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MAGAZINE



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MAGAZINE

APRIL 1980
VOLUME 63, NUMBER 4

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ABOUT THE COVER



Air Force instructors in undergraduate pilot and navigator training are handpicked and thoroughly trained. Here a UPT instructor trains in the T-37, which will be replaced by a "next-generation trainer" as part of the new look in USAF flying training. See article beginning on p. 36. (Photo by David N. Stead)

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AN EDITORIAL

Making the Most of Manpower

APRIL in the United States is traditionally a month of hope and new directions as spring prevails over retreating winter. In 1775, the battles of Lexington and Concord on April 19 gave hope that independence could be won by beating the British in battle. On April 9 in 1865, Lee's surrender at Appomattox effectively ended the Civil War and started the process of reuniting the torn nation. In 1942, the launch of Doolittle's raiders from the carrier *Hornet* on April 18 shattered the myth of Japanese invincibility and gave hope to a nation setting out on the long trail to victory.

The past winter has been somewhat shy of hopeful events. There were some pluses, to be sure. Mild temperatures helped to conserve fuel. Eric Heiden and the Olympic hockey team gave the nation the winners it needed. But elsewhere gloom abounded. Inflation zoomed upward. Terrorists in Tehran still held fifty Americans, the Embassy, and the American government hostage. Attacks on American embassies were mounted elsewhere, and diplomats were killed or held hostage by mobs and terrorists. The Russians invaded Afghanistan. Not much was done in response to that watershed event, either by the United States or its allies. The President's rhetoric initially waxed bellicose. But the reality of America's military limitations restrained what actually could be done, and the Administration had to fall back to a discussion of rebuilding the nation's defenses.

The defense budget Secretary of Defense Harold Brown presented to Congress in January was admittedly a pre-Afghanistan product, subject to upward revision sometime. Most of the increase is expected in hardware, not people. That is consistent with the way "people issues" have been treated by the executive branch in recent years. In his Fiscal Year 1981 Posture Statement, Dr. Brown devoted only twenty of 300 pages to the chapter titled "People." Much of that section consisted of tables showing worsening trends, but scant mention of the Secretary's proposals to correct them. When members of Congress chided Dr. Brown for the parlous state of America's defenses, he implied that discussion of shortcomings was somehow harmful to security.

This litany of negatives may suggest that April 1980 does not bring much to hope for, except warmer weather. But in fact the negative events of the winter have created a climate much different from that of last autumn. It is a climate in which substantial numbers of Americans seem willing to face the facts of national defense inadequacies.

That is real cause for hope.

In this regard, Congress and the public are ahead of the Administration. It still seems dedicated to finding a cheap way to provide for national defense. That includes cheap ways of

finding and keeping the people who dedicate their lives to it. Consequently, the issues of national defense and defense manpower are being discussed by more people, in more detail, more widely than last year. The discussion has expanded from being the exclusive province of a few experts and partisans into a rather widespread consciousness that we have fallen behind and had better figure out what to do about it. The 1980 election campaigns will help fuel the discussions. Candidates will state their positions (or try to duck), and opponents or the voters will keep discussion of the issues bubbling.

A hopeful sign is that the uniformed leaders of the armed services are speaking out forcefully about the need to act now to improve the plight of the men and women in uniform. This year, it is not the *pro forma* nod to "people issues" characteristic of the Secretary of Defense's Posture Statement. It is different, because the Chiefs have "gone public" with the facts. They (and the Congress) know that civilian control of the military doesn't mean that military leaders must remain silent as their best people leave.

Air Force Chief of Staff Gen. Lew Allen has told Congress, "... my single greatest concern lies not with hardware, nor maintenance, nor training—it is with people." General Allen told Congress that "in return for their service, our people ask for nothing more than a fair standard of living."

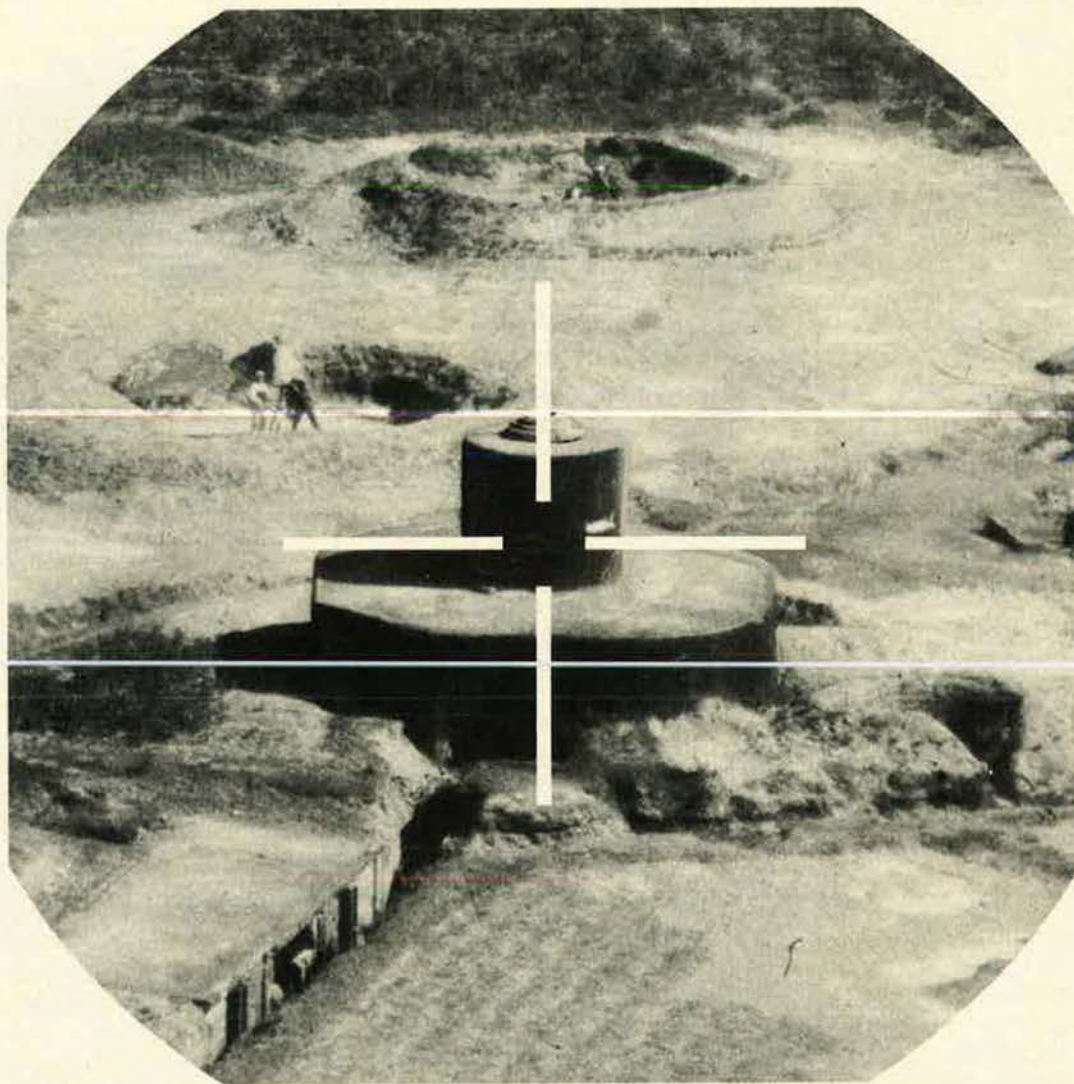
At the same time, General Allen and his JCS counterparts are taking actions to improve the quality of life in the services that do not require appropriations. (Ed Gates's article on page 56 gives examples in the USAF enlisted career fields.) The Air Force Chief's BUCK STOP program is a case in point. In it, he encourages USAF supervisors to "suggest opportunities whereby leadership can be enhanced, procedures simplified, and operations made more efficient through delegation of authority to lower levels of organization."

This is the kind of action the troops want and expect, and it needs desperately to be articulated downward as well as upward. The interest on the part of the leadership must be a matter of perception by those who are restive in their jobs, as well as reiteration to the Congress and the public. The military audience may be the hardest to convince.

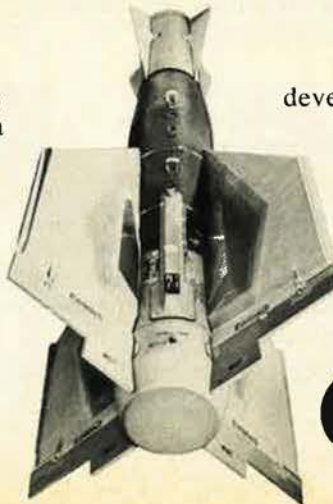
Lt. Gen. Ira Eaker wrote recently that military people "have lost hope of any equitable treatment from their political leaders." In this month of General Eaker's eighty-fourth birthday, there is unmistakable evidence that their uniformed leaders are determined to tell the public that equity for military men and women is a *sine qua non* in the rebuilding of this nation's defenses. On that reason alone, this April there is hope, hope that must be translated quickly into reality.

—F. CLIFTON BERRY, JR., EXECUTIVE EDITOR

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Sperry Update

9

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

Sperry units to control space shuttle experiments.

Sperry communication and data handling systems, based on Sperry multiplexer-demultiplexer (MDM) systems for the Orbiter itself, will help integrate scientific experiments as space shuttle payloads.

The flexible MDM units with microprocessors will provide experiment control independent of the Orbiter's main on-board computers. One application of the Sperry flexible MDM will be for the NASA/TRW Materials Processing in Space (MPS) Program, a shuttle/spacelab experiment to commence in the early 1980s.

Mitsubishi, Piper select Sperry flight controls.

Mitsubishi Aircraft International has selected Sperry integrated autopilot/flight director systems for its new Diamond I business jet and the Marquise and Solitaire propjet executive transports, while Piper Aircraft Corp. will offer the Sperry SPZ-200A system in its Cheyenne II turboprop.

The SPZ-900 system will be standard in the Diamond I, and the SPZ-500 system with torque programming will be Marquise and Solitaire factory equipment. Piper plans to make the SPZ-200A a customer option beginning early in 1980.

Sperry FMCS chosen for new Airbus A310.

The digital Sperry automatic navigation and performance monitoring flight management computer system (FMCS) will be standard equipment on the new A310 wide-body airliner to be built by Airbus Industrie. The FMCS will serve as the nerve center for the aircraft's digital avionics suite. A similar system was earlier selected by Boeing Commercial Aircraft Company for its 757 and 767 airliners.



Sperry to convert F-100s to U.S. Air Force drones.

Sperry has commenced conversion of surplus F-100 fighter-bombers to QF-100 full scale afterburning targets under contract from the U.S. Air Force Armament Development and Test Center, Eglin AFB, Florida.

The QF-100 will succeed the PQM-102, of which Sperry is converting 145 from F-102 interceptors. The QF-100 will be a multiservice target for air-to-air and ground-to-air missile evaluation and combat crew training. The first of nine QF-100s will be delivered to Tyndall AFB, Fla., under an engineering development contract running through March 1982.

The QF-100 will use present PQM-102 ground control and test equipment as well as many PQM-102 airborne sub systems. However, a digital flight control computer replaces four analog computers. The digital system will offer ease of testing and flexibility for future growth of operational modes.

Sperry expands offerings for business aviation.

New flight instruments, a cockpit voice advisory system, and a digital air data command display have been introduced by the Avionics Division of Sperry Flight Systems for business and commuter aircraft.

In addition, Sperry integrated autopilot/flight director systems are now available for retrofit into early serial number Cessna Citation I aircraft and as part of improvement pack-

ages for Model 23, 24, and 25 Learjets.

The new four-inch flight director instruments feature advanced digital electronic radio altitude displays in attitude director indicators. The new line, designated SPI-401 and 402, replaces the popular four-inch STARS line introduced in 1970.

A female voice advises pilots of vital flight conditions in the VA-100 voice advisory system. It will provide vocal callouts of altitude alert, landing gear status, track change, minimum decision height, autopilot disconnect and gyroscopic sensor anomalies.

The Sperry CD-125 air data command display offers convenient, precise control and monitoring of speed and vertical rate in high performance business jets. The 3.2 by 1.5 in. panel mounted display annunciates indicated airspeed, vertical speed, or Mach on a seven-segment incandescent numerical readout.

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Airmail

More on Raid 250: Target Berlin

The Eighth Air Force Raid 250 on March 6, 1944, will be remembered most as the first maximum effort of US fighters and bombers to penetrate the airspace of Berlin and return in reasonably good shape [*January '80 issue, p. 74*]. That alone could well vindicate the decision to go, but permit me to comment on the mission with an interesting sidelight or two.

First, the decision to go was made on the assumption that the weather was reasonable. Surely, RAF Mosquitoes and/or P-38 weather reconnaissance were available to give a more accurate assessment of the weather in the target area. To muster an all-out effort and then be unable to report any damage to the assigned targets because of weather in this case questions the theory that the means justifies the end. But let us not overlook the polemics the two previous aborts had in the decision to go.

Second, albeit with substantial escort fighters (approximately 750), the length of the bomber stream and the time spent in the enemy's backyard overtaxed the "little friends'" top-cover capabilities; regardless, the bomber and fighter losses were acceptable, and the message was loud and clear to my friend, Kommodore Adolf Galland, and his Luftwaffe day fighters that the skies six miles above Europe had become frightfully unfriendly.

Third, the Fifteenth Air Force based in Italy had been bombing targets in Southern Germany since November 1943, although still without the versatile P-51 Mustang (they would be operational in April). P-38 and P-47 fighter groups were doing a yeoman's job escorting the B-17s and -24s.

In conjunction with Raid 250, the Fifteenth Air Force's target was Breslau, Poland, which was approximately 175 miles southeast of Berlin and 500 miles from bases in Italy; however, it was not to be. The mission was aborted due to bad weather in the target area, and Galland probably breathed a sigh of relief because the siphoning off of his fighters to meet the threat from the south would have allowed Raid 250 to escape with even fewer losses. The elements truly were on the side of the enemy that day.

It seems that the planners at Hq. Fifteenth Air Force learned little from Raid 250, for deep into the summer on August 29, 1944, what was expected to be a milk run to Moraska Astrava, Czechoslovakia (now called Ostrava), 600 miles from Italy, heavy losses were sustained by a B-17 group due to enemy fighters. Again, the length of the bomber stream and insufficient fighter cover told the grim story. I know, for I led two squadrons of the 31st Fighter Group covering the bombers over the last 100 miles to the target.

James L. Brooks
Los Angeles, Calif.

• *The writer is credited with thirteen victories in WW II.—THE EDITORS*

The Military Profession

General Milton's typically provocative column, "What's Happening to the Military Profession?" (February '80) prompts me to concur and respond.

Supplementing his rationale, I believe that "enough good people no longer find service life attractive" because good people need to be winners, at least occasionally.

Consider the thirty-five-year losing streak of the home team, and the resultant retention problems should be no surprise. While money, perks, PME, promotions, etc., are vital, no benefit can even closely compare with victory over one's adversary (*viz.*, enemy).

We can continue, in futility, to treat all the obvious symptoms, but the disease cannot be cured, in my view, until the team owners and general management (*i.e.*, the American voter and our political leadership) develop and execute a winning strategy, both in foreign policy and supportive military capability.

Col. F. M. Kellam, USAFR
Clayton, Mo.

Gen T. R. Milton's article in the February 1980 issue ("What's Happening to the Military Profession?") brings this response from a perhaps unexpected source—an Air National Guardsman.

One of his major points was the erosion of benefits and the resulting exodus of so many well-qualified,

maturing, junior people. The present phenomenon isn't new—I've watched people leave the Regular Establishment from my vantage point from private on up, both on and off active duty, for thirty years. Over those years, many complex and varied reasons were used, but the bottom line really is very simple.

Reservists (for sure this one) are amazed at and ashamed of the attitudes seen in some Regulars due to the erosion General Milton cites. The real truth is that they have reason to feel that way. Without a solid, dedicated, determined (and compensated) career force, how can we expect to attain, maintain, and retain a viable Total Force? To expect continued success in the All-Volunteer environment, with current dollar constraints, is like expecting the second team to bolster up the varsity when the coach has quit!

Sure, some exit the active force to separate themselves from the "Mickey Mouse" treatment they perceive, which includes the up-or-out syndrome. That, sadly, is even happening among the ranks of graduates of the Air Force Academy. Most, however, leave active service because they can continue, in the ANG or USAFR (if they so choose), to do what they love to do (*i.e.*, fly), and pursue a more stable, lucrative endeavor on the outside.

It's as simple as that.

Col. Charles L. Weidinger,
ANGUS
Springfield, Va.

EB-66 Pathfinders

I read the article by Capt. Kenneth C. Stoehrmann, "New Roles for TAC's F-111," in your February issue, and was impressed with the news that it was used as a "pathfinder" in SEA. This concept was used by Det. 001, 25th Tac Recon Wg., flying EB-66Bs out of Tahkli, Thailand, in late 1965 until mid-June 1966.

I was unable to bring this to light prior to my retirement in June 1968 because of the classification assigned to the project, and would appreciate any help that your readers can give.

Detachment 001 was formed and deployed from France on temporary duty status with the initial purpose of active electronic countermeasures. Long periods of inclement weather and highly restrictive rules of engagement soon brought out the need for all-weather and night interdiction. The EB-66B, even though antiquated, was still capable of radar bombing

Airmail

and was maneuverable enough to operate with the F-4 and F-105 aircraft; thus, it was selected to conduct feasibility tests. Long hours and much hard work by all of the Detachment personnel soon paid off, and the pathfinder missions became of equal importance to electronics.

The highly classified status, plus sensitivity of our missions, blocked all attempts to get proper mission credit and other recognition. Many missions involved two air refuelings and rendezvous with six different flights of fighters, all of which were escorted over NVN. This type of operation was extremely taxing on support personnel as well as crews, and I feel that it is time they were rewarded in some manner.

If anyone has any additional information, please contact me.

Lt. Col. W. H. Roberson,
USAF (Ret.)

810 N. Gulf Blvd.
Indian Rocks Beach, Fla. 33535

POMO vs. Centralized Maintenance

I enjoyed "Air Force Maintenance—Issues and Challenges of the Eighties," by Maj. Gene E. Townsend, in the January issue. It was refreshing and amusing to note the return of decentralized maintenance. POMO seems much like what we used to call the Line Chief/Crew Chief system in our time. Fighter squadrons can be well served by decentralized maintenance.

Centralized maintenance came into being when rapid Air Force expansion left us with perhaps five or six mechanics per squadron with training on the airplanes assigned. These fortunate few had to direct the maintenance effort. As the war and postwar period progressed, the Air Staff and other headquarters needed information to plan future needs. Although some organizations had good data-collection systems, decentralized maintenance cannot easily supply such information. Each squadron differed from all the others, often within the same group or wing. Who had the best way? Based on what criteria could the best maintenance methods be chosen?

Air Force Manual 66-1 was the comprehensive effort to answer the two questions posed above. It worked

admirably for most maintenance activities but left some questions unanswered in TAC and ADCOM fighter squadrons. During many staff and IG visits, I became convinced the largest functions in centralized maintenance were control and data collection. But the cost was usually justified by accurate information provided for critical management decisions. However, we usually could not get sufficient qualified people to maintain the hardware and man control and data centers.

