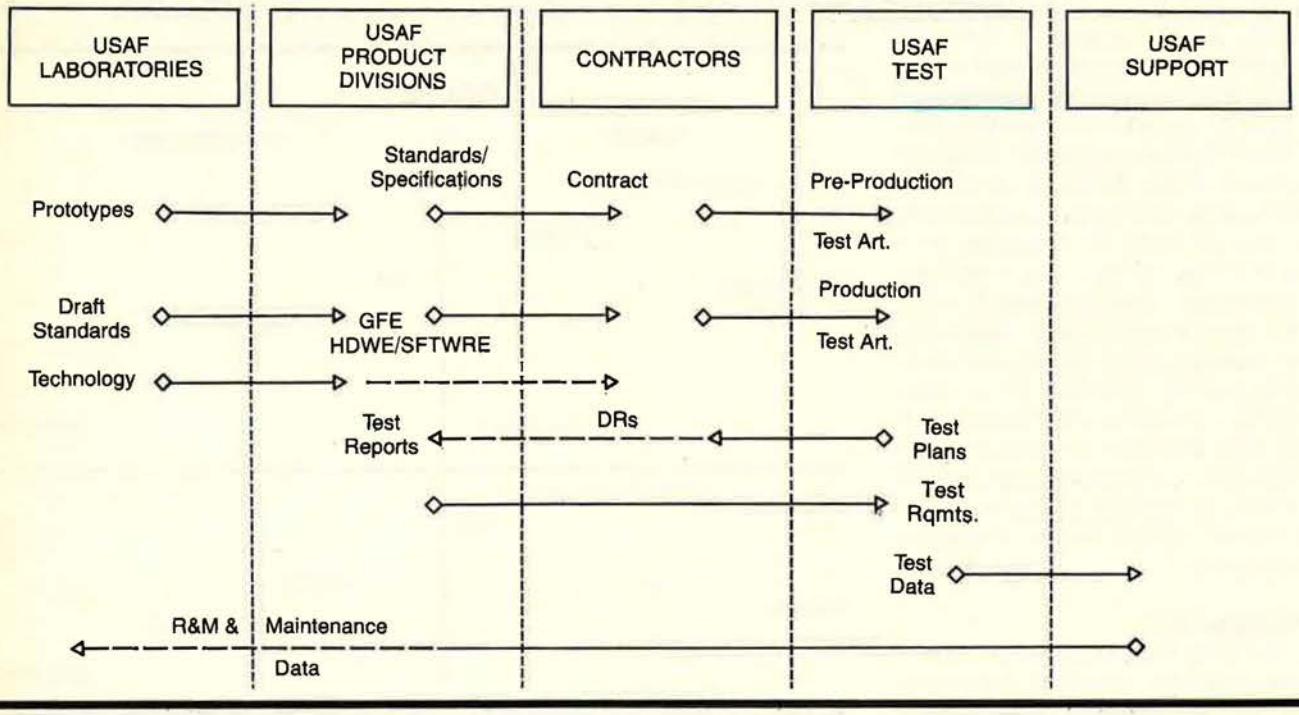
"...attention to front-end architecture is extremely important if the natural force of evolution is not to cause chaos in the logistics community."

One class of facility not mentioned above—simulators—is used by the largest prime contractors for their early weapon system definition work. Simulators can have an important role in avionics system definition, especially for new major weapon systems. Today, both fixed

FIGURE 2: CHARACTERISTICS

Laboratory Technology Development Facilities	Program Oriented System Design & Integration Facilities
• Maximum Flexibility	• Schedule Driven
• Alternative Approaches	• Hard Interfaces
• Generic Interfaces	• Aircraft Specific
• Generic Simulation	• Specific Models
• Experimental	• Cost Constrained
• Not Constrained	• Must Transition to Flight Test
• Time	• Extensive Documentation-Contractual
• Interfaces	• State of the Art
• Generic Models	
• Relaxed Documentation	
• Beyond State of the Art	

FIGURE 3: FACILITY PRODUCT FLOW



and motion-based simulators are in constant use by the competitors for major new programs to test out new weapon delivery and crew interface concepts, and are often used to check out mode logic, while the simulator puts the crew through a variety of simulated flight profiles. The latest techniques include full "head-up" and "head-down" simulations simultaneously for two-place concepts. Plans are under way to integrate actual flight software into the simulator operation as a further check of mode timing and logic.

Recalling that these facilities can have either a research role or a program-oriented role, let us examine the implications of these different roles. Figure 2 lists the characteristics most widely attached to these two classes of facilities. One main point to be recognized is that many of the characteristics seem to be *mutually exclusive,* so that it is rare to see one facility serving both roles. This fact is reflected in a very real division, both within industry and the Air Force. It is also indicative of why we have had difficulty in transitioning products out of our laboratory-sponsored DAIS program, directly to aircraft acquisition programs. This is why we have been trying for so long to define a USAF program-oriented avionics facility—now called the SEAFAC/IDA program—that can correlate better with the contractor's program facilities.

Figure 3 shows how the products of an optimum collection of government-industry avionics facilities might flow. Note the emphasis placed on feedback from the test and support phases to the system definition phase, as well as the contiguous position of the USAF program-oriented facilities to the contractor's program facilities.

The Industrial Avionics Process

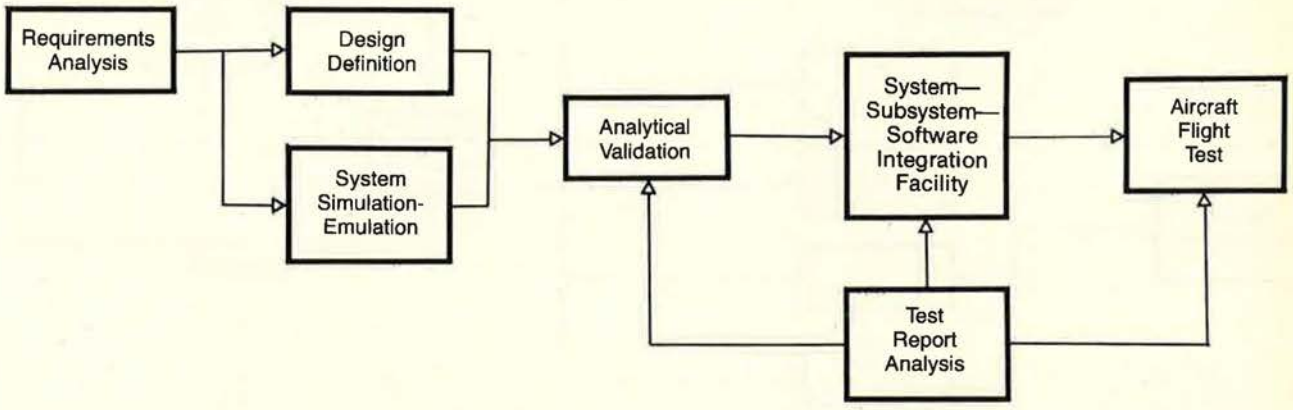
The question might reasonably be asked, "Is the foregoing description of interrelated government-industry facilities realistic and attainable?" Let us attempt to answer this question by examining the industrial avionics development process more deeply.

Figure 4 shows what I believe is a generally universal approach used by all of the major avionics contractors. An interactive requirement analysis starts the process off and provides the fundamental front end of the system definition. From the requirements analysis, which is based on the roles and mission of the weapon system, progress is to a preliminary design definition that usually involves heavy use of simulation and emulation. The process to this point is aimed at producing a Part I specification. The analytical validation phase then produces mathematical and software models of the ultimate system which can now be demonstrated on dynamic test stations. Next, actual system hardware and software begin to appear and to be installed in Hot Benches and cockpit simulations with aircraft flight test and the extensive feedback of test data to the development facilities as final steps before freezing the configuration for production.

"...we are now seeing a large requirement for diagnostic flights if an on-site ground-based capability is not provided. IFAST will provide that on-site capability, managed by the Air Force, but operated during program test by joint contractor-Air Force teams."

Figure 5 expands the front end of the development process, leading to the generation of the Part I specification. This activity is

FIGURE 4: CONTRACTOR AVIONICS DEVELOPMENT PROCESS



characterized by continuous, iterative tradeoff analyses designed to define a properly allocated set of avionics functions that eventually can be realized in hardware and software.

Figure 6 shows in more detail the steps following generation of the Part I specification. Now "make or buy" decisions are made for the subsystem hardware. First integration activities involve hardware emulations working with dynamic environmental models. The Operational Flight Program (OFP) generation is now entering its design-code-test phase, generally structured in discrete software modules. As the modules are linked, the resulting executive and application program replaces the FORTRAN validation programs in driving the integrated Hot Bench. The integration facility may be quite distributed at this point, with complex subsystems, such as fire-control radars in roofhouse facilities, remotely connected to the Hot Bench. The decision to proceed directly to the aircraft from the integration facility or to make an intermediate stop in a full-scale cockpit mockup or Iron Bird is variable from com-

FIGURE 5: CONTRACTOR AVIONICS DEFINITION

Specification Development

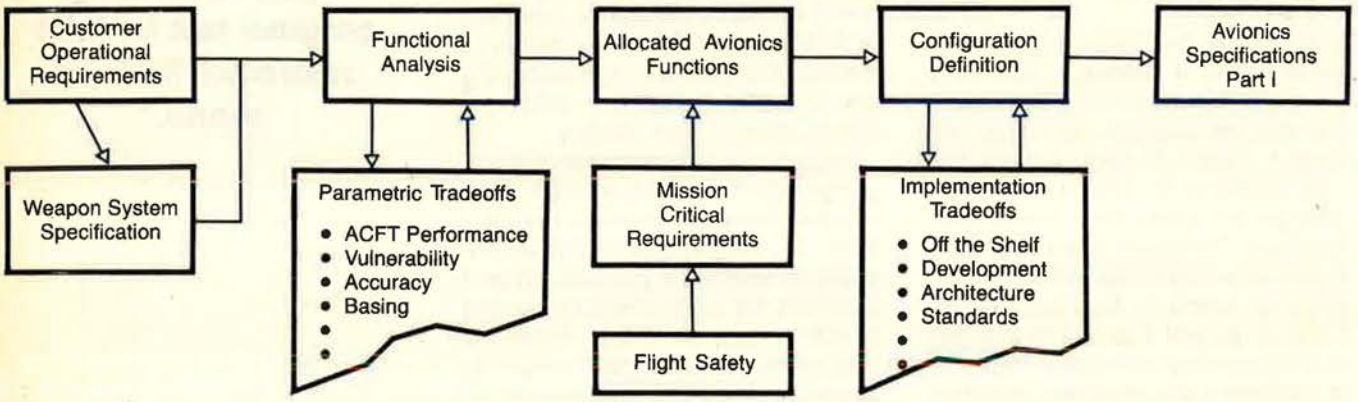
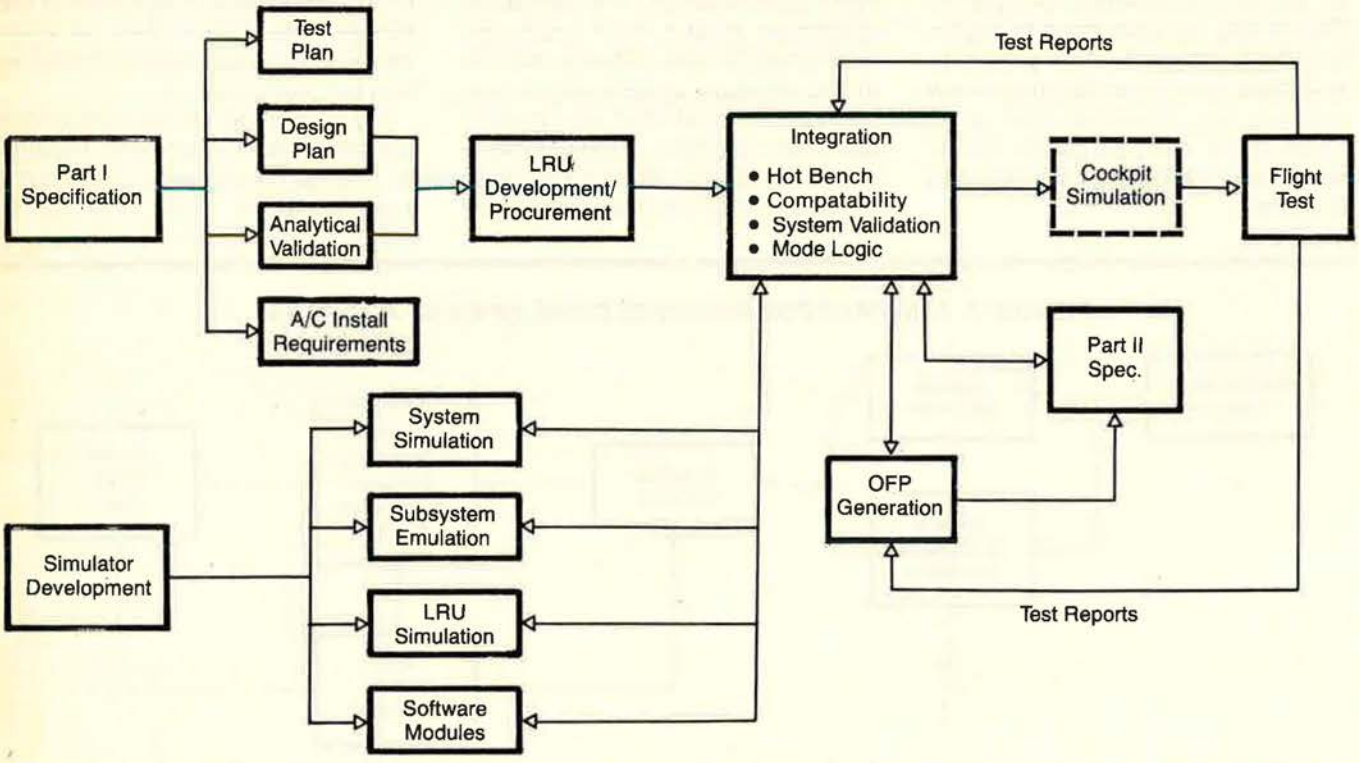


FIGURE 6: CONTRACTOR AVIONICS ACTIVITY DESIGN/DEVELOPMENT PHASES



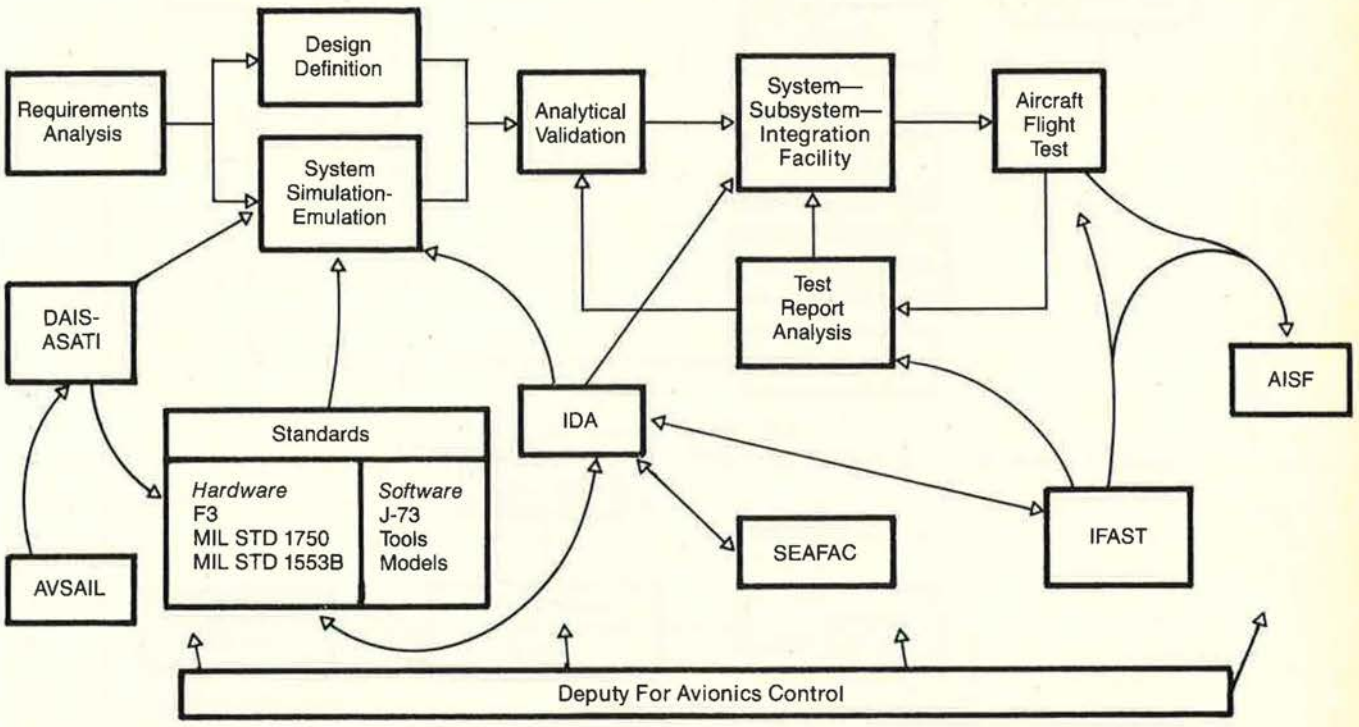
pany to company and depends on the corporate design philosophy.

Now let us overlay the Air Force facilities to clarify their function (Figure 7). Recall that in Figure 3, we speculated on how the products of the various facilities would interrelate. Here we show how the Air Force-owned laboratory, program development, test, and support facilities correlate with the key development steps and facilities of the contractors. The Deputy for Avionics Control uses the Air Force facilities as its technical resource to ensure that hardware/software standards and architectural concepts are properly generated, enforced, and accepted by industry throughout the avionics life cycle. The collection of facilities must be treated as a whole. Even though each facility has a different orientation, such as development, test, or support, *all facilities must share a common baseline architecture and support structure,* such as simulation models and software tools. Again, it must be emphasized that *government facilities do not supplant contractor facilities, but complement and form a baseline for them.* An example may illustrate this point.

Prior to his retirement on June 30, 1979, Col. Robert S. Ziernicki was Assistant DCS/Plans and Programs for System Integration and Architecture at Hq., Air Force Systems Command. Earlier assignments included Chief of the Avionics Division, DCS/R&D at Air Force Headquarters, command of an avionics maintenance squadron in Southeast Asia, and a variety of engineering and crew duty assignments in SAC and PACAF. Colonel Ziernicki, who holds a doctorate in solid-state applied physics, has joined Honeywell Avionics Division, Clearwater, Fla., as Director of Guidance and Navigation.

Figure 8 shows how the IFAST facility would interact with the contractor during DT&E/IOT&E testing. The primary mode of testing is still flight test. Flight testing will surface various classes of problems, many design-related. Without an IFAST, the contractor must build up a comparable facility on-site, or return the system to the home plant. This is an extremely costly and time-consuming process at best. Additionally, we are now seeing a large requirement for diagnostic flights if an on-site ground-based capability is not provided. IFAST will provide that on-site capability, managed by the Air Force, but operated during program test by joint contractor-Air Force teams. Note

FIGURE 7: USAF INTERACTION WITH CONTRACTOR PROCESS



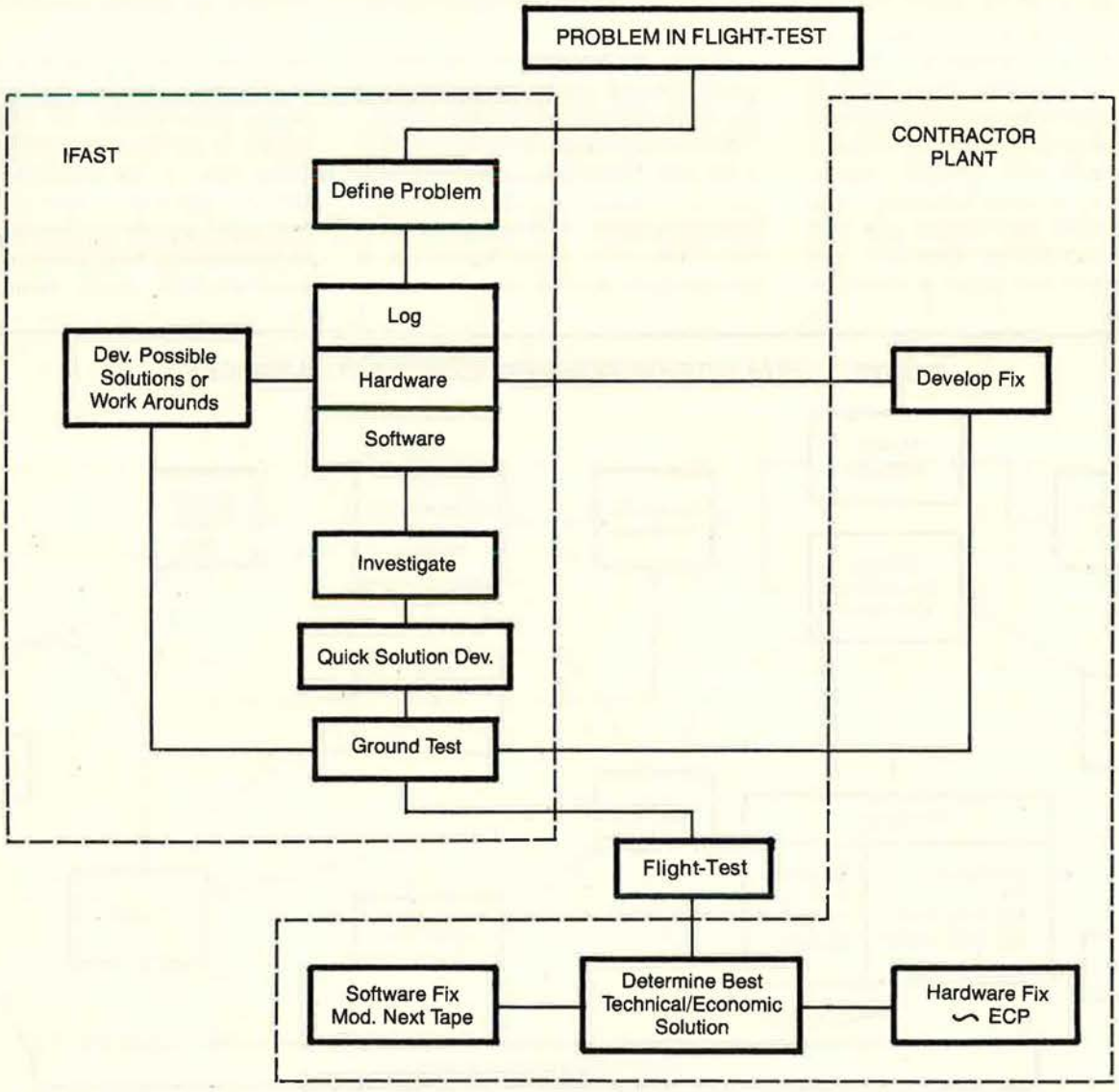
that the redevelopment activities still occur at the contractor's facility where the primary design expertise is resident, but better definition of test-generated problems should occur with considerably fewer diagnostic-only test flights being required.

Of course, all blessings are mixed. Managers of government avionics facilities must be constantly concerned with keeping up to date, preventing a logjam from developing, avoiding bureaucratic roadblocks, maintaining access to all essential information, and establishing priorities. Generally, aircraft development programs run on quite a fast track, once under contract. We could further complicate and extend an already complicated process if we do not take great care. But I remind you of the alligators mentioned earlier that demand we take this problem on. Good will and promises will not cope with those alligators—only hard, disciplined systems engineering concepts will.

The concerns listed above can be overcome with good management and planning. This will be one of the principal tasks of the Deputy for Avionics Control. Yet, it will happen only with the full cooperation and support of both the industrial and Air Force avionics communities. The framework is here. The policy support is here. The budgetary support is here. Now the people must make it work.

Let me suggest one way that the Air Force and industry could work the problem jointly. By now, you probably have concluded that one of the more critical Air Force programs is IDA, since this seems to correlate most closely with the industrial system definition and integration processes. Figure 9 shows one possible scenario of how IDA might evolve. The key elements of avionics architecture could be partitioned out to the largest aircraft

FIGURE 8



"The prosecution of these technical strategies... will demand a stronger Air Force-industry partnership than ever before."

prime manufacturers as manager, all operating under a knowledgeable system supervisor. As the resulting government facility evolves, similar evolution occurs at the contractor facilities. Perhaps the companies identified here are not quite properly aligned in this example, but I believe the principle is correct. IDA must involve substantial, long-term participation and commitment by industry as partners with the Air Force, or the IDA role will soon become ineffective.

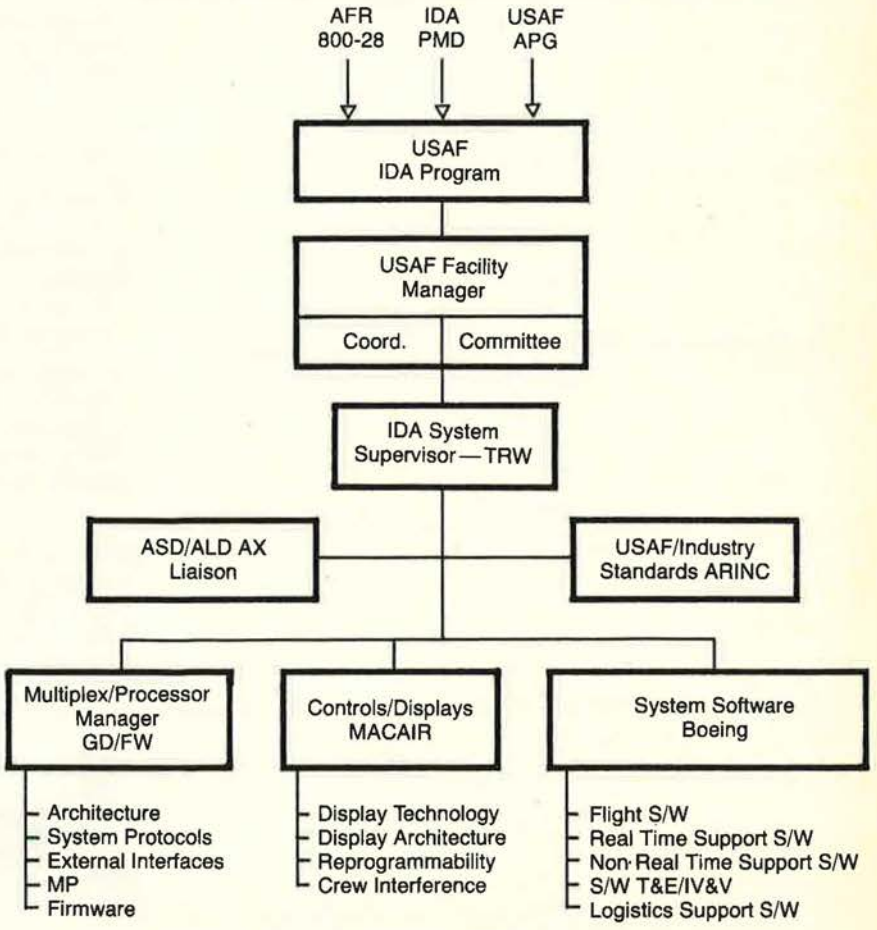
In Summary

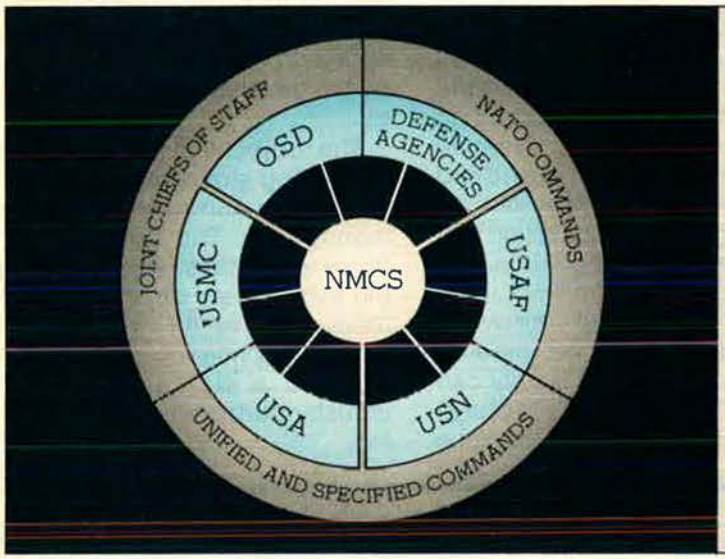
I have tried to give a fairly complete description of where we have come and where we are going in avionics. Our future direction seems to be more technically oriented than strictly managerial. Although we have established a sound foundation of policy, directives, and organizations, a fundamental technical thrust must be maintained if we are to be successful. The key element in the technical thrust is a more capable Air Force systems engineering capability that can interact more effectively with the industrial avionics development process. Attaining this systems engineering capability will require facility investment.

The principal role of this new capability is to serve as a single, but dynamic, point of reference where all current avionics hardware, software, and architectural standards are implemented, tested, evaluated, and supported to validate their use in operational weapon system acquisition programs. A properly oriented facility can also substantially aid the technology transition process by providing an easily accessible program-oriented environment to laboratory products. A dynamic implementation of standard hardware, software, and system architecture can form a baseline that can be used from program to program, yet allow the contractors to do what they do best—innovate, trade-off, and design for production. A jointly operated facility can establish certain architectural standards that should be immune to tradeoffs because they support a larger, force-wide maintenance of a common support base. Finally, the operation, maintenance, and application of capable systems engineering facilities can become an invaluable tool in increasing the technical competence of its operators. There is nothing like assignment of technical responsibility to motivate and technically mature an engineer, whether he be employed by the government or by the industry.

The objectives are clear. The supporting strategies now seem to be technical in nature as well as managerial. The prosecution of these technical strategies, through the evolutionary development of a more effective Air Force avionics system engineering capability, will demand a stronger Air Force-industry partnership than ever before. ■

FIGURE 9





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Electronic Warfare Initiatives

A wide range of recent innovations in hardware, software, planning, and management has led to EW systems that are more reliable, maintainable, standardized, and carefully integrated with the total avionics package.

BY LT. GEN. LAWRENCE A. SKANTZE, USAF
COMMANDER, AERONAUTICAL SYSTEMS DIVISION, AFSC

THE BIRTH of electronic warfare is obscure, but it is known that during May 1916, the Royal Navy's Admiral Sir Henry Jackson used coastal radio direction finders under Admiralty supervision to detect movement of the German fleet. Although changes in the apparent direction of arrival of the German radio signals were very small, Sir Henry used this information to direct the British fleet against the enemy.

Electronic warfare (EW) made dramatic strides in the inter-war years, and by World War II, the Battle of the Beams was in full swing. Advances continued after the war, and by the time of the Vietnam conflict, sophisticated, highly specialized electronic warfare equipment and techniques were in daily use. Today, electronic warfare is one of the most critical challenges facing our strategic and tactical forces.

The textbooks define electronic warfare as encompassing the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile employment of the electromagnetic spectrum, and those actions that permit its use by friendly forces. EW is now a major factor in military operations and cuts across the whole range of air warfare. Within the overall purview of EW are systems and subsystems directly integrated into offensive and defensive aircraft, as well as unique EW capabilities installed in specifically configured electronic warfare aircraft.

EW can be divided into three major categories. The first, often referred to as electronic warfare support measures (ESM), involves intelligence-gathering, including electronic intelligence (ELINT) and communications intelligence (COMINT). While ESM may be used prior to the start of a conflict, the second category, electronic countermeasures (ECM), supports friendly forces during hostilities and is composed of actions taken to prevent or reduce an enemy's use of the electromagnetic spectrum. Electronic counter-countermeasures (ECCM), the third major category, includes any action taken to ensure that friendly electromagnetic systems operate effectively despite an enemy's use of ECM.

Within the Air Force, the responsibility for developing new EW equipment lies primarily with Air Force Systems Command's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio. Throughout ASD, EW research and development work is under way, but the prime responsibility for developing new sophisticated EW equipment lies with the Electronic Warfare Systems Program Office of the Deputy for Aeronautical Equipment.

It may be useful to look back at where we have been and to describe some of our accomplishments in this critical area. In the July 1976 issue of AIR FORCE Magazine, Senior Editor Edgar Ulsamer reported on many EW achievements and on plans for developing more advanced EW capabilities. The majority of those plans have been fulfilled, and many new EW systems are now in full-scale production or in the active inventory. It now seems appropriate to report on some of the major EW programs and to provide a brief road map of where we are going.

Some Hardware Milestones

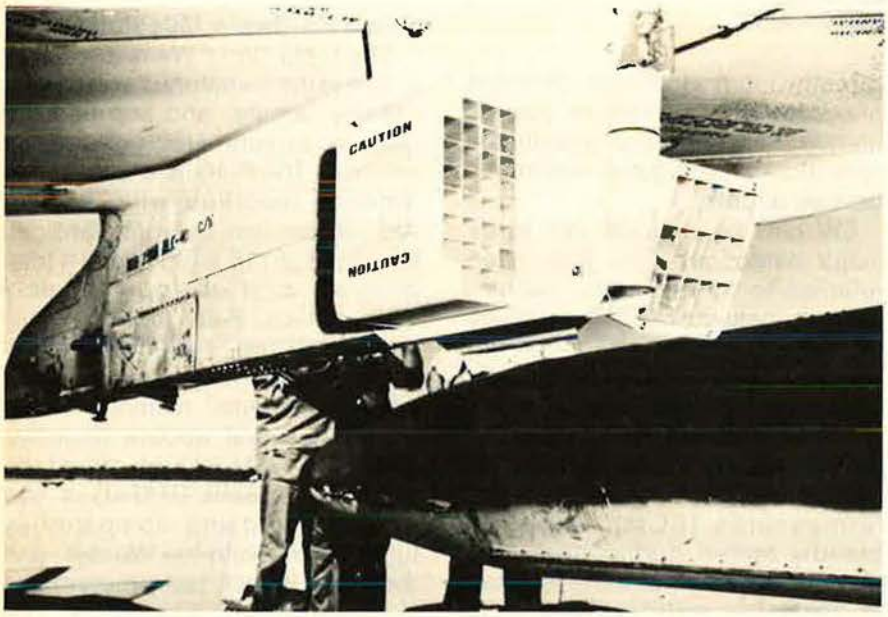
The F-4G "Wild Weasel" aircraft is now in the inventory. It will detect, identify, locate, and suppress or destroy enemy electromagnetic emitters. The F-4G is a basic F-4E airframe modified with the AN/APR-38 receiver. Current plans call for a fleet of 116 aircraft with a total program cost of approximately $365 million. F-4G improvements are continuing, including an enhancement program to study APR-38 computer memory expansion and threat update improvement. The AGM-88 high-speed antiradiation missile (HARM) is currently undergoing compatibility flight testing with the Weasel, and the initial launch test program has been progressing smoothly. The combined F-4G/AGM-88 weapon system presents a formidable defensive/offensive EW capability.

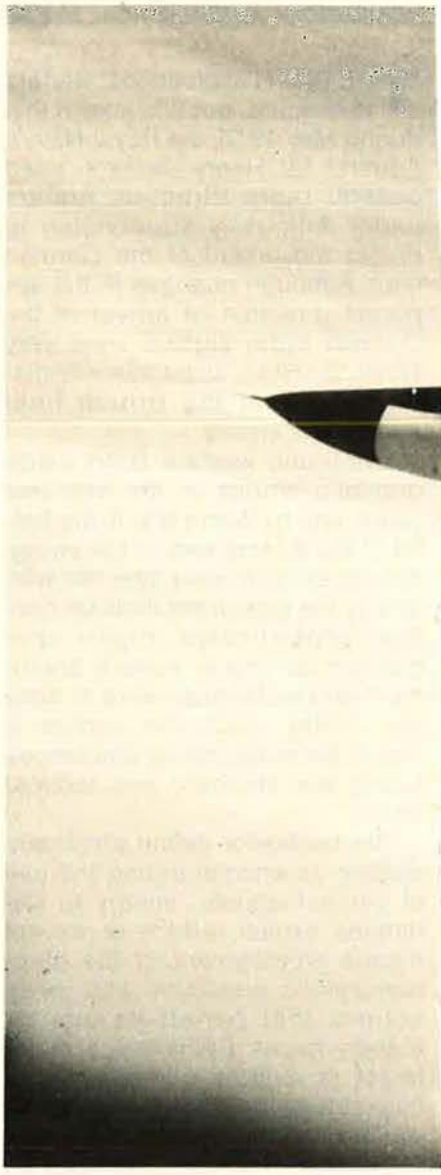
The Wild Weasel's first cousin in the information-gathering role is the Tactical Electronic Reconnaissance (TEREC) system, scheduled for first production delivery in the latter part of 1979. TEREC, a modification of the RF-4C, will locate and identify emitters for both peacetime and wartime ELINT. Information is data-linked to ground stations where it is used to provide tactical air commanders with real-time intelligence about hostile radar systems. The TEREC aircraft can provide this information from either a standoff position or while

penetrating with the strike force. All data that is not data-linked to the ground is recorded on tape during the mission and analyzed, using sophisticated ground processors, after the aircraft has landed. This data, providing such information as emitter operating characteristics and locations, is used by the ground commander for updating his Electronic Order of Battle. The TEREC aircraft will begin field tests in late 1979 with eighteen aircraft scheduled for modification.

One of the major milestones in EW during the last few years was demonstration of the AN/ALQ-131 ECM jammer pod's high reliability and maintainability. Through a joint Air Force/contractor team, experienced ECM pod maintenance technicians participated directly in the day-to-day design of the diagnostic software used to check out the ALQ-131 in the field shop. The result is a checkout system that not only is highly flexible for the experienced maintenance technician, but will semiautomatically lead less-experienced technicians through the procedures necessary to diagnose and maintain the ALQ-131.

The net effort is an ECM pod with a calculated operational availability greater than ninety percent. The 168 ALQ-131 systems already ordered are going to the Tactical Air Command. The ALQ-131, representative of the new generation of rapidly programmable ECM systems, has growth capacity in the area of power management, an ability to direct the system's energy to the most immediate threat. Recently we completed a series of ALQ-131 flight tests that included an installed receiver/processor to test and refine this capability.





The ALE-40 countermeasures dispenser (above) can carry both chaff and flares to counter radar and infrared seekers. A modular addition to the ALQ-131 pod is being developed for the EF-111 (right) to provide surveillance radar support jamming.

Managing the Software Problem

Software continues to be one of the Air Force's largest single investments for such systems as the ALQ-131 that are controlled by computers or processors. Because of the complexity of most EW software and the "configuration control" problems associated with maintaining and reprogramming it, tens of millions of dollars are at stake each year.

A major problem has been the

sheer magnitude of EW computer reprogramming required by current and anticipated enemy threat changes. In order to meet this challenge, the Air Force has developed the Electronic Warfare Integrated Reprogramming Concept (EWIRC). The ultimate objective is to provide the Air Force with a clear and comprehensive picture of the entire reprogramming process, including identification of threat changes, impact analyses, operational decisions, software engineering, and combat aircraft upgrade in the field. Such a picture helps not only to ensure a well-integrated EW capability but also to explain the need for funds and manpower required for EW reprogramming. EWIRC will provide clear lines of responsibility in order to avoid both gaps and overlaps.

Recently, an Electronics Warfare Avionics Integrated Support Facility (EWAISF) was established at Warner Robins Air Logistics Center in Georgia. The EWAISF provides Air Force-wide configuration control for some twenty EW systems with an increasing workload expected in the immediate future. The facility is staffed by 135 engineers and technicians and 130 item managers and logisticians working closely with the user commands. The organization will move to a new facility in November 1979.

Warning and Dispenser Systems

Significant advances also have been made in the area of threat-warning systems, including both infrared and radar warning devices. During December 1978, the Air Force awarded a production contract to the Westinghouse Electric Corp. for B-52G/H tail warning sets (TWS), the AN/ALQ-153. This contract was the culmination of a three-and-a-half-year development program that consisted of a competitive flyoff between competing designs. Although TWS development is continuing for F-15 and F/FB-111 aircraft, it is anticipated that commonality for the B-52, F-15, and F/FB-111 will exceed ninety percent. This will result in significant life-cycle cost savings in spares, intermediate and depot-level support equipment, technical orders, and training. The TWS also

Lt. Gen. Lawrence A. Skantze, a 1952 graduate of the US Naval Academy, is Commander of the Aeronautical Systems Division of Air Force Systems Command. Subsequent to pilot training and a tour of duty with the 90th Bomb Squadron in Korea, General Skantze's career has been largely in research and development. He has served as Director of System Engineering and Advanced Planning for the Air Force Manned Orbiting Laboratory Program, Deputy to the Commander of ASD for the SRAM program, Systems Program Director for the E-3 AWACS, and Deputy Chief of Staff for Systems at AFSC Headquarters. He has a master's degree in nuclear engineering from the Air Force Institute of Technology.

uses a new maintenance concept that requires less intermediate-level support equipment than most current EW systems and will achieve savings in spares, maintenance costs, training, and transportation as well as provide for a more efficient maintenance schedule.

A prototype infrared warning receiver (IRWR) has been built under a competitive development program. In this initial development, both the scanning and storing technologies are used. The systems are currently being tested side-by-side in a competitive ground- and flight-test program. The IRWR is being developed for possible application to various Air Force cargo aircraft and helicopters.

Several other projects are also under way to modernize the F/FB-111 EW capabilities, including installation of the ALR-62 radar warning receivers and the ALQ-137 jammer and replacing the AAR-34 infrared (IR) tail warning system with the AN/ALQ-153 pulse Doppler radar. The first ALR-62 operational installation was made in November 1978. This improvement program is scheduled for completion in early 1982.

The ALR-62 is another example of the new generation of software reprogrammable ECM systems that can be rapidly changed to meet evolving EW threats. One of its notable features is the alphanumeric display that provides an easier and more efficient interpretation of the displayed threat data. The ALQ-137 jammer is also in production, with installation of the first F-111 operational system planned for the latter part of 1979. This system will provide a substantially improved countermeasures capability.

The ALE-40 Countermeasures Dispenser System is being installed in the F-4, F-16, A-7D, and A-10. Plans are also being formulated to install the system in C-130 aircraft. The ALE-40 uses a modular approach to maximize commonality. Capable of carrying chaff and flare payloads, the system can counter both IR and radar seekers. The ALE-40 also has automatic modes for "tie-in" to threat warning systems such as the Doppler tail warning set or radar warning systems.

The MJU-10/B flare, commonly referred to as the 2 × 2.5 flare, to be dispensed from the ALE-40, is completing development. This flare will be used to protect tactical aircraft with IR signatures too great for present flares. As now configured, six MJU-10/Bs will fit into an ALE-40, with each flare consisting of a cartridge case, end cap, flare pellet, and an ejection gas generator (squib). The flare is presently undergoing qualification and safety testing. Environmental chamber testing and flight testing to measure the IR spectrum and other performance characteristics of the MJU-10/B are scheduled for June 1979 through May 1980. Full-scale production is planned for FY '80. The MJU-10/B is being developed under a competitive development effort. Upon completion of the flyoff between the competing contractors, the Air Force will decide on future production alternatives.

The pyrophoric flare currently under development is designed to be used with the AN/ALQ-153 and other threat warning receivers. This flammable fuel flare is a highly intense, rapid-igniting device that can be tailored to closely match the IR spectrum of various aircraft. A full-scale engineering development contract for pyrophoric flares is scheduled to be released in early FY '80, with the first production buy planned for FY '82.

Several ECM programs also are under way in the Electronic Warfare SPO. In support of the EF-111, an electronic warfare jamming platform being developed by ASD's Deputy for Systems, a modular addition to the ALQ-131 pod, is being investigated to provide surveillance radar support jamming and complementary support jamming to the EF-111 aircraft.

Planning and Management Initiatives

What about the future? Where are we heading? A number of new initiatives are under way that will have a dramatic effect on the EW community.

The July 1976 AIR FORCE Magazine article concluded that "the first order of business is to get away from the Southeast Asian war syndrome of building EW systems in a hurry. Our emphasis now must be on reliability, maintainability, lower life-cycle costs, and standardization." Again, I think our report card looks good. Advances, many of them considered to be major, have been made. Today, EW is an integrated member of the total avionics package and not simply an addition that comes along after the fact. A great deal of emphasis has been,

and will continue to be, expended to ensure that EW maintains this position.

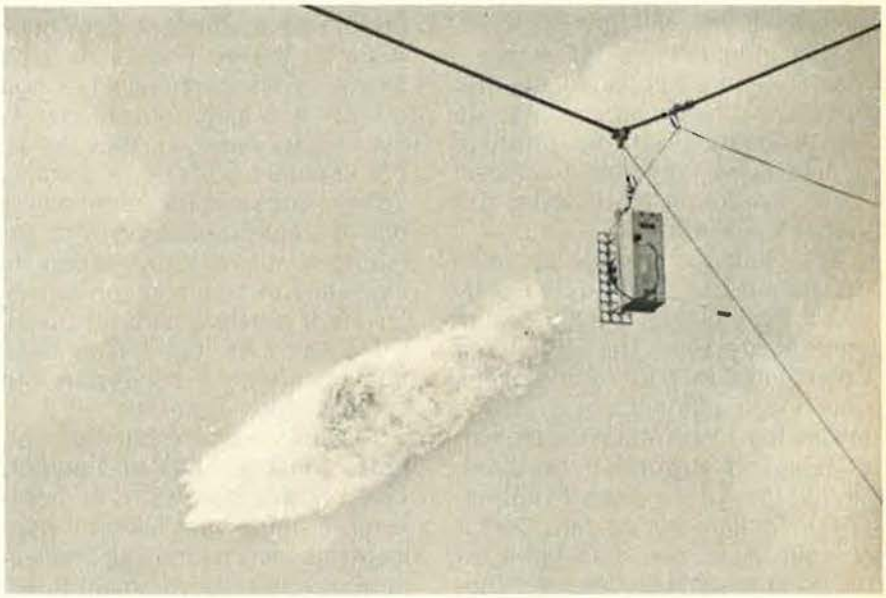
In September 1978, Air Force Regulation 800-28 went into effect. This regulation, entitled Air Force Policy on Avionics Acquisition and Support, establishes policy and assigns responsibility for acquiring and supporting all Air Force avionics components, equipment, and systems and their support suites, including those used in electronic warfare. This regulation ensures that assessment and decisions on avionics issues are made Air Force-wide. It applies to all Air Force organizations that manage, plan, identify, select, research, develop, test, produce, support, or modify avionics equipment during any phase of its life cycle. By inclusion in this process, electronic warfare programs will substantially benefit from investigations and developments geared to commonality, interchangeability, standardization, supportability, reliability, and interoperability. Improvements in these areas will greatly increase the availability of existing and proposed Air Force weapon systems.