Human perversity being what it is, the inside jobs nearly always seemed to be better manned than those out in the flight-line weather or in the drafty hangars. Conversely, the old decentralized systems had stressed skilled men working on the hardware. Only a line chief, and maybe a squadron inspector, might be found in an office.

Control and data collection provide many kinds of information for management, but the man-hours per flying hour and the equipment failure rates provided the more useful tools for squadron, group, and wing maintenance officers. These statistics usually pointed the way to problem solutions. Man-hours per flying hour, or sortie generation rates, or a combination of the two would seem valid today as tools for maintenance management. Some device for measurement and comparison must exist if performance is to be improved.

Sam H. Andrew
Austin, Tex.

Thunderchief/Cobra Squadron Insignia

Between 1960 and 1967, the F-105 was King-of-the-Hill at Nellis AFB, Nev. Republic Aviation, creator of the Thunderchief, distributed what was called the Arrowhead patch. This patch was shaped as its name implies with a silver border. It came with a blue, green, yellow, or red background and with a top (or bottom) silhouette of the F-105 and the word Thunderchief below the exhaust eyelids.

At the same time, the top F-105 squadron at Nellis was the 39th, or Cobra Squadron. The insignia representing this unit was a cobra with a flared hood and with the numerals 39th embroidered on it.

Several boxes containing my personal effects have been lost in storage, and I would like to replace the patches described above. I realize it has been several years since the F-105 and the Cobra Squadron were at Nellis, so I am hoping someone who reads this can put me in con-

tact with a source so that I may purchase one of the Thunderchief and one of the Cobra Squadron insignia.

A. G. Milton
P. O. Box 7397
Murray, Utah 84107

Richards-Gebaur AFB

In your December issue under the heading "Ghost Bases," you printed a request from an AFROTC cadet who collects Air Force base guides.

Contrary to the information presented by the cadet, Richards-Gebaur AFB, Mo., has not been deactivated. Officially R-G is a MAC base and the Air Force Reserve's 442d Tactical Airlift Wing continues to operate from the base. Additionally, active-duty personnel in the Kansas City area continue to reside in government housing there.

Prior to the move of Air Force Communications Service headquarters from Richards-Gebaur AFB to Scott AFB, Ill., the base belonged to AFCS.

Maj. Lawrence H. Hannon,
USAFR
Director of Public Affairs
McClellan AFB, Calif.

Airpower Pioneer John Macready

I thoroughly enjoyed the article on Col. John A. Macready in the February AIR FORCE Magazine. The story mentioned Macready made his record-breaking high-altitude flights from McCook Field.

However, the article failed to mention the fact that the then Lieutenant Macready was a 1923 graduate of the Air Service Engineering School at McCook. As I'm sure you're aware, that school is a predecessor of the Air Force Institute of Technology.

SSgt. Timothy L. Miller,
USAF

Chief, Internal Information
AFIT Office of Public Affairs
Wright-Patterson AFB, Ohio

Aero Clubs

I wholeheartedly agree with Major Gallagher's comments in "Airmail," January 1980 issue, regarding MRW costs for aero club operations. He states that "high administrative cost eliminated much of the benefit associated with the aero club in comparison with rental rates at local airports."

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.

Epsilon

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designed & developed
for the french air force
first flight: Dec. 22, 1979



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Airmail

There is a second factor equally devastating to aero club survival, and that is the stripping of instructor judgment and almost total reliance on unreasonable time requirements on each and every type of operation. As an example, an instructor cannot initially solo a student or allow a student to fly solo cross-country until a check pilot has given the student a check-ride. Such redundancy is unheard of in the civilian flying community. Another example—a potential member, even if he has 10,000 hours of retractables and an ATP certificate, requires an expensive, fuel-wasting, four-hour checkout to fly aero club retractable aircraft if he is noncurrent. One can imagine the overwhelming volume of experienced pilots a club obtains when these same pilots need only satisfy an instructor at the local airport that they can operate the aircraft safely.

I have two recommendations. First, update the governing regulation, AFR 215-1. Second, let instructors serve as instructors and be allowed to assume the responsibilities given them by the Federal Aviation Agency regulations. Name withheld by request

We Thought You'd Like to Know

The HH-53 heavy lift helo specially equipped with a winch and pole system for catching dead weights dropped from various altitudes (*February 1980 issue, p. 27*) belongs to the 6514th Test Squadron based at Hill AFB, Utah.

Donald M. Dalton
Program Analyst
Hill AFB, Utah

Thud Ridge

I am a member of the 5th Fighter Interceptor Squadron and am looking for the book *Thud Ridge*, by Lt. Col. Jack Broughton, published by J. P. Lippincott in 1969. Any assistance in my acquiring this book would be appreciated. Hard bound preferred.

TSgt. Arvid G. Pomeroy, USAF
514 Lincoln Dr.
Minot, N. D. 58701

UNIT REUNIONS

American Ex-POWs

National Convention, American Ex-

Prisoners of War, Inc. July 20-23, 1980, Las Vegas, Nev. **Contact:** Ed Fontaine, 1294 Marwood St., Boulder City, Nev. 89005. Phone: (702) 293-2728.

Brookley AFB

Third Brookley AFB Reunion, May 17, 1980, Mobile, Ala. Open to public. **Contact:** Frank M. Lugo, 5 S. Springbank Rd., Mobile, Ala. 36608.

Glider Pilots Ass'n

National Association of World War II Glider Pilots, Region 12, (New York, New Jersey, and Pennsylvania), and all others invited. May 2-3, 1980, Otesaga Inn, Cooperstown, N. Y. **Contact:** George N. Van Fleet, 2360 James St., Syracuse, N. Y. 13206.

Iceland Veterans

Iceland vets, June 22-26, 1980, reunion at Kutshers Country Club, Monticello, N. Y. **Contact:** Dave Zinkoff, 2101 Walnut St., Apt. 1109, Philadelphia, Pa. 19103.

Ninety-Nines, Inc.

International convention. July 23-27, 1980, Vail, Colo. **Contact:** Page Shamburger, Page Travel, P. O. Box 1406, Southern Pines, N. C. 28387. Phone: (919) 692-8362.

2d AD Ass'n, 8th AF (WW II)

33d annual reunion of 2d Air Division Association, July 3-5, 1980, Hyatt Regency Hotel, Cambridge, Mass. Minireunions on July 4, 1980, of B-24 Bomb Groups: 44th, 93d, 389th, 392d, 445th, 446th, 448th, 453d, 458th, 466th, 467th, 489th, 491st, and 492d. Fighter Groups: 4th, 55th, 355th, 361st, and 479th. Also Hq., 2d AD and related units. **Contact:** Evelyn Cohen, Apt. 06410 Delaire Landing, 9300 State Rd., Philadelphia, Pa. 19114.

2d Armored Division Ass'n

Annual reunion, July 30 to August 3, 1980, Holiday Inn Embarcadero, San Diego, Calif. **Contact:** Milton Feir, 2255 26th St., Santa Monica, Calif. 90405. Phone: (213) 450-0545.

8th Service Gp. (WW II)

11th Service Sqdn. and 482d Service Sqdn. May 30 to June 1, 1980, Lancaster, Pa. **Contact:** John J. (Jack) Heckler, 76 East Harbor Dr., Teaticket, Mass. 02536.

11th Army Air Force

2d reunion, August 9-12, Anchorage, Alaska. Commemorating 40th anniversary of arrival of first 11th AAF cadre at Elmendorf. Elmendorf AFB has invited us to be a part of their 40th birthday celebration. **Contact:** Lt. Col. Charles A. Pinney, USAF (Ret.), Chamber of Commerce, P. O. Box 404, Hermosa Beach, Calif. 90254.

19th Bombardment Gp. and Wing

July 28 to August 3, 1980, Warner Robins, Ga. **Contact:** Herbert A. Frank, 90-13 201 St., Hollis, N. Y. 11423.

27th Fighter Bomber Group

June 20-22, 1980, Four Seasons Motor

Inn, Colorado Springs, Colo. Visits to the Air Force Academy and other programs planned. **Contact:** Col. John Devine, 4440 E. Araphoe, Phoenix, Ariz. 85044, or Lowell A. Smith, 4449 Charlotte Ann Dr., Louisville, Ky. 40216.

33d Photo-Recon Sqdn. (WW II)

July 4-6, 1980, Airport Hilton Inn, St. Louis, Mo. **Contact:** Leo Shelton, 610 W. Michigan Ave., Hammond, La. 70401.

49th Fighter Gp. (WW II)

7th, 8th, 9th Sqdns., and Headquarters, July 10-12, 1980, San Francisco, Calif. **Contact:** Harry Dilworth, 59 Stanford Heights Ave., San Francisco, Calif. 94127.

57th Bomb Wing (M)

12th Reunion. July 8-13, 1980, N. Myrtle Beach Hilton Hotel, N. Myrtle Beach, S. C. **Contact:** Hal Lynch, 11720 Whisper Bow Dr., San Antonio, Tex. 78230.

58th Bomb Wing Ass'n

All 20th Air Force personnel invited. July 23-27, 1980, Best Western Hotel, Nashville, Tenn. **Contact:** John A. Kavulich, 145 N. 5th St., Indiana, Pa. 15701.

90th Bomb Gp. (H) "Jolly Rogers"

"The Best Damn Heavy Bomb Group in the World." Annual reunion September 18-21, 1980, Minneapolis, Minn. Minireunion May 15-17, 1980, the Pocosinos, Pa. **Contact:** Tom C. Fetter, 701 Brightwood Dr., Marion, Ohio 43302; or Tom Keyworth, 38 Crestlyn Dr., York, Pa. 17402.

307th Bomb Group (H)

Southwest Pacific, World War II. May 24-25, 1980, Ramada Inn South, Oklahoma City, Okla. **Contact:** Dan Cauffiel, 3960 Melody Lane, Riverside, Calif. 92504. Phone: (714) 689-2827.

319th Bombardment Gp. (WW II)

6th reunion. July 19-23, 1980, Atlanta, Ga. **Contact:** Harold E. Oyster, 662 Deering Dr., Akron, Ohio 44313.

347th Fighter Sqdn., 350th Fighter Gp.

Annual reunion. July 11-13, 1980, Colorado Springs, Colo. **Contact:** Andy Freeborn, 5222 Barrego Dr., Colorado Springs, Colo. 80918.

384th Bomb Group

7th reunion. July 31 to August 3, 1980, Dayton, Ohio. **Contact:** The 384th Bomb Group, Inc., P. O. Box 1021-A, Rahway, N. J. 07065.

454th Bomb Sqdn., 323d Bomb Gp.

5th reunion. July 18-20, 1980, Hampton, Va. **Contact:** Joe Havrilla, 1208 Margaret St., Munhall, Pa. 15120. Phone: (412) 461-6373.

494th Bomb Group (H)

2d reunion. May 2-4, 1980, Scottsdale Radisson Hotel, Scottsdale, Ariz. **Contact:** Charles B. Downing, 8102 North 18th Pl., Phoenix, Ariz. 85020. Phone: (602) 997-9063.

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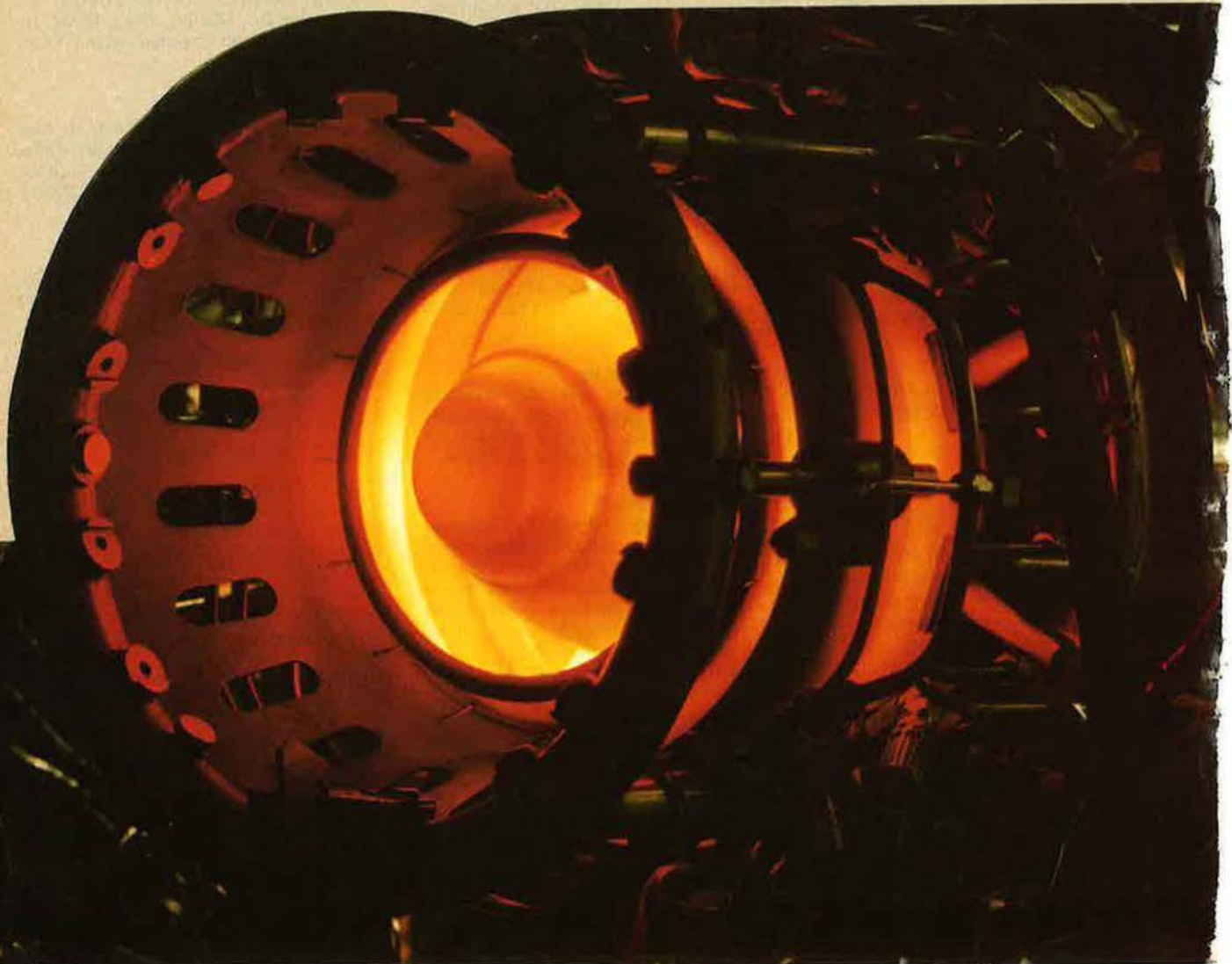
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InFocus...

BY EDGAR ULSAMER, SENIOR EDITOR

Washington, D. C., March 4 SALT II to Be Bypassed?

Senior Administration officials reportedly are weighing carefully recommendations by the US Embassy in Moscow that SALT II be bypassed, so far as Senate ratification is concerned, and that instead the US seek to engage the Soviets in negotiations for a SALT III accord. These negotiations might get under way within a few months, according to advocates of this approach.

If SALT III, as originally planned, is to be multinational in scope and is to cover a wider range of nuclear weapons than did SALT II, the negotiating process probably will be drawn out and difficult. SALT III, as suggested by SALT II, is to include—in addition to intercontinental strategic weapons—the so-called forward-based theater nuclear systems (in the main nuclear-capable aircraft), tactical nuclear missiles, and nuclear artillery stationed in NATO countries.

Also, the intention is to involve as SALT III signatories those US allies who have independent nuclear forces, such as Britain and France. The probability that France—so jealous of its political and military independence—would subject its *force de frappe* to SALT restrictions seems extremely low.

This also may be true for Britain, whose current government tends to stake out strongly independent positions in national defense matters. Further, there is uncertainty about the SALT-related status of two Soviet weapon systems—the SS-20 intermediate-range ballistic missile and the Backfire strategic bomber—that do not fall into either the category of long-range strategic weapons as interpreted by Soviet arms-control negotiators or into the classification of forward-based forces. Presumably the Soviets will insist that these two systems be kept out of SALT III, just as they persisted in keeping them outside the purview of SALT II. Yet to give these versatile and important systems a free ride while subjecting NATO's forward-based forces to SALT III constraints would make a mockery of the

principles of even-handed arms control and be contrary to the policies enunciated by PD-50, the Presidential Decision document governing this country's stance on arms-control agreements.

The strong arms-control interests within the Administration, meanwhile, are attempting to woo the Soviets toward concessions on Backfire and the SS-20 by hinting at the possibility of a unilateral US concession: increasing to 2,000 the number of US nuclear weapons to be withdrawn from NATO. The number presented during MBFR (Mutual and Balanced Force Reduction) negotiations last year was 1,000. Congressional sources report no Soviet response to this negotiating feeler.

Another arms-control accord, the proposed Comprehensive Test Ban Treaty (CTBT) that would ban underground testing of nuclear weapons, is once again at an impasse. Negotiations were resurrected briefly by British willingness to permit the Soviets five National Seismic Stations (NSS) on UK territory—or half the number first requested by Moscow—and by intense Soviet interest in obtaining, on a loan basis, the sophisticated US NSS monitoring equipment developed by this country's nuclear weapons laboratories. Pentagon and National Security Council officials believe that President Carter's decision—in the wake of Moscow's invasion of Afghanistan—to halt the transfer of US technology to the Soviet Union rules out making NSS available to the Russians.

A group of Soviet scientists had been permitted to inspect the US equipment while touring this country last year. They were so intrigued by its capabilities that the Soviet government has been trying ever since to get permission to "test" it in the Soviet Union. Under the proposed CTBT, seismic detection equipment of this type would be installed by the US, the USSR, and Britain on each other's territory. The US NSS technology is a significant advance in the ability to measure and detect underground nuclear detonations from afar.

The Joint Chiefs of Staff, in language that barely conceals their reservations or even opposition, commented on the proposed treaty in the FY '81 Military Posture Statement: "The Comprehensive Test Ban Treaty . . . being negotiated by the United States, United Kingdom, and Soviet Union can serve US interests if it is adequately verifiable, allows necessary nuclear testing for weapon design and stockpile reliability, and does not lead to the development of strategic asymmetries. At the current state of CTBT negotiations, these essential requirements have not been fully satisfied. The Joint Chiefs of Staff continue to give careful review to the results of each round of these important negotiations." In the view of most of the country's ranking nuclear-weapons designers, CTBT, as presently conceived, meets none of the criteria spelled out in the Military Posture Statement.