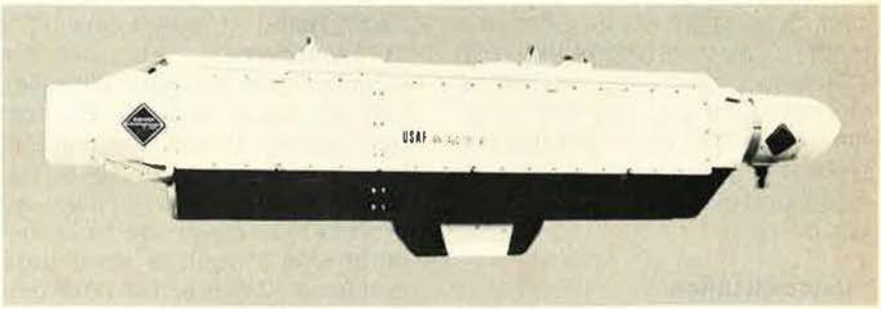
AFR 800-28 institutionalized several items of major importance to EW. First, it established the Deputy for Avionics Control at ASD (ASD/AX). This deputate is now the single Air Force organization responsible for focusing and controlling all Air Force avionics. Manned with both Air Force Systems Command and Air Force Logistics Command people, it will review all avionics programs, including EW, whether they are new starts or an avionics modification or update program. This centralized review will assure that new avionics programs meet operational needs and ensure standardization whenever possible.

The Deputy for Avionics Control is responsible for formulating and updating the USAF Avionics Master Plan, of which EW will be a major part. This plan will integrate all avionics planning, acquisition, modification, and support with overall mission and functional area planning. The primary objective of the plan is to provide cost-effective, time-phased avionics that meet the need of present and future aeronautical weapon systems.

Continual updating of the plan is done in part through an annual Avionics Planning Conference directed by AFR 800-28. The purpose of this conference, participated in by both the Air Force users and developers as well as the Army and Navy, is to exchange technical information, to consider consolidating requirements, and to discover opportunities for standardization. We have conducted two of these conferences, which included an EW subpanel that emphasized long-term EW planning. Findings of the conference are then included in an Avionics Planning Guidance Document that lists avionics development needs in order of priority, based on near-term and far-term avionics requirements for the planned force structure.

Under the initiatives established by the Commander of Air Force Systems Command, Gen. Alton Slay, AFSC has developed a new,





The pyrophoric flare now under development (above) is a rapid-firing countermeasure that can be tailored to match the IR spectrum of various aircraft. The AN/ALQ-131 jammer pod (below) is one of the new generation of rapidly reprogrammable ECM systems. It has great growth capacity in the area of power management.

"out-front" approach called Vanguard. Vanguard consists of a family of master plans, now totaling thirty, that provide innovative thinking for every major technical discipline of interest to the Air Force. Two of the thirty Vanguard areas deal with EW and include an Electronics Warfare Master Plan and a Defense Suppression Master Plan. These two Vanguard master plans will be major EW planning vehicles for use by both the Air Force and industry. The results of the AFSC Vanguard plans, in particular the EW and Defense Suppression Plans, will provide an important input to the USAF Avionics Master Plan established by AFR 800-28 discussed above. We are devoting considerable effort to getting away from "the Southeast Asian syndrome of building EW systems in a hurry."

The using commands are also doing their part to advance EW by providing inputs to the USAF Avionics Master Plan. The Tactical Air Command (TAC), for example, has been making significant strides to ensure that EW is receiving the emphasis and support it requires. Under the Green Flag Program, TAC's Tactical Air Warfare Center at Eglin AFB, Fla., has been directed to assume the lead in defining and implementing the blueprint for all TAC electronic warfare requirements, with special emphasis on integrated defense suppression. Relying heavily on innovative testing, training, modeling, and analysis, Green Flag will be instrumental in yielding sound requirements and decisions that will significantly improve Tactical Air Command's electronic combat capabilities.

Standardization

Because of the extent of EW development, it is imperative that standardization among the services and with NATO allies be continually investigated. Commonality and standardization among military EW activities will stretch the taxpayers' dollars as far as possible. The Air Force is exploring all avenues to share developments and acquisition whenever possible. Commonality, and all its associated savings, now stands in the forefront. An example of this joint services cooperation is the Memorandum of Agreement (MOA) signed by the Navy and the Air Force in October 1978 for a shared development of the Airborne Self-Protection Jammer (ASPJ) program. While the Navy has the overall lead for ASPJ, the Air Force is sharing in front-end development costs.

Standardization concepts originating from the ASPJ program include the possibility of using the power management portions of the ASPJ for the Air Force's ALQ-131 jammer. This commonality would provide two major advantages for the military services: reduction of development costs for a common system, and possible price savings due to increased buys. The Air Force is not only examining the feasibility of common subsystems for such existing aircraft as the F-111 and F-16, but is also investigating common subsystems for future weapon systems.

The technical benefits and potential cost savings of standardization are not without problems. For the last several years there has been increasing pressure at all levels of government to use competitive development as much as possible. The concepts of commonality and competition are often at odds unless procurement concepts using "leader/follower" or "reprocurement data" are employed. These concepts allow second sources to remain in the competition after the prime contractor has been selected. These, as well as other similar procurement approaches, however, do have their technical, financial, and legal problems. We are therefore continually exploring ways to maintain competition, while at the same time ensuring as much commonality and standardization as possible. I believe the establishment of a USAF avionics focal point is a major step in the right direction.

Air Force electronic warfare systems are also candidates for depot maintenance interservicing. Under this program, systems are maintained by the military service with the capability and capacity to repair the item at the lowest life-cycle cost. As individual systems are developed and procured, the system specifications are distributed to all services for evaluation. The services then identify existing equipment and capacity that can be used to repair each item. This process will greatly reduce the overall system cost by using existing assets rather than developing new support equipment. Since Army and Navy systems can now be maintained by the Air Force and vice versa, each service will maintain effective wartime repair capability while greatly reducing costs.

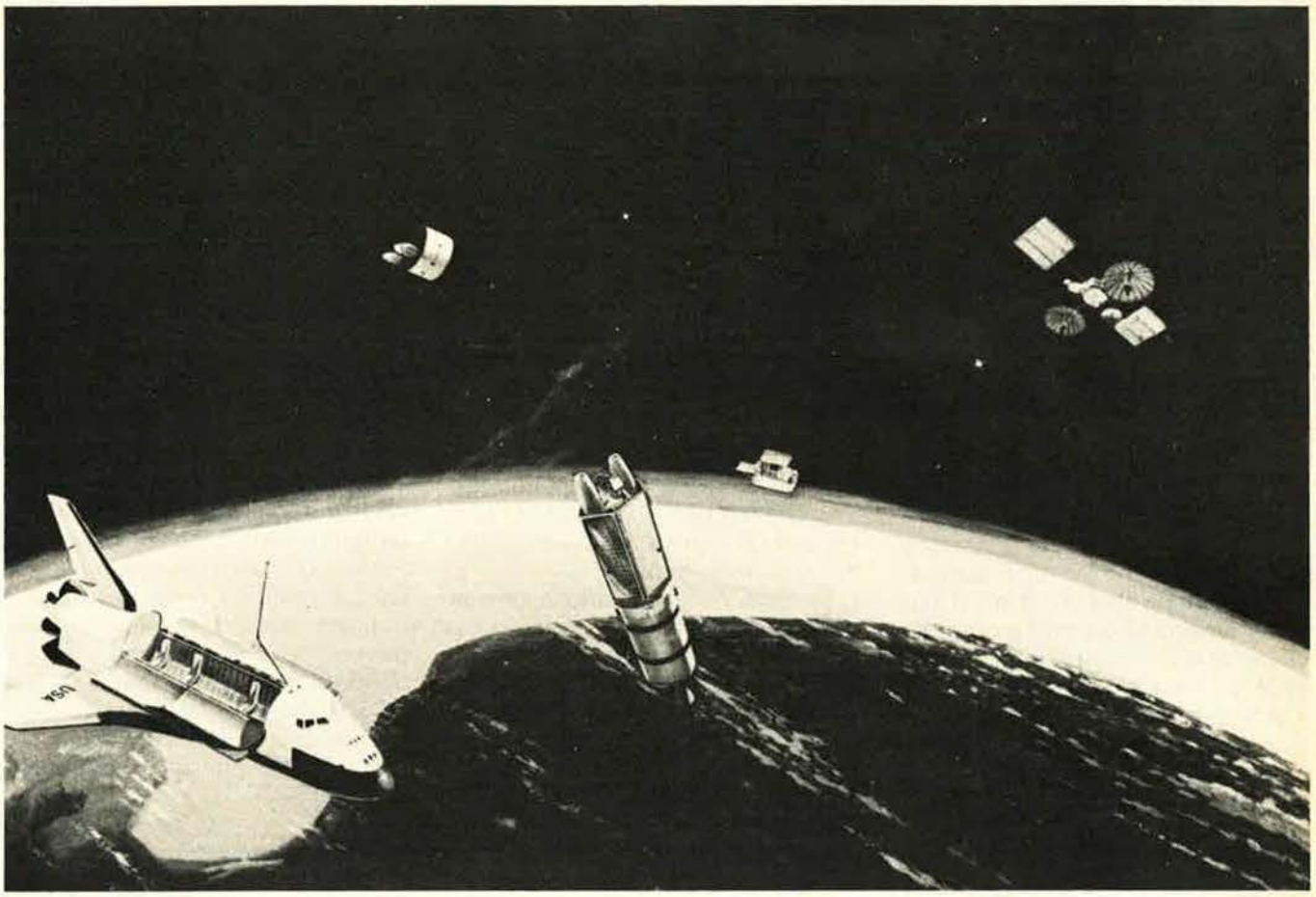
As the benefits of standardization and commonality became more apparent, and the savings in people, dollars, and other critical areas began to increase, a more formal agreement between the military services was required.

In December 1978, the Army, Navy, and Air Force Joint Logistic Commanders signed an agreement to establish the Joint Technical Coordinating Group for Electronic Warfare. The objective of this triservice agreement is to establish a formal process to review various EW programs that may have across-the-board application with resultant savings in funding, personnel, and support.

Other significant EW management and organization changes also are under way. Recently, Brig. Gen. Robert W. Kennedy was named Director of Electronic Combat and is organizing a new Air Staff EW office at the Pentagon. The responsibility and roles of this organization are now being formulated, but it is quite certain that establishing a focal point for EW in the Air Staff will provide a major impetus to the EW program.

We must continue to look at EW as an integrated member of the total avionics package and not simply as a subsequent addition. Using the initiatives and developments discussed above, I believe we will continue to provide the EW equipment and techniques so urgently needed to support our electronic Air Force. ■

TELEMETRY, TRACKING & COMMAND



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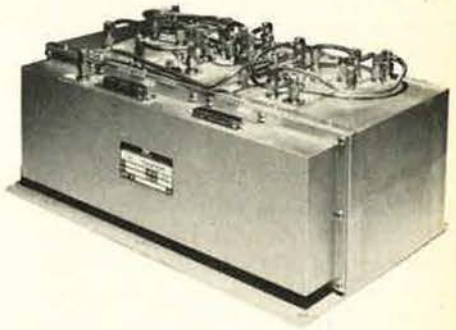

Standard NASA/DoD transponders can easily be tailored to specific mission requirements without major design changes

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DCA's Route to Readiness

The Defense Communications Agency's goal of total combat readiness is being achieved by reducing wartime vulnerabilities, enhancing security, integrating strategic and tactical resources, and tightening the relationship between communications and command and control.

BY VICE ADM. SAMUEL L. GRAVELY, JR., USN
DIRECTOR, DEFENSE COMMUNICATIONS AGENCY

SINCE becoming Director of the Defense Communications Agency (DCA) in the fall of 1978, I have had a fresh look at the many demands placed on communications systems that must meet the requirements of our military forces. Many of the services provided by DCA to its Defense Department customers are similar to those provided in the commercial world. Telephone calls are made, messages are exchanged, and large quantities of digital data are transferred between computers. In view of this, it is difficult for some to understand just why plans for military communications systems must be, in many cases, quite different from those prepared by commercial planners. And, yes, quite different usually means that they cost more—in some cases a good deal more.

The business of a commercial communications organization is to provide mass communications services, at reasonable cost, that work fairly well most of the time under normal conditions. Here "normal" includes almost all conditions except those that have never occurred before. In going about such a business, statistical analysis is clearly an indispensable tool, and probably no one understands the use of this tool better than the commercial telephone companies. Statistics tell how to deal economically with all but the wild fluctuations. In the business of commercial communications, the wild fluctuations may be embarrassing and cost money, but one can learn from them, and they are not apt to be deadly. It is not cost-effective to try to anticipate the wild fluctuations.

Defense communications, on the other hand, must try to anticipate some wild fluctuations. The impact of not doing so could be deadly. Things that can happen to a communications system in a crisis or war come under the heading of wild fluctuations. Defense communications must be designed to function adequately under such circumstances. This is the concept of "readiness." Commercial and defense communications planners thus elect to accept potential embarrassment at different times for different reasons. Commercial firms must risk embarrassment when their communications systems fail due to circumstances that were uneconomical to plan for. Defense planners must risk embarrassment when they are required, in peacetime, to propose communications systems that are more expensive than similar civilian systems, so that military systems can function in the abnormal situations that occur during crises and war.

Today, DCA manages a worldwide communications system that provides the basic framework for meeting the long-distance communications requirements of our military forces. Known as the Defense Communications System, or DCS, it is an important part of the World-Wide Military Command Control System (WWMCCS). Some statistics may be helpful in understanding the size and scope of the DCS.

The DCS contains more than 50,000 individual circuits, totaling some 30,000,000 miles of circuits. Nearly 900,000 calls a day are processed. Today's DCS has five satellites in orbit, four of which are active with one to serve as a spare. The government will shortly own more than 100 satellite earth terminals. This number will grow to 445 by 1987 when the services' 356 Ground Mobile Force Satellite terminals are tied into the system. We lease satellite terminals as well.

More than 100 automatic switches are included in this worldwide network, with a comparable number of manual switches. Some 600 facilities are operated and maintained by about 15,000 military personnel and civilian government employees. Nearly $550 million will be spent on the DCS during the 1979 fiscal year. Obviously the DCS represents a major investment by the American taxpayer.

The Readiness Concept

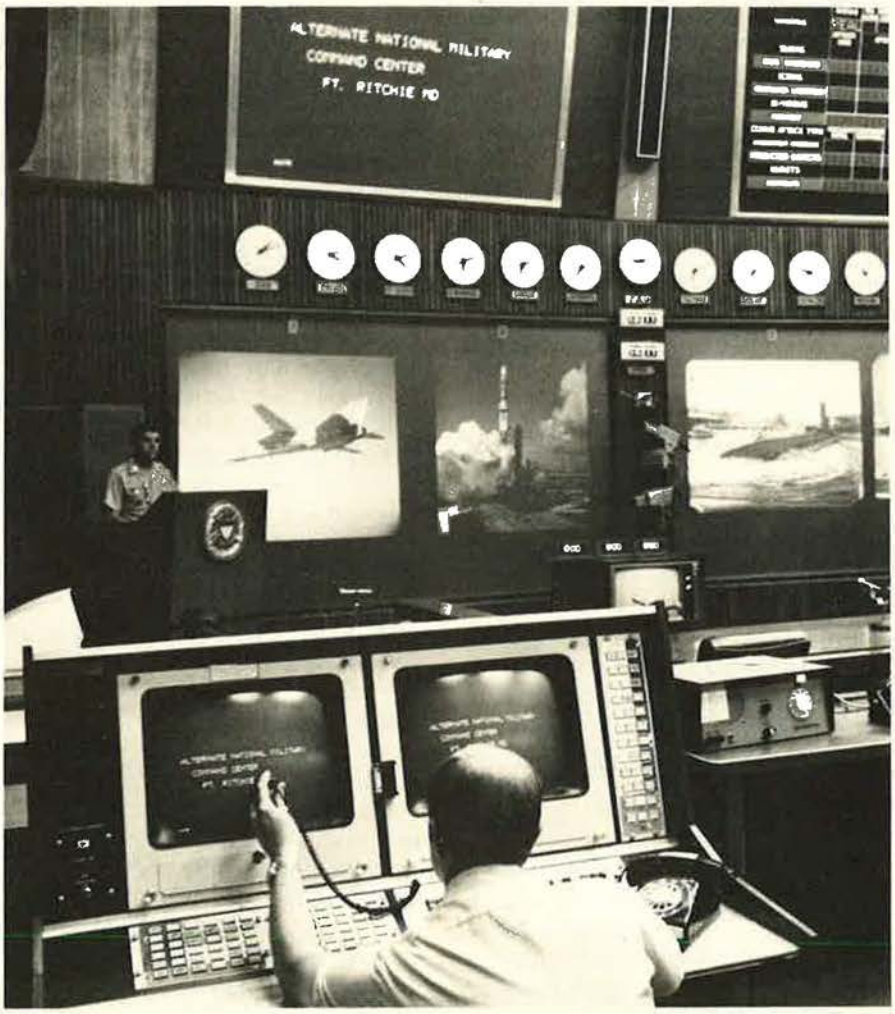
We have already made the point that readiness is a key objective for the DCS. Let us examine further just what this readiness concept means in terms of the DCS.

Military communications have traditionally been categorized as tactical or strategic to describe the missions they support. To most people, tactical communications implies equipment that is mobile, rugged, and closely aligned with command and control. Such equipment is primarily intended for use by people in the field under a wide variety of environmental and combat conditions. Although these tactical communications systems may have a somewhat limited capacity, they can be called on to handle voice, record, or data traffic. Such communications can be point-to-point, or as part of a switched, multichannel network.

Communications not fitting the tactical definition tend to be lumped into the strategic category. DCS equipment, not normally

thought of as being mobile, is considered by many to be strategic. The DCS, however, does not just serve the strategic offensive and defensive forces. The charter for DCA defines the DCS as long haul. Nowhere is it restricted to strategic functions. In addition to the strategic forces, the DCS does, in fact, serve the general-purpose forces, the intelligence community, theater and national level command and control functions, and many other support functions. When one considers the large, fixed DCS installations, the high data rate requirements that the DCS must accommodate, and the very large number of circuits, the tendency of some to classify the DCS as nontactical—and therefore strategic—is understandable.

The strategic label on the DCS is unfortunate in one sense. It causes many to believe that short of a strategic attack upon the United States, DCS needs should be adequately satisfied with commercial communications concepts, equipment, and procedures. It is sometimes forgotten that the threat to tactical communications that will exist in a combat theater will also apply to DCS facilities in that theater. DCS readiness also applies to supporting the tactical forces under wartime conditions. Many of the characteristics needed by tactical communications in order to survive must also apply to DCS facilities in a theater. One need only look at the European theater to see that DCS facilities are potential targets of air strikes, sabotage teams, and jamming. A DCS that neglects such considerations, and in which changes are made based exclusively on performance, efficiency, and reduced costs, risks not being ready when critically needed. This is a risk we cannot take.



The Alternate National Military Command Center, Fort Ritchie, Md., shown here, supplements the Command Center in the Pentagon and the Airborne Command Post.

In this same vein, a comment about the personnel operating DCS facilities is appropriate. These people, supplied by the military departments, are not categorized today as direct combat-support personnel. Under wartime conditions, however, they are going to get hit, suffer casualties, defend their facilities, restore them, and do it over and over again as long as the battle continues. They may be manning communications that are strategic in the minds of many, but when a war starts, they are tactical in everything except the kind of gear provided to do the job. These people must be equipped, trained, and exercised so they can successfully cope with such tactical situations. All this is part of the readiness picture for the DCS.

It is important to remember this readiness role when viewing plans for improving the DCS. DCA today is heavily involved in architectural efforts to guide the evolution of our voice and record communications systems. Significantly reducing the known wartime vulnerabilities of today's DCS is a major consideration in these plans. Artificial boundaries between so-called strategic and tactical resources are being broken down in these architectures. The concept of a Joint Multichannel Trunking and Switching System (JMTSS), for example, calls for DCS and tactical resources to be combined into a single operating system in a theater of operations during wartime. It is also clear that intelligence traffic required by our military users, and on which command and control heavily relies, must flow unimpeded across both tactical and DCS resources. Today's architectural concepts are intended to ensure that necessary management boundaries in the DCS and tactical arena do not impose unnecessary technical boundaries between systems.

The Secure Voice Program

In the July 1978 issue of AIR FORCE Magazine, my predeces-

sor, Lt. Gen. Lee Paschall, provided an excellent rundown on DCA's plans for the second-generation DCS. He indicated that DCA's plans for an improved secure voice program were still not final because of General Accounting Office and congressional concern, principally with regard to the program's cost. The history of our efforts to improve secure voice service is a painful case study in cost vs. readiness for military communications. Our original concept called for building a digital, secure voice system in the government-owned overseas DCS, using digital tactical equipment developed by the TRI-TAC office. The equivalent capability was to be provided in the CONUS by leased service emulating the overseas system. That arrangement looked attractive because it guaranteed interoperability between the DCS and the tactical forces.

The digital approach was somewhat more expensive in the short run than analog approaches that make use of in-place analog communications systems. In the long run, digital technology will make communications far cheaper than today. But the digital approach to secure voice would have put the DoD ahead of the commercial carriers in going all-digital. A key ingredient of the cost issue relates to the rate at which large communications systems convert from analog to digital transmission. For a number of years, DCA has been outlining the benefits of digital communications for military purposes. Digital communications also offer economic and reliability advantages to the commercial world, and the trend is definitely toward conversion from analog to digital as systems are upgraded or expanded. The transition period has already begun. In view of the tremendous investment in today's commercial analog transmission plant, it will be some time, however, before such a transition will be complete.

As originally proposed by DCA, the improved secure voice system called for using digital transmission rates that were too high and thus not suitable for the bulk of today's commercial analog circuits. In the view of the Defense Department, there were strong and legitimate military considerations for proposing this high transmission rate. Congress decided, however, that the cost of our original proposal was too high, and directed that we plan for secure voice improvements using the analog circuits available today. The evolution of secure voice will thus follow the evolution of the AUTOVON network, rather than drive it. The DCS secure voice improvement program has been modified to comply with this congressional direction.

For some time now, it has been clear that the lack of a widely available, easy-to-use, secure voice network has been a major weakness in military communications. The decision to tie secure voice improvements to the evolution of AUTOVON has thus significantly raised the priority of developing DCA's plans for the next-generation AUTOVON. There had been no impetus to change AUTOVON as a system until this past year.

During this period, we also observed plans for eliminating the tariff that provided reduced rates for bulk users of commercial voice communications. Eliminating the TELPAK tariff, which applies to AUTOVON, could raise costs by as much as thirty to fifty percent over the next five years. This combination of events has caused us to work very hard during the past year to develop alternatives for the existing AUTOVON network that could be implemented by the late 1980s. Although we have not yet settled on a preferred approach, certain features have been identified that are attractive from a system survivability viewpoint, as well as for helping us deal with the uncertainties of predicting future tariffs. We intend to exploit these as much as possible.

To illustrate some of the thinking about the future AUTOVON, consider the advent of today's commercially available, small, powerful digital switches. These devices can be programmed to provide many of the attributes currently available in today's larger switches. Their existence has allowed DCS architects to reexamine the traditional relationships between switching and transmission functions. Today, the majority of AUTOVON users are connected to a single backbone switch through a single set of access lines. Should either the switch or the access line fail, service is interrupted. Dual homing, because of the cost, is provided to only a very restricted number of users.

Future voice communications system designs will be able to consider using larger numbers of smaller switches, and thus decentralize the required switching functions. These smaller switches could be collocated with the users and contain the appropriate software to provide rerouting, precedence/preemption, and other desirable features. Such switches could be interconnected by various transmission media including dedicated terrestrial lines, commercial common carrier networks, and satellite links.

The ability to draw on a wide variety of surviving communications links under wartime conditions is very attractive for military applications. From an economic viewpoint, the ability to alter the transmission media employed in a relatively simple fashion has distinct advantages. As tariffs change with time, the government can consider altering its mix of transmission media to keep the service provided as economical as possible. The cost trends that we have seen for commercial, off-the-shelf digital switches make us confident that designing such flexibility into the system is practical.

DCA's Role in C²

Perhaps the most important function of communications systems, and the prime motivation for emphasizing readiness, is their role in supporting the command and control of our military forces. To provide our command and control subscribers with a service that is ready when needed, we at DCA must be more than communications specialists. We must also

understand the mission that our subscribers are working to accomplish with the aid of communications, such as command and control. Like the question used in a telephone company commercial, DCA must be prepared to respond when asked: "Sure, you know telephones; but what do you know about command and control?"

In recent months, people have been asking that question, motivated by a Defense Science Board study that recommended the creation of a central focus for the development of command and control systems, cutting across service boundaries, with an expanded DCA as a possible home for this focus. The DCA has, in fact, been in the command and control business almost since its inception. Our Command and Control Technical Center (CCTC) provides support to the Organization of the Joint Chiefs of Staff (OJCS) for the National Military Command System (NMCS). This includes the National Military Command Center (NMCC) in the Pentagon, the Alternate NMCC at Fort Ritchie, Md., and the National Emergency Airborne Command Post (NEACP).

Command and control (C^2) systems contain as subsystems: command centers, executive aids, computers, sensors, and communications. The procedures associated with command and control also must play a major role in the design of C^2 systems. Because of the importance of the communications subsystems to the effective functioning of C^2 systems, the term command, control, and communications (C^3) is often used interchangeably with C^2. The recent trend in the community, however, is to use C^2, in lieu of C^3, as the umbrella for all command and control subsystems and procedures.

DCA's involvement with the communications subsystems portion of C^2 systems is obvious. In this role, we provide systems engineering to the so-called Minimum Essential Emergency Communications Network (MEECN), which serves our nuclear-capable forces. We do, however, become involved with all the elements of C^2 in meeting our responsibilities to support the NMCS. The Command and Control Processing and Display System (CCPDS), for example, used by NORAD, SAC, and the OJCS for handling warning information, receives engineering and software support from DCA. DCA was also involved in the specifications for and the deployment of the Improved Emergency Message Automatic Transmission System (IEMATS), which helps translate decisions of the National Command Authorities (*i.e.*, the President and Secretary of Defense) into formatted instructions for our military forces.

As part of the technical support to the OJCS, DCA develops standard system software for today's WWMCCS computers, which are common throughout the WWMCCS community. Applications software to meet specific requirements for the NMCS is also developed by DCA. And we were responsible for building on the packet switching technology developed by the Defense Advanced Research Projects Agency (DARPA) to establish a Prototype WWMCCS Intercomputer Network (PWIN), and its operational successor, the WIN. Efforts of these types have required that DCA work hard to gain an understanding of the user's needs with respect to C^2 systems. We are becoming more and more proficient in our understanding of these needs. Today, almost forty percent of the resources of DCA are invested in C^2 technical support.

Most recently the WWMCCS System Engineering Office has been established at DCA, and I wear a hat labeled Director, WWMCCS Systems Engineering. In this role I have responsibilities for seeing to it that the architecture approved by the WWMCCS Council for our highest level command and control functions is engineered to provide the National Command Authorities with a system responsive to our needs.

In the past year, the management and acquisition of command and control systems have received increased attention within the Defense Department. I have already mentioned the Defense Science Board study and a possible expanded role for the DCA. It has resulted in OJCS considering a reorganization to give increased attention to the area of command, control, and communications. The close coupling between communications and command and control is now well recognized by the Defense community. This recognition, and the associated steps to foster interaction between system developers and system users, will go a long way toward ensuring that our defense communications are indeed ready when needed. ■

Vice Adm. Samuel L. Gravely, Jr., has been Director of the Defense Communications Agency since September 1978. Much of his career has been in the communications field as Program Manager of the National Military Command Center and the National Emergency Airborne Command Post, Coordinator of the Navy Satellite Communications Program, head of the Naval Communications Command, and Director of the Naval Communications Division. Admiral Gravely has commanded destroyers, a cruiser-destroyer group, the Eleventh Naval District, and the Navy's Third Fleet.

Computerized Crisis Forecasting

The Department of Defense is modernizing the indications and warning process through work on a computer-based, fully automated system for monitoring and evaluating international information and events. The system will enhance, rather than replace, human judgment.

BY STEPHEN J. ANDRIOLE AND JUDITH AYRES DALY

NATIONAL defense priorities in the immediate and longer-range future will revolve around US interests and goals in a dramatically changing international environment. This environment will continue to be characterized by ideological conflict, resource and energy scarcities, population expansion and maldistribution, increased nuclear proliferation and arms trade, heightened nationalism and terrorism, and unstable trade and monetary conditions.

—Wide World Photos

To help predict future political and military conflicts between paired nations, such crisis precedents as the 1968 Soviet invasion of Czechoslovakia would be integrated into the computer data base. Here a Czech youth defies a Soviet tank.

The predominant position of the US and the scope of its external interests inevitably will give rise to tensions that may evolve into crises threatening national interests and goals. It therefore is imperative that procedures for anticipating and averting or for managing international security crises continue to be developed, evaluated, and improved.

The US has, of course, developed methods of crisis warning and management. Responsibility for analyzing past crises in order to forecast, avert, or manage future ones is spread across a number of government offices and agencies, including the Defense Intelligence Agency, the Office of the Assistant Secretary of Defense for International Security Affairs, the Central Intelligence Agency, the National Security Agency, the many US military commands, and other offices and agencies. Special attention has been devoted to techniques for nuclear-crisis forecasting.

The I&W Process

The indications and warnings (I&W) process itself is complex and somewhat antiquated. It begins with an intelligence analyst who arrives at work in the morning, grabs a cup of coffee, lights a cigarette, and begins the tedious task of examining the mound of intelligence information in front of him. This intelligence can be comprised of all kinds of public and classified information, including that generated by the wire services, the Foreign Broadcast Information Service (FBIS), and classified message and cable traffic. He scans this information and, often in conjunction with lists of indicators, attempts to characterize the situation. Usually there is little change; sometimes things are dramatically different. When significant changes are detected, the analyst may issue a warning.

Today, the methods by which such estimates are arrived at as well as those by which "im-

portance" is assessed, are primarily qualitative. Qualitative methods rely heavily upon the judgment, intuition, and experience of the analyst (who may have been on the job for only six months and who is likely to be reassigned in twenty-four). This process is further complicated by:

- Manual processing and analysis of information;
- The use of military indicators (to the relative neglect of political and economic ones);
- The use of qualitative estimates of US interests and goals; and
- Forecasting methods that seldom draw on progress recently made in the social, behavioral, and computer sciences.

To simplify and improve US monitoring of the international environment and forecasting important international events and crises, work recently was begun on an integrated early warning and monitoring system comprised of quantitative political indicators of international activity, a monitoring and short-range quantitative-statistical forecasting capability, and a computer base. These components were developed to remedy the essentially antiquated nature of the I&W process, which during the period from 1946 to 1976 had a successful forecasting or "hit" rate of only fifty-four percent.

Developing the System

There has been considerable progress in developing the three major elements of the early warning and monitoring system, each of which is discussed below.

Quantitative Political Indicators: Quantifying narrative information about international political affairs was (and to a large extent still is) believed to be either impossible or distortive. Popular belief held that political information, unlike military information, was too subtle and inherently deceptive to yield useful quantitative indicators. Yet, nearly a decade ago research was undertaken to develop a methodology for converting so-called "soft" narrative information about international political affairs into hard quantitative data, which could then be collected and analyzed. The procedure involved converting narrative information to quantitative information with the World Event Interaction Survey (WEIS) coding scheme that recognized sixty-three distinct kinds of international political events. These event types have since been aggregated into twenty-two major categories, ten of which are cooperative and twelve conflictual, as Figure 1 indicates.

This coding scheme has been

Figure 1: Coding Scheme for World Event Interaction Survey (WEIS) Data

1. YIELD
   - 011 Surrender, yield to order, submit to arrest, etc.
   - 012 Yield position; retreat; evacuate
   - 013 Admit wrongdoing; retract statement
2. COMMENT
   - 021 Explicit decline to comment
   - 022 Comment on situation-pessimistic
   - 023 Comment on situation-neutral
   - 024 Comment on situation-optimistic
   - 025 Explain policy or future position
3. CONSULT
   - 031 Meet with; at a neutral site; or send note
   - 032 Visit; go to
   - 033 Receive visit; host
4. APPROVE
   - 041 Praise, hail, applaud, condolences
   - 042 Endorse other policy or position; give verbal support
5. PROMISE
   - 051 Promise own policy support
   - 052 Promise material support
   - 053 Promise other future support
   - 054 Assure; reassure
6. GRANT
   - 061 Express regret; apologize
   - 062 Give state invitation
   - 063 Grant asylum
   - 064 Grant privilege, diplomatic recognition, de facto relations, etc.
   - 065 Suspend negative sanctions; truce
   - 066 Release and/or return persons or property
7. REWARD
   - 071 Extend economic aid
   - 072 Extend military assistance
   - 073 Give other assistance
8. AGREE
   - 081 Make substantive agreement
   - 082 Agree to future action or procedure; agree to meet, to negotiate
9. REQUEST
   - 091 Ask for information
   - 092 Ask for policy assistance
   - 093 Ask for material assistance
   - 094 Request action; call for
   - 095 Entreat; plead; appeal to
10. PROPOSE
    - 101 Offer proposal
    - 102 Urge or suggest action or policy
11. REJECT
    - 111 Turn down proposal; reject protest demand, threat, etc.
    - 112 Refuse; oppose, refuse to allow
12. ACCUSE
    - 121 Charge; criticize; blame; disapprove
    - 122 Denounce; denigrate; abuse
13. PROTEST
    - 131 Make complaint (not formal)
    - 132 Formal complaint or protest
14. DENY
    - 141 Deny an accusation
    - 142 Deny an attributed policy, action, role, or position
15. DEMAND
    - 150 Issue order or command, insist; demand compliance, etc.
16. WARN
    - 160 Give warning
17. THREATEN
    - 171 Threat without specific negative sanctions
    - 172 Threat with specific negative sanctions
    - 173 Threat with force specified
    - 174 Ultimatum; threat with time limit and negative sanctions specified
18. DEMONSTRATE
    - 181 Nonmilitary demonstration; walk out on
    - 182 Armed force mobilization, exercise and/or display
19. REDUCE RELATIONSHIP
    - 191 Cancel or postpone event
    - 192 Reduce routine international activity; recall officials, etc.
    - 194 Halt negotiations
    - 195 Break diplomatic relations
20. EXPEL
    - 201 Order personnel out of country
    - 202 Expel organization or group
21. SEIZE
    - 211 Seize position or possessions
    - 212 Detain or arrest person(s)
22. FORCE
    - 221 Noninjury destructive act
    - 222 Nonmilitary injury/destruction
    - 223 Military engagement

used to generate a number of international political data bases. Among these is an extremely large base constructed from the New York *Times*. Each of the 110,000 events in this data base include information on who did what to whom, *i.e.*, what country projected (sent) what kind of action to which other country. An event thus consists of an initiator, a type, a target or recipient, and a calendar date. All of these coding elements have numeric equivalents and are stored digitally on computer tape or disc. The *Times* data base contains international political data on all of the events sent and received by all of the world's countries and international organizations since 1966.

From this data base researchers have developed quantitative indicators of international political behavior. The five indicators now in the early warning and monitoring system include:

- The aggregate of *all* political event types sent or exchanged by a pair of countries;
- The aggregate of cooperative political events sent or exchanged;
- The aggregate of conflictual political events sent or exchanged;
- Political tension or the ratio between cooperative and conflictual events sent or exchanged; and
- Political uncertainty or a measure of the range of events sent or exchanged across the twenty-two major event categories; uncertainty ranges from 0 to +1, the 0 value representing relatively consistent behavior (low uncertainty), while +1 represents inconsistent behavior (high uncertainty).

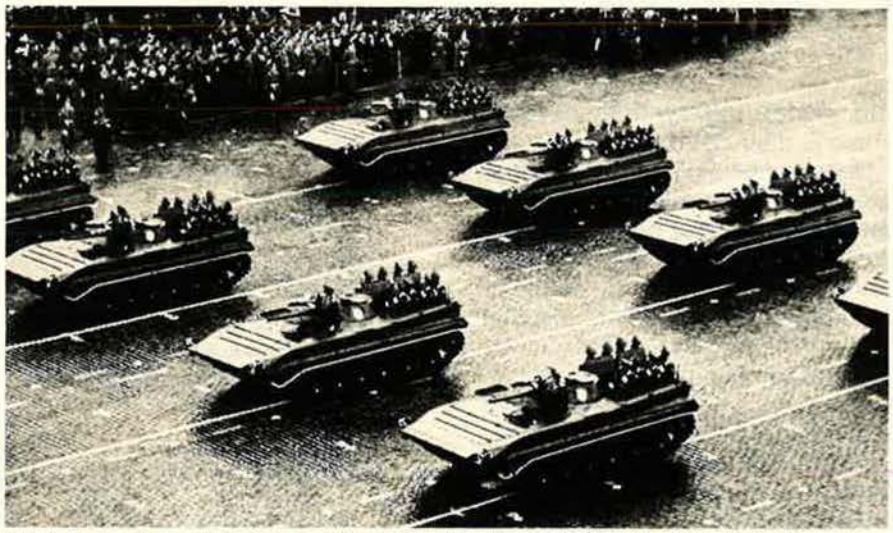
Monitoring and Forecasting: The early warning and monitoring system enables a user to monitor and forecast international political activity by discovering deviations from normal political activity, tension, and uncertainty. The deviations from normal behavior are measured in Z-scores, which represent the number of standard deviations from the mean (or average) political activity, tension, and uncertainty for whatever pair of countries is under investigation. This methodology enables one to track the political relations between any two countries and immediately isolate those country pairs behaving abnormally.

These measures of international political abnormality are used to generate short-range forecasts. More specifically, when Z-scores are generated by a user, they are interpreted with reference to scores observed during twenty-seven previous international crises. With the aid of a computer program (which also calculates the Z-scores), it is possible to correlate scores generated in real-time (or retrospectively) with scores preceding twenty-seven earlier crises.

For example, when a monthly Z-score of +10 is observed (again, either in real-time or retrospectively) indicating ten standard deviations from the average conflictual political activity, the computer will immediately search through the entire international event data base, locate the twenty-seven past international crises, calculate the monthly pre-crisis scores, and then attempt to match the observed score with those generated from the analysis of the twenty-seven previous crises. The crisis probabilities reflect the percentage of times the observed current scores match scores observed in the past.

Suppose, for instance, that an analysis of past events showed that a military crisis occurred within thirty days when Z-scores of conflictual activity ranged from +8 to +11. Now, if similar current scores were observed, a crisis probability of .75 would be postulated. (Note that twenty-five percent of the time when scores of +8 to +11 were observed in the past, a crisis did not occur.)

The Computer Base: The system's computer base is its most



Crisis forecasting will be improved by integrating the political indicator system with existing computer-based military indicator systems of similar design.

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Dr. Judith Ayres Daly is a Program Manager in DARPA's Cybernetics Technology Office. She has been a Program Manager and Research Analyst at Decisions and Designs, Inc., and has authored reports and papers in the fields of indicator technology and applied quantitative international relations.

The views expressed in this article are those of the authors and do not necessarily represent official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or any other agency of the US government.

novel component. Currently the whole system (event data, indicators, and monitoring and forecasting methodology) resides in a small (PDP 11/70) minicomputer and is accessible through Tektronix graphic terminals connected to the computer. The computer base includes Tektronix hard-copy units that enable users to generate high-quality paper copies of whatever appears on the graphic terminal screens.

Operation of the Early Warning and Monitoring System

The computer software developed by James F. Wittmeyer and Brenda D. Bell enables one to query the system and receive various kinds of output. By using a very flexible set of inputs, a user can specify the countries (or regions), the direction of international political activity, the time aggregations (daily, weekly, monthly, quarterly, or annually), and the time periods he wants to examine. Figure 2 illustrates these options with hard copy generated directly from a graphic terminal connected to the system. In the example, the user is curious about US-USSR relations.

When the system has searched the data base, calculated the Z-scores for all of the indicators, correlated the deviations with deviations observed during previous pre-crisis periods, and generated crisis probabilities (which it can do in from five to 120 seconds), it returns to the user a menu of display options. Table 1 presents the monthly total cooperative and conflictual indicators in terms of raw (event) frequencies, deviations (if any) from normal US-USSR rela-

Figure 2: Early Warning and Monitoring System Options

```
*** EARLY WARNING AND MONITORING SYSTEM ACTIVATED ***

Are your actors:
    1. Countries
    2. JCS regions
    3. Both                    (1)

Please select two countries {usa  usr}: usa  usr

Specify activity flow:
    0. one way {usa XXX usr}
    1. one way {usa XXX usr}
    2. two way {usa X-X usr}   (2)

Select time increment:
    1. monthly
    2. quarterly
    3. yearly                  (1)

Set time parameters {7501-7712}:  7710-7809
```

Table 1: US<——>USSR Total Cooperative and Conflictual Political Relations, October 1977 to September 1978

Monthly Activity
Oct, 1977 - Sep, 1978

*** usa <<<<<< Two-Way Flow >>>>>> usr ***

Date	Total Activity number	z-score	prob	Cooperative Activity number	z-score	prob	Conflictual Activity number	z-score	prob
Oct 77	35	0.55	0.13	23	0.52	0.15	12	0.38	0.18
Nov 77	30	0.26	0.13	24	0.60	0.15	6	-0.40	0.10
Dec 77	32	0.37	0.13	24	0.60	0.15	8	-0.14	0.10
Jan 78	19	-0.39	0.10	9	-0.61	0.10	10	0.12	0.18
Feb 78	33	0.43	0.13	17	0.04	0.15	16	0.91	0.18
Mar 78	39	0.78	0.13	25	0.68	0.15	14	0.64	0.18
Apr 78	60	2.02	0.40	49	2.62	0.21	11	0.24	0.18
May 78	55	1.68	0.16	34	1.35	0.21	21	1.56	0.23
Jun 78	65	2.23	0.40	33	1.25	0.21	32	2.98	0.48
Jul 78	36	0.53	0.13	13	-0.33	0.10	23	1.71	0.23
Aug 78	12	-0.84	0.10	5	-0.96	0.10	7	-0.33	0.10
Sep 78	11	-0.89	0.10	8	-0.71	0.10	3	-0.83	0.10

tions, and the crisis probabilities associated with the deviations (Z-scores).

Figure 3 illustrates how the system can generate graphic displays of the same indicators.

If a user wants to retrieve brief descriptions of the actual events that are aggregated into the indicators, he need only specify the event types, and the system responds with, in this case, all of the accusations exchanged between the US and USSR in September 1978, and shown in Figure 4.

Finally, the system has a keyword search routine that allows rapid search of more than 110,000 international political events exchanged between all of the countries in the world from 1966 to the present. It can be used to retrieve all text containing any combination of key words, *e.g.*, SALT and cruise missiles.

Some Future System Enhancements

Of the many coming improvements to the system, two are highly relevant to readers of this magazine. The first concerns integration of the political indicator system with existing computer-based military indicator systems of similar design. This will allow examination of the contention that political indicators are likely to precede military ones, and thus increase the time to analyze and prepare for important international events and crises.

The second enhancement will make the whole system "intelligent." The present system is passive; it only responds to user queries. An intelligent early warning and monitoring system would automatically calculate and compute the following:

- Alert lists of most politically tense country pairs;
- Historical precedent searches when country pairs appearing on the alert list have active crisis and conflict histories, *e.g.*, a .70 crisis probability between the USSR and Czechoslovakia today would automatically trigger information on the 1968 invasion for immediate comparison; and
- Threat networks, *e.g.*, a North Korean-South Korean tension level of .80 would automatically trigger an examination of relations between the US and South Korea and the USSR and North Korea.

Work on computer-based systems such as the one described here is aimed at modernizing the processes by which the Department of Defense conducts much of its business. Modernizing the indications and warning process is particularly important, given the improved state-of-the-art and the rather poor thirty-year track record. Yet, such systems cannot and should not eliminate human judgment. Experienced evaluation of statistical data is essential to the warning process.