Washington Observations

★ CIA Director Adm. Stansfield Turner, USN (Ret.), continues to present net assessments of US vs. Soviet military capabilities to Congress and the executive branch, rather than confining his reports to the intelligence community's findings on Soviet activities and capabilities. Net assessments are the function of the Joint Chiefs of Staff and OSD, as well as the National Security Council, and should be based on those agencies' expertise in establishing US strengths and weaknesses and relating them to the intelligence community's analyses and findings concerning Soviet capabilities. Yet, in spite of repeated admonitions by members of congressional oversight committees, Admiral Turner insists on exceeding the intelligence community's mandate. There are further misgivings about the intelligence chief's peculiar style of reporting, according to highly placed congressional intelligence experts. The CIA Director's reports are said to be so arcane in terms of weighting the confidence factor of the information presented and so voluminous and abstruse as to become unintelligible even to other intelligence experts.

★ A recent Soviet SLBM test involving the encryption (concealment) of performance data—in violation of the terms of the as yet not ratified SALT II accord—is being interpreted by some congressional pundits as a Russian countermove to US actions following

InFocus...

Moscow's invasion of Afghanistan. But Pentagon experts who specialize in ballistic missile matters reject this interpretation. They point out that the lead times in arranging such test flights—especially in such a fundamental decision as to whether to encrypt or not—are too long to have been affected by the Afghanistan crisis. These officials, therefore, view the latest Soviet encryption of ballistic missile flight data as another example of Russia's unwillingness to abide by mutual arms-control accords.

★ The US won't be ready to test its ASAT (antisatellite weapon) prototype against a special target satellite for another two years. Concern over White House delays in authorizing ASAT tests in space, therefore, could be premature. Confidence remains high among congressional and Pentagon space experts that the US space weapons, once fielded, will surpass existing and foreseeable Soviet ASAT capabilities. The Soviets, according to the FY '81 Military Posture Statement, "have demonstrated a nonnuclear orbital interceptor which presents a threat to low-altitude US satellites. . . . The United States, however, is vigorously pursuing its own development program to offset this potentially dangerous Soviet advantage."

The US objective in developing an ASAT prototype, according to Secretary of Defense Harold Brown, is the capability "to destroy enemy military satellites that represent a threat to our forces." The Administration, he told Congress, would prefer verifiable limitations on antisatellite weapon systems and is opposed to a space-weapons race. The US, therefore, has "begun discussions with the Soviets on these subjects. However, in the absence of an agreement and in the face of proven Soviet capabilities, we must work to defend our satellites, if necessary."

★ Gen. David C. Jones, Chairman of the Joint Chiefs of Staff, in his overview of the US Military Posture, drew this conclusion from the Soviet invasion of Afghanistan: "I see little basis to expect future Soviet restraint in circumstances where (a) they believe the overall as well as the local power balance favors them, (b) countervail-

ing political and economic sanctions are deemed ineffective, deterred, or already exhausted, and (c) they see their interests served by military action. I believe it would be a serious strategic error if we failed to raise the risks and stiffen the certain and adverse nature of the consequences to the Soviets of such action."

Air Force Secretary Hans M. Mark, in assessing the meaning of the invasion before the House Armed Services Committee, suggested that "the direct subjugation of a neighboring state [Afghanistan] by Russian troops, marks not something that is new and dangerous in Russian policy, but simply a return to something old and dangerous, something unsophisticated, something brutal. Given the uncertainty of the future of the leadership in Iran, the move into Afghanistan is also most menacing to the interests of the United States and of its major allies who depend upon the Persian Gulf nations, including Iran, for continued supplies of oil. Thus, while the Russian move is not something new, or even unexpected, it is something that requires a firm response, as did the Russian threats to expand indefinitely at the end of the Second World War and as did the Russian challenge in space which was unveiled so suddenly in 1957 by the orbiting of Sputnik, the first earth-orbiting satellite."

★ General Jones ended his somber assessment of the US Military Posture and of the magnitude of the Soviet threat with a sanguine observation of profound importance: "We appear to be entering the coming decade with a fresh perception and a new maturity regarding the phenomenon of American power. The paralyzing premise that the mere existence of strength creates an inclination to use it irresponsibly or arrogantly seems to have given way to a renewed awareness that the greater our national power in all its dimensions—political, economic, military, and moral—the less the likelihood that military force will have to be used. This awareness and the will to act on it will enable us to do whatever is necessary to prevail over the challenges we face in the 1980s."

★ During the decade of the 1970s, Soviet military expenditures exceeded those of the US by about \$240 billion, measured in the current purchasing power of the dollar. Over the coming decade, the CIA estimates, the Soviets will spend between \$90

and \$100 billion on equipping and maintaining their National Air Defense (PVO Strany) troops, whose preponderant function is to counter the air-breathing element of the US strategic triad. PVO Strany already has some 10,000 SAMs, 6,000 dedicated radars, and 3,000 interceptors—and is manned by about 590,000 troops, more than the active-duty strength of the entire United States Air Force. According to the CIA analysis, the Soviet air defense force is getting ready to acquire thousands of new interceptors with look-down, shoot-down capabilities, a fleet of AWACS aircraft, large numbers of new SA-10 SAMs, and an internetworked command control and communications (C³) system, which the Soviets now lack. USAF experts don't believe that the USSR's investments in advanced air defense systems will provide a broadly effective counter to this nation's air-launched cruise missiles (ALCM) before the late 1980s, especially in view of the fact that the US could deploy up to 5,000 ALCMs on existing B-52Gs and Hs. By the end of the decade and early in the 1990s the Soviets, however, might be able to cut significantly into the ALCMs' ability to penetrate Soviet airspace unless second- or third-generation ALCMs, designed for greater survivability, are available by then.

The Defense Advanced Research Projects Agency (DARPA) soon will transfer to USAF its advanced cruise missile vehicle technology program that has demonstrated long range and low probability of detection. The long range of ALCM, DARPA reported to Congress, "permits more flexible target routing and increased survivability for the cruise missile carrier. . . . This range capability can also be traded for more payload (larger nuclear warheads or conventional munitions) on the target. The key to [ALCM] survivability is low detectability, which can be achieved by low-altitude penetration and low . . . observables. This combination compounds the enemy's problem of detecting the cruise missile by coupling together horizon limit, terrain masking, and clutter with low detectability" of the ALCM design.

★ Secretary of the Air Force Hans M. Mark told Congress recently that the MX ICBM, weighing about 190,000 pounds and with a throw-weight of about 7,900 pounds, is well suited as a backup space launch vehicle "if the Space Shuttle should have technical

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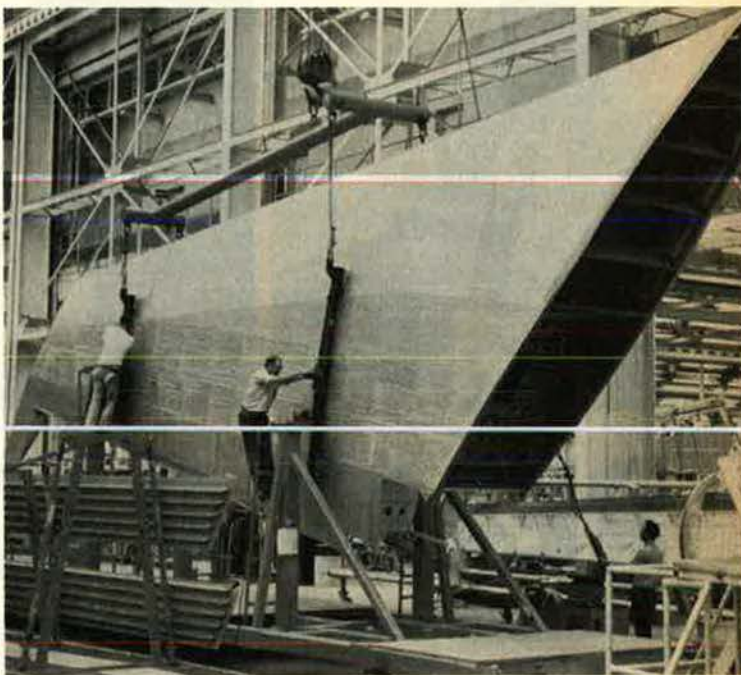
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InFocus...

problems. . . . The MX could also be used to boost payloads into orbit should the Space Shuttle face the threat of attack."

★ Pentagon acquisition experts believe that the US industrial base might not be able to absorb major boosts in weapons production above the levels provided for by the FY '81 budget request. The mood of the Congress suggests that major production increases might be requested and authorized this year. Three limiting factors come into play. There is an across-the-board acute shortage of technically trained personnel, especially engineers. Obviously the lead time in producing engineers is several years and provides no real options for quick fixes. Secondly, there are some twenty-odd essential materials that are either in short supply or imported from countries with which the US has no reliable relationship. Included are cobalt, manganese, chromium, and titanium. While in theory a national stockpile of scarce materials essential for national defense is to be maintained, in practice that stockpile is nonexistent. Lastly, industrial capacity itself is woefully lacking in such key areas as large hydraulic presses for forging such aircraft parts as landing gears and wing center sections.

The problem here is that the Air Force and the Defense Department have to compete with a booming commercial aircraft industry for the limited production capacity. The situation is deteriorating as ever stricter environmental regulations drive profits down and cause more and more heavy industry to shift to less hamstrung fields.

The fact that the Defense Priority Act of 1950 may be permitted to expire this spring is a sword of Damocles hanging over the Pentagon's acquisition process. This Act, administered by the Commerce Department, was invoked last year at the behest of USAF to halt a series of strikes that curtailed Pratt & Whitney's production of the F100 engines powering both the F-15 and F-16. Even though the Act was invoked relatively quickly, there will be a time this year when about thirty F-15s and thirty F-16s will come off the lines without engines. The problem is expected to ease after September 1980, when invocation of

the Defense Priority Act is expected to pay off.

★ At this writing, the White House reportedly is close to completing a Presidential Decision Memorandum that will set forth procedures and mechanisms for a comprehensive and rapid mobilization of all national resources in time of crisis. The pending decree putatively covers civil defense, American industry, and all elements of government involved in bringing the country to a wartime footing. Special emphasis will be placed on "continuity-of-government" features to assure that even under catastrophic conditions government will be able to function. Industrial mobilization is to be patterned after the War Production Board of World War II.

★ Although the Defense Department and the Air Force have made no final decision concerning a CX advanced airlift aircraft to support the US rapid deployment force (RDF), certain features of the design seem to have been agreed upon. The aircraft probably will be in the 400,000-pound class (vs. about 800,000 pounds for the largest 747 variant and some 500,000 pounds for the DC-10/L-1011) with a payload of about 130,000 pounds (approximately the weight of the Army's new XM-1 tank), and a range of about 2,800 nautical miles. That range is compatible with the Military Airlift Command's "channel routes," a global network linking air bases owned by or available to US forces. The number of CX aircraft to be acquired appears, at this time, to be slightly below 200.

While the CX, which is expected to enter the inventory in quantity during the second half of this decade, is not considered by Air Force R&D experts an ideal cruise missile carrier aircraft (CMCA), its ready availability and "sunk-cost" advantage "might" nevertheless make it attractive for that role. In the CMCA role, CX probably would have to be "stretched" by about fifty percent over its initial size. Diminishing CX's chances as a cruise missile carrier, however, is the fact that the Air Force has been authorized to spend about \$120 million between now and 1983 to convert and test the third B-1 aircraft as an ALCM launcher. The B-1 offers the advantage of high nuclear hardness. Its "fast escape time" makes it invulnerable to even an unconstrained SLBM attack, where there would be only eight to ten minutes of tactical warn-

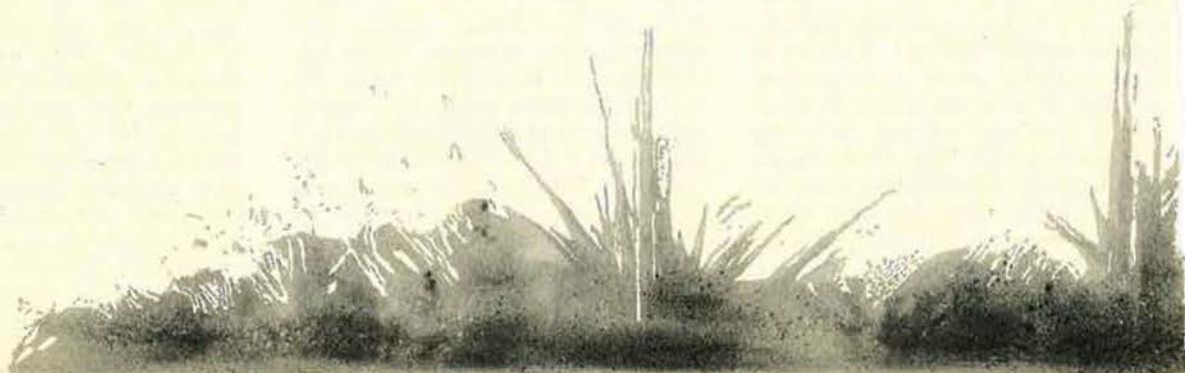
ing. While there may be no need to replace the B-52 as a cruise missile carrier until the mid-1990s, USAF wants to retain the option of acquiring a dedicated CMCA by the mid-1980s in case of unforeseen problems with the thirty-year-old B-52s.

★ Air Force Secretary Hans M. Mark told this column that USAF is short some 1,200 engineering officers, which causes severe problems in program management. Because of a nationwide shortage in graduate engineers—induced by the anti-technology mood during the Southeast Asian War—industry is "bidding up the price" of new graduates to a point where the Air Force's starting pay is only half the industry going rate.

★ The FY '81 defense budget will support an Air Force flying hour program that is 56.7 percent below what it was ten years ago. This decrease in flying hours is proportionately higher than the 27.3 percent decrease in the active aircraft inventory. Ten years ago, USAF had 12,746 aircraft; today's inventory is 9,236. Aircraft procurement funding is down from last year by almost \$450 million. It would take about \$1.3 billion to bring USAF's aircraft acquisition program up to its original schedule. It is ironic that the acquisition stretchout will increase costs by more than \$800 million, mainly because of inflation and a less-than-optimum buy rate. In short, this is an artificially induced cost increase to be paid for eventually by the taxpayer. There also are steep drops from FY '80 in tactical missile and munitions procurement. Funds for procuring AIM-7 and AIM-9 missiles, for example, are about \$100 million below the actual requirement.

★ Lt. Gen. Kelly H. Burke, USAF's DCS/Research, Development and Acquisition, recently told Pentagon reporters that while high-energy lasers which operate at the speed of light have the potential to revolutionize warfare, they are, like the longbow and the rifle, only devices that transmit energy. Since they neither produce nor increase the energy they transmit, they remain totally dependent on their power source. General Burke suggested that space-based laser weapons probably won't come into their own until there are large power collectors in space that might cost several hundred billions of dollars and might serve primarily for commercial power generation. ■

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Aerospace World News, Views & Comments

By William P. Schlitz, ASSISTANT MANAGING EDITOR

Washington, D. C., March 6
★ NASA and the Chinese Academy of Sciences signed a Memorandum of Understanding in Beijing late in January formalizing the previously agreed-to participation of China in the US's Landsat earth resources survey program.

The agreement calls for the establishment of a ground station in the Beijing area to receive resources data from earth-orbiting Landsat-D, expected to be operating in 1982.

The ground station is to be purchased from US private firms under the Understanding on Cooperation in Space Technology agreed to in January 1979. The Landsat Memorandum of Understanding is the first formal agreement on space utilization since US and China relations were normalized.

The signing came during a visit to China by a delegation headed by Dr.

Frank Press, Presidential Science Advisor, which included NASA Administrator Dr. Robert A. Frosch.

The agreement, which parallels those signed with a number of foreign nations, provides that the Chinese Academy of Sciences will make Landsat data it receives openly and uniformly available to others.

Six Landsat ground stations are in operation outside the US: two in Canada and one each in Brazil, Italy, Sweden, and Japan. Stations in Australia and India are now receiving test data and should be operational soon. Another is under construction in Argentina, and several others are in planning stages elsewhere. US stations are at Fairbanks, Alaska; Goldstone, Calif.; and at the NASA Goddard Space Flight Center, Greenbelt, Md.

Landsat-3, orbited in March 1978, is still operating.

In a related matter, according to Assistant Secretary of Defense (Public Affairs) Thomas B. Ross, "Technology transfer was one of the major topics of discussion during [Defense] Secretary [Harold] Brown's recent visit to the [People's Republic of China]. During his discussion there, he indicated that the US is prepared to sell to the Chinese civilian technology which we would not approve for sale to the Soviet Union. . . . While the discussions with the PRC during Secretary Brown's visit focused primarily on the sale of civilian technology, designed to assist China in its industrial and economic modernization, it was recognized that some of the technology could also be used for military purposes.

" . . . Secretary Brown also indicated that the US was prepared to consider, on a case-by-case basis, the sale of certain carefully selected items of support equipment also suitable for military use, e.g., trucks, communications gear, certain types of early warning radar. . . the US has not changed its position that it has no plans to sell arms or weapon systems to China."

★ On January 31, the Israeli Air Force officially accepted the first of an ordered seventy-five F-16 multirole fighters at the General Dynamics plant in Fort Worth, Tex.

Following signing ceremonies, IAF Brig. Gen. Amos Lapidot and USAF Lt. Col. Jerry Singleton flew the two-seat version of the F-16 to Hill AFB, Utah, where twelve Israeli pilots are to begin flight training in the aircraft. IAF personnel are scheduled for preliminary F-16 maintenance training at the Fort Worth facility this year.

Thus, the IAF became the third air force within a week to begin flying the advanced, Mach 2-plus fighter. Earlier in Europe, the Royal Norwegian Air Force took possession of the first of a planned seventy-two F-16s and the Royal Danish Air Force accepted the first of fifty-eight.

Seven Israeli F-16s are to be assigned to the 388th Tactical Fighter Wing at Hill for initial IAF pilot and maintenance training. Subsequent F-16s will be ferried directly to Israel by US pilots. During 1980, thirty-five of the aircraft are slated for delivery to Israel and the seventy-fifth late in 1981.

The 388th at Hill is responsible for training the first cadres of pilots for the six nations so far to buy the F-16: the US, Belgium, Denmark, the Netherlands, Norway, and Israel. In



During the recent F-16 acceptance ceremonies, at table from left, Maj. Gen. J. A. Abrahamson, USAF F-16 Program Director; Israeli Air Force Maj. Gen. Arie Levy; General Dynamics Vice President R. E. Adams; and IAF Brig. Gen. Amos Lapidot. See item.



Gen. Robert C. Mathis, who has served as both Vice Commander of AFSC and TAC, has become USAF's nineteenth Vice Chief of Staff, second highest Air Force post. He succeeds retiring Gen. James A. Hill.

addition, the plane is a finalist in competition to provide new fighters for Australia, Canada, and Spain.

★ NASA has signed a \$183.96 million contract for the manufacture and delivery in 1984 of a second Spacelab.

The first Spacelab, visualized as a reusable spaceborne scientific laboratory, is currently being built in Europe. Plans call for it to be aboard an early operational flight of the Space Shuttle. (Development problems have pushed first flights of the Shuttle back to late in 1980 at the earliest.)

Funding for development and manufacture of the first Spacelab is by European Space Agency member nations and is estimated at more than \$850 million. (After delivery to the US, NASA will be responsible for its integration into Shuttle operations.) In return for the European Space Agency's investment in the first Spacelab, the US agreed to fund the second flight unit and others if future needs dictate.

The second Spacelab is also to be built by the ERNO industrial facility, Bremen, Germany, prime contractor to the European Space Agency.

At least twenty-six subcontractors in the member nations of Germany, France, Italy, UK, Spain, Belgium, the Netherlands, Switzerland, Austria, and Denmark, as well as in the US, are expected to produce components of the second Spacelab.

Spacelab is to have facilities and equipment similar to earthbound labs but adapted for zero gravity. It will provide a shirt-sleeve environment for up to four payload specialists who will eat and sleep in the Space Shuttle Orbiter.

According to NASA officials, the Spacelab program will lay the foundation for greatly expanded international participation in space, and NASA and the European Space Agency are publicizing the prospective benefits and availability of Spacelab to potential users in the international community.

★ In late February, Northrop Corp. was awarded a \$235 million contract



Honorary USAF Colonel Bob Reeves is flanked by Lt. Gen. Winfield Scott, Jr., Commander of Alaskan Air Command, and Robert Atwood, President of AAC's Civilian Affairs Board. The famed seventy-seven-year-old former bush pilot and aviation pioneer was awarded the honorary rank at recent ceremonies.

for full-scale engineering development of the key guidance system element of the MX strategic missile.

The Air Force contract, which includes \$17.5 million for initial funding, underwrites a four-year program to develop a guidance system element called the Advanced Inertial Reference Sphere (AIRS) that provides velocity and attitude information to the guidance computer, which directs the missile on its course.

Intelligence Briefing...A Roundup

According to *Foreign Report*, published by London's *Economist*, for several months there has been a trickle of information to the West about a serious accident at a bacteriological warfare plant inside the Soviet Union. Some reports described the escape of lethal bacteria from an establishment in the suburbs of Novosibirsk in Siberia.

Foreign Report has now received detailed information about a hitherto-unreported disaster in the spring of last year at a site officially known as "Military Village 19," north of the village of Kashino, to the southwest of the city of Sverdlovsk, on the eastern flank of the Ural Mountains. According to reliable sources, some kind of explosion took place at this base in April 1979, leading to the release into the atmosphere of a lethal strain of bacteria known as V-21. The wind carried the bacteria to Kashino, but only a negligible quantity reached Sverdlovsk.

The total death toll—including military and civilian inhabitants of Kashino, and workers at the local ceramics plant—is said to have topped 1,000. A special ward in a Sverdlovsk hospital was opened for those affected; the civilian nursing staff was evacuated, and army nurses wearing protective clothing were brought in. The

first victims were said to have died on April 4, within one to three hours of hospitalization. To maintain secrecy, the bodies of those who died were not returned to their families. . . . The man-made plague is said to have raged for about a month, with thirty to forty deaths a day. . . . While refusing to admit to the cause of the unexplained deaths, the authorities sent bulldozers in at the beginning of May to pave the streets of Kashino with asphalt and to scour the surrounding countryside of topsoil—apparently to remove any lingering pools of bacteria.

This was not the first man-made disaster in the Sverdlovsk area. In 1957, the radioactive cloud resulting from the now-notorious nuclear explosion in Kyshtym was observed to be drifting directly toward Sverdlovsk itself, and the town was saved only by a last-minute shift in the direction of the wind. On New Year's Eve, 1978-79, there was a serious fire in the reactor area at the Beloyarsk nuclear power station, some forty miles away from Sverdlovsk.

The people of Sverdlovsk were alerted to the risk only when it was noticed that virtually all the firefighting appliances from the town had been rushed to Beloyarsk.

Berry Named Executive Editor

F. Clifton Berry, Jr., has been named Executive Editor of this magazine by John F. Loosbrock, Editor in Chief and Publisher. In the new post, Berry will be responsible for coordinating editorial content with other functions of AIR FORCE Magazine and the Air Force Association. He will also plan and execute special projects as directed by Loosbrock and Editor John Frisbee.

Berry joined the magazine in 1979 as Senior Editor. This followed an Army career from 1954 to 1975, co-editorship of *Armed Forces Journal* from 1975 to 1978, and feature writing for US and European publications on international military affairs.

Richard M. Skinner, now in his twenty-ninth year with the magazine, continues as Managing Editor and Associate Publisher.

Under the award, Northrop will produce and test twenty-three AIRS guidance platforms, provide test equipment, and perform engineering services. Beginning in January 1983, the Air Force plans to test fly systems in prototype missiles launched from Vandenberg AFB, Calif.

Four working models of AIRS built under an advanced development pact are already in use by USAF; Northrop will further refine such instrumentation with emphasis on reliability, effective maintenance, and low life-cycle costs.

For a status report on the MX missile program, see p. 28.

★ A US Customs Service air officer aboard an Air Force E-3A AWACS aircraft in January was instrumental in the apprehension of a pilot and aircraft allegedly smuggling drugs into the US.

Under a DoD and Treasury Department agreement, Customs officers fly aboard normal E-3A training missions conducted by the 552d Airborne Warning and Control Wing, Tinker AFB, Okla.

While on a training mission on January 16, Air Force controllers aboard the E-3A were directing F-15

US Sinai Field Mission in Role Expansion

The Sinai Field Mission (SFM), staffed by volunteer American civilians maintaining a peacekeeping vigil in the Sinai Desert, has assumed an expanded role in the sensitive Mideast area.

The Americans have shut down Red River, Alamo, Quarter Horse, Rodeo, and Rockwall. These were the sensor fields and watch stations used by the SFM to monitor the strategic Gidi and Mitla Passes since February 1976 under terms of the 1975 Egypt/Israeli Sinai agreement.

The close-down follows Israel's return to Egyptian control of another section—some 5,800 square miles—of the peninsula captured in the 1967 war, under terms of the Peace Treaty signed in March 1979.

The SFM will continue to operate its twelve-acre base camp, from which it is now monitoring 15,000 square miles of the peninsula—sixty times as large as the original area. The SFM will have the use of three Bell 212 helicopters and a Heli Porter STOL aircraft to perform this task. The aircraft are in place, and a hangar has been erected to house the equipment and provide maintenance space. In accordance with the treaty, SFM teams are to inspect Egyptian military installations in the zone extending west from a 200-mile line between El Arish on the Mediterranean Sea to Ras Mohammad on the Red Sea.

The SFM inspection teams will verify force levels and armaments at the installations every two weeks and provide reports to the Egyptian, Israeli, and US governments.

In the past four years, more than 450 US civilians have endured eighteen-month assignments in the bleak and uncompromising Sinai as SFM personnel and those of the US government's Washington-headquartered Sinai Support Mission. They have contended with heat, sandstorms, hailstorms, snakes, scorpions, and all manner of insects.

Overseeing SFM activities since February 1976 has been an American company, E-Systems, Inc., of Dallas, Tex., under contract to the US government. Also under contract, E-Systems will continue in its supervisory capacity in the SFM's expanded inspection role. Israel has agreed to evacuate the final third of the Sinai Peninsula in April 1982.

In a congratulatory message to SFM personnel on January 25, Secretary of State Cyrus Vance said:

"You effectively met the difficult challenge of first building and then successfully operating an Early Warning System in the Sinai despite the harsh environment and isolation of the area.

"Your presence in the Sinai in a peacekeeping role has served to underline our determination to continue our efforts to resolve the difficult and tragic conflict in the Middle East."

Eagles from the 49th TFW, Holloman AFB, N. M., in practice intercepts against each other.

USCS air officer Jack Aarsvold, monitoring an E-3A radar console, detected a suspect aircraft entering US airspace. Continuing to track the aircraft, he scrambled a USCS plane to intercept it. Suddenly, what turned out later to be a Cessna 210 disappeared off the radar. Agent Aarsvold directed USCS officers to the area of the disappearance where a damaged Cessna was found. The slightly injured pilot was arrested and 800 pounds of marijuana confiscated.

★ According to a NASA-directed study, demand for telecommunications services in the US is expected to grow fivefold by the turn of the century. An increasingly prominent role is predicted for space satellite video and data communications traffic.

By the turn of the century, the study asserts, as much as one-fourth of all long-distance voice traffic may be carried by satellites, as well as half of all data and video traffic.

The study was undertaken in conjunction with NASA's recently announced decision to renew programs directed at advanced communications satellite research and technology, to assure the US's continued preeminence in the field. To accommodate the rapid growth in demand, more versatile satellites that have higher capacity and operate in the twenty to thirty gigahertz band will be needed. The 20/30 Ghz band, called the Ka-band and not used previously in the US, has a range five times that of bands currently in use, or an increase of fifty to 100 times message capacity.

The study concludes that most data-services traffic will originate and



TEAMWORK.

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end at terminals served by computers, with executive videoconferencing expected to become a substitute for business travel by the year 2000. By then, ninety percent of all telecommunications traffic will be in real time; the other ten percent, such as electronic mail delivery, will be in nonreal time.

US Telephone and Telegraph Corp., a subsidiary of IT&T, and Western Union Corp. undertook the study on NASA's behalf.

★ Three Japanese companies and British Rolls-Royce Ltd. have agreed on the joint development, production, and sale of a new-technology fanjet aircraft engine.

The three Japanese firms are Ishikawajima-Harima Heavy Industries, Mitsubishi Heavy Industries, and Kawasaki Heavy Industries. Their government will fund seventy-five percent of their share of the project, with the monies to be repaid when the endeavor goes into the black. That will amount to a sizable investment, with Rolls and the three companies expecting to split costs of the project down the middle: some \$560 million over an eight-year development period, according to *The Wing*, Japan's weekly aviation newsletter.

The objective of the "XJB Project" is to develop a clean-burning, quiet, fuel-efficient fanjet engine in the nine-ton-thrust class for use on 120- to 150-seat commercial transport aircraft.

Basic design work will be conducted jointly by Rolls and Japanese engineers, and the technology of both parties is being exchanged without charge.

Estimates put the number of aircraft for which the engine is being tailored at 1,700 between now and 1995.

★ Three units of AFSC's Armament Division, Eglin AFB, Fla., were presented major Air Force organizational awards late in January. The presentations were made by Gen. Alton D. Slay, AFSC Commander.

The 3246th Test Wing received the Air Force Outstanding Unit Award for exceptional service between January

Military Losing Pilots to Airlines

A recent survey of pilots hired during 1979 by thirty-four major airlines in the US has produced some alarming statistics, in terms of pilot retention by USAF and the other services.

According to Future Airline Pilots of America, which conducted the survey, of the 3,316 pilots hired in calendar 1979, close to half—forty-six percent—came from the military. Pilots signing on with only civilian experience numbered twenty-eight percent. The remaining twenty-six percent "had experience in both areas"—meaning at some point they had been military pilots.

Cockpit experience of these pilots ranged from 500 hours to 11,000 hours, with an average of 3,012 hours.

1, 1977, and December 31, 1978, when wing personnel were "credited with the completion of 197 munitions test projects which significantly improved Air Force munitions and electronics/avionics capabilities." This achievement led to DoD production decisions involving billions of dollars and increased the effectiveness of NATO's tactical and strategic forces.

The Armament Division's GBU-15 System Program Office earned the Air Force Organizational Excellence Award for actions between September 1, 1976, and September 1, 1978, when "superb management, performance, and engineering expertise" was exhibited in completing the development decision for a major Air Force weapon system, a standoff, defense-suppression glide-bomb weapon.

An Air Force Organizational Excel-

lence Award was also presented the Armament Division's Deputy for Comptroller for service between May 1, 1975, and July 31, 1978, in support of all research, development, and testing programs of all agencies on the vast Eglin complex.

★ Jean-Marc Boivin of France has been presented the International Award for Valor in Sport for 1979.

M. Boivin climbed the previously unconquered face of the Himalayan peak known as K-2, the second highest mountain in the world, carrying a forty-four-pound pack. The ascent of four months was frequently delayed by exceptionally bad weather. During it, M. Boivin suffered damage—later to prove permanent—to both eyes.

At the summit, M. Boivin, almost blind, mounted a hang-glider for the

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★ **NEWS NOTES**—Edwin A. Link, who among other things has excelled as an inventor, explorer, pilot, archeologist, and oceanographer, has been named recipient of the **Lindbergh Award for 1980**. The award, sponsored by the Charles A. Lindbergh Fund, will be presented at the annual Lindbergh Awards Dinner on May 20 in New York City.

Embry-Riddle Aeronautical University, Daytona Beach, Fla., will host an **Open House on April 25-27**, at which many exhibits, including military and civil aircraft, science displays, and the robot R2D2 of the movie "Star Wars," will be on view. Call Bob Cessna (904-252-5561 Ext. 339) for details and reservations of free exhibit space during the event.

NASA is planning a **nationwide competition for secondary school students**, to begin in September, for the submission of proposals for scientific and engineering experiments **to be flown on the Space Shuttle in late 1981 or 1982**. A similar program to involve college-level students also is to be developed. While such competitions as the Skylab student ex-

periments were one-time-only events, the Shuttle Student Involvement Project will be held annually and NASA hopes to attract university support and industry sponsorship of winning entries.

Gen. T. R. Milton, USAF (Ret.), a regular contributor to AIR FORCE

Magazine, has been selected by the Freedoms Foundation, Valley Forge, Pa., to receive the organization's **George Washington Honor Medal Award** for his article "A Strategy—Or a Capacity for Revenge?" which appeared in the July 1979 issue of AIR FORCE.



At presentation of the 1979 USAF Wing Historian of the Year award, from the left, USAF CINC Gen. J. W. Pauly; SSgt. Vincent C. Breslin, 10th Tac Recon Wing Historian; and Maj. Gen. John W. Huston, Chief, Office of Air Force History.

Perspective

Comment & Opinion

By Lt. Col. Donald R. Baucom, USAF, NORMAN, OKLA.

American Military Profession: Dark Night of the Soul?

In a recent speech, Gen. Alexander Haig warned that the 1980s would be a decade of supreme danger for the US. Growing Soviet strength, coupled with internal economic and social problems, may lead to bolder, more dangerous Soviet initiatives. This would seem to be an era in which the military in America should be at its strongest, but is it and will it be?

There is ample evidence that the All-Volunteer Force (AVF) has failed to provide the quality and quantity of people needed for national defense. The litany of AVF failures includes, among other things, military services that are not representative of the population, failure to meet recruiting goals, decline of reading skills that has forced the Army to rewrite its manuals (this is especially damning in view of emphasis on sophisticated technology as a force multiplier), and below-strength reserve forces.

These failings of the AVF are summarized in an article appearing in the Winter 1979 *Armed Forces and Society*. Here Morris Janowitz and Charles C. Moskos, Jr., contend that the AVF has failed to achieve virtually every goal originally set for it. The success it has achieved in providing sufficient numbers for the armed forces came against a background of steadily decreasing force levels. Furthermore, this questionable success was achieved at least in part through unprecedented recruitment of women, which raises a question about the surge capacity of our armed forces, given current reservations about the use of women in combat.

As grave as are the failings of the AVF, a more serious problem may be changes the AVF seems to be inducing in the ethos of America's military profession. The soldier can no longer profess that the only reason for the military's existence is to win the nation's wars. In the AVF environment, he must speak to young people in

terms of an Army that wants to join them; a Navy that is an adventure, not just a job; and an Air Force that is a great way of life. Where are the sublime phrases that call men and women to the service of their country? Where is the frank discussion of the violence of war that is the reason for the authoritarian nature of the military institution?

The AVF has forced the counter-culture on the nation's armed forces. A graphic description of the AVF's impact on the Army can be found in "Boys in the Barracks," a recent serial article in *Army Times*. The picture is one of troops so widely separated from their NCOs and officers as to be difficult to lead, even in peacetime.

My focus thus far on the Army's problems is not to say that AVF-induced difficulties are restricted to that service. In the Army, combat duties are widely shared, and this tends to intensify Army problems in the AVF environment. On the other hand, a majority of Air Force personnel expect never to hear the sound of guns, even in war. As a result, many see the Air Force as a vocational training experience with minimal impingements from traditional military activities. These views are reflected in statistics on recruit attitudes published in 1976, which show that thirty-seven percent of the recruits would not have enlisted had the nation been at war, only forty-nine percent were sure they would defend their base against an attack, and seventy-one percent said they enlisted to learn a trade. How would such airmen respond to a Soviet blitz in Europe that would begin with heavy strikes on US air bases?

Without the draft to encourage enlistment, Air Force personnel programs must pander to occupational attitudes of prospective recruits. This trend is illustrated by the "PROMIS" program, which places the recruit's enlistment on a contract basis, preventing his use to satisfy institutional needs of the Air Force.

Furthermore, the destructive effect of the complaint system described in the January '79 issue of this magazine upon the traditional chain of command is obvious. Does anyone seriously believe a military organization can operate on these premises in time of war?

While the AVF is undermining the military profession from the bottom up, government policies and the pressures of the budgetary process are eroding the old professional ethic of the officer corps from the top. Lt. Gen. Daniel Graham wrote of this change in the August '77 issue of *AIR FORCE Magazine*. According to General Graham, Robert McNamara's cost-effectiveness system led to "intense competition among various individual hardware programs." This enhanced the position of managers and bureaucrats whose rise came at the expense of soldiers. "The military profession became one in which successful program managing was the best road to high position, and strategic thought a dead end."

How far the transition in the military ethic has progressed is highlighted in a statement by a "senior Pentagon aide" that recently appeared in *Time*. "The era is over of flamboyant combat heroes rising to the top of the military. The military is no longer going to win the budget game through image and authority. The brass are going to win it by knowing their stuff and knowing how to present it." One can only hope this "stuff" includes the ability to command a theater army or lead Air Force wings. Will our new soldiers win the budget game only to lose the next war?

The emphasis on management within the Air Force is especially dangerous to the traditional military ethic, which emphasizes combat leadership. Unlike the Army and Navy, our cutting edge of warriors—the aircrew members—is extremely thin. They must be able to fight and fly better than any other air force; preparing for this wartime mission should consume all their energies in peace.

How do our warriors compete for recognition and hard-to-earn promotions in an Air Force that seems to place major emphasis on support functions? Are we to start the next war with commanders who can manage, but not command? The two are not synonymous, and we would do well to remember the warning of Richard Gabriel and Paul Savage in *Crisis in Command*: "Good management does not necessarily provide

good leadership. Good leadership involves good management, to be sure, for a combat leader cannot mismanage his ammunition supplies or other logistical items. However, more importantly, a leader cannot 'manage' his men to their deaths."

I learned long ago the dangers of inductive logic, but I am concerned by what I see in the Air Force and by what colleagues in many different parts of the Air Force write to me. Too many officers are tired of trying to get the job done with too few people, many of

whom cannot be made to carry their load in an environment that prevents swift and meaningful corrective action. Far too many lieutenant colonels and majors are eager to retire at twenty years to escape what they perceive as a hopeless situation. Too many pilots prefer transports over fighters because the former are more similar to the airliners they hope to fly after leaving the service.

All of this indicates to me that the American military profession is undergoing a dark night of the soul. If it

does not find its soul, if it does not rediscover the essence of the military calling, our nation will weather the storms of the '80s only with the greatest of difficulties.