The computer makes statistical data more easily accessible to the analyst and provides a flexible means of analyzing and displaying information relevant to national security, as an aid to conceptualization and interpretation. ■

Figure 3: US<—>USSR Total Cooperative and Conflictual Political Relations, October 1977 to September 1978

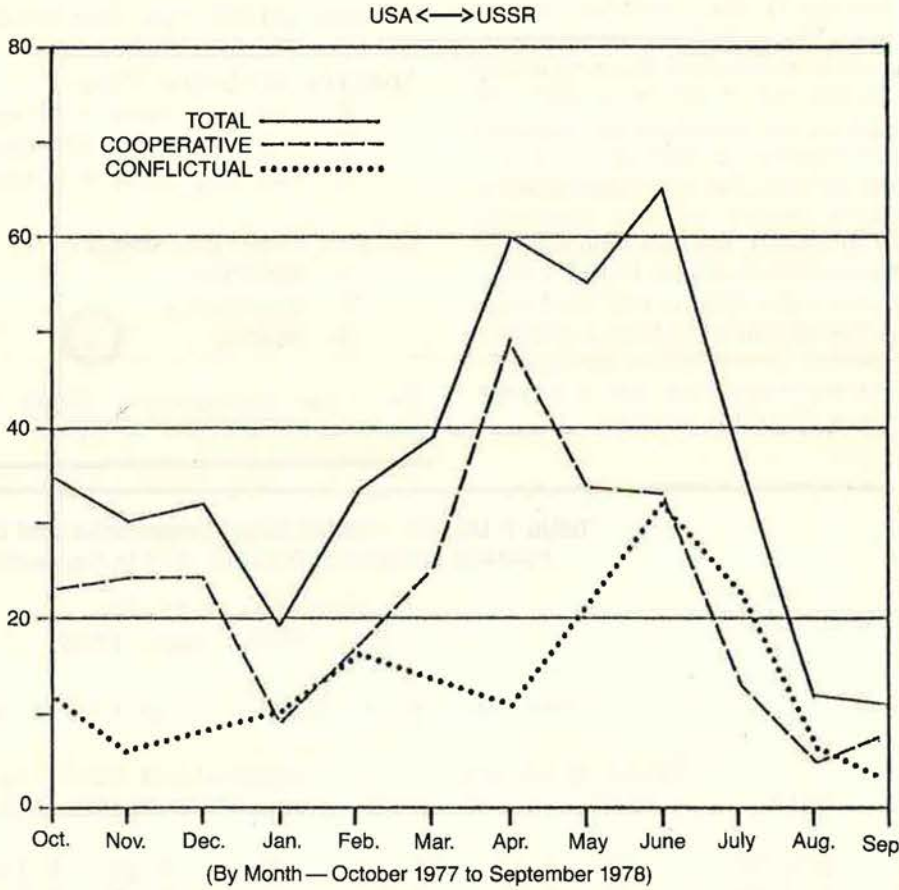

Figure 4: US<—> USSR Accusations, September 1978

```
date: 7809 6 actor: 365 event: 121 target: 2 arena: 10
    the soviet union press agency tass says that even
    the name "camp david" for the location of the com-
    ing summit meeting of the leaders of israel, egypt
    and the usa shows a bias towards isr and the star
    of david has always been given preference in the
    usa over the flag of any arab country usr
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The Air Force Institute of Technology celebrates its sixtieth anniversary this fall, at a time when the Air Force is faced with a shortage of officers trained in science and engineering. For Air Force educators, it will be a time not only to reflect on past accomplishments, but also to look at . . .

AFIT'S FUTURE COMMITMENTS

BY MAJ. CHARLES G. TUCKER, USAF
CONTRIBUTING EDITOR

Maj. Adolphus Andrews is pursuing a doctorate in political science at Ohio State University.

ONE NEEDS only a quick perusal of the newspaper and industrial journal want ads to appreciate our nation's critical shortage of engineers. The Air Force is feeling the crunch also. For USAF, the problem is compounded because the Air Force has always had difficulty recruiting enough engineers. The average starting salary of $18,500 in industry is stiff competition for the $12,500 offered annually to engineers commissioned as USAF second lieutenants. Today, USAF's failure to attract engineering officers is felt most in its critical research-and-development programs.

Deputy Secretary of Defense Charles W. Duncan, Jr., recently put the shortage of engineers in the US armed forces into perspective. Addressing the December 1978 graduating class of the Air Force Institute of Technology (AFIT), he said the Soviet Union is not only " . . . acquiring new and more sophisticated weapons at a rapid pace, they're getting to a position to do so in an even improved way in the future.

"The Soviet effort in education is particularly strong. Between 1960 and 1969, total enrollment in higher educational institutions nearly doubled and the majority of undergraduates in the Soviet Union continues to study scientific and technical subjects. In 1973–74, forty-two percent of the enrollment was in engineering specialties.

"In 1971, some seven years ago, 250,000 engineers were graduated in the Soviet Union. In that same year, 50,000 graduated in the United States," Mr. Duncan said. (Figures for 1976, the latest year available, showed 275,500 Soviet vs. 39,000 US engineering graduates.)

Mr. Duncan used the Soviet Navy as an example: "The Soviets want fifty percent of their naval officer corps to hold advanced technical degrees. I'm told that they are upset today that only forty-five percent of the naval officers hold advanced technical degrees. I'm told that the Soviets operate 118 military engineering schools." Then Mr. Duncan reminded his audience that the US armed forces have only three in-house sources of technical education for officers: the service academies, the Naval Postgraduate School, and AFIT.

AFIT, Sixty Years Old This Year

AFIT, which will celebrate its sixtieth anniversary in November, operates two resident degree-granting schools (Engineering, and Systems and Logistics), a civil engineering school to update professional USAF engineers, and a unique program that sends Air Force people to study in more than 400 civilian colleges, universities, medical facilities, and industrial firms. *(For additional information on AFIT's programs, see "AFIT Facts" below.)*

In addition to its advanced technical education, a major benefit of AFIT graduate programs for the USAF is research produced through student theses and dissertations. Ninety percent of the theses and dissertations written by AFIT resident students are directly related to current Air Force problems and programs. Annual surveys show that research by AFIT resident students, if contracted by Air Force Systems Command (AFSC) and other users, would cost between $4 million and $5 million each year. AFSC also estimates a savings of $1 million annually in on-the-job training costs of AFIT graduates because they are ready to go to work the day they arrive at their new assignments.

Another important factor in resident research is the collocation of AFIT with the Air Force Wright Aeronautical Laboratories at Wright-Patterson AFB, Ohio, the largest concentration of research and development in the Department of Defense. This gives AFIT students and faculty access to data and current problems as well as the expertise of a high concentration of scientists, engineers, and logistics experts who also serve as visiting lecturers and thesis advisors to AFIT students.

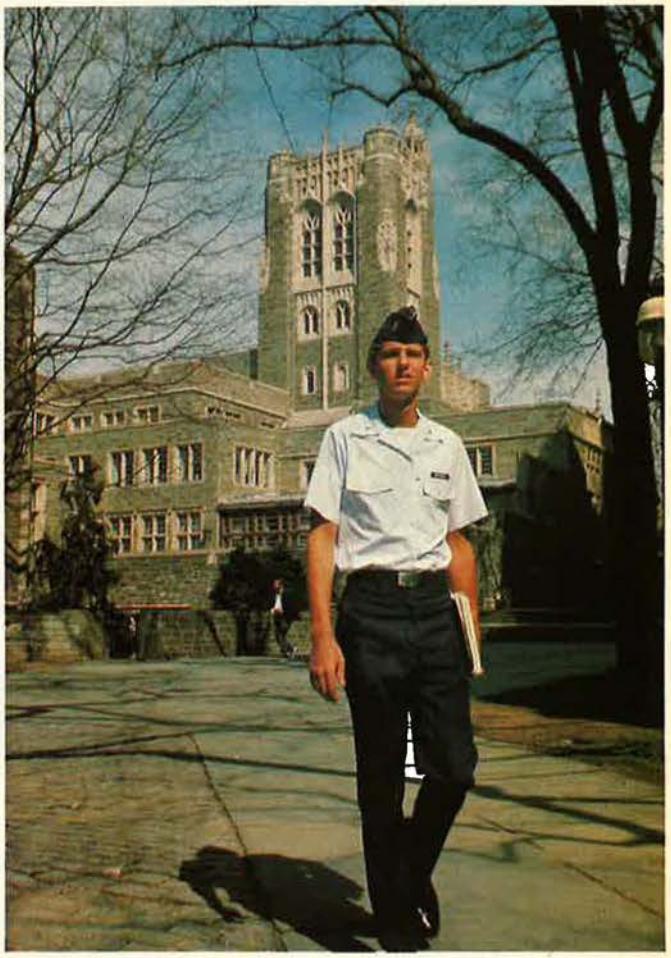
Facing USAF Educational Needs

Air Force Chief of Staff Gen. Lew Allen, Jr., has said the Air Force is losing good, experienced people in the critical skill areas of engineering and scientific specialties or "the storehouse of our technical expertise," and that many of these people are impossible to replace in the short term. In addition to proposing mid- and long-term programs to help alleviate the shortage of USAF engineers, AFIT has recently begun a test program to identify officers with mathematics and other quantitative backgrounds to cross-educate them for systems acquisition management positions.

AFIT is also addressing the educational problems of civilian employees. Because more than a third of Air Force members are civilians, AFIT reasons that civilian and military personnel should be given the same opportunity for graduate education. Historically, Air Force military members have had graduate education (one-and-one-half or two-year programs) available as part of their career progression. The civilian employee is limited

by Civil Service regulation to twelve months' residence school in a ten-year period.

Forty spaces are provided this year for civilians in AFIT's graduate School of Systems and Logistics, which offers a twelve-month logistics master's program that is not available elsewhere. Additionally, working with AFLC, AFIT is in the process of identifying funds and developing a master's-level program for Civil Service employees at the San Antonio Air Logistics Center, Kelly AFB, Tex., modeled after SAC's successful Minuteman Education Program for their ICBM bases. The program is designed to provide the opportunity for higher



Top: Capt. Roderick S. Neal, Hq. SAC, was an AFIT student at Boeing Aerospace Co. under the Education With Industry program.

Above, right: 1st Lt. William J. Koenitzer, an aeronautical engineering major, is studying at Princeton University.

Right: Maj. Jeffrey Schofield attends a class in Applied Regression Analysis at Ohio State. He is a doctoral candidate in aeronautical engineering.

Above: Dr. (Lt. Col.) James J. Conklin discusses a gallium study with Dr. Ramleth Shaklr, a nuclear cardiologist at Johns Hopkins Hospital.

Right: Officer Trainee Philip S. Prince, Jr., is an AECP undergraduate student in electronic computation at the Massachusetts Institute of Technology.

education to younger employees who are destined to replace many of the highly experienced logisticians retiring over the next few years and to minimize the transitional impact on the Center. If successful at Kelly AFB, the program could expand to other logistics centers.

Another innovation is the proposed establishment of a master's program in the AFIT School of Civil Engineering. Already, academic credit is awarded for most courses in the school. This new program would count toward a master's degree in engineering applications.

The third new program is a master's degree in Strategic and Tactical Sciences. Air Force experience has shown that combat operations and operational readiness today require a great deal of analytical expertise and that future commanders will have to cope with an increasing amount of quantitative data and scientific methodology in making rapid decisions. AFIT's new master's program combines quantitative, decision-making, operational planning and execution, and weapons engineering disciplines to produce strategists and tacticians for the future. The first class of fifteen master's recipients of the Strategic and Tactical Sciences degree graduated in March. The second class graduates in a year.

Alumni Accomplishments and Future Concerns

The accomplishments of the Institute over six decades are impressive. Commenting on the many AFIT graduates who have distinguished themselves in the Air Force, Maj. Gen. Gerald E. Cooke, the AFIT Commandant, told AIR FORCE Magazine, "As of February 1979, of our 97,000 active-duty Air Force officers, more than 18,000, or nineteen percent, held AFIT degrees. Of the 339 USAF line general officers, 136 had one or more AFIT-sponsored degrees. Of the fifty-three new brigadier generals announced this year, almost half earned degrees through AFIT. About one third of Air Force colonels have one or more AFIT degrees. . . . We're at a point where we all have to recognize that the Air Force is irreversibly committed to constantly changing and advancing technology. That commitment to technology is an inexorable commitment to education."

With such a commitment, one is moved to wonder if scientific and technical education programs are adequate to support the technologically intensive Air Force of today and the future.

The answer may be deduced from Secretary Duncan's remarks: "Thirty-eight percent of the Air Force officer corps have graduate degrees, [but] only eleven percent . . . have advanced degrees in the scientific, technical disciplines that are so critically needed in the USAF. I gather from forecasts that this figure can likely drop to about nine percent as early as 1983. Of the Air Force officer master's degrees, only 9,200 can be counted toward the USAF objective of 10,400 in needed disciplines. That leaves a deficit of 1,200 right now." A projection indicated that the deficit will grow even higher unless enough officers are entered into AFIT programs.

"At the same time that the need for advanced technical and scientific education is increasing," Secretary Duncan continued, "congressional austerity and other demands have reduced the number of man-years annually invested in degree education for line officers. In 1973, it was 1,820. In 1979, it's 955. A shrinkage of fifty percent. The number of line-officer students funded in the Fiscal Year 1979 budget alone dropped fifteen percent, and that drop was directed by the Congress. That means fewer officers will be able to go on to Air Force graduate education this year. As a defense problem, we've got cause for concern. We have to work with the Congress to stress the importance of this issue and hopefully to obtain relief."

Asked how USAF trends compare with known Soviet programs, General Cooke responded, "There is a leveling trend in the Soviet education growth rate, but the forecast is for continued growth of Soviet engineering graduates into the 1980s. We might even see a decline in that growth rate sometime in the 1980s due to demographic factors, but that would still leave the Soviets outproducing us in engineers by a five-to-one margin."

Labor Department officials say the national shortage of engineers will not be resolved soon. Meanwhile, the Air Force is using several new approaches to help alleviate the engineer recruiting problem. The educational opportunities offered by AFIT are an integral part of this program. ■

AFIT FACTS

AFIT is a part of the Air University system under the Air Training Command. The Institute is accredited by the North Central Association of Colleges and Schools. Certain programs of AFIT's School of Engineering, which are parallel to the "certifiable civilian engineer," are also accredited by the Engineers' Council for Professional Development. Since its beginning in November 1919 as the Air Service Engineering School, more than 160,000 Armed Forces employees have attended AFIT programs. Of those, 24,800 have received degrees since the Institute was accredited in 1956.

The education available through AFIT's on-campus schools fills Air Force requirements that cannot be met by existing programs at civilian universities, either because appropriate programs are not available or because they can be provided more economically by AFIT.

AFIT's resident School of Engineering graduates some 230 master's degree recipients annually in eleven different programs, putting the Institute in the top ten percent of the nation's 200 engineering schools in numbers of graduate degrees. Most are eighteen-month programs, and nearly seventy USAF people are enrolled in the Institute's resident engineering doctoral program.

The Institute's School of Systems and Logistics confers 150 graduate degrees each year and conducts more than forty continuing education courses of from one to ten weeks for nearly 6,000 students to meet DoD and USAF requirements. The faculty of the Logistics School, as do members of the School of Engineering faculty, offers consultative service and, if needed, can take programs into the field with on-site seminars and similar programs.

The School of Civil Engineering instructs more than 2,700 USAF students in twenty-three resident courses and twelve nonresident courses each year. Through its "teleteach" program that offers courses by telephone, the school reaches another 1,600.

About eighty percent of AFIT-sponsored degrees are granted through the Civilian Institution Programs, which include Regular and Special Degree Programs, Education With Industry, Airman's Education and Commissioning, Minuteman Education Program, Health Professions and Scholarship Program, Funded Legal Education Program, and Fellowships and Scholarships. In Fiscal Year 1978, more than 1,300 degrees were granted through the Civilian Institutions Programs. In that year, the Institute sponsored more than 1,800 degree-holding professionals and nearly 13,000 students in professional continuing education—all for a total cost of $27 million.

Tenth Anniversary of a Giant Step

BY WILLIAM P. SCHLITZ, ASSISTANT MANAGING EDITOR

This month marks the tenth anniversary of an event that even in the retrospect of a decade continues to stir the imagination. The first lunar landing—by Neil Armstrong and Edwin "Buzz" Aldrin with Michael Collins orbiting in the Apollo 11 Command Module—combined high drama, human courage, and, above all, technological achievement.

Special ceremonies to honor the three former astronauts are to be conducted by NASA and the National Air and Space Museum in Washington, D. C., on July 20. Videotapes of the first moon walk will be shown, along with highlights of network coverage of the Apollo-11 mission.

To commemorate the anniversary, NASA has also issued a souvenir edition of the original Apollo-11 information kit whose 250 pages describe the mission in the minutest detail from countdown onward. Interesting reading even now, the booklet returns us to those charged-up days of 1969, when the US took the final step to make good on President John F. Kennedy's pledge to put an American on the moon before the end of the decade.

Events had run apace since that pledge. Preparations for the lunar landing—the first tentative spaceflights and the subsequent full-dress Apollo missions—had dwarfed any of man's previous exploratory ventures. Mankind's—and America's—genius for cooperative undertakings was reflected in the meticulous attention to detail that characterized the spadework preceding the actual landing.

It was only years later, following a series of successful Apollo moon landings, that the revisionists proclaimed the effort an "arrogant statement of American nationalism" and a waste of resources. By and large at the time, the country was galvanized and its spirit uplifted.

Highlighted by drama, courage, and technological achievement, the first lunar landing, and the preparations leading to it, dwarfed any of man's previous exploratory ventures.

Nothing was left to chance. Provision had even been made for the crew's quarantine, should the astronauts return bearing alien germs.

But the key to a successful Apollo-11 mission was American technology. To enable the Apollo-11 crew to survive the hostile environment of space and moon, NASA and its thousands of subcontractors faced two general constraints: the size and the weight of equipment. These limiting factors dictated a design approach resulting in electronic and other advances that were breakthroughs bordering on the technologically miraculous. Science fiction became reality. These achievements made the landing, and other mission objectives, possible. (Astronaut Frank Borman, Commander of Apollo-8's flight around the moon in December 1968, summed up confidence in US industry when he remarked following the mission: "We knew the people who built the equipment; we knew the equipment; we knew it would work, and it did.")

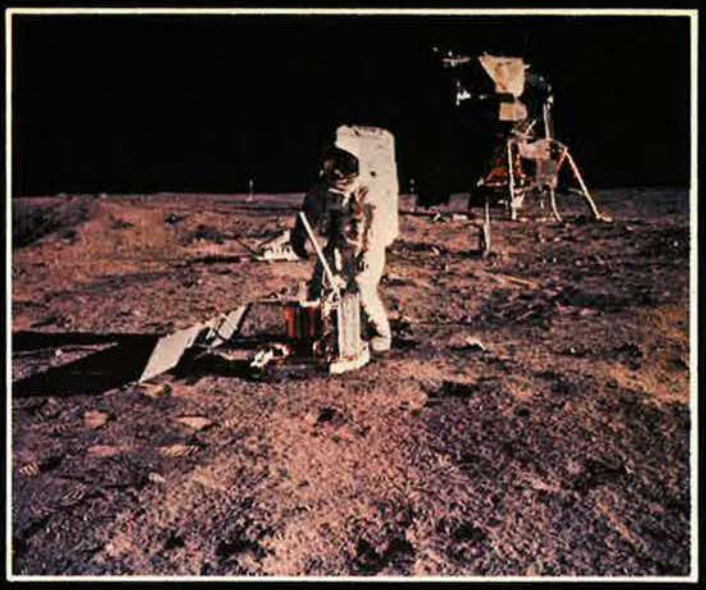
Take, for example, the Lunar Module's communications system. Designed to transmit telemetry data, biomedical information, tracking signals, and television images (which allowed the world to watch as man took his first steps on the moon), it was also responsible for voice communications with the orbiting Command Module and with earth. The system weighed less than 100 pounds. Its antenna, thirty-eight *miles* of hair-fine wire, was packed into a cylinder just ten inches in diameter until deployment, when it assumed a dish shape ten feet across.

In another electronic innovation required for a safe landing, a miniature radar aboard the Lunar Module bounced a quartet of signals off the lunar surface to indicate such essentials as approach speed and distance.

And while the miniaturization of electronic equipment continues (work once accomplished by an entire room of computers is now done by a piece of equipment the size of a shoebox), other developments leading to Apollo-11 have established themselves as the building blocks of technological progress. They became the foundation of an extremely broad storehouse of technical and other knowledge that continues to expand.

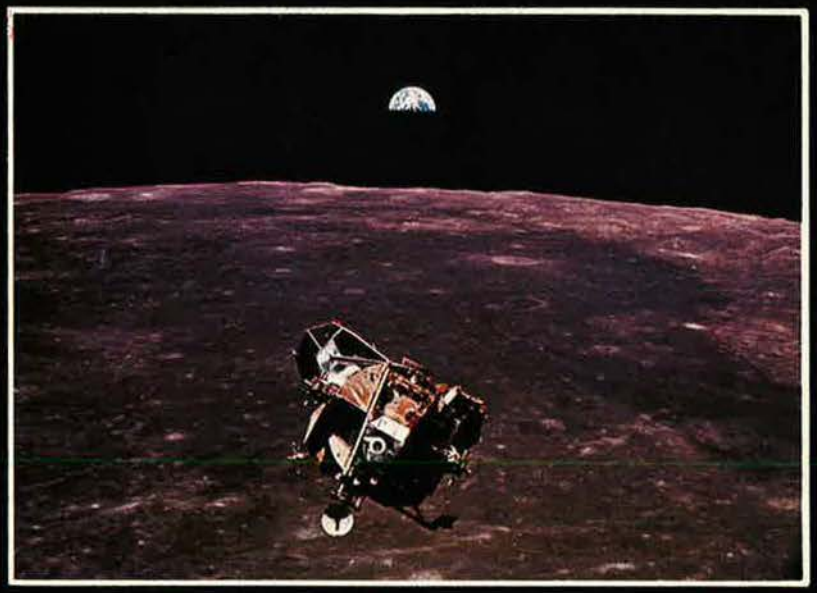
The range of Apollo spinoffs—technology and other means to improve or create commercial products—is extraordinary. In the public sector, and through NASA's good offices, Apollo technology has found its way into medicine, transportation, public safety, industrial processes, energy systems, construction, communications, home appliances, sports and recreation, and food products, to name but a few general categories. Literally thousands of products are involved.

So in very practical terms, Apollo turned out to be something more than a pioneering venture of unprecedented scope—something more than a demonstration of the almost limitless capacity of man to penetrate the frontiers of the unknown. Its benefits are concrete and countable. But even if they were not, who can say we should not have gone to the moon anyway? ■



Above, the awesome moment of liftoff – the historic journey begins. Right, Edwin Aldrin follows Neil Armstrong onto the lunar surface.

Top, setting up an experiment. Above, displaying the colors. Left, moon walking in the lunar twilight.



Above, footprints in the lunar dust. Right, rendezvous with the Lunar Module ascent stage for return to earth.

Airman's Bookshelf

A Look at World War III

The Third World War—August 1985, by Gen. Sir John Hackett, Macmillan, New York, N. Y., 1978. 327 pages, appendix and index. $12.95.

Sir John Hackett's latest work creates the scenario of a future world war fought again in battle-scarred Europe. Unlike many works of fiction using future war as its focus, this volume presents a carefully thought-out and detailed description of the events and conditions that could usher in the next world war. Generals and advisors associated with NATO collaborate to give the narrative an authoritative quality with specialized contributions. They succeed in presenting an intriguing view of a future world war.

Hackett strives to lay a comprehensive foundation for his story by reviewing the world situation before 1985. The result, however, is uneven; the description of African affairs, for example, reads like a travelogue. The author's military assessments offer little that is new from NATO's historical concerns—the threat of Soviet numbers and mechanization overrunning the northern plain of Germany and Western Europe. The Allied forces, as usual, have serious limitations, and certain questions on the use of tactical nuclear weapons remain unanswered. Fortunately for the West, extensive efforts to upgrade its offensive capability take place in the years preceding the war and ultimately prove to be the critical margin.

World War III erupts in 1985, the author explains, when the Soviets attempt by force to achieve a political end—the demotion of the United States from its world role. For the margin of victory, NATO depends on airpower and superior technology, largely the product of competitive marketplace economies. With the start of fighting, Hackett's volume tests the reader's patience with excessively long descriptions of unit strength and capability. But his work also contains many very interesting chapters—the Battle of the Atlantic (similar to that of World War II) and the battle in space. For the first two weeks of the war, the scenario holds to reality.

Then suddenly, the Soviet thrust loses momentum. Successful Allied logistics turn the tide and partisan warfare breaks out within the Warsaw Pact countries. The Soviet leadership decides to use nuclear weapons as a means of preventing "creeping political decay and forcible decolonization." A gripping chapter describes a limited nuclear exchange: the destruction of Birmingham followed by a horrible counterattack on Minsk. The book concludes with the different nationalities within the USSR throwing off their masters, the war ending, and a new bipolar world emerging with the United States and China/Japan as the leaders. Like Austria-Hungary in World War I, the Soviet Union collapses under the global conflict and loses its superpower status.