Lt. Col. Donald Baucom is a 1962 graduate of the Air Force Academy. A former USAFA faculty member, he is currently Chief, Engineering and Installations Systems Analysis, Hq. Southern Communications Area, AFCC. The opinions expressed in this article are solely those of the author.

By Keith B. Payne, CROTON-ON-HUDSON, N. Y.

Afghanistan and the Enduring Crisis

The Soviet invasion of Afghanistan was greeted with surprise by US officials—including President Carter. Some professional analysts of Soviet foreign policy, particularly the group of American revisionist historians, have declared in muted and indignant dismay that the Soviet Union has "broken the rules of the game." However, there is no justification for surprise over recent Soviet actions in Afghanistan. And the Soviet Union should *not* be taken to task for breaking "rules of the game" to which it never agreed.

The concept of *détente*, or peaceful coexistence, as entailing a moderation of Soviet foreign policy, a renunciation of its interventionist policies, has been solely a Western hope unrelated to declared Soviet policy or behavior. The Soviet Union should not be charged with violating any trust or unspoken agreement with the US by its invasion of Afghanistan. At no time has the USSR considered *détente* a commitment to the international political *status quo*, or to peaceful means for changing that *status quo*.

The Soviet Union has been quite explicit in explaining to all who would listen or read that peaceful coexistence is a period of intensified struggle in the global transition from capitalism to socialism.

Soviet behavior in Angola, with the help of 35,000 Cuban proxies, determined the political orientation of that strategic country, at least for the short run and possibly longer. The Soviet Union justified its actions as wholly consistent with the principles of peaceful coexistence. Indeed, President Brezhnev jeered Henry Kissinger for attempting to link Soviet interven-

tion in Angola to *détente*. Only months later with a *déjà vu*-like quality, the Soviets and Cubans were in Ethiopia defeating the Somali guerrillas and regulars, and putting down a seventeen-year-old liberation movement in Eritrea. This time President Carter tried to tie Soviet intervention to peaceful coexistence. The Soviets, with some sign of exasperation, made explicit that *détente* neither could entail a moderation of its support for "progressive forces" and "social progress" or a Soviet commitment to stay out of a region characterized by a power vacuum simply because the US was so inclined.

Indeed, the Soviets have openly stated that, consistent with the principles of peaceful coexistence, the Soviet armed forces have entered a new stage wherein they have taken on an "external function" of directly advancing the global transition from capitalism to socialism. This is the essence of the "Peace Program" announced in 1971 at the Twenty-fourth Congress of the Communist Party of the Soviet Union.

According to the Soviet use of the term "peace," it is indeed such a program because "peace" can come only with the ending of the capitalist states' "imperialistic" foreign policies.

Afghanistan is the most recent and blatant illustration of the "external function" of the Soviet armed forces. Angola and Ethiopia should have provided the most ardent apologist for the Soviets with a foreshadow of Afghanistan. In addition, the initial entry of Soviet troops into Afghanistan in December 1979 was determined some twenty months prior to the invasion by a Soviet-sponsored coup.

It is unfortunate that Americans

now express surprise over Afghanistan or take the Soviets to task for violating the "rules of the game." Such statements reflect an unfamiliarity with Soviet foreign policy and declared intention. The only group ever to consider such "rules of the game" applicable to Soviet foreign policy have been Western analysts—perhaps more as an expression of hope than of reason.

The Soviet Union has emerged from the status of a weak revolutionary power to become a truly global revolutionary power. One constant has been a willingness to create and exploit international political situations to the detriment of the West. That willingness has been complemented over the past decade by two very significant developments: the unparalleled growth of Soviet strategic and power projection capabilities, and the increasing lack of US will and capability to contest Soviet activities. The effect of these developments has been an increased and increasingly successful Soviet effort to fill the relative power vacuum of the Third World.

There are several possible US responses to the current situation. All of them are, to a degree, belated. The most dangerous response would be an indignant rhetorical crusade backed up with insufficient power; that appears to be the course we are on. If the US intends to contest successfully Soviet efforts to export "social progress" and determine the political orientation of the Persian Gulf, it must be prepared to redress its military deficit. Political equilibrium cannot be built upon military asymmetry.

Keith Payne is a member of the Professional Staff of Hudson Institute, specializing in strategic and defense policy, international security affairs, and Soviet strategy.

When the facts associated with the need for the MX ICBM, and the nature of the weapon system itself, are understood, there emerges . . .

A SOLID CASE FOR MX

BY EDGAR ULSAMER, SENIOR EDITOR



Artist's concept showing parts of two closed-loop "grids." Each grid will have twenty-three protective structures for the one MX missile deployed in it.

THE preamble of Secretary of Defense Harold Brown's Annual Report to Congress highlights an observation by Sir Winston Churchill that captures the rationale of the MX ICBM program: "You can't ask us to take sides against arithmetic."

From the Soviet point of view, attacking MX by whatever means is tantamount to taking sides against arithmetic, even if there are massive advances in Soviet strategic offensive capabilities. In the terminology of Defense analysts, the attacker inexorably faces an "adverse exchange ratio." In attacking MX, he uses up, or "draws down," a far greater portion of his strategic offensive forces than the portion of US capabilities he is able to destroy. As a result, he is worse off relative to US residual strength *after* attacking MX than he was *before*. Short of total irrationality, he won't be tempted to undertake—or threaten to undertake—such a senseless step.

The case for MX is inseparable from the logic that makes land-based ballistic missiles the keystone of strategic deterrence and, for the foreseeable future, provides the only realistic hope of limiting nuclear war to levels below virtual annihilation of both sides' civil population.

But the principle of "adverse exchange ratios" applies uniquely to MX. The picture is reversed in the case of the submarine-launched ballistic missile (SLBM) force, the other element of the strategic triad designed to gain survivability through mobility and concealment. Once detected and pinpointed, a single Soviet torpedo, depth-charge, or warhead detonating relatively close to a Trident submarine would destroy the boat and the twenty-four C-4 SLBMs (accommodating 240 warheads) it carries. Admittedly, there is no evidence that, as yet, the USSR has solved the towering challenge of detecting and tracking submarines operating at depth. But there is every evidence that the Soviet antisubmarine warfare (ASW) program is intensive and making headway.

The temptation for the Soviet strategist to destroy twenty-four submarine-launched ballistic missiles and their MIRVed payload (a total of up to 240 warheads) for the price of one weapon is great. Conversely, the prospect of having to expend at least twenty-three or, more likely, forty-six highly accurate, high-yield reentry vehicles (RVs) in order to be reasonably certain of destroying one MX missile hiding in any one of twenty-three alter-

nate, hardened shelters will act as a "disincentive" for a prospective aggressor.

Conversely, as in the case of SLBMs, a silo-based ICBM force also fails to produce an "adverse exchange ratio." The Soviets, at least hypothetically, have the ability to destroy one Minuteman III ICBM and its three MIRVed warheads with one of their warheads. In reality, they probably would need to target two RVs against each silo-based ICBM in order to have a high P_k (probability of kill). Either way, the exchange ratio favors the Soviets, who have more and larger ICBMs, capable of carrying more and larger warheads than the US force. This adverse ratio for the US introduces the "destabilizing" US temptation to "use or lose" its force.

MX and the Triad

A unique feature of the land-based ICBM force is that it is both the principal target of the Soviet drive for strategic superiority and, once survivably based, the principal counter to that drive. Neither the air-breathing nor the sea-based component of the triad is affected in a major way by the USSR's vast ICBM buildup. The Soviets invest in their ICBM force a far greater share of total spending on strategic warfare than does the US.

US failure to maintain a viable ICBM force would enable the Soviet Union to reallocate the major share of its current strategic spending to achieve superiority also in other areas of strategic warfare. Further, the argument most likely to persuade the Soviet Union to engage in equitable strategic arms control might be the presence of survivably based ICBM forces on both sides. If both sides consider mobile ICBMs deployed in multiple protective structures (MPS) as unattractive or even invulnerable targets, the Soviets might view an ICBM "arms race" as pointless and, hence, accept an evenly balanced arms-control arrangement for this type of weapon.

The serendipitous relationship between MX and arms control is reinforced by the fact that this weapon system's survivability is relatively independent of the number of missiles deployed. On the one hand, if the objective is to increase the number of bombers or submarines that survive a given threat, the obvious solution is to build more of them. Equally obvious, the other side would recognize such a step as an increased threat to its own forces and probably respond by upping its own

numbers. But on the other hand, in the case of MX, survivability can be boosted simply by adding more shelters without increasing the number of missiles, and hence the threat to the other side.

Further, attacking the MX or any other land-based ICBM located in the American heartland forces an aggressor into the open. Such an attack would involve a very large number of ICBM warheads with a flight time of about thirty minutes from Soviet launch sites to US targets. The attacker *knows* that the intended victim *knows* with certainty and in some detail that a strike has been launched. The attacker also is aware that the victim has enough time to react to his unambiguous act, and probably will.

Soviet war planners concerned with inflicting broad, maximum damage on US strategic offensive forces probably would want to fire their SLBMs from relatively close-in positions to achieve flight times of less than fifteen minutes, as compared to thirty minutes for their ICBMs. But the Soviet targeteer faces a dilemma regardless of how he arranges the attack sequence. Should he fire his ICBM and SLBM forces simultaneously? If he does, there will be a gap of up to twenty minutes between the time the first SLBM warhead detonates and the arrival of ICBMs assigned against the US ICBMs. How confident is the Soviet targeteer that under these circumstances the US would not launch its ICBMs before his warheads arrive? Or should the Soviet delay his SLBM launches so that both his ICBMs and SLBMs would arrive at about the same time? In this case, his ICBMs would have to be launched fifteen to twenty minutes earlier than his SLBMs and the US would have enough warning to get its bombers off the ground and on their way before the first Soviet weapon detonated. Clearly neither approach solves the Soviet war planner's dilemma.

Finally, retaining a viable triad, each element with different characteristics and vulnerabilities, protects against temporary deficiencies in any one category due to Soviet technological breakthroughs. MX is needed because Soviet breakthroughs in ICBM accuracy coupled with increased ICBM deployment has made the US silo-based ICBMs vulnerable. But this breakthrough did not impinge decisively on the other two triad components. By the same token, the air-breathing leg of the triad could be jeopardized by significant improvements in Soviet air defenses, or the SLBMs could be threatened by major advances in Soviet ASW capabilities. Yet, neither development would have an appreciable effect on the ICBM force.

At present, the air-breathing and sea-based components of the triad have to backstop the vulnerable ICBM force until MX restores the survivability of the land-based ballistic missile force late in this decade. But there is a long-term danger if the US were to permit its ICBM force to atrophy: The Soviets then would be free to concentrate their resources on neutralizing the remaining two components of the triad and, over time, might well succeed.

The interaction, or synergism, of the triad has been understood for some time. Nevertheless, it wasn't until the completion of last year's wrenching and exhaustive MX debate, inside and often at the highest levels of the Carter Administration, that its logic won out over the



Under Secretary Chayes believes the MX/IMPS system will convince the Soviets of the futility of an arms race.

lore and lure of a bomber/SLBM dyad, anchored mainly in a large SLBM force. After a long and painstaking review, President Carter opted for retention of the triad, with the survivably based MX its centerpiece. A key factor in the decision was a comprehensive Defense Department analysis of the costs and benefits of a dyad vs. a triad. The results showed that the cost of either a dyad or a triad of comparable size was about the same. But, more importantly, a dyad of equal size turns out to be inferior in capability. The dyad not only loses the synergism of the triad but lacks the crucial capabilities of the ICBMs, such as their unmatched command and control and their singular flexibility in attacking all categories of strategic targets.

MX in Full-Scale Engineering Development

The FY '81 Defense Report asserts that "reducing the vulnerability of the land-based ICBM force is the highest-priority strategic initiative in the [Defense Department's] five-year plan." Antonia Handler Chayes, Under Secretary of the Air Force, the Pentagon executive primarily concerned with the socioeconomic and environmental aspects of the new missile system, told this writer that the Carter Administration will provide high-level and sustained support for the MX program before Congress and elsewhere. This support will crest, she said, once the Pentagon and the White House—probably this fall—settle remaining questions about final refinements of the MPS basing mode.

The current review of MPS basing for MX was triggered late in 1979 by Sen. Ted Stevens (R-Alaska) after President Carter had authorized full-scale engineering development (FSED) of the system and without objections from the Administration. The Stevens amendment authorizes FSED for the MX missile itself, but forbids a commitment to any one basing mode until the end of FY '80. According to Brig. Gen. Guy L. Hecker, Jr., the Air Staff Special Assistant for MX Mat-

ters, the Air Force will need to begin focusing its efforts on a fairly specific design by July of this year to meet the initial operating capability date (IOC) of July 4, 1986. This does not mean that other variants of the design would be ruled out, only that they would take a little longer to field. In the meantime, work is progressing on both the missile and basing to protect the planned IOC.

Another factor affecting a full go-ahead decision on the new ICBMs, according to Secretary Chayes, involves completion of the system's EIS (environmental impact statement) preceded by a decision on precisely where the MX missiles will be deployed. (Public land in Utah and Nevada is the preferred siting at this time.)

The baseline MX system that emerged from studying at least thirty-five different basing modes over the past fifteen years calls, according to Secretary Chayes, for deploying 200 missiles and 4,600 multiple protective structures, or shelters, arranged in a closed-loop pattern. This basing mode is designed to assure that about fifty percent of the MX missiles—each carrying ten MIRVed warheads—can survive the predicted Soviet ICBM threat. According to Secretary Chayes, a force of 6,000 Soviet RVs, each with a yield of about one megaton, is postulated by the "national intelligence community as the most likely [threat] for the mid- to late 1980s. Our estimates of Soviet capability to grow beyond this point are within the built-in resiliency of the design."

Elaborating on this resiliency, USAF Chief of Staff Gen. Lew Allen, Jr., points out that "the MPS basing mode configuration has been expressly designed to permit modifications that would allow us to maintain the desired level of survivability against greatly increased Soviet threats. Our response options include: constructing additional protective structures; deploying additional missiles; increasing the numbers of reentry vehicles carried by the missile; deploying a specially designed, hard-point ballistic missile defense system, or some combination of these measures."

If built up to full capacity, such an MX system, combined with ABM defenses, could survive an attack by 20,000 Soviet RVs. That number far exceeds even "nightmare" assumptions about Soviet capabilities in the foreseeable future to produce near-infinite quantities of warheads and of the scarce special nuclear material (SNM) needed for warheads.

The MX/MPS System

Within the MPS basing mode concept a number of variations are being considered. All variants assure long-term survivability of the land-based ICBM force by providing large numbers of shelters (protective structures) to house a much smaller number of concealed missiles. Principal differences among these variants, according to Secretary Chayes, are the design of the protective structures and the transporter vehicle that moves the missile from shelter to shelter.

The three principal variants of the MX/MPS design are the horizontal dash, the horizontal loading dock, and the vertical shelter.

All MPS designs are based on 4,600 shelters that can be increased in number if the threat exceeds current assumptions. In each approach, 200 MX ICBMs would be deployed in a like number of closed loops, or "grids," each of which contains twenty-three shelters. The sys-

tem also envisions one transporter for each missile.

The MX sites are planned to be on public land. Only about twenty-five square miles of land will be withdrawn from public use. According to Secretary Chayes, "our decision to use the method of 'point security' for each of the protective shelters rather than area security which would have required the withdrawal of large parcels of land, was based primarily on this objective. We plan to withdraw from public use approximately two and a half acres for each shelter. Although the total MX deployment area is expected to be about 7,000 or 8,000 square miles, only twenty-five square miles will be fenced so that access is denied to the public. There will be complete public access around and up to the individual fenced parcels of land on which the shelters are built." The public also will have access to the approximately 10,000 miles of road required by the system.

Of the three MX/MPS variants, the most sophisticated and costly is the horizontal dash. Its principal feature is a computer- or manually controlled TEL (Transporter, Erector, Launcher) vehicle that, at the push of a button, can move from shelter to shelter or from a point on the "grid" to a shelter, in far less time than would elapse between first warning of an impending Soviet ICBM attack and the arrival of the warheads. The cost in FY '80 dollars to build this system is estimated at about \$33.8 billion spread over about ten years, while annual operating costs, in current dollars, would be about \$448 million.

The time required to "reconfigure" the system in crisis situations, that is have the TEL visit all twenty-three shelters on the loop, is about twelve hours. (Since the TEL uses a "shield" and there will be "simulators" that mimic the seismic and infrared emission and other signals that give away the location of the TEL, the Soviets are prevented from knowing which one of the twenty-three shelters houses the MX and which ones are empty.)

To increase confidence in the survivability of the system, according to Secretary Chayes, "the design was modified to provide three additional modes beyond reliance upon concealment of the missile. First, should we suspect the location of the missile has been compromised or should we simply want to negate whatever information on missile location the Soviets might have accumulated, we can readily reconfigure the entire force within a few hours. Second, if our location uncertainty is in severe doubt or if we wish to make a visible response to deep crises, we can put some or all of the missiles and their transporters into constant motion around their respective loops so that they can move to a nearby shelter on tactical warning. Finally, as an alternative to constant motion, some or all of the missiles and transporters could be kept within their shelters, ready to dash upon receipt of tactical warning to any other shelter on their closed loops. This could be done within the flight time of attacking Soviet ICBMs. By adding these mobility features, we deny the Soviets any prospect of executing a successful, selective attack in the highly unlikely case that they could gather information on the location of a significant portion of the MX missiles."

In the horizontal dash variant the missile can be fired from inside the shelter—the TEL can break through the shelter roof—or from outside. One of the problems of the horizontal dash approach, General Hecker points out, is



Of the three MX/MPS deployment modes, the vertical shelter, shown here, is the least expensive, but also the least well adapted to rapid reconfiguration in a crisis, or on tactical warning of an attack.

the difficulty of designing a device that will simulate the mass of the TEL in a shielded transporter that is not carrying an MX. The gross weight of the "mass simulator" would have to be more than 1,000,000 pounds.

The horizontal loading dock variant of MX/MPS is an engineering refinement of the dash design, costs less, and, at this writing, is considered a very promising approach. Rather than an integral TEL, the loading dock concept uses a transporter that moves the missile and its canister from shelter to shelter as needed. The transporter is manned rather than self-propelled and drops off the missile at a shelter instead of entering the shelter as a unit. The benefit of this approach is that both the transporter and the shelter are smaller and less costly than in the case of the horizontal dash configuration. Also the weight and complexity of the mass simulator are reduced and thus it is far easier to build than the horizontal dash version.

The horizontal loading dock envisions launching the missile from the shelter entrance and retains most of the flexibility of the dash design. Under crisis conditions, called the "pregenerated mode," the manned transporters in some of the loops would be constantly in motion, with a number of them actually shunting the MX missile around; others would only carry a mass simulator. In some of the loops the missiles would remain in their shelters. In case of tactical warning, of course, all missiles would be deposited into shelters. On the average, the time required to reach the nearest shelter is seven minutes. The time required to reconfigure the horizontal loading dock design is twelve hours, identical to that of the horizontal dash approach. Key drawback of the loading dock system compared to the dash design is the absence of a shelter-to-shelter dash capability. This feature probably won't be important, however.

Cost of the loading dock design is \$31.6 billion, while

annual operating costs are estimated at \$434 million. The number of personnel required to operate the loading dock variant of MPS is lower, by some 250, than for the horizontal dash approach.

The vertical shelter, the basing mode originally recommended for MX, is the one most deficient in terms of rapid relocation of the system in case of emergencies. Reconfiguration requires about forty-eight hours, and the ability to dash, either between shelters or from points on the road to nearby shelters, is lacking. Cost of the system is roughly equal to the loading dock design, \$31.6 vs. \$31.5 billion, while annual operating costs are about \$13 million lower.

Principal operational concerns over the vertical shelter design stem from the fact that it takes about one hour to lower an MX missile into its shelter. If, from the point of view of the military user, the ability to relocate the system relatively rapidly has value, the vertical system probably is inadequate. On the other hand, if it turns out that an MX/MPS system is not as time-sensitive as assumed by some Pentagon analysts, the somewhat lower acquisition and operating costs of the vertical system would be attractive.

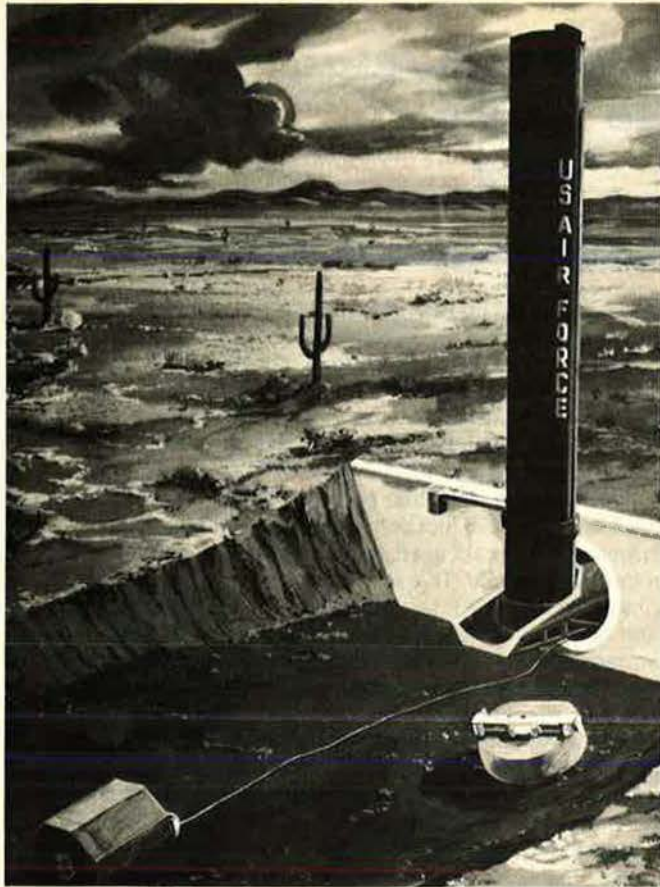
Flexibility Against a Changing Threat

All MX/MPS systems offer the option of "backfill," meaning that in case of greater-than-anticipated growth in Soviet warheads, the number of shelters or "aim-points" that must be targeted by the Soviets can be increased relatively quickly and economically. As Secretary Chayes points out, MX/MPS is flexible enough to meet even the most unlikely "nightmare scenarios. For example, were the Soviets to deploy 2,000 or 3,000 smaller-yield RVs beyond the postulated threat, the system is designed to maintain an adverse exchange ratio without using more land. System spacing—that is, the distance between any two of the original 4,600 shelters—would permit 'backfill' of additional shelters within the same number of loops or grids."

The system's flexibility, she told this writer, "serves more than just enhancing MX survivability should massive buildups in the Soviet threat actually occur. The fact that we have ways to keep the system survivable serves as a powerful deterrent against that very enlargement of Soviet forces. And, of course, in responding to worst-case scenarios, there are ways to increase the size and survivability of the other legs of the triad. But, by assuring that the Soviets do not have an unobstructed path to overwhelm our strategic systems, we demonstrate to them that a spiraling arms race serves them to no avail."

While military planners obviously need to allow for the unthinkable, she points out, the most crucial factor underlying the "selection and refinement of this basing mode is the fact that it does not become a sunk cost if circumstances fluctuate, however drastically. It is the view of the Administration—not only of the Air Force—that of all systems examined, the MX system now under development would be the most resilient under attack and the most inherently adaptable to change in response to the threat."

"Backfilling," General Hecker told AIR FORCE Magazine, makes it possible to double the number of shelters without requiring a significant amount of ad-



ditional land, and no land outside the initial deployment areas. These shelters—at about \$2.2 million each—would be slightly less expensive than the Soviet cost of building and deploying additional warheads.

The size of the proposed MX/MPS force was predicated on the assumption that a major part of the existing Titan II and Minuteman II and III force (either 1,054 silo-based ICBMs, in the case SALT II limits are dropped, or about 800 if the provisions of the as yet unratified accord remain in force) will stay in the inventory. The logic is clear. MX, in effect, transfers its own resistance to attack to the fixed-site component of the land-based ICBM force. Once the potential attacker recognizes that he can't overwhelm one category of ICBMs it makes no sense to attack the other component, even though the latter by itself is vulnerable. From a point of force effectiveness and economics, it pays to capitalize on the silo-based ICBMs' sunk acquisition and low operating costs, since the older systems add to the survivability of MX in "worst-case" scenarios.

Deputy Under Secretary of Defense for Strategic and Space Systems Dr. Seymour Zeiberg calculates that an attack on 800 Minuteman ICBMs would drain off 1,600 highly accurate, high-yield warheads from the Soviet ICBM inventory. Because of the hardness of the silos and the requirement for certainty, "it would take two warheads" per silo, he said. Yet the current rate of Soviet ICBM and warhead production, according to US intelligence estimates, is at "full capacity," and probably could only be increased appreciably by siphoning off resources from other military programs. "I personally think," Dr. Zeiberg stresses that, "it doesn't make much sense to entertain scenarios where they double their



ABOVE: The most sophisticated and expensive of the MXIMPS variants is the horizontal dash. This artist's concept shows one of the twenty-three "dash" version shelters in a grid, with its ports open for inspection.

LEFT: Horizontal loading dock deployment is perhaps the most promising MPS mode. It is somewhat cheaper, and technically simpler than horizontal dash, but still has most of the flexibility of the horizontal dash design.

number of warheads. They have an arsenal that is consuming their total industrial base right now in order to keep up. I cannot imagine their economy or their manpower sustaining further acceleration of their arms buildup."

Invalid Arguments Against MX

One of the reasons why some of the traditional supporters of defense programs in the Congress and elsewhere take a jaundiced view of MX/MPS is the assumption that the system is burdened by design features meant solely to accommodate arms-control concerns, but which at the same time detract from the system's operational performance and drive up cost.

This view is not shared by responsible civilian and military leaders of the Air Force. General Hecker points out that MX was sized and designed independent of SALT limiting the number of Soviet warheads that could be deployed against it. The spacing between shelters, even if there is a need to "backfill," is such that the Soviets won't be able to kill two shelters with one reentry vehicle unless they go to extremely high-yield warheads that would squander the available throw-weight by drastically reducing the number of MIRVs carried by each ICBM.

Secretary Chayes adds that MX/MPS "is definitely not dependent on SALT II coming into effect—or being followed by an equivalent agreement" covering the period when MX will be deployed. (SALT II, if ratified, expires about six months ahead of MX reaching IOC and more than three years ahead of its full operational capability, a fact that did not escape the designers of the system.)

Even if the Soviets were to expand their hard target capability beyond the limits promulgated by SALT II, Secretary Chayes asserts that the baseline MX/MPS sys-

MX Technical, Environmental, and Defense Issues

An interview with Lt. Gen. Kelly H. Burke,
DCS/Research, Development and Acquisition, Hq. USAF

Because of the importance of the topic, the following AIR FORCE Magazine interview with Lt. Gen. Kelly H. Burke, USAF's Deputy Chief of Staff for Research, Development and Acquisition, is presented verbatim, in question and answer form. General Burke has extensive background in strategic, program management, and legislative matters.

Question: There have been many reports that the MX program is running into difficulty both in Congress and in the likely deployment areas of Nevada and Utah. Several senators and congressmen who normally support defense programs are concerned that in accommodating MX to SALT and arms-control objectives, the MX basing design has somehow been fatally flawed. Officials and concerned citizens of Nevada and Utah are worried about the impact of the projected rapid increase in population in a sparsely settled area and about increased water consumption in a region where water is limited. Is MX in real trouble?

Answer: Well, first—these concerns are understandable. But I'm convinced once we've answered the questions fully and accurately—which we will—MX will be accepted and supported by a substantial majority in Congress and in the selected deployment area.

It's certainly not surprising that there would be some confusion and doubt at this point. We briefed Congress and others last year that the Air Force's recommended basing mode was vertical multiple protective structures (MPS). Vertical MPS is the lowest-cost solution and in our judgment we thought it offered adequate survivability through concealment of a relatively small number of missiles in a large number of shelters.

The Administration accepted the Air Force's basic recommendation for MPS but during further reviews added a refinement—horizontal rather than vertical storage. Since it is inherently easier and much quicker to relocate missiles already in the horizontal position, this refinement added a second guarantee of survivability—enhanced mobility, including the ability to dash if necessary.

The key point, though, is that horizontal MPS is essentially the same in design and concept as vertical MPS. Like vertical MPS, its basic means of ensuring survivability is through concealment; like vertical MPS, it retains the important military characteristics of ICBMs; like vertical MPS, it accomplishes this without undue impact on the environment; like vertical MPS, it is compatible not just with the requirements of SALT II, should that come to pass, but, more importantly, with our long-term objective for arms control.

There are only two important differences between horizontal and vertical MPS. Horizontal MPS provides enhanced mobility as a backup to concealment to increase our confidence in survivability; and it costs more. The Air Force agrees that the added confidence is well worth the additional cost.

It is now incumbent on the Air Force to get back to Congress to explain why and how the refinements to our original proposal were made. We need to make it clear that we have high confidence in the current design, both from a military

and a technical point of view. This is not to say the horizontal MPS design can't be further refined and improved. I'm hopeful that our continuing development efforts will allow us to make the system even more effective and to reduce the projected costs. Once we explain the Air Force position to Congress, I believe we will receive support from a substantial majority in both houses.

Nor is it surprising that people in Nevada and Utah are troubled. We have just completed the first phase of the environmental impact assessment to support the selection of a deployment site. This first phase is called the "scoping" phase and its purpose is to determine the relevant issues and how they should be studied during the environmental impact assessment. To do that, we've held a number of meetings in the two states to learn from local residents the areas of concern they think we ought to study. In effect, we were asking at these meetings, "What are the questions?" But not surprisingly, people came to these meetings expecting to hear not questions, but answers, and this created considerable frustration.

Now that we've defined the issues to be studied—and the views of the local residents were very helpful—we are moving out at full speed to develop accurate and complete answers. This will be completed later this year, and we will have another series of meetings to discuss our findings with the local residents. I believe that we will then be able to convince most of them that the problems associated with MX, while consequential, are all manageable and are more than balanced by the advantages offered by MX.

MX will add about 12,000 permanent direct jobs, plus a large number of indirect jobs to the deployment area. The problems associated with integrating these workers and families into the local society and economy is substantial but really no different than would be associated with any other endeavor that would add that number of jobs there.

A key point often overlooked is that the Air Force has an abiding interest in ensuring that changes associated with MX do not produce harmful effects. These 12,000 direct workers, and their families, will be Air Force people, and the last thing we want is to put our people in an unwholesome environment or an area where they would not be welcome. The MX would be valueless if we cannot recruit and retain high-quality people to operate and maintain it.

In the final analysis, I expect MX in the MPS basing mode to move ahead on schedule because it is critically needed to retain—many would say to restore—the strategic balance with the Soviet Union. It is for this reason MX in MPS basing emerged as the country's preferred choice after years of rigorous and agonizing study of all other alternatives. It is for this reason that MX in MPS has been assigned the Air Force's highest priority, and that our recommendations have been endorsed by the Joint Chiefs of Staff, the Secretary of Defense, the National Security Council, and the President.

MX in MPS provides for our nation's most pressing defense needs—preservation of a survivable ICBM force, essential equivalence, and stable deterrence. In that context, I'm confident it will be accepted and supported.

tem "would still provide a significant number of surviving warheads following an attack. For example, the baseline system would provide adequate surviving RVs if the Soviet force dedicated to an attack on MX were doubled. Inherent hardness and spacing of the shelters ensures a certain number would survive due to the expected unreliability and inaccuracy of a portion of the Soviet attacking force. However, if in the absence of SALT limits the level of the Soviet strategic threat increased greatly, all aspects of our strategic and conventional systems should then be reexamined and altered. Should we begin to see a Soviet move toward even greater spending, our defense costs would have to rise further in response."

Congressional critics of the MX/MPS design tend to question the system's survivability against a combined ICBM/SLBM attack. If the Soviets used SLBMs against MX while some of the missiles were in the open, moving between shelters, MX would be vulnerable to these smaller, less accurate SLBM warheads. Because of the SLBM's shorter flight time, there also would be less warning than in the case of an ICBM attack. Dr. Zeiberg doesn't believe that the Soviets "could move a large number of submarines near our coasts without us knowing well in advance, and I mean days or weeks, not minutes or hours." Further, the system is designed—by virtue of the relatively high speed of its transporter (except for the vertical shelter variant)—to dive into the nearest shelter within seven minutes, which is shorter than the time from tactical warning to the arrival of the SLBM's warheads. General Hecker explained: "The minute we see the breakwater of an SLBM launch the signal goes out to MX to seek out a shelter. Some MX missiles wouldn't be on the road to begin with, since we plan to have different missiles do different things at a given time."

The key feature of MX/MPS—and, in the view of many Pentagon and Air Force analysts, its *sine qua non*—is summed up by what the latest defense report calls "preservation of location uncertainty," or PLU. This means covered, periodic movements of the missile within its complex of shelters, continuous motion in crisis, or dash on tactical warning. The Air Force plans to safeguard PLU meticulously. General Hecker argues that "if you believe that the Soviets, over the long term, could break the code [meaning the system's random pattern of missile concealment], the ability to relocate and hide the missiles rapidly is vital from the military point of view." While there is no absolute way for the US to know that the Soviets have broken this code and thus know where all or a major portion of the MX missiles are located at a given time, the fact that the system would be reconfigured periodically and in motion during crisis automatically counteracts whatever advantage the Soviets derive from a temporary breaking of the code. This feature should dissuade the Soviets from mounting a major effort to break the code.

Of course, the fact that the Soviets had broken, or were close to breaking, the code could manifest itself in other ways. For example, the Soviet President for purposes of blackmail "picks up" the Washington-Moscow hotline to inform the US President that the MX missiles are located in the following shelters, and a check reveals that the information is indeed correct. Another cir-

cumstance causing an immediate reconfiguration of the system might be the discovery of covert sensors in the MX deployment areas that beam seismic or other telltale information to Soviet satellites. Or, as General Hecker puts it, "if our own Red/Blue team is continually breaking the code we also would get very nervous" and keep the system in a rapid relocation mode until the problem is fixed.

The Red/Blue teams that the Air Force plans to use to assure the integrity of PLU are being patterned after similar teams used by the Navy to probe for weaknesses in the PLU of its ballistic missile launching subs. These teams will have access to all information that the Soviets might have under reasonable conditions, including data from space-based sensors. Any weakness detected by Red/Blue team experts in various fields of intelligence and technology will be corrected promptly.

Possibly the greatest threat to MX is not the Soviet Union but a small vocal group of scientists on the fringe of strategic weapons design who are promoting pet schemes often of dubious merits. There is concern that the underlying motive is a "technological filibuster" by adherents of the minimum assured deterrence philosophy who seek to block the development of any new strategic system. Among these schemes are deploying a mobile Minuteman force, putting ICBMs on small German-built diesel-powered submarines operating along the Continental Shelf, or deploying MX in the Great Lakes.

In the first instance, the cost of converting the Minuteman force from silo deployment to MPS basing exceeds by fifty percent the cost of building an optimized, larger missile of the MX type. In the second case, the so-called SUM "bottom-crawling-submarine" would not be available until the 1990s and would be highly vulnerable to tidal waves, known as the Van Dorn effect, that could be induced by a Soviet barrage bombing of the Continental Shelf area. This tidal wave in shallow water would crush any sub in its path. Once aware of this phenomenon, the proponents of this approach switched to a "Deep Underwater Missile," or DUM, which would make such a weapon an alternate for the Trident SSBN, rather than for the ICBMs. In case of MX ICBMs deployed in the Great Lakes, barrage bombing, in a similar manner, would rapidly and surely destroy such a force.

As in the case of any proposed weapon system, it is possible to postulate larger-than-life threats to MX that, if valid, would make its development unwise. For example, at a time when neither the US nor the USSR has demonstrated the operational feasibility of laser and other directed energy weapons, aficionados of science fiction credit the Soviets with the ability to use space-based ray guns to shoot down the MX post-boost vehicle before it could release its warheads.

What clearly is needed is for the Congress and the news media to heed the findings of the vast majority of responsible and well-informed scientists and engineers—including the President, the National Security Council, OSD, the Defense Science Board, and USAF's Scientific Advisory Board—who support MX as this country's last hope of countering the Soviet drive toward strategic superiority. Perhaps by the time the 1980 election campaign is over, the program can be cleared for full-scale engineering development of both basing mode and missile design. ■

The Air Force is attacking with imaginative innovations the problem of training superior pilots and navigators in an era of tight budgets, technological turbulence, increased student enrollment, and the urgent need for equipment modernization.



The Northrop T-38, the nation's first supersonic trainer, fills a variety of roles for both the Air Force and NASA.

FLYING training has changed drastically in both systems and philosophy. Some readers may remember the Ryan PT-22 used in primary training during World War II. Others will recall flying the North American AT-6 Texan advanced trainer. Although introduced in 1938, the reliable Texan continued training Air Force pilots until 1956.

Or how about the Beech model 18 light commercial transport? It was used to train thousands of navigators and bombardiers during World War II. The AT-11 version was well-known to the 45,000 bombardiers, and the AT-7 to the 50,000 navigators needed for that war.

Money to support flying training was tight then, as it is now. Gen. H. H. Arnold, in 1938, convinced civilian aviation leaders to build training facilities with no more collateral than his word that money would be forthcoming. Congress did not let him down.

Today, as in the past, a student enrolled in an Air Force undergraduate flying training program must complete an arduous

New Horizons for Flying Training

BY MAJ. GENE E. TOWNSEND, USAF
CONTRIBUTING EDITOR

course lasting many months before being awarded the wings of a pilot or navigator. These months are crammed with twelve-hour days that take their toll not only in time but also in sweat—and national treasure. For example, it costs approximately \$200,000 to train a new pilot and more than \$60,000 for a navigator. With requirements due to increase because of the pilot and navigator retention problem, most would agree that those new silver wings are now, as they were in years gone by, worth more than their weight in gold.