Despite several tedious chapters, Hackett's work is thought-provoking and worthwhile. Readers may find his description of Soviet collapse wishful thinking. In the earliest days of the cold war, many military planners believed the Communist government was vulnerable to internal overthrow. Indeed, the authors of NSC 68 in 1950 seriously entertained these thoughts. Although the idea seems to have lost popularity in the 1950s, Hackett resurrects the possibility. He presents, however, no hard evidence for this optimistic assessment in his volume. Nevertheless, for a thoughtful and detailed World War III scenario, Hackett's work ranks as the best. It will enjoy great success among readers of all persuasions.

—Reviewed by Maj. Harry R. Borowski, USAF, Department of History, USAF Academy.

Japan and the Soviet Union

The Soviet Union and Postwar Japan, Escalating Challenge and Response, by Rodger Swearingen. Hoover Institution Press, Stanford, Calif., 1978. 340 pages. $14.95.

As seen from Moscow, Japan is America's "Cuba"—a US strategic bastion situated dangerously near the Soviet Pacific coast, where potent US nuclear naval forces, airpower, and ground troops have been based since World War II. Japan is far more than a Cuba, with its industrial power ranking third in the world and with its small but growing "self-defense forces" that are a reminder of the Japanese power that defeated the Russians at sea early in the century and almost imposed its "Coprosperity Sphere" over the Pacific and much of Asia in the 1940s.

It is not surprising, therefore, that the long-range goal of Soviet strategists would be to eliminate the US military presence from Japan and eventually to envelop Japan under Soviet influence or control.

Rodger Swearingen writes in this, his eighth major book on Japan, that a secret Japanese government study prepared in 1945 just before Japan's defeat predicted that the Russians, after the war, would wage an anti-US campaign through Japanese Communists to establish a "Red government in Japan."

Swearingen served as a Japanese language officer with General MacArthur's SCAP (Supreme Commander for Allied Powers) in Tokyo after the war. He is now a professor at the School of International Relations at the University of Southern California.

Tracing the course of Soviet efforts in Japan, Swearingen finds that Moscow followed an opportunistic, zigzag course that has thus far failed to gain any substantial foothold in Japan.

The Soviets had short-term and long-term goals for Japan, but not "any well-defined Soviet policy for postwar Japan," Swearingen says.

He recalls that a US analysis from the embassy in Moscow on November 2, 1945, predicted that the Soviet Politburo would not worry about the revival of Japanese imperialism and aggression, but would become uneasy about the possibility that "Japan like Germany might someday be utilized by Western Powers as a springboard for attack on the USSR." The study suggested Moscow would

try to employ Japanese Communists and leftists to exploit postwar disorder and economic unrest.

The Soviet strategy, according to Swearingen, was to handpick Japanese war prisoners from among the hundreds of thousands of POWs rounded up by the Russian army in Asia and to indoctrinate them in Communist dogma and methodology before returning them to Japan to revive and expand the Japanese Communist Party.

"As it turned out, the Soviet program of indoctrination of Japanese prisoners of war was not a huge success by any standard," Swearingen says. "In some ways it may have backfired. . . ." He found from Japanese surveys among repatriates that the "overwhelming majority" did not join the Communist Party and were hostile toward their Soviet captors. Later Japanese opinion polls showed repeatedly that Russia was "the most hated nation."

The Japanese Communist Party was loyal to its Moscow mentors, but after the war took off on its own approach to "peaceful revolution" and a "lovable" Communist Party; resorted to violent tactics on pressure from Moscow; then flirted with a nationalistic version of Titoism and Eurocommunism; wavered between pro-Peking and pro-Moscow leanings or independent communism; and now seems to tilt toward Peking.

Moscow shifted from hard-line bullying and threats to coexistence and détente, and to Soviet offers of attractive joint ventures with Japan in Siberian oil, natural gas, and vital mineral resources. But Moscow's continued refusal to return the "northern territories" to Tokyo's control is a bone in Japan's throat that precludes warming friendship or alliance.

Swearingen notes that Japan's negative attitude toward Russia also reflects traditional historic distrust, fear of the threat of international communism, memory of the treatment of Japanese war prisoners, and Soviet capture of Japanese fishing boats. But he also observes that Japan is troubled by feelings of isolation and insecurity as Soviet military power in the Pacific mounts and as communism spreads in Asia, particularly after the US "defeat" in Southeast Asia, and by gnawing doubts about reliability and steadfastness of US commitments of defense and security in Asia following US decisions to pull troops out of South Korea and to renounce its defense treaty with Taiwan.

In his preoccupation with the Soviet threat, and Japan's uneasiness over apparent US fainthearted policy in Asia, Swearingen seems to overlook Japan's shortcomings—its failure to pay its full share of the Asian defense cost which falls mostly upon the US; and Japan's rather feeble efforts to reduce the huge US deficit in trade with Japan.

The US is faced with a dilemma: It wants to reduce the US Asian defense burden. But it doesn't want to force Japan to submit to Moscow's threats or to take the other extreme of arming with nuclear weapons to become another nuclear power.

Swearingen's rather slim volume does not probe deeply into Japan's strategic and political dilemma. Nor does it offer any firm policy guidance to Japanese or US planners. But the serious military reader will find the book contains a useful outline of Japan's relations with the USSR, China, and other Asian nations, as well as copies and excerpts of significant Japanese treaties and agreements since World War II. These helpful materials alone justify the rather high price of the book.

—Reviewed by Lloyd Norman, retired Newsweek correspondent.

SALT II: What's Ahead?

The Fateful Ends and Shades of SALT, by Paul H. Nitze, James E. Dougherty, and Francis X. Kane. Crane, Russak & Co., Inc., New York, N. Y., 1979. 132 pages. $4.

The three authors look at the Strategic Arms Limitation Talks from different perspectives but arrive at much the same conclusion: The Soviet Union comes out ahead.

Paul H. Nitze served as the representative of the Defense Secretary to the US Delegation to the SALT negotiations from the spring of 1969 through June 1974. He served during the Kennedy and Johnson Administrations as an Assistant Defense Secretary, Navy Secretary, and, finally, Deputy Defense Secretary.

Nitze points out how far short the SALT II agreements fall from the original US objectives, noting that "the first casualty was the goal of achieving a treaty of unlimited duration" and "the second casualty was parity, or essential equivalence." He says the US instead has accepted "the appearance" of equal limitations.

The "gray-area" systems that affect US allies in Europe, Nitze says, have been treated in "a most inequitable way." He notes, as an example, that mobile Soviet SS-20 missiles are not being limited, while the cruise missile, which could be a NATO counter to the SS-20, is under limitations.

Because of his background, Nitze's warning is all the more chilling: "US program decisions and delays in making decisions since Vladivostok, combined with the terms of the probable SALT II agreements, now make it difficult, if not impossible, for the US to maintain crisis stability and rough equivalence."

James E. Dougherty is professor of political science of Saint Joseph's University, Philadelphia, and a senior staff member of the Institute for Foreign Policy Analysis, at Cambridge, Mass.

Dougherty says the fact that Secretary Vance carried a basing proposal for the MX missile to Geneva in July 1978, when negotiations were so close to the final stage, "was evidence of poor planning in the fields of national defense and arms control." He gives an excellent review of the negotiations and the factors that delayed the conclusion of the treaty. He points out that Soviet leaders have blamed the Congress for the slow pace of the SALT negotiations and have warned the Carter Administration against trying to use the threat of Senate rejection to obtain concessions from Moscow.

Francis X. Kane is a staff member of TRW's Defense and Space Systems Group, with more than thirty-five years' service as a planner of future systems and technology, principally in the areas of space and ballistic missiles.

Kane points out that the Soviet threat to the US ICBMs will continue to grow even during the new treaty period, and concludes: "Once again, therefore, the US must have a program of 'safeguards' to protect its security against deficiencies in the outcome of the SALT process." He explains why this is so and what the US must do.

Kane suggests guidelines for negotiations after SALT II should include all Soviet forces that can attack the US, and calls for major improvements in US strategic forces, including full-scale development of the MX missile, a new ballistic missile submarine program, a new manned bomber, and an "emphasis on research for new technical breakthroughs."

The book, which includes an excel-

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lent introduction by Frank R. Barnett, president of the National Strategy Information Center, is a must for readers who wish to follow the long-anticipated Senate debate on SALT II.

—Reviewed by Bonner Day, Senior Editor.

New Books in Brief

The Missing Man: Politics and the MIA, by Capt. Douglas L. Clarke, USN. Pursuit of the MIA issue has been inimical to the best interests of the US and of the MIA families, the author says. Both the US and Vietnam have used the MIA issue for political ends. Hanoi has offered a partial accounting to obtain political or economic concessions, while the US has used it to justify its relations with the Vietnamese. By creating expectations and demands that could never be met, the US has caused a bitterness toward its government by a small but significant number of American citizens. The author concludes that the US did the families a tragic disservice by encouraging the belief that there would or could be an adequate accounting. Bibliography. National Defense University Research Directorate, Washington, D. C., 1979. 212 pages. $2.75.

Neither Athens nor Sparta?: The American Service Academies in Transition, by John P. Lovell. Not just a history, this book provides insight into the major changes that occurred at the four US service academies in the post-World War II years. The author covers the controversial academic deanship of Robert McDermott, who was determined to break with the seminary model proposed for the fledgling Air Force Academy. He emphasizes the distinctiveness of each academy as well as similarities, and contends that all four are at a critical juncture. Included are suggestions for future changes. Notes, index. Indiana Univ. Press, Bloomington, Ind., 1979. 362 pages. $17.50.

Shuttle: The World's First Spaceship, by Robert M. Powers. The author, a science writer, takes you aboard the world's first spaceship for a cockpit view of a launch, orbit, reentry, and return to earth. You preview the scheduled NASA Shuttle missions in hundreds of line drawings and photos of the crew at work in orbit. The Shuttle system is the key to unlocking the next era of technology and the forerunner of space transportation systems of tomorrow. Stackpole Books, Box 1831, Harrisburg, Pa. 17105, 1979. 255 pages. $10.95.

Soviet Dynamics—Political, Economic, Military, World Affairs Council of Pittsburgh. Here are the findings of three distinguished panels of internationally recognized American and British scholars who analyze the global, political, economic, and military capabilities of the USSR and their implications for US foreign policy. The findings were presented at the 17th World Affairs Forum in June 1978, sponsored by the Council and attended by more than 400. World Affairs Council of Pittsburgh, Pittsburgh, Pa., 1978. 97 pages. $5.

Their Eyes on the Skies, by Martin Cole. Here are stories about a handful of colorful but relatively unknown men who made major contributions to aeronautical history. Foreword by retired Air Force Lt. Gen. Jimmy Doolittle. Photos, illustrations. Aviation Book Co., Glendale, Calif., 1979. 173 pages. $8.95.

—Reviewed by Robin Whittle

Recent and of Interest

The Road to Khartoum, A Life of General Charles Gordon, by Charles Chenevix Trench, W. W. Norton & Co., New York, N. Y., 1979. 320 pages. $13.95.

Pilot's Manual for B-25 Mitchell, by Leo J. Kohn, Aviation Book Co., Glendale, Calif., 1979. 120 pages. $8.95.

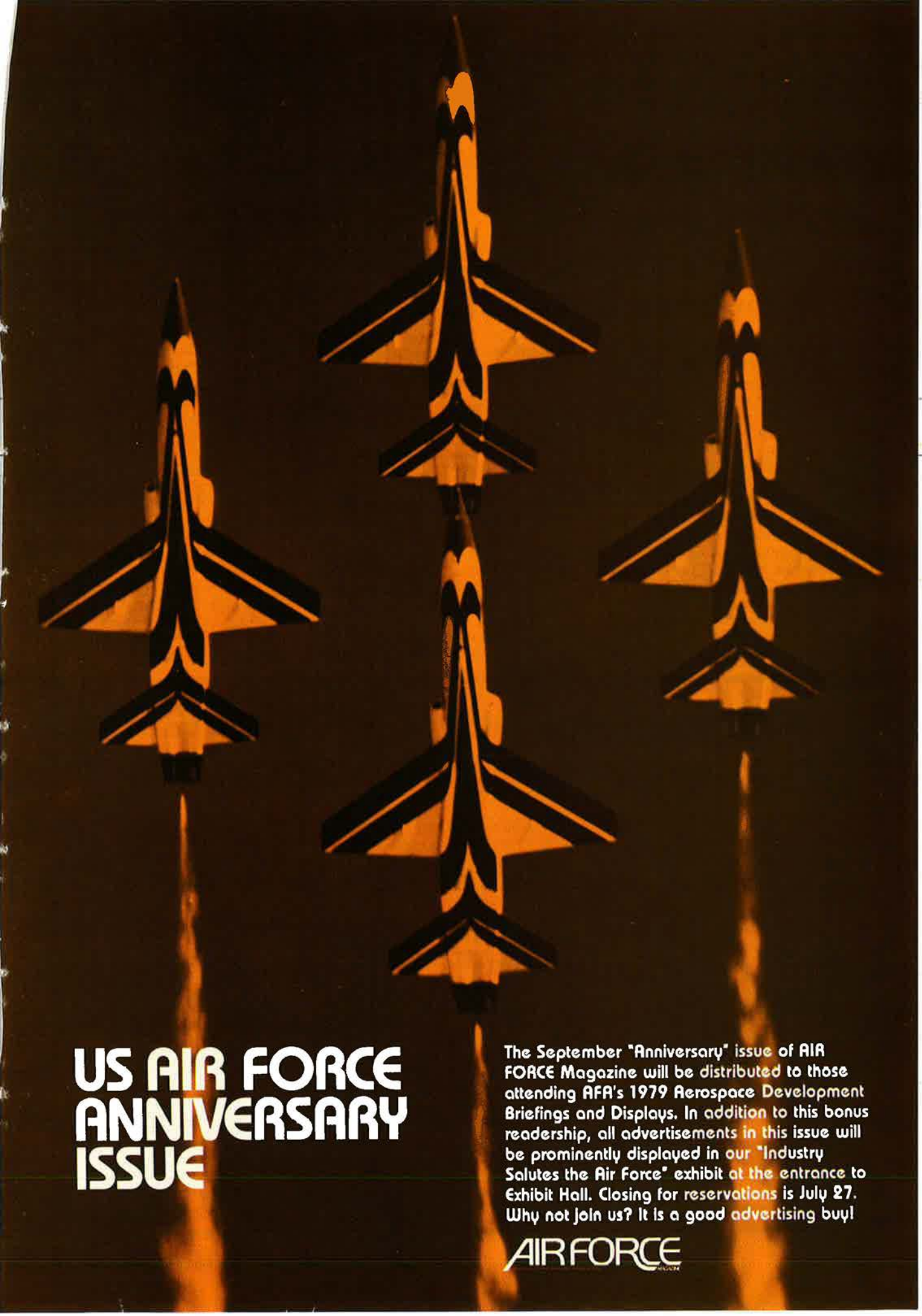
Pilot's Handbook for Grumman Wildcat, by Leo J. Kohn, Aviation Book Co., Glendale, Calif., 1979. 89 pages. $8.95.

Seventh Air Force Story, by Kenn C. Rust, Aviation Book Co., Glendale, Calif., 1979. 64 pages. $7.50.

Super-Planes, by John Gabriel Navarra, Doubleday & Co., New York, N. Y., 1979. 79 pages. $6.95. For readers ten to fourteen.

U-Boat War, by Lothar-Gunther Buchheim, Bantam Books, New York, N. Y., 1979. 320 pages. $8.95. Photos and text by an eyewitness.

Weapons of the Third Reich, Doubleday & Co., New York, N. Y., 1979. 371 pages. $25. Encyclopedia of small arms, artillery, and special weapons of the land forces. ■



US AIR FORCE ANNIVERSARY ISSUE

The September "Anniversary" issue of AIR FORCE Magazine will be distributed to those attending AFA's 1979 Aerospace Development Briefings and Displays. In addition to this bonus readership, all advertisements in this issue will be prominently displayed in our "Industry Salutes the Air Force" exhibit at the entrance to Exhibit Hall. Closing for reservations is July 27. Why not join us? It is a good advertising buy!

AIR FORCE

The Bulletin Board

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

Conference Pushes BAS for All

Most married airmen draw monthly basic allowance for subsistence (BAS), amounting to $3 to $4.50 per day. A great many single airmen, however, draw no BAS; they are expected to eat in the dining hall. But this is gross discrimination, many claim. The unpleasant situation, combined with the denial of quarters allowance to many bachelors who would like to live off base, has created severe retention problems.

The Second Annual Senior Enlisted Advisor (SEA) Conference, sponsored by AFA and composed of prominent NCOs from throughout the Air Force, wants to help solve this and other personnel problems. Accordingly, at its annual meeting at the AFA Convention last fall, the Conference drew up a list of sixteen "items of interest" dealing with airmen policies and compensation needs. These were sent to the Air Force.

The lead item urged the service to reexamine its BAS policy, give BAS to all bachelors on first enlistment, and strain to achieve full BAS for all. USAF, in a sympathetic response, has explained that single E-7s through E-9s in supervisory jobs have received BAS since 1976. Furthermore, this practice may be extended to E-6s—the matter is under study.

But BAS for all is not in the works now. The money is just too hard to find at this point. A long test of a partial—or "weekend"—BAS plan, conducted at McChord AFB, Wash., and Elmendorf AFB, Alaska, had to be discontinued because it was too expensive, Maj. Gen. Harry A. Morris said in USAF's formal reply to the Council. He is the Hq. USAF Assistant Deputy C/S for Manpower and Personnel. General Morris, however, said USAF's "ultimate goal" is to provide BAS to all except basic trainees.

The Conference also urged the Air Force to push hard for a family separation allowance for E-3s and below, and a cost-of-living allowance for single enlisteds overseas. General Morris explained that both items, now awaiting congressional action, have strong Air Force support.

The group also recommended that pay raises at the twenty-fourth and twenty-eighth years of service be cranked into the pay scales, to help retention of senior members. The Air Force replied that any new compensation proposal must wait the outcome of the Defense Department's overhaul of retired pay and related pay items.

Other topics discussed in the SEA Conference's report to Hq. USAF included senior NCO assignments, career management of first sergeants, professional military education of NCOs, household goods shipment problems, and wear of

Air Force Responds to AFA's JOAC Report

AFA's Junior Officer Advisory Council late last year, in a comprehensive document of unusual candor, faulted the Air Force for a variety of actions, or lack of them, which the JOAC said hurt retention.

Their leadoff complaint held that senior officers do not understand or are indifferent to the juniors' problems. The JOAC report also urged the service to improve junior officers' job security, consider modifying the up-or-out system, delegate decision-making authority to lower command levels, give broader recognition to young officers for jobs well done, and invoke other reforms. The report scored what it called "the documented loss of benefits."

The JOAC, composed of twenty-six outstanding young officers assigned throughout the Air Force, bucked its report to the Deputy Chief of Staff for Personnel, Hq. USAF. Other top leaders also examined it.

Chief of Staff Gen. Lew Allen, Jr., in a recent official response to the report, said several of the recommendations have been approved. The JOAC, he added, "has taken a thoughtful and constructive approach and produced a valuable set of observations and recommendations." He said this type of exchange "is vital to meaningful policy development."

A synopsis of the seven sections of the report and the Air Staff response follow:

1. Senior Air Force Leadership. Junior officers perceive that service leaders are not aware of their problems and don't motivate middle managers to take specific stands on issues and to provide accurate information on areas of concern. Senior leaders should visibly address the issues. The service should expand its information program on the legislative process and threats to benefits.

Air Staff Response. We agree that broader information efforts are needed on people programs and issues. We are working on it. Examples of new efforts include visits and briefings by Personnel Management Teams, advising commands of the status of pending legislation, and command programs such as TAC's "TOP CARE." Effective communication up and down the line is vital. USAF leaders, at Headquarters and in the field, are involved.

2. Job Security. Until recently young officers joined USAF firm in the conviction that an Air Force career offered a good chance of success and self-fulfillment. Now, however, junior officers are reevaluating their choice; they are confronted with such things as promotion uncertainties, advancement phase points changed because of budgetary limits, and an unacceptable (controlled) OER system. Furthermore, officers chosen for advancement should be able to wear their new rank—"frocking"—when promotion lists appear. Consideration should be given to easing the tough up-or-out rules, thereby allowing passed-over captains to stay on active duty.

Air Staff Response. Actually, promotion opportunity and timing have held fairly steady. Concerns such as those expressed by the JOAC over the OER led to the recent removal of controls. We have also increased selection opportunity to temporary captain and permanent-regular major. And numerous twice-passed-over captains will be continued on active duty. The antifrocking policy will remain, however, since frocking "violates the spirit and intent of congressionally imposed grade ceilings."

3. Career Growth. Junior officers see no clear-cut pattern for career growth. Few guides exist which adequately prepare them to

atigue uniforms. There are too many urbs on wearing the latter off base, he advisors said, but the Air Force in s response disagreed. It did go along with their position that members should be allowed to roll up the sleeves of their fatigues.

Hike Authority Threatened Again

USAF has been forced to request another extension—its tenth since 1959—of its temporary authority to promote above statutory officer grade ceilings. It wants the present temporary ceilings, which expire September 30, made permanent. Without any extension, many promotions won't materialize and hundreds of demotions will occur, the Air Force has declared. The DOPMA legislation contains the permanent grade ceilings the Air Force requires. But the Senate Armed Services Committee, which has blocked DOPMA before, gives no indication of taking it up. Therefore, the simple extension measure, which Air Force has asked the Defense Department to send to Congress, has become crucial. A DoD authority said that the proposal will be sent to Congress in mid-July.

USAF Strength Continues Decline

Only the Air Force will continue to lose personnel under the FY '80 military authorization bill as reported out by the House Armed Services Committee. USAF is down for just 558,761 active-duty members by end-FY '80, nearly 20,000 fewer than in early 1978. The other services are earmarked for manpower increases, if the Committee's measure prevails and recruiters can meet their quotas. Here are the Committee's strength recommendations compared with the Pentagon's most recent estimates of onboard personnel:

	End-FY '80 (Sept. 30, 1980)	Mar. 31, 1979
Air Force	558,761	564,611
Army	780,337	751,294
Navy	529,002	524,922
Marine Corps	189,000	185,518
Total	2,057,100	2,026,345

The authorization bill requires registration of males who become eighteen after December 31, 1980. The language adopted demands an annual assessment of the Selective Service System's mobilization capability. It also preserves the System as an independent agency.

Also in approving the authorization measure, the Committee okayed the advance payment of station housing allowances for service personnel assigned overseas. The move is designed to help members pay "moving-in" expenses, which in the past have plunged many overseas newcomers into debt.

The bill boosts the President's FY '80 budget recommendation for hardware and research from $40 billion to $42.1 billion.

Radio-TV star Arthur Godfrey received a special plaque from Lt. Gen. K. L. Tallman, USAF Academy Superintendent, during the Academy's twenty-fifth anniversary dinner dance at Colorado Springs, Colo.