Difficult Challenges

Flying training is beset by increasingly difficult challenges, and its programs are somewhat in a state of flux. A few of the factors underlying this fluid environment include: the need to continually revise training methodology because of the impact of changing technology on weapon systems; increased training costs in an era of austere budgets; pressing requirements to modernize aging aircraft instructional systems; and, as mentioned earlier, larger student enrollment due to the rated retention problem.

The figures stack up this way. For pilots, current approved rates for active-duty students are 1,575 for FY '80 and 1,850 in FY '81, '82, and '83. However, the recent retention problem will probably lead to even higher rates in FY '82 and '83. Current navigator rates are 600 in FY '80; 650 in FY '81; 700 in FY '82; and 750 in FY '83. Again, the retention problem will probably result in higher rates from FY '82 on. In addition, a few hundred Air Force Reserve, Air National Guard, and foreign students will be trained each



year by the Air Force in both programs.

There are some other recently implemented or programmed changes, discussed in more detail below:

- Undergraduate navigator students now get 120 days of common-core subjects instead of everyone completing the same 140-day course. They then get advanced training especially tailored to their initial assignments. Navigator training requirements will probably remain high well into the future since long-term Air Force needs are projected to hold steady throughout the 1990s.

- In undergraduate pilot training (UPT), the bulk of instrument training is now done in simulators. However, even more dramatic changes could be in store for pilot training.

- Plans are under review at Air Force Headquarters, with a final decision soon due, for implementing a new pilot training program called "specialized undergraduate pilot training" (SUPT), and purchasing a "next-generation train-

er"—either a completely new aircraft or a modernized Cessna T-37 with fuel-efficient engines, new instruments, and other updated equipment. These programs would produce a better pilot at a saving of millions of dollars annually. However, time is running out. To ensure that the Air Force can continue meeting its training requirements, both SUPT and the next-generation trainer should be operational by about 1986.

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Additional Challenges

In an exclusive interview with AIR FORCE Magazine, Gen. Bennie L. Davis, Commander of Air Training Command, discussed some additional challenges and initiatives under way for Air Force undergraduate flying training programs. "The very readiness of the force stems from what students ac-

complish in initial flying training. We work directly with the user commands to establish the skill level each graduate must have on completing training to successfully enter and complete advanced weapon system training," he said.

General Davis explained that a significant challenge in more recent times is dealing with the increasing volume of air traffic. "Not only are we trying to fit more sorties into the same space over our training areas, but there is also an ever-increasing volume of civilian aircraft with their own requirements. These competing demands will present a significant management challenge to us as we innovate and expand our curriculum.

"In 1979, we trained only 993 fixed-wing, active-duty Air Force pilots, the fewest since 1949. Both our supervisor and instructor force were pared down to this level. By 1982, our pilot output requirement will nearly double—but our instructor force will not." Making better use of people, eliminating nonessential duties, ensuring a smooth-flowing training schedule,



Gen. Bennie L. Davis, Commander, Air Training Command: "... as long as I continue to have a high-quality instructor force, we will be successful."

coupled with the continued dedication of the instructor force, will carry the Air Force through the shortfall, General Davis observed.

"I am also concerned about the quality-of-life issues that face us and the rest of the Air Force. However, as long as I continue to have a high-quality instructor force, we will be successful," he said.

Undergraduate Pilot Training

Undergraduate pilot training currently provides about 800 hours of flight and academic instruction and lasts forty-nine weeks. It is conducted at five Air Force bases—down from ten at the height of the Vietnam War. These are Williams AFB, Ariz.; Columbus AFB, Miss.; Vance AFB, Okla.; and Laughlin and Reese AFBs, Tex. The program has three main phases—preflight, primary (T-37 training), and basic (T-38 training). Preflight includes a variety of subjects such as safety, ground operations and radio procedures, training philosophy, and orientation to military life.

The T-37 phase emphasizes the basics of flying, along with such academic subjects as map reading and navigation. The aircraft, built by Cessna, is a twinjet trainer, with side-by-side seating for student and instructor. Training, which includes night, instrument, and cross-

country flight, progresses in difficulty, finally moving into aerobatics and formation flying. Students spend a little more than seventy-four hours in the air and about thirty-two hours in the simulator. Training flights last about eighty minutes.

Lt. Col. Carl "Dutch" Hintze, Commander of the 85th Flying Training Squadron, Laughlin AFB, Tex., put it this way. "The T-37 phase provides students with a good foundation. We continually emphasize airmanship—how a student acts and thinks in the air. We teach procedures and we use the building-block approach in our training, putting a student in more and more complicated situations. The program is paced to an average student. However, not average in a general sense. Air Force flying is much more demanding and quite different from civilian flying."

The T-38 Phase

Following T-37 training, students transition to a higher-performance supersonic aircraft, the T-38, built by Northrop. Its rate of climb can exceed 30,000 feet a minute at sea level and it is effective in preparing students to fly more-demanding Air

Force operational aircraft. During this phase, students receive about 100 actual flying hours—about thirty-five on contact missions, seventeen on navigation flights, and forty-four in formation flying. Some thirty-four hours are spent in the instrument flight simulator.

Lt. Col. William F. "Pappy" Flanagan, Commander of the 86th Flying Training Squadron at Laughlin, explained: "The T-38 is a much faster airplane than the T-37. Basically, what we are doing here is teaching a student to fly a new airplane. We continue to cultivate basic skills and try to find out how much each person can do. The bulk of the program is spent on formation flying. Tactical formation flying is probably the hardest thing to teach. It requires that the student have good judgment." He pointed out that there is probably less procedural training in the T-38 phase than in the T-37.

Laced throughout all three phases are several hundred hours of academic and military training. Much of the student's twelve-hour workday is taken up in ground school, studying navigation, flight planning, aircraft accident prevention, principles of flight, instru-



Students at all five UPT bases receive most of their instrument flying training in simulators, such as the one shown above, which duplicate the cockpits of their aircraft counterparts.

ments and other procedures, and in physical training.

Old vs. the New

There have been wide fluctuations in undergraduate pilot training methods and philosophy over the past several decades. Although the UPT course has averaged a year in length, it fell to a minimum of twenty-seven weeks in 1944, then increased to a maximum of fifty-eight weeks between 1946 and 1947. Total flying hours also have varied considerably. Students were given about 200 flying hours during World War II, between 250-285 in the early postwar period, then around 210 until recently. The instrument flight simulator has allowed flying time to be reduced to its present level of about 175 hours.

Aircraft used in training pretty well follow the advances in technology. The propeller-driven T-6, P-51, P-47, B-17, and B-25 were used during the 1940s, with the first jet aircraft—the F-80—introduced in 1949. The T-28 was introduced in 1950 and the T-34 in 1954, the former ultimately replacing the T-6. The T-33 was introduced in 1952. The B-25 was the lone multiengine trainer from 1948 to 1959. The T-37 was brought into the program in 1958, replacing the T-34 and T-28 in primary training. In 1961, the T-38 was introduced into the basic phase, replacing the T-33s, which were finally phased out in 1967.

Over the years, training philosophy also has changed to keep up with changing requirements of Air Training Command's clientele of major commands. In 1959 a generalized training program was adopted. It produced a pilot who could, theoretically, be assigned to fly any aircraft. That concept, still in use, will be changed if the Air Force implements specialized undergraduate pilot training.

In 1972, the Air Force Chief of Staff directed that where practical, training programs would use the instructional systems development concept. This led in 1975 to the "building-block approach" to training where instruction starts at a basic level and builds in complexity, using specific course training standards. "Training first in the cheapest medium" was one main objective of this method.



Above, a student (foreground) and his instructor run through a checklist before taking off on a dual T-37 training flight. The T-37 phase of UPT emphasizes the basics of flying.

Most Significant Innovation

According to General Davis, the most significant training innovation in recent times is the use of instrument flight simulators. Air Training Command identified a requirement for them in 1972 following an analysis that predicted three major advantages: an extension of the useful life of existing trainers, direct and indirect savings, and a reduction in airspace congestion.

"I am amazed at the fidelity and quality that is gained from the simulators," General Davis said. "Although not a cure-all, or an aircraft replacement, they are a quantum improvement in training technology. Their sound and motion cues, visual display, complete instrumentation, and advanced instructional features provide a very realistic flying experience." Early in the planning phase General Davis was dubious, but today he is a strong advocate of the new training devices. "There is no question in my mind that the young pilots we are turning out today understand instrument procedures far better than their predecessors."

Simulator Acquisition

Lt. Col. Jon D. Black, Chief of the Air Training Command's Acquisition Division, outlined the simulator program. He explained that the original concept would have substituted instrument flying in the simulator for instrument flying in an aircraft, except for a validating sor-

tie in the T-37 and T-38. However, following testing and detailed analysis, it was decided to leave a total of three aircraft instrument sorties in both the T-37 and T-38 phases of training. The result: By graduation, today's student gets about 175 hours of aircraft flying time, plus slightly more than sixty-six hours in the simulator. All five pilot training bases are now using the new instrument training devices.

Each base has four complexes—two for the T-37 and two for the T-38. Each complex has four cockpits, which means that a total of sixteen cockpits are normally available for training at any one time. They exactly duplicate the cockpits of their aircraft counterparts. Civilian operators monitor the simulators on television consoles, acting as air traffic or ground controllers and safety observers. They also assist the instructor pilots in establishing flying conditions for each mission such as weather, visibility, and wind speed.

Colonel Black pointed out that although the total costs of the simulator program are large—more than \$135 million for equipment and facilities—because of the cutback in aircraft use, Air Training Command expects to amortize the acquisition costs in about six years. Of course, the rate of payback will accelerate as the cost of fuel continues to rise. Looking at the savings in terms of marginal costs for an hour of training: It costs about \$396 in a T-37,

\$659 in a T-38, and \$90 in a simulator. Assuming an optimum simulator-to-aircraft training hour ratio of approximately two to one, the cost-effectiveness of simulators is readily apparent.

Close-up Examination

Lt. Col. Jerry Twaddell, Chief of the Simulator Branch at Laughlin, showed me the nuts and bolts of his operation and gave me rides in both the T-37 and T-38 simulators. It was impressive. The rides duplicated everything but G-forces—even engine noise and air controller chatter. Although there is only forward visibility (unlike the complete wraparound capability that some other systems have), the ride was extremely realistic. It was like looking into a television scene, then flying off into it.

Colonel Twaddell pointed out that before the simulators were used, the twenty-five instrument training sorties were somewhat repetitious. Now no two rides are alike. A variety of weather and day-night conditions can be programmed at will. However, probably the biggest advantage the simulators offer is training students in emergency procedures. For example, engine failure or overheating, structural damage, electrical failure, and changing weather



Instructors like Capt. Edward Lester, above, not only track student performance in the undergraduate navigator training (UNT) simulator, but also play the roles of pilot and flight controllers. The instructors control computer inputs for simulated navigation training missions.

conditions can be planned in advance. The simulator can even be flown "into the ground." The main difference now—everyone walks away without a scratch.

There is even an instant playback feature, similar to those on home video recorders. This allows for immediate reinforcement of a learning experience.

The television scene is produced by either a large terrain model board with movable optic probe capable of day-dusk-night projection or a dusk

and night-only, computer-generated image system.

Instructor pilots fly all dual simulator missions with their students to ensure realism and vitality of training.

Future Plans for UPT

Air Training Command officials point out three new initiatives that, when implemented, will have far-reaching impact. First, the T-37 is approaching the end of its certified service life and must be replaced. Plans call for buying an aircraft—the next-generation trainer. The aircraft could be a new design, or a modified, reworked T-37. In either case, it will have several improvements over the current model.

The replacement aircraft will be pressurized, powered by fuel-efficient, turbofan engines, have increased range, improved weather capability, and the latest avionics and flight instruments. Studies show that, depending on future fuel costs, the next-generation trainer could save \$43 million a year, with a possible \$8 million additional saved in maintenance. The concept definition phase is now under way, and the decision whether to modernize the T-37 or purchase a new aircraft is expected in early 1981.

A second initiative is specialized undergraduate pilot training. All students now undergo the same training no matter what their follow-on assignments might be. Because of the types of aircraft



Capt. Neal Doten, above, instructs a UNT class on the "wind triangle." Students spend about 120 training days on subjects ranging from airmanship and celestial navigation to physiology and weather. Following classroom instruction, they train in simulators, then in aircraft for hands-on experience.

available, training is necessarily fighter-oriented. However, only about fifty percent of UPT graduates go on to fly fighter or reconnaissance aircraft. The other half are assigned to tankers, transports, or bombers.

Also, the T-38 is relatively expensive to operate. The solution to all these problems, Air Training Command officials believe, is specialized undergraduate pilot training. If adopted by the Air Force, the most significant aspect of SUPT is that it will tailor training to a student's initial assignment by establishing special tracks. Fighter-bound students will receive one type of training and multiengine students another. Simulators will continue to be used in the new program. The draft syllabus calls for a primary and intermediate phase for SUPT.

The primary phase will use the next-generation trainer (T-37 replacement). Students will be taught basic skills that are common to all Air Force flying. However, in the intermediate phase, they will train in one of two tracks—either fighter-attack-reconnaissance or tanker-transport-bomber.

Training in the fighter track will be similar to that now given in the basic phase. Some minor adjustments will be made to improve the transition to advanced training in fighter aircraft. Only future fighter pilots will be trained in the T-38, thus reducing T-38 flying hours almost fifty percent. In addition to significant O&M savings, the



The Air Force provides UNT training for other services and nations. Here a foreign student takes a heading check observation from a T-43.

T-38's useful life will be extended to about the year 2000.

The tanker-transport-bomber track will mark the greatest departure from the current program. Special emphasis will be given to air-drop fundamentals, low-level navigation, radar procedures, crew coordination, airborne rendezvous, and cell formation. Another new trainer will be needed for this track, and studies are under way to determine aircraft requirements. It may be an off-the-shelf multiplace aircraft.

A third program being worked by Air Training Command is Euro-NATO Joint Jet Pilot Training, a NATO-oriented pilot training pro-

gram, to be administered by the Air Force. The objective is to establish a single-base training program capable of producing about 320 pilots annually. Several NATO countries, including the US, will select students and instructor pilots to participate in the program. Most students will be assigned to NATO aircraft following graduation. The course will consist of academic pre-flight, basic, and advanced phases of flying with 260 hours of flight training. It will be a jointly funded, cost-sharing program, and is currently being finalized by a NATO working group.

Navigator Issues

General Davis had a special word for anyone concerned over the future of Air Force navigators. "Last year, the Air Force conducted a study to determine long-range navigator requirements. That study concluded that navigator requirements—about 9,000 plus—will remain essentially unchanged through 1990. In fact, there will be a slight increase in the near-term."

He noted that some say with the advent of single cockpit fighter aircraft and dual and triple inertial navigation sets in larger aircraft the day of the navigator is gone. "That just isn't so," he said. "Certainly, technology advances will precipitate significant changes in the role of the navigator. However, there are solid requirements for them in the future. In fact, as technology advances, the need for quality people



A UPT student and instructor pilot head for their aircraft to begin a training mission. Students get about 175 hours of flying time.

to enter navigator training will be even higher than it is now. I see a solid future for navigators."

General Davis pointed out that as late as 1974, Title 10 prohibited navigators from holding command and some senior staff positions. "Understandably, that contributed to some dissatisfaction, and in my view denied the Air Force a lot of leadership talent. Even when the law was changed, the Air Force was slow to put navigators in command positions. Today, the Air Force has about 117 navigators in flying organizations holding responsible command positions. In Air Training Command alone, we have seventeen navigators assigned to flying units in command positions," he said.

"We have broken the barrier and repealed the law so they can now effectively compete in flying organizations."

Undergraduate Navigator Training

Officials point out that as the complexity of the Air Force's global mission has increased, so has the navigator's role. He not only must ensure that the weapon system gets to the target on time, but also be adept at offensive and defensive combat skills. In July 1976, the Department of Defense consolidated Air Force undergraduate navigator training at Mather AFB, Calif. Mather also provides a variety of support for the navigator programs of the other services.

Navigator training uses the building-block approach, providing students a solid understanding of navigation fundamentals. Classroom instruction covers rudiments of navigation, which students apply first in a simulator, then in an aircraft for hands-on experience. The course lasts approximately twenty-eight weeks with more than 700 hours of academics, flying, military subjects, and physical training.

Simulators are not as new to navigator training as in pilot training. In the early 1970s, the Air Force decided to modernize the equipment and update the program. The obsolete T-29 was replaced with complementary systems that today include the T-43A and T-37 aircraft, and the T45 and other simulators.

The T-43A, an Air Force version of the Boeing 737, is the principal aircraft used in training. It has the latest navigational equipment and communications gear. Each T-43A has twelve student training stations, three instructor positions, and four continuation training stations. Navigation equipment includes Doppler and search radar, LORAN (long-range-navigation), VOR (VHF omnirange), TACAN (tactical air navigation), inertial navigation systems, periscopic sextant, and radar altimeters. The aircraft, introduced into training in 1973, was fully operational in October 1975.

The T-43A and its simulator counterpart, the T45, were purchased as a package. The simulator, which duplicates the T-43's computers, radar controls, and other equipment, also became fully operational in 1975. The thirteen complexes can provide fifty-two student navigators with individual navigation problems and one-on-one instruction through a master computer and thirty-nine minicomputers.

The T45 can simulate flight from ground level to 70,000 feet and speeds up to Mach 2 and can duplicate the operational and mission profiles of all aircraft in the Air Force inventory. Students spend about sixty-four hours in the T45 simulator and sixty-eight hours of actual flight instruction in the T-43A. Another nine hours of flying time is provided in the T-37. In addition, students receive almost 400 hours of academic training in such subjects as airmanship, day-night and celestial navigation, and operational procedures.

New Training Philosophy

Late in 1978, Air Training Command implemented a new philosophy for navigator training. Formerly, students completed a 140-day course, then received their wings. Under the new program, students receive 120 days of instruction in common-core subjects, with follow-on training in advanced tracks specifically tailored to an individual's initial assignment.

• Navigators with assignments to tanker, transport, or bomber aircraft proceed to a twenty-day "advanced-navigation" course for training principally in high-level,

overwater navigation procedures.

• Weapon systems operators destined for fighter, attack, or reconnaissance aircraft attend a twenty-five-day "tactical navigation course." It teaches advanced instrument procedures, aerodynamics, and electronic warfare. Emphasis is placed on low-level navigation, including weapon delivery.

Upon completion of the new program, approximately half of the graduates proceed to their initial aircraft qualification training and the rest remain at Mather for navigator, bombardier, or electronic warfare officer training.

Impact of Initiatives on Quality

Instructors, staff officers, and commanders throughout Air Training Command are unanimous in their conviction that the young men and women graduating from flying training today are as good or better than their predecessors.

General Davis gave several reasons why this is so.

First, the quality of people entering UPT and UNT now is much better than in the past. They are better trained and better prepared academically for flying training than at any time in our history.