DoD Booms Retirement Plan

Department of Defense officials, preparing to formally launch their

fill senior staff jobs. Longer tours, fewer PME quotas, and the long wait to vie for gold leaves compound frustrations. Many juniors feel the emphasis has shifted from job performance to "square-filling" activities such as additional duties, advanced degrees, and community activities. But since the emphasis is often inconsistently applied, individuals are not sure how to establish priorities or determine career prospects. An appraisal board at the eight-year point would make junior officers more aware of their career potential.

Air Staff Response. There is no single path to success; rather there are many routes but more depends on the individual than on any specific career plan. We are increasing publicity about career development and assignment practices. Each officer, with advice from his superior and resource manager, should choose the combination and priority of academic and military education and other factors best suited to his own circumstances. We don't emphasize PME or academic education as such, but rather their potential for boosting job performance. Job performance remains the big determinant of success. We are studying the appraisal board recommendation.

4. Decentralization of Authority. The decision-making process is so complex that junior officers feel left out of it. This lack of authority and management opportunity damages career satisfaction and retention. ATC's "BUCK STOP" program, which gives lower levels more authority and responsibility, is a good way to alleviate this.

Air Staff Response. We support BUCK STOP and commands are studying similar ideas. Decentralization of decision-making is vital for fostering sound leadership and motivation at all levels.

5. Compensation. Junior officers say the erosion caused by inflation and the documented loss of benefits has cut purchasing power in recent years. The future holds further losses. All the services should publicize the unique and arduous demands made on service people, vigorously support adequate pay raises, and oppose further cuts in entitlements.

Air Staff Response. We agree. Air Force leadership has taken a strong stand on all these points and will continue to do so. General Allen has publicly committed himself to defending the rights, benefits, and privileges of all Air Force members.

6. Institutional Legitimacy. Junior officers see a lack of public support, negative media portrayals, and perceptions of government indifference to the military. This lowers junior officer morale and dedication and hurts retention. The USAF and service-oriented organizations must expand their efforts to "tell our story to the public."

Air Staff Response. We agree with and are actively pursuing many of the JOAC's community-relations proposals. Air Force leaders are addressing a wide range of public audiences on the threat, ICBM force, and other issues. Organizations like AFA can be a great help in improving public awareness of Air Force programs.

7. Recognition. Air Force supervisors too often fail to recognize sterling junior officer performance. Complex regulations and procedures discourage supervisors from making awards. It's time to simplify them. Air Force leaders should reemphasize the importance of recognition and awards and decorations as positive incentives.

Air Staff Response. The recommendations have merit, and we will take them up at a conference in May. (The group began development of an Air Force Recognition Pamphlet, which officials expect will be widely distributed this year, the Military Personnel Center reported.) ■

The Bulletin Board

package to overhaul the military retirement system, said that if Congress approves the legislation, "one-quarter to one-half" the active-duty membership will switch to it. The plan's early withdrawal features, which they hailed, will give participants "greater flexibility in their financial planning," they added.

Furthermore, they said the new plan will actually improve personnel retention and "silence the debate and controversy" that have surrounded the retirement issue for years.

These signals from Defense are not the same ones Air Force has received from its troops, however. An internal USAF survey reported in this space last month indicates that few current members would elect the proposed system and that it would hurt retention and recruiting. Defense's package is officially titled the Uniformed Services Retirement Benefits Act (USRBA).

President Carter was scheduled to kick off Defense's drive to sell USRBA, to the military community and Congress, with an announcement in late June. Much of the tough selling chore falls on the Office of the Deputy Assistant Secretary of Defense (Military Personnel Policy). Officials of that office, including USAF Col. Leon Hirsh, have been briefing military associations and other groups in search of their support for USRBA.

This is no small project; the draft legislation covers 295 pages. It was explained that related statutes like the Survivor Benefits Plan must be altered to mesh with USRBA.

Under USRBA, all active-duty members will remain covered by the present retirement system. However, anyone could elect the new system, something Defense will encourage. The only requirement is a commitment for four extra years of service.

"We feel," one DoD official said, "that young members in their first and second terms will elect to switch . . . so they can use the early withdrawal options." These would let persons with ten years of service withdraw up to ten months' basic pay; at fifteen years of service, ten more months of basic pay could be withdrawn. Thus, hard cash would be available for home buying, car purchases, and other important projects. Early withdrawals, of course, will reduce ultimate retirement benefits.

Other key features of USRBA include a two-tier annuity arrangemen payable at twenty years' service and at age sixty, CPI (Consumer Price Index) protection, a Social Security offset, and severance pay for all grades. Lifetime retirement pay for those serving twenty years would decrease by about twenty-five percent; this remains the major reason USRBA turns so many people off.

Because of the early withdrawal feature, officials now estimate that USRBA will cost slightly more than the present system until the year 2000. While they doubt that Congress will give the package serious attention this year, they clearly plan to press for action in 1980.

Club Dues Too High?

Air Force officers pay an average of $10.80 per month in club dues, a figure a majority of them say is unreasonable. The average monthly tab at Army and Marine clubs, where there are considerably fewer complainers, is $9.60 and $6.30, respectively. These are among the findings of a recent study of military club and package-store operations conducted by US Comptroller General Elmer B. Staats.

The Navy was not involved in the dues issue because very few of its clubs charge dues.

Defense-wide, the Comptroller reported, monthly club dues become

Ed Gates . . . Speaking of People

Meeting the Need for Child-Care Centers

Sandra Smith dropped off her year-old son, Derek, at the base child-care center. It was 8:30 a.m. She then drove the three miles to her secretarial job, secure in the knowledge that the lad was in good hands. She would pick him up late that afternoon.

The location of this scenario, now Sandra's regular weekday routine, happens to be Wright-Patterson AFB, Ohio. But it could also be any of the 125 other USAF bases that operate all-day child-care centers. Indeed, officials report that Air Force-wide more than 14,000 children attend them on a daily basis. And attendance is growing.

That is not surprising, for the care dispensed is generally considered to be of high quality. And the couple or the single parent using these centers appreciates the very nominal fees; they're well below those charged by civilian child-care facilities.

Military child-care programs are a relatively new and unsung fringe benefit. Their emergence hasn't created much of a stir because actual and perceived erosion of benefits have hogged the spotlight in recent years.

Base child-care projects were originally established by wives' clubs or other private groups. They provided short-time baby-sitting service so mothers could go shopping, or just get away for a couple of hours.

But military wives more and more have become full-time jobholders, and the number of single parents in uniform, women and men, has soared. They all need a convenient, professionally-run place to park *die Kinder* for longer than normal baby-sitting periods, and USAF has responded. The other services also report growing child-care operations.

To accommodate increasing customer demand, the Air Force in 1974 tied child-care centers to the MWR (morale, welfare, recreational) program as a central base fund activity. This provided centralized direction. It also means that care centers, along with such other MWR projects as clubs, bowling alleys, golf courses, recreational centers, and youth activities, share in both appropriated and nonappropriated funds.

The MWR enterprise is big business. Officials report that last year alone it took almost half a billion—repeat, billion—dollars to support just the Air Force's MWR activities. About one-third, or $168 million, was appropriated by Congress. Much of it went for equipment, supplies, and building maintenance.

The lion's share, $329 million, came from exchange store profits and fees charged by the various MWR activities. This income helps cover salaries, normal operating costs, and expansion of projects necessary to keep pace with today's changing life styles. Women's sports activities, outdoor programs, and do-it-yourself projects are, like child-care centers, growing in popularity, USAF authorities declare.

Fees charged at most MWR facilities, like everything else, have been rising, but they remain well below rates at comparable civilian activities. Child-care center fees vary by base, because of local wage and other cost factors. But Air Force-wide, officials report, they average forty-five to fifty cents an hour for full-time care.

ojectionable when they reach $4–$5 or senior enlisteds. For officers, 6–$10 is considered unreasonable y a large percentage of the officers, nd more than $11 is objectionable to wo-thirds of them, Mr. Staats reported. He heads the General Accounting Office, which is the congressional watchdog of executive agency spending.

The report faulted many club management practices. It also states that without the revenue from base package-store sales—which hit $35 million in FY '77—about fifty-seven percent of all clubs would have shown losses. The intent of Congress, the report indicated in what could be bad news ahead for club solvency, is that package store profits should be distributed among all base personnel, not just for the benefit of club members.

Elsewhere in the report the Comptroller recommended that management of clubs be taken out of the hands of local commanders. He noted that many officers complained about being pressured into joining their clubs. There was no talk of reducing dues.

Care Improvement Bills Grow

Lawmakers are backing a spate of proposals to improve military physicians' compensation in hopes of improving doctor recruiting and retention. The House Armed Services Committee in H.R. 4040, its version of the FY '80 military authorization act, voted to (1) raise the Armed Forces Health Professions Scholarships from $400 to $450 a month, and (2) give graduates of that program an annual $9,000 bonus after four years of service rather than the present eight years.

On the Senate side, Sens. Henry Bellmon (R-Okla.) and Strom Thurmond (R-S. C.) are backing a total of five bills designed to attract and retain more military physicians. Other new bills include:

- **H.R. 4070** (James R. Jones, D-Okla.) would change the Internal Revenue Code to continue tax-exempt status for veterans organizations if seventy-five percent of the members are "veterans," not necessarily "war veterans" as the present code reads.
- **S. 1130** (Birch Bayh, D-Ind., and others) provides a statutory basis for the military's now voluntary legal assistance program. New related bills include **H.R. 3805** (Melvin Price, D-Ill., and Bob Wilson, R-Calif.), which would improve the quality and efficiency of the military judicial system, and **H.R. 4001** (Patricia Schroeder, D-Colo.). The latter would guarantee the right of legal assistance to service members and their dependents.

Sen. Charles McC. Mathias (R-Md.) said he will introduce a measure providing financial aid for military families overseas with college-age children. It would pay travel expenses for two annual round trips for students pursuing a degree. Military children traveling to obtain a high school diploma would get one annual round trip, courtesy of Uncle Sam. The Senate has already approved Mathias's plan to give these same benefits to Foreign Service families abroad.

Short Bursts

The Air Force has put out a hurried call for **civil engineering officers,** captains through lieutenant colonels, to volunteer for **unaccompanied tours in Israel** starting in August. Their mission: build air bases (in support of the President's Mideast peace initiative). Work weeks of sixty to eighty hours are promised. "Uncommon tact and diplomacy" are essential, the announcement added, because those picked "will be under considerable pressure during daily negotiations with Israelis."

Because the service needs **new Officer Training School grads** quickly, the Air Force will rush the most outstanding applicants through processing and medical tests and enroll them promptly. OTS is located at Lackland

For short-term care, the hourly average runs about eighty cents.

Parents appreciate the genuine care and attention dispensed. One Air Force wife and mother particularly lauded the "protective health attitude" displayed at various base centers. "Each child has his temperature taken before admittance; only food in sealed containers is allowed; each child and his belongings [food, formula, clothes, etc.] are marked to prevent mix-up; and no medications are permitted in diaper bags," she said.

Air Force, meanwhile, is about to expand child care by lowering the minimum age for admittance from the present six months to six weeks. This innovation is being tested, and a special infant-care training guide for care-givers is being prepared. The USAF Manpower and Military Personnel Center, Randolph AFB, Tex., which shapes child care and other MWR policies, explained the infant-care plan for AIR FORCE Magazine readers:

- Infants as young as six weeks will be enrolled in base care facilities. Even those with such chronic problems as asthma or allergies will be admitted if local authorities agree the health and safety of all the children can be safeguarded.
- If a tot requires regularly administered oral (no injections) medication, the parent (or specially designated trained caregiver) must come to the center and administer it.

Randolph officials also report that base care centers recently completed the first year of a five-year plan to establish full "early childhood development" programs. This includes workshops for center directors and staffers. The goal, the officials said, is "to provide children meaningful activities that will assist in their cognitive, social, language, physical and emotional development."

In related moves, staff training has been accelerated, and the Air Force is asking Congress for appropriated funds to pay the salaries of all child-care directors.

MWR activities clearly are playing an ever-growing role in the lives of USAF people. Officials note that the American public is in the midst "of a real boom in the leisure-time business." Thus, they say, it is not surprising that "more of our people are seeking the good life—entertainment, sports, and self-improvement."

Air Force is responding. "The changing mix of our force is now placing new demands on our child-care centers and women's sports activities, and we are meeting them. Outdoor programs are becoming the thing—we are providing them," Hq. USAF is telling the field.

Authorities, of course, remain highly concerned about the ever-rising costs and the need to boost MWR user fees from time to time. This raises a question: Couldn't USAF members and their families rely more on nearby civilian facilities and programs, thus reducing the need to expand on-base projects?

The answer, the Air Force says, is that local communities, following the "Proposition 13" message from California, are cutting tax-supported recreation programs and curtailing facilities. Also, there are often transportation and hours-of-operation problems that deter military participation outside military reservations.

Another problem is with Congress: It continues to question various MWR projects and their costs. The lawmakers, for instance, have forced the services to reduce the number of uniformed people assigned to MWR activities. This requires more civilian hiring and boosts costs of operation.

Problems notwithstanding, the important question is: What does USAF get in return for its investment in child-care centers and other MWR programs?

The leaders' response is that "our people are using our programs to meet their individual needs—self-education, improving their physical fitness, helping out with the family.

"Commanders have found that by meeting these needs the disciplinary rate is better, drug and alcohol abuse are reduced, productivity is increased, and our people feel that we care for them." ■

AFB, Tex. To rate the hurry-up treatment, applicants must present high qualifying test scores and hold graduate degrees or B.A. degrees with at least a 2.7 grade point average. Officials report, meanwhile, that the majority of the FY '79 selectees for the Airman Education Commission Program have between a 3.0 and a 4.0 GPA.

Mrs. Lillian C. Roberts received the first **Women's Airforce Service Pilots (WASP)** discharge certificate—nearly thirty-five years after her actual discharge—in ceremonies at the Pentagon May 22. Acting Under Secretary of the Air Force **Antonia H. Chayes,** in presenting the certificate, lauded the WASPs and their dedication. More than 1,100 WASPs flew for the Army Air Forces during World War II. Their service was recently declared to be active-duty service, and they became eligible for veterans benefits, a move strongly supported by AFA.

The Comptroller General, in a recent report to Congress, made a strong pitch for the **Air Force Reserve to merge with the Air National Guard.** Rather a strange suggestion since the idea has been rejected time after time and it remains not politically feasible. ■

Senior Staff Changes

PROMOTIONS: To **Major General:** Philip J. **Conley,** Jr.; Charles C. **Irions.** To **Brigadier General:** Robert D. **Caudry;** Albert J. **Kaehn,** Jr.; Norris W. **Overton;** Robert H. **Reed.**

RETIREMENTS: B/G Robert S. **Berg;** L/G Raymond B. **Furlong;** B/G Francis A. **Humphreys;** B/G Elwood A. **Kees,** Jr.; B/G Carl S. **Miller;** B/G George K. **Patterson;** B/G James N. **Portis;** B/G Eugene D. **Scott;** M/G Lucius **Theus.**

CHANGES: B/G (M/G selectee) Christopher S. Adams, Jr., from Asst. DCS/Ops., Hq. SAC, Offutt AFB, Neb., to DCS/Ops. Plans, Hq. SAC, and Dep. Dir. for SIOP, JSTPS, Offutt AFB, Neb., replacing M/G George D. Miller . . . **M/G James H. Ahmann,** from Dir. of Plans, DCS/OP&R, Hq. USAF, Washington, D. C., to ACS/Ops., SHAPE, Casteau, Belgium, replacing M/G (L/G selectee) William H. Ginn, Jr. . . . **Gen. James R. Allen,** from C/S, SHAPE, Casteau, Belgium, to Dep. CINC, US EUCOM, Vaihingen, Germany, replacing Gen. Robert E. Huyser . . . **B/G Jerome R. Barnes, Jr.,** from Cmdr., 7th AD, SAC, Ramstein AB, Germany, to US DCS/LIVE OAK, Casteau, Belgium . . . **Col. (B/G selectee) Robert D. Beckel,** from Cmdr., 410th BMW, SAC, K. I. Sawyer AFB, Mich., to Cmdr., 7th AD, SAC, Ramstein AB, Germany, replacing B/G Jerome R. Barnes, Jr. . . . **B/G Schuyler Bissell,** from Defense Air Attaché, Tel Aviv, Israel, to Dep. Asst. C/S, C-2, Combined Forces Comd., Seoul, Korea . . . **B/G Richard A. Burpee,** from Cmdr., 19th AD, SAC, Carswell AFB, Tex., to IG, Hq. SAC, Offutt AFB, Neb., replacing B/G (M/G selectee) Patrick J. Halloran . . . **Col. (B/G selectee) Lyman E. Buzard,** from Cmdr., 43d SW, SAC, Andersen AFB, Guam, to Cmdr., 19th AD, SAC, Carswell AFB, Tex., replacing B/G Richard A. Burpee.

B/G Alonzo L. Ferguson, from Dep. Dir. for Ops. & Readiness, DCS/OP&R, Hq. USAF, Washington, D. C., to Cmdr., 21st NORAD/ADCOM Rgn., Hancock Fld., N. Y., replacing retiring B/G Carl S. Miller . . . **M/G (L/G selectee) William H. Ginn, Jr.,** from ACS/Ops., SHAPE, Casteau, Belgium, to Cmdr., US Forces Japan, and Cmdr., 5th AF, PACAF, Yokota, Japan, replacing retiring L/G George G. Loving, Jr. . . . **B/G (M/G selectee) Irwin P. Graham,** from Dep. Dir. for Politico-Military Affairs, J-5, JCS, Washington, D.C., to DCS/Plans, Hq. PACAF, Hickam AFB, Hawaii, replacing B/G (M/G selectee) Herman O. Thomson . . . **B/G (M/G selectee) Patrick J. Halloran,** from IG, Hq. SAC, Offutt AFB, Neb., to Asst. DCS/Ops., Hq. SAC, Offutt AFB, Neb., replacing B/G(M/G selectee) Christopher S. Adams, Jr. . . . **M/G Charles C. Irions,** from Dir. of Trnsp., DCS/L&E, Hq. USAF, Washington, D. C., to Dep. Dir. for Log. (Strat. Mobility), J-4, JCS, Washington, D. C.

B/G William L. Kirk, from Asst. DCS/Ops. & Readiness, Hq. PACAF, Hickam AFB, Hawaii, to IG, Hq. PACAF, Hickam AFB, Hawaii, replacing B/G Alfred M. Miller, Jr. . . . **B/G John R. Lasater,** from Cmdr., 4th AD, SAC, F. E. Warren AFB, Wyo., to Senior Mil. Advisor to Dir., ACDA, Washington, D. C. . . . **B/G George C. Lynch,** from Dep. Dir. of Budget, AF Comptroller, Hq. USAF, Washington, D. C., to Dir. of Acctg. & Finance, & Cmdr., AFAFC, Denver, Colo., replacing retiring M/G Lucius Theus . . . **B/G Alfred M. Miller, Jr.,** from IG, Hq. PACAF, Hickam AFB, Hawaii, to Cmdr., 25th NORAD/ADCOM Rgn., McChord AFB, Wash., replacing retiring B/G Elwood A. Kees, Jr. . . . **M/G George D. Miller,** from DCS/Ops. Plans, Hq. SAC, & Dep. Dir. for SIOP, JSTPS, Offutt AFB, Neb., to Dir. of Plans, DCS/OP&R, Hq. USAF, Washington, D. C., replacing M/G James H. Ahmann . . . **Col. (B/G selectee) Richard D. Murray,** from DCS/Comptroller, Hq. TAC, Langley AFB, Va., to Dep. Dir. of Budget, AF Comptroller, Hq. USAF, Washington, D. C., replacing B/G George C. Lynch.

Col. (B/G selectee) David L. Patton, from Dep. Dir. for Ops. & Tng., DCS/OP&R, Hq. USAF, Washington, D. C., to Dep. Dir. for Ops. & Readiness, DCS/OP&R, Hq. USAF, Washington, D. C., replacing B/G Alonzo L. Ferguson . . . **M/G Don H. Payne,** from DCS/Ops. & Intel., Hq. PACAF, Hickam AFB, Hawaii, to Cmdr., Keesler TTC, ATC, Keesler AFB, Miss., replacing M/G John S. Pustay . . . **B/G George B. Powers, Jr.,** from Cmdr., 437th MAW, MAC, Charleston AFB, S. C., to Dir. of Trnsp., DCS/L&E, Hq. USAF, Washington, D. C., replacing M/G Charles C. Irions . . . **M/G (L/G selectee) John S. Pustay,** from Cmdr., Keesler TTC, ATC, Keesler AFB, Miss., to Asst. to Chairman, JCS, Washington, D. C., replacing L/G (Gen. selectee) William Y. Smith . . . **B/G John P. Russell,** from IG, Hq. TAC, Langley AFB, Va., to Dep. Dir., J-3, USREDCOM, MacDill AFB, Fla., replacing retiring B/G Francis A. Humphreys . . . **AFRES B/G Donald T. Schweitzer,** from Mob. Asst. to Asst. DCS/OP&R, Hq. USAF, Washington, D. C., to Mob. Asst. to DCS/OP&R, Hq. USAF, Washington, D. C.

L/G (Gen. selectee) William Y. Smith, from Asst. to Chairman, JCS, Washington, D. C., to C/S, SHAPE, Casteau, Belgium . . . **B/G (M/G selectee) Herman O. Thomson,** from DCS/Plans, Hq. PACAF, Hickam AFB, Hawaii, to DCS/Ops. & Intel., Hq. PACAF, Hickam AFB, Hawaii, replacing M/G John H. Payne . . . **M/G (L/G selectee) Stanley M. Umstead, Jr.,** from Dep. Asst. Sec. Def. (Military Personnel Policy), OSD, Washington, D. C., to Cmdr., AU, ATC, Maxwell AFB, Ala., replacing retiring L/G Raymond B. Furlong. ■

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Iron Gate Chapter's Sixteenth National Air Force Salute

An unusual dual presentation of the Iron Gate Chapter's Maxwell A. Kriendler Memorial Award for 1979 highlighted the Sixteenth National Air Force Salute in New York City on Saturday, March 24.

For only the second time since its establishment in 1966, the prestigious trophy (originally named the Bronze Eagle Award but renamed in 1974 to honor the Chapter's founder) was presented to two individuals. Twice before, groups had shared the spotlight.

Sen. Howard W. Cannon was honored for his "thorough knowledge and profound support of military airpower evidenced while serving as the Chairman of the Subcommittee on Tactical Airpower of the Senate Armed Services Committee." Noting that the Senator has served as a pilot in air combat, the award citation acknowledged his role in the "modernization of tactical airpower and the enhancement of national security."

Also honored was AFA National Director J. Gilbert Nettleton, Jr., for his continuing and effective support "of AFA activities, including distinguished service as a National Director and Committeeman; as Chairman of the Board, Aerospace Education Foundation; as President of the Iron Gate Chapter and Chairman on three occasions of its annual National Air Force Salute, being the primary fund-raiser for this important charitable event."

The Salutes have raised close to a million dollars for charities that include the Air Force Enlisted Men's Widows and Dependents Home Foundation, the Air Force Village Foundation, the Aerospace Education Foundation, the Falcon Foundation, and the Air Force Historical Foundation.

During the evening, Sen. Barry M. Goldwater, Chairman of the Board of Trustees of AFA's Aerospace Education Foundation, presented five Jimmy Doolittle Fellow plaques to five individuals sponsored by the Chapter.

Next year's Salute is scheduled for Saturday, March 22.

—BY JAMES A. McDONNELL, JR.

Visiting during the ball are, left, James H. Straubel, AFA's Executive Director, and Air Force Chief of Staff Gen. Lew Allen, Jr.

Some of the more than 900 military, civilian, and aerospace leaders who made this year's Salute a roaring success enter the New York Hilton's Grand Ballroom.

Sen. Barry M. Goldwater, Chairman of the Board of Trustees of AFA's Aerospace Education Foundation, and the five Iron Gate Chapter-sponsored Jimmy Doolittle Fellows named during the Salute: from left, Senator Goldwater; Iron Gate Chapter Secretary Dorothy L. Welker; AFA's Associate Executive Director/Field Operations Donald W. Steele, Sr.; Nathaniel A. Gallagher, Chairman of the Sixteenth Salute Committee; the Iron Gate Chapter President, retired Air Force Col. Francis S. Gabreski; and AFA's Chairman of the Board George M. Douglas.

Symbolic of the many AFA, Air Force, and business leaders in attendance at the Salute are, left to right, AFA President and Mrs. Gerald V. Hasler; Secretary of the Air Force and Mrs. John C. Stetson; Harold S. Geneen, Chairman of the Board, ITT, and Honorary Salute Chairman, and Mrs. Geneen; Chairman of the Joint Chiefs of Staff Gen. David C. Jones and Mrs. Jones.

Secretary of the Air Force John C. Stetson congratulates Salute Committee Chairman Nathaniel A. Gallagher on another successful fund-raising effort. Sharing the congratulations are Vice Chairman John C. Messerschmitt (right) and Arthur H. Hutton (left).

Chairman of the Joint Chiefs of Staff Gen. David C. Jones and Mrs. Jones visit with Salute attendees.

Maxwell A. Kriendler Memorial Award recipients (left, J. Gilbert Nettleton, Jr., and, second from right, Sen. Howard W. Cannon) were presented their coveted trophies by Iron Gate Chapter President Francis S. Gabreski (right). Also on hand was Sheldon Tannen, nephew of the late Maxwell A. Kriendler, who gave a short presentation on the history of the Iron Gate Chapter and the awards. The Chapter is named after the iron gate in New York's famous 21 Club, the original Chapter meeting place. The Kreindler family was a cofounder of the club. Mr. Tannen is currently an executive with the 21 Club.

—Photos by Sid Birns

AFA News

By Don Steele, AFA AFFAIRS EDITOR

Dick Becker (left), President of AFA's Chicagoland Chapter, Ill., discusses the Air Force Art Program with Chicago artist John Michael Downs. The Chicagoland Chapter recently sponsored a reception for seventeen local artists at the Museum of Science and Industry during which they displayed twenty-five paintings that are being donated to the Air Force Art Collection.

The Jerry Waterman Chapter at MacDill AFB, Fla., recently recalled the World War II days when many Martin B-26 Marauder crew members were trained on the base. Chapter President Marion Chadwick, center, enjoys an anecdote during the program with Maj. Gen. John Ewbank, USAF (Ret.) (right), commander of one of the first Marauder squadrons to deploy to the Pacific, and Gen. Paul D. Adams, USA (Ret.), first Commander in Chief of the former US Strike Command, also based at MacDill.

AFA's Blue Barons Chapter, Colo., recently honored Noel A. Bullock (center), Director of Aerospace Education for Colorado AFA and Regional Director of Aerospace Education, USAF/CAP Rocky Mountain Region, for his outstanding contributions to aerospace education. Presenting him a painting of the Blue Baron is Blue Barons Chapter President Karl Benkesser (left) and Colorado AFA State President Steve Brantley.

COMING EVENTS

New York State AFA Convention, Dutch Inn, Islip, Long Island, July 13–15 . . . **AFA's 33d Annual National Convention,** Sheraton-Park Hotel, Washington, D.C., September 16–19 . . . **AFA's Aerospace Development Briefings and Displays,** Sheraton-Park Hotel, Washington, D. C., September 18–20.

chapter and state photo gallery

More than 300 guests gathered at the K. I. Sawyer AFB, Mich., officers' club recently for an AFA banquet and speech by Gen. Richard H. Ellis, Commander in Chief, Strategic Air Command. Visiting during a break in the program are, from left, Gerry Grundstrom, Superior-Northland Chapter President; Sam Cohodas; General Ellis; Lynn Coleman; and Col. (Brig. Gen. selectee) Robert D. Beckel, 410th Bombardment Wing Commander.

"Objectives of the AFA" was discussed by AFA National Director of Membership Max Keeney at a meeting to launch the Mid-Ohio Chapter's annual membership drive. Participants in the program, which was held at Newark (Ohio) Air Force Station, are, from left, Charles E. Skidmore, Jr., Mid-Ohio Chapter's Director of Communications and Ohio State AFA Secretary; Francis Spalding, Ohio State AFA Vice President, and President of the Capt. Eddie Rickenbacker Chapter; Mr. Keeney; Roy Haberlandt, Mid-Ohio Chapter President; and Bob Puglisi, immediate past President of Mid-Ohio Chapter and Ohio AFA State President.

George Chabbott (left), National Vice President for AFA's Central East Region, and Delaware AFA State President Jack Strickland (right) present AFA's Medal of Merit Award for 1978 to Col. Archer Durham, Commander of the 436th Military Airlift Wing at Dover AFB, Del. The medal was presented on behalf of AFA in recognition of Colonel Durham's outstanding support of the New Mexico AFA prior to his transfer to Dover.

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Including, For The First Time, The Outstanding Airmen Dinner

September 16-20, Washington, D.C.

Despite inflationary barriers, a new approach to convention programming will result in the lowest registration fees in many years: $50 advance and $60 regular. In addition, registrants will have more options than ever and, for the first time, will be able to attend the popular Outstanding Airmen Dinner.

All reservation requests for rooms at the Sheraton-Park should be sent to: Reservations Office, Sheraton-Park Hotel, 2660 Woodley Road, N.W., Washington, D.C. 20008. The nearby 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.

Sheraton-Park Hotel and Motor Inn, Washington, D.C.
AFA National Convention & Exposition
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Reserve the following for me:

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Tickets may also be purchased separately for the following:

☐ Aerospace Ed. Foundation Luncheon @ $15 each $ _____

☐ Outstanding Airmen Dinner @ $30 each $ _____

☐ ☐ AF Chief of Staff Luncheon @ $20 each $ _____

☐ ☐ Annual Anniversary Reception @ $20 each $ _____

☐ ☐ Salute to Congress* @ $20 each $ _____

☐ ☐ AF Secretary's Luncheon @ $20 each $ _____

☐ AF 32nd Anniversary Reception & Dinner Dance @ $45 each $ _____

Total for separate tickets $ _____

Total amount enclosed $ _____

*Advance registration Fee before September 7 — $50.00 (After Sept

AFA News photo gallery

AFA's West Coast office recently sponsored a reception to honor the military cohosts of the 1978 Air Force Ball. During the reception, Emmett C. McGaughey (center), General Chairman of this year's Ball, visited with the guests of honor, Lt. Gens. James P. Mullins (left) and Richard C. Henry. General Mullins is Commander of Fifteenth Air Force at March AFB; General Henry commands the Space and Missile Systems Organization (SAMSO). More than 200 USAF, industry, and community leaders attended the reception.

During a recent meeting of AFA's Anchorage Chapter, Alaska, Lt. Gen. Winfield W. Scott, Jr. (second from right), Commander of the Alaskan Air Command, introduced two of the Air Force's twelve Outstanding Airmen of the Year for 1978 to Dave Robinson (left), Alaska State AFA President. The Outstanding Airmen, TSgt. Robert L. LaPointe (right) and SSgt. Arturo Aguirre, gave a report on their participation in the February meeting of AFA's Enlisted Council, of which they are members.

Participants in a conference for State Organizations and Chapters in AFA's Northeast Region, which was held at McGuire AFB, N. J., are, from left, Don Steele, AFA's Associate Executive Director for Field Operations; Leonard Schiff, New Jersey AFA State President; Robert L. Carr, AFA National Director; Gerald V. Hasler, AFA National President; Amos L. Chalif, National Vice President for AFA's Northeast Region; Jack Flaig, Pennsylvania State AFA Central Regional Director; James P. Grazioso, AFA National Director (standing in front of Mr. Flaig); and Maj. Gen. Thomas M. Sadler, Commander of the Twenty-first Air Force.

This Is AFA

The Air Force Association is an independent, nonprofit, aerospace organization serving no personal, political, or commercial interests; established January 26, 1946; incorporated February 4, 1946.

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

OBJECTIVES

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 for all mankind.

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Pittsburgh, Pa.

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Roy, Utah

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San Antonio, Tex.

J. P. McConnell
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J. B. Montgomery
Los Angeles, Calif.

Edward T. Nedder
Hyde Park, Mass.

J. Gilbert Nettleton, Jr.
Washington, D.C.

James O. Newhouse
Germantown, Md.

Martin M. Ostrow
Beverly Hills, Calif.

William C. Rapp
Buffalo, N. Y.

R. Steve Ritchie
Golden, Colo.

Julian B. Rosenthal
Sun City, Ariz.

John D. Ryan
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Essex Junction, Vt.

Joe L. Shosid
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C. R. Smith
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Harold C. Stuart
Tulsa, Okla.

Zack Taylor
Lompoc, Calif.

James M. Trail
Boise, Idaho

Nathan F. Twining
Clearwater, Fla.

A. A. West
Newport News, Va.

Herbert M. West, Jr.
Tallahassee, Fla.

Sherman W. Wilkins
Bellevue, Wash.

Jack Withers
Dayton, Ohio

Thomas C. Lennep, Jr.
(ex officio)
National Commander
Arnold Air Society
Hattiesburg, Miss.

Rev. Msgr. Rosario L. U. Montcalm
(ex officio)
National Chaplain
Holyoke, Mass.

James H. Straubel
(ex officio)
Executive Director
Air Force Association
Washington, D.C.

CMSgt. J. B. Woods
(ex officio)
Chairman,
Enlisted Council
Washington, D.C.

Capt. Craig Lindberg
(ex officio)
Chairman, JOAC
USAF Academy, Colo.

VICE PRESIDENTS

Information regarding AFA activity within a particular state may be obtained from the Vice President of the Region in which the state is located.

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P. O. Box 2584
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(205) 281-7770

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George H. Chabbott
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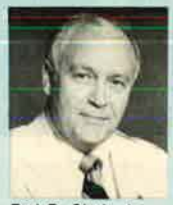
Dover, Del. 19901
(302) 697-3234

Central East Region
Maryland, Delaware, District of Columbia, Virginia, West Virginia, Kentucky

Amos L. Chalif
162 Lafayette Ave.
Chatham, N.J. 07928
(201) 635-8082

Northeast Region
New York, New Jersey, Pennsylvania



Earl D. Clark, Jr.
1030 Pawnee St.
Kansas City, Kan. 66103
(913) 342-1510

Midwest Region
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Hoadley Dean
P. O. Box 2800
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North Central Region
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Southeast Region
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R. L. Devoucoux
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(603) 436-5811

New England Region
Maine, New Hampshire, Massachusetts, Vermont, Connecticut, Rhode Island

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Wichita Falls, Tex. 76309
(817) 692-5480

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Rocky Mountain Region
Colorado, Wyoming, Utah

Margaret A. Reed
P. O. Box 88850
Seattle, Wash. 98188
(206) 575-2875

Northwest Region
Montana, Idaho, Washington, Oregon, Alaska

NOW AFA OFFERS YOU

HIGHER COVERAGE . . .

The New High Option PLUS Plan

With inflation eating away your family's life insurance protection at a 10% a year clip, you'll be glad to know you can get a lot more coverage for just a **little** more money.

AFA's new High Option **PLUS** Plan offers benefits **double** those of the Standard Plan for just $20 per month. Members currently under age 30 can now obtain $170,000 in coverage for this low premium. Aviation death benefits are also proportionately higher.

And the Extra Accidental Death Benefit for both the High Option Plan and High Option PLUS Plan has been increased as well.

You will be glad to know, also, that the 1978 20% dividend payment reduced net cost of this coverage to the lowest point in the 18-year history of AFA Military Group Life Insurance.

COMPLETE INFORMATION, AND AN APPLICATION, ARE ON THE NEXT TWO PAGES.

20% Dividend Paid for 1978 Reduced Net Cost to All-Time Low

New, Low-Cost Protection for the Hi

HIGH OPTION PLU

CURRENT BENEFIT TABLES

Insured's Attained Age	STANDARD PREMIUM: $10 per month Basic Benefit*	HIGH OPTION PREMIUM: $15 per month Basic Benefit*	HIGH OPTION PLUS PREMIUM: $20 per month Basic Benefit*
20-29	$85,000	$127,500	$170,000
30-34	65,000	97,500	130,000
35-39	50,000	75,000	100,000
40-44	35,000	52,500	70,000
45-49	20,000	30,000	40,000
50-54	12,500	18,750	25,000
55-59	10,000	15,000	20,000
60-64	7,500	11,250	15,000
65-69	4,000	6,000	8,000
70-74	2,500	3,750	5,000
Aviation Death Benefit*			
Non-war related	$25,000	$37,500	$50,000
War related	$15,000	$22,500	$30,000
Extra Accidental Death Benefit*	$12,500*	$15,000*	$17,500*

*The Extra Accidental Death Benefit is payable in addition to the basic benefit in the event an accidental death occurs within 13 weeks of the accident, except as noted under AVIATION DEATH BENEFIT (below).

*AVIATION DEATH BENEFIT: The coverage provided under the Aviation Death Benefit is paid for death which is caused by an aviation accident in which the insured is serving as pilot or crew member of the aircraft involved. Under this condition, the Aviation Death Benefit is paid in lieu of all other benefits of this coverage. Furthermore the non-war related benefit will be paid in all cases where the death does not result from war or an act of war, whether declared or undeclared.

OTHER 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 in all but three years (during the Vietnam War) since the program was initiated in 1961, and basic coverage has been increased on six 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 and retired* personnel of the Armed Forces of the United States, members of the Ready Reserve* and National Guard*, Armed Forces Academy cadets*, and college or university ROTC cadets* are eligible to apply for this coverage provided they are under age 60 and are now, or become, members of the Air Force Association.

*Because of certain restrictions on the issuance of group insurance coverage, applications for coverage under the group program cannot be accepted from non-active duty personnel residing in either New York or Ohio. Non-active duty members residing in these states, however, may request special application forms from AFA for individual policies which provide coverage quite similar to the group program.

OPTIONAL FAMILY COVERAGE
(may be added to any of the above Plans)
PREMIUM: $2.50 per month

Insured's Attained Age	Life Insurance Coverage for Spouse	Life Insurance Coverage for each Child*
20-39	$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
70-74	750	2,000

*Between the ages of six months and 21 years, each child is provided $2,000 coverage. Children under 6 months are provided with $250 coverage once they are 15 days old and discharged from hospital.

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.

from AFA Military Group Life Insurance

verage Up to $170,000

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
- ☐ Ready Reserve
- ☐ National Guard
- ☐ Retired
- ☐ Armed Forces Academy
- ☐ ROTC Cadet
- ☐ Air Force
- ☐ Other _____ (Branch of service)

Name and relationship of primary beneficiary

Name and relationship of contingent beneficiary

This insurance is available only to AFA members

- ☐ I enclose $13 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:

Plan of Insurance

Mode of Payment	Standard Plan: Member Only	Standard Plan: Member And Dependents	High Option Plan: Member Only	High Option Plan: Member And Dependents	High Option PLUS Plan: Member Only	High Option PLUS Plan: Member And Dependents
Monthly government allotment. I enclose 2 month's premium to cover the necessary period for my allotment (payable to Air Force Association) to be established.	☐ $ 10.00	☐ $ 12.50	☐ $ 15.00	☐ $ 17.50	☐ $ 20.00	☐ $ 22.50
Quarterly. I enclose amount checked.	☐ $ 30.00	☐ $ 37.50	☐ $ 45.00	☐ $ 52.50	☐ $ 60.00	☐ $ 67.50
Semi-Annually. I enclose amount checked.	☐ $ 60.00	☐ $ 75.00	☐ $ 90.00	☐ $105.00	☐ $120.00	☐ $135.00
Annually. I enclose amount checked.	☐ $120.00	☐ $150.00	☐ $180.00	☐ $210.00	☐ $240.00	☐ $270.00

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, sanatorium, 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

7/79
Form 3676GL App

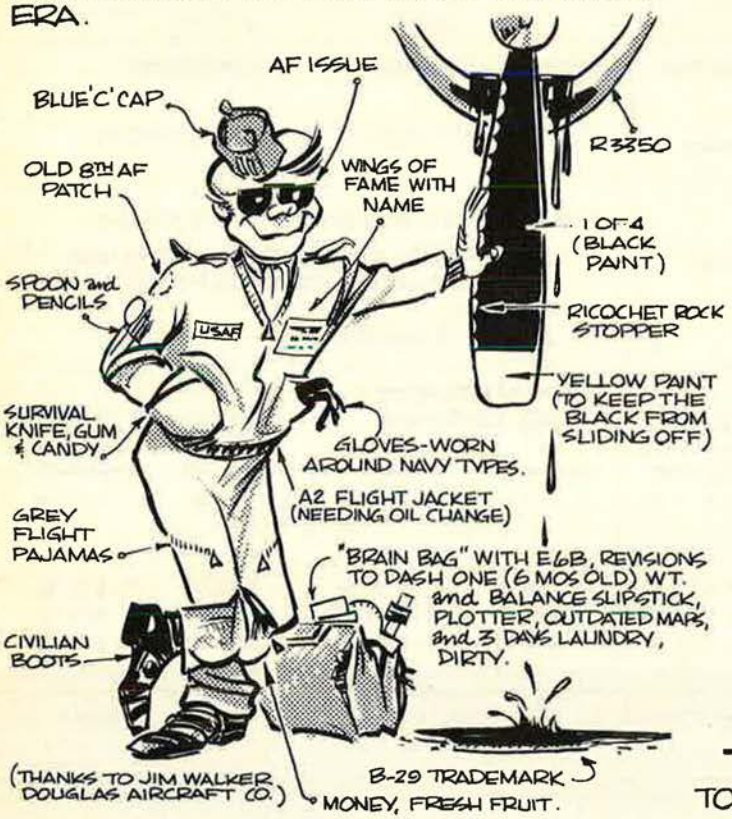
Application must be accompanied by a check or money order. Send remittance to:
Insurance Division, AFA, 1750 Pennsylvania Avenue, NW, Washington, D.C. 20006

Bob Stevens'

"There I was..."

COVERING THE SUBLIME TO THE RIDICULOUS, THIS ISSUE WE'RE GOING TO WANDER DOWN MEMORY LANE IN CREW TRAINING. WE'VE COME A LONG WAY... *HAVEN'T* WE?

LET'S LOOK AT A TYPICAL "SUPERFORT" INSTRUCTOR PILOT DURING THE POSTWAR ERA.

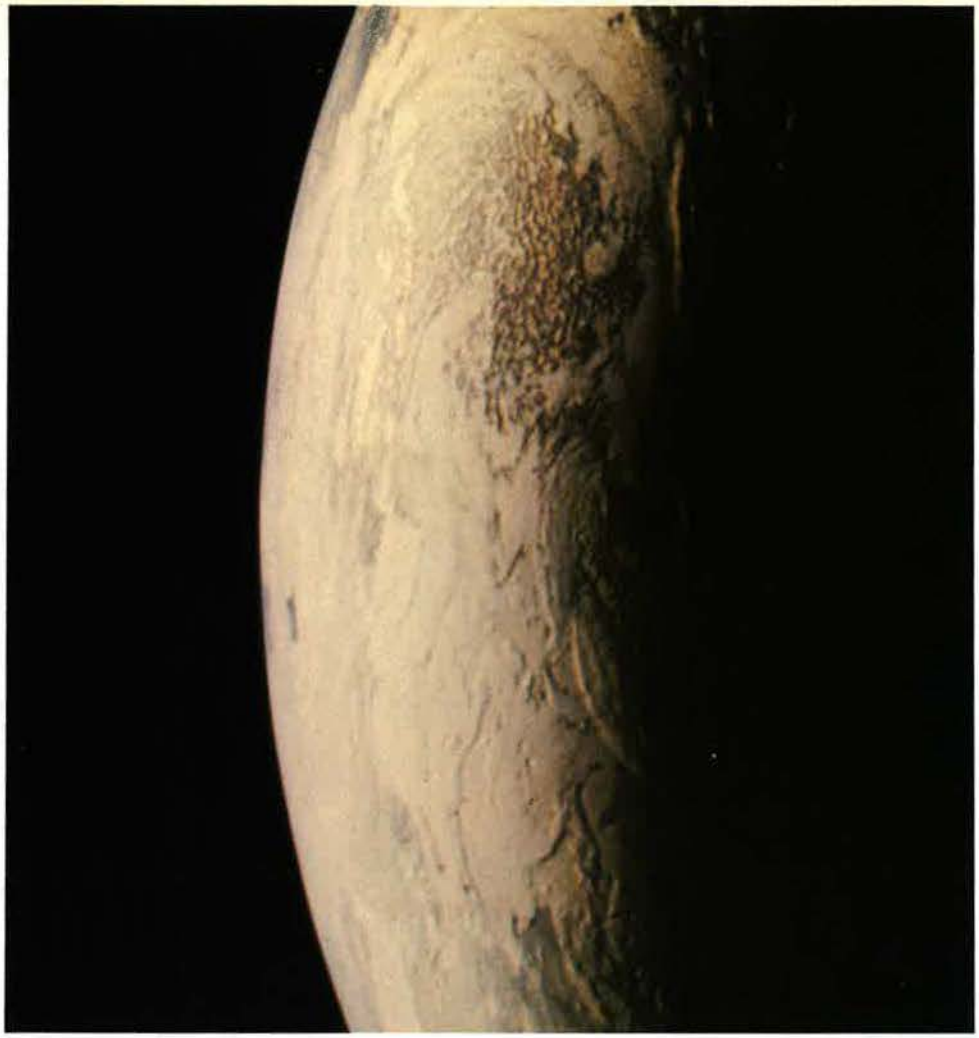


(THANKS TO JIM WALKER DOUGLAS AIRCRAFT CO.)

NAVIGATOR TRAINEES APPROACH RIDE FM-5 (AEROBATIC FAMILIARZATION IN THE FIGHTER ENVIRONMENT) WITH ZEST and ENTHUSIASM! PICK OUT THE STUDENT WHO JUST HAD A LUNCH OF TACOS, BEANS, FOOT-LONG HOT DOG and FRIES—

(THANKS TO HENRY BRINKMAN, MATHER AFB)

THE T-BIRD DIDN'T HAVE THE THRUST-TO-WEIGHT OF AN F-15...



Whose line-of-sight radio talks to the other side of the world?

With just a flip of a switch, the E-Systems AN/WSC-3 UHF radio —popularly known as "Whiskey-3" —can switch from line-of-sight communications with nearby land mobile forces to satellite communications with a command center on the other side of the world. Despite its complexity and versatility, the unit has proven its capability to operate for over 2,000 hours before repairs are necessary, as validated in military operation. And the unit can be serviced in 10 minutes or less by unskilled personnel.

The practical, effective application of advanced technology has earned E-Systems leadership positions in electronics products, command and control systems, aircraft maintenance and modification, guidance and navigation aids, communications, and electronic warfare.
As a result, E-Systems has more than doubled sales in just five years as an independent business organization. For a copy of the brochure that fully describes E-Systems capabilities, write: E-Systems, Inc., P.O. Box 226030, Dallas, Texas 75266

E-Systems is the answer.

E-SYSTEMS

"Eagle two, we have 9 hostiles, 10 degrees, angels 70"...

The challenge? Intercept any threat. Response: The F-15 Eagle. With all-weather armament, advanced multi-mode radar, extended range, and Mach 2.5 speed, this aircraft is ideally suited to the USAF strategic defense mission.

The F-15

MCDONNELL DOUGLAS