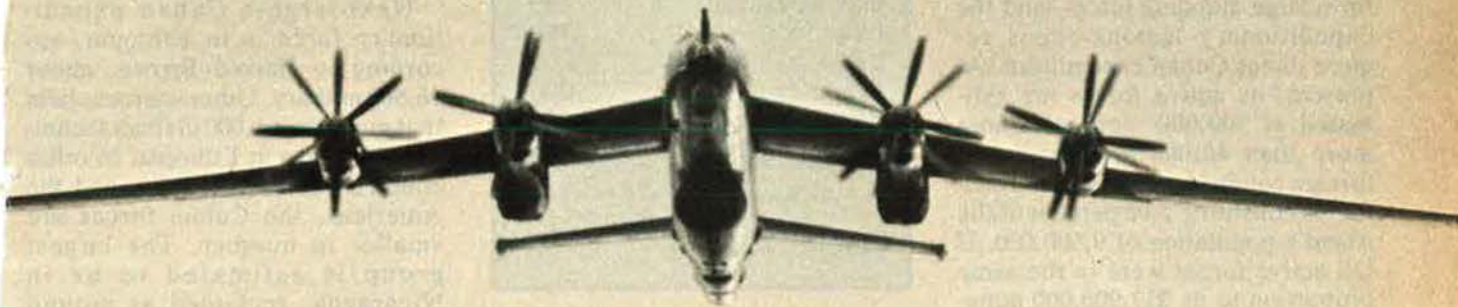
Second, the screening process ensures that high standards are met and maintained throughout training. It has reached a level of sophistication where most training eliminations occur before significant costs are incurred.

Finally, the preparation and grooming of flying instructors provides a dedicated, professional training force. "These men and women are among the best pilots and navigators in the Air Force—hand-picked and thoroughly trained. One of the most convincing proofs is that we have significantly reduced attrition in the advanced phases of flying training. In addition, accident statistics continue to show lower rates for our new graduates in spite of a significant reduction in flying time the past five or six years. In other words, our new pilots and navigators are flying less, in higher-risk training missions, but having fewer accidents. Finally, direct feedback from all major commands reflects favorably on their quality," General Davis said. ■

More than a regional nuisance, Cuba has been built up by the Soviet Union into a modern power with demonstrated military and technical resources and intentions to stride meaningfully across the world stage. The result is a potential for interfering with US interests in many areas that far transcends the threat of a Russian "combat" brigade on the island.

Cuba's Expanding Power Potential

BY F. CLIFTON BERRY, JR., EXECUTIVE EDITOR



Soviet Air Force Tu-95 Bear aircraft regularly stop at Cuban air bases for servicing. This Tu-95's countervailing propellers are clearly depicted, as a US Navy F-4 Phantom moves into formation. (US Navy photo)

THE old recruiting slogan said, "Join the Navy and See the World." In these days of reduced fleets, fewer young Americans can take advantage of that opportunity. But for young Cubans, "seeing the world" is very much a likely prospect. In fact, Cuban expeditionary forces are a reflection of the realities of world power plays in the 1980s. They are but one of the several ways the Cuban nation and its armed forces have become a matter for serious strategic concern.

This brief survey sketches major elements of Cuba's importance to United States actions. Now that the flurry over the Soviet "combat brigade" in Cuba has subsided, a broader assessment of the Soviet-Cuban relationship can be made. At present, Cuba plays several roles, either on its own or in concert with the Soviet Union. It acts as a surrogate for the Russians in countries and regions of instability. It pro-

vides forward bases for the Soviet Union in the Western Hemisphere. It acts as a training base and supply depot for international terrorist organizations, and is a springboard for exporting revolution and instability to other nations of the Western Hemisphere. Finally, by virtue of its location and

modern military strength, Cuba has the potential for choking off US access to important waters in the event of conflict.

Underlying all these roles is the fact of Cuban military strength. The expenditures needed to build up and maintain this modern force have not been generated totally through the

Cuban Population and Armed Forces Trends, 1969-77

(And Military Expenditure Estimates)

	Mil. Ex. (\$ million)	Population (millions)	Armed Forces (thousands)	AF/Pop. (percent)
1969	185	8.4	140	1.67
1971	237	8.6	140	1.63
1973	288	9.0	140	1.56
1975	389	9.3	120	1.29
1977	Not available	9.6	200	2.08

SOURCE: World Military Expenditures and Arms Transfers 1968-1977, US Arms Control and Disarmament Agency, Washington, D. C., October 1979.

labors of the Cuban people or the sickness of its economy. At present, according to President Carter, the Soviet Union pumps more than \$8 million per day into supporting the Cuban economy, or about \$3 billion annually. In addition, the equipment and support for operations and maintenance come in large measure from the Soviet accounts, not directly as Cuban expenditures.

However, the manpower needed for a large standing force—and the expeditionary legions—does require direct Cuban expenditure. At present, its active forces are estimated at 200,000 men, of whom more than 40,000 are serving in foreign countries. The active armed forces constitute 2.08 percent of the island's population of 9,600,000. If US active forces were in the same proportion to its 217,000,000 population, they would be 4,513,600. That is more than twice the actual size of the US active-duty force. In human terms, more than twice the proportion of young Cubans are on active military service than in the US.

Comparing the human burden regionally, only Brazil, with 450,000 men on active service, has larger forces than Cuba. But Brazil's population is 118,000,000, thirteen times larger than Cuba; its armed forces are only 2.25 times as large. Mexico has seven times more people (63,000,000), with armed forces

**Secretary of Defense
Estimates of Cuban Military
Technicians in Africa,
Middle East, and South
Asia, 1978**

Algeria	15
Angola	19,000
Equatorial Guinea	150
Ethiopia	16,500
Guinea	200
Guinea-Bissau	140
Iraq	150
Libya	200
Mozambique	800
South Yemen	1,000
Other	485

Source: Secretary of Defense Harold Brown's Annual Report, Fiscal Year 1981, January 1980. Estimates are for number of persons present for a period of more than one month.

half as large as Cuba's (100,000). Chile has ten percent more people (10,500,000), and armed forces half as large (111,000). So on throughout the Western Hemisphere. So Cuba's armed forces sop up a disproportionately large share of its population, and are available for employment elsewhere in the world.

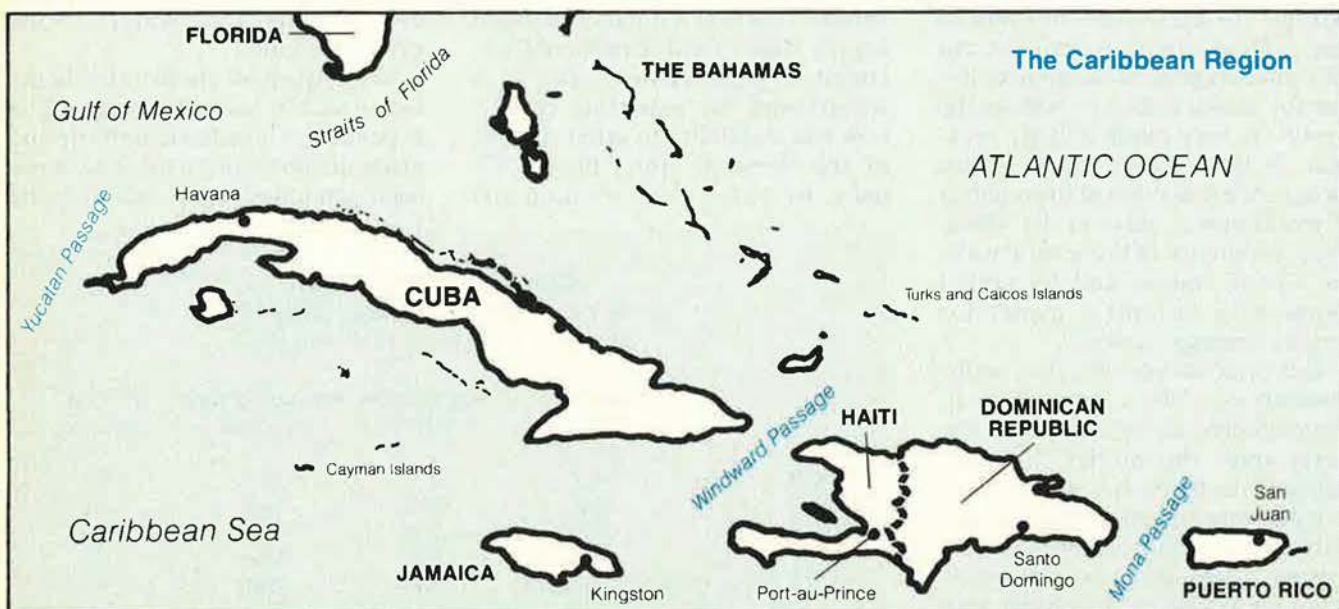
Cubans Serving Abroad

The largest expeditionary force of Cubans is in Angola. Secretary of Defense Harold Brown told Con-

gress in January that 19,000 Cuban military were in Angola. Other sources add between 6,000 and 9,000 civilian technicians to the number in that West African country. Their presence is not totally free to Angola; the *Foreign Report* (of the *Economist* of London) notes that the Angolan government has been paying Cuba about \$98 million per month for the services of those Cubans.

Next-largest Cuban expeditionary force is in Ethiopia, according to Harold Brown, about 16,500 military. Other sources claim that more than 1,000 civilian technicians are also in Ethiopia. In other countries of Africa, Asia, and the Americas, the Cuban forces are smaller in number. The largest group is estimated to be in Nicaragua, reckoned at around 2,000 military and civilian technicians assisting in the Sandinista consolidation of power. Harold Brown listed for Congress several of the countries where Cubans are active; they are shown in the accompanying table.

Secretary Brown says that the Cubans in Ethiopia are joining with the Soviets to supply arms, training, construction services, and advice to Ethiopian forces. He says that in Angola, "the Soviets and Cubans have maintained their support for combat operations against the rival liberation movement of UNITA,"



Cuba's strategic position in relation to these vital chokepoints is clear. It can seal off the Yucatan and Windward Passages with short-range actions. Closing the Mona Passage is riskier. Whether Cuba can dominate the Caribbean approaches to the Panama Canal depends on the Panamanian position and availability of US power.



You can run, but you can't hide . . . troops of an antiaircraft battery scampers for concealment too late, as a low-flying USAF reconnaissance aircraft takes their picture east of the San Cristobal missile site, October 1962. (USAF photo)

which opposes the Soviet-supported Neto regime.

Other sources, such as *Foreign Report*, identify Cuban support of the Polisario guerrillas in the Western Sahara. They claim that the supreme commander of Cuban forces in Ethiopia and South Yemen, Maj. Gen. Ochoa, was transferred to Mauritania last autumn to work with the Polisario forces against King Hassan's Moroccan army in the field.

In all, Cuban military people can be identified as functioning as advisors, technicians, or combat troops in two dozen countries outside the Western Hemisphere. Within the hemisphere, they perform several functions for the Soviet Union, not least of which is serving as a forward base.

The Forward Base

Following the abortive attempt to install medium-range ballistic missiles in Cuba, the Soviet Union kept a fairly low profile in the region while US attention turned elsewhere. Soviet forces dwindled from a high of around 20,000 combat troops to perhaps one-quarter that number. But the USSR continued the steady process of building Cuba into a military power, capable of in-

dependent action in the hemisphere, or serving as a base for Soviet forces if necessary. When, in 1970, the US objected to construction of the Soviet submarine base at Cienfuegos, the Soviets backed off temporarily. But construction continued and the base has since been used to service Soviet submarines on regular visits to it. It is there to provide access, whether Russian subs are based at it or not. Cien-

fuegos and other naval bases also service Soviet surface ships, such as fleet units cruising the Caribbean and electronic intelligence-collection trawlers operating in the Atlantic and Caribbean. The bases can save a long transatlantic voyage, increasing station time.

So also do Cuban airfields provide access to Western Hemisphere airspace for Soviet aircraft. Russian Tu-95 Bear long-range recon-



MiG-17 will soon be phased out of Cuban air force inventory, as more MiG-21 and MiG-23/27 modern aircraft are received from the Soviet Union. This MiG-17 was photographed at Homestead AFB, Fla., in October 1969, flown there by a defecting Cuban pilot. (Wide World Photos)

Estimated Numbers of Cuban Military Aircraft

FIGHTERS

MiG-15	30
MiG-17	25
MiG-19	40
MiG-21	100*
MiG-23/27	20

HELICOPTERS

Mi-1	30
Mi-4	60
Mi-8	6

TRANSPORTS

An-2	50
An-24	5
Il-14	20
An-26	20**

TRAINERS

MiG-15UTI	10
Zlin 326	about 30
MiG-21U	about 10

*Evenly split between fighter/ground attack and interceptor models.
**Some with Cubana.

naissance bombers call regularly at Cuba at one end of their long intelligence-gathering flights along the US East Coast. Also, Cuban air bases have served as stopping points for Russian ferrying flights of combat aircraft, people, and spares to Peru. The stocks of spare parts for Cuban ships and aircraft serve equally well as depots for identical Russian equipment if necessary.

Terrorist Training Base

In his 1980 State of the Union message, President Carter high-

lighted the rapid social and political change in Central America and the Caribbean region. He said, "There is a threat that intervention by Cuba may thwart the desire of the people of the region for progress within a democratic framework. . . ." The US government is working closely with others in the region to aid in the developmental process and we "are prepared to assist those threatened by outside intervention."

Secretary Brown underscored the Administration's concern and intentions, saying: "The Cubans are engaged in a series of military adventures that support Soviet foreign policy objectives as well as their own." Dr. Brown noted that Cuba—and other nations in the region—helped to supply the Sandinistas in Nicaragua with arms and military supplies. Looking further ahead, "Castro, probably with the support of the Soviet Union, may seek to undermine further the stability of the Caribbean and Central America." He said that the US and its allies are "expanding our military presence" and helping states in the region to meet legitimate security needs.

Against international terrorism, however, the conventional "security needs" are often counterproductive. And Castro has long been a supporter of terrorist groups. Secretary Brown cited support of the Sandinistas, which included training, liaison, and financing in addition to arms and supplies. Reliable observers of transnational ter-

rorism claim that Cuba has assisted in training Palestinian guerrillas, and the Polisario in Western Sahara, already cited. The *Foreign Report*, a usually authoritative source, says that Cuba also has entered into a new agreement with the Baader-Meinhof gang of Germany, Italy's Red Brigades, and Japan's Red Army group. According to *Foreign Report*, Havana will be headquarters for a large-scale coordinated "terrorist international." This squares with observations by US government and private experts on transnational terrorism who have been warning of such a step.

Besides training terrorists, providing intelligence, and being a conduit for terrorist financing, Cuba serves as a depot for weapons and other military supplies that can be exported as required to "revolutionary" organizations within the Western Hemisphere. According to Washington sources, a Cuban diplomat told a group of foreign-policy professionals in Washington that his country will send aid to guerrilla movements in El Salvador, Guatemala, and Honduras, as it had done in Nicaragua. Other observers add Grenada to that list, noting that Cuban military advisors are training troops which the government of neighboring Trinidad and Tobago fears may be used against it.

Potential for Choking Sea Routes

The final strategic concern to be mentioned in this survey is Cuba's ability to close or deny access to narrow maritime routes that are vital to US interests. Cuba's power to close the Windward and Yucatan Passages at its east and west ends could dry up ocean traffic from the Panama Canal, northern South America, and Caribbean countries destined for Gulf and East Coast ports. With Soviet help—and support or noninterference from other countries in the region—it could interfere with commercial and naval traffic through the Panama Canal and the Mona Passage.

The US Coast Guard and Navy could fight back, of course, if not committed elsewhere in the world. Their foes: Cuban missile patrol boats of the *Osa* and *Komar* class, now numbering more than two dozen, according to *Jane's Fight-*



MiG-23 Flogger variable-geometry fighter in Cuban inventory created a flurry in the US when its presence surfaced publicly, because the aircraft can be nuclear-capable. The Carter Administration chooses to believe that the MiG-23/27s in Cuba are not wired for nuclear weapons. (DoD photo)



ing Ships and Defense Intelligence Agency's *Unclassified Communist Naval Orders of Battle*. Armed with the radar-homing twenty-three-nautical-mile-range Styx missile, they have the potential for inflicting serious damage on scores of naval vessels or merchant ships. They are now buttressed by two modern diesel-powered Foxtrot attack submarines capable of launching twenty-two conventional torpedoes each, plus an obsolete Whiskey-

class training submarine. (The latter is reported in very sorry shape, so leaky that it is unlikely to venture to sea, and limited to a training role alongside the pier.)

Several conclusions emerge from this survey. They underscore the fact that Cuba in 1980 is more than a regional power with the ability to affect US interests in our own backyard. It is also a player on the world stage, whose actions abroad serve not only its own immediate interests

but those of the Soviet Union and lend support to Castro's aspirations for long-term leadership of the Third World. US politicians and policymakers should not be mesmerized by revelations about single Soviet units in Cuba, or who failed to do anything about them, and when. Instead, their concern should be with Cuba's rising capabilities to interfere with the US and its allies in many locations, and its obvious intentions to do so. ■



US naval base at Guantánamo Bay, Cuba, October 1979. At the piers are Navy frigates (from left to right) USS Paul (FF-1080), USS McCandless (FF-1084), and USS Vreeland (FF-1068). The ships participated with others in amphibious landing maneuvers in October, bringing to reality the statement by President Carter on October 1 that "we will expand military maneuvers in the region." (US Navy photo)

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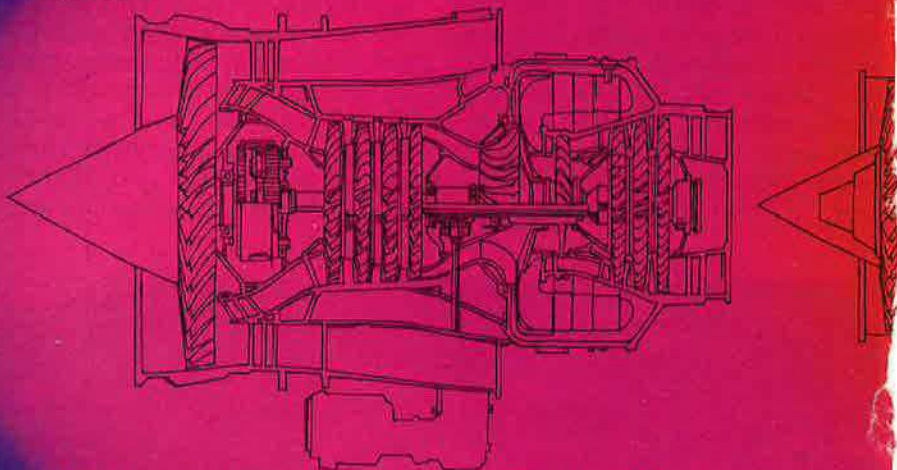
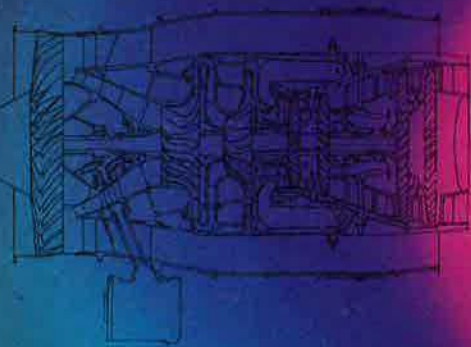
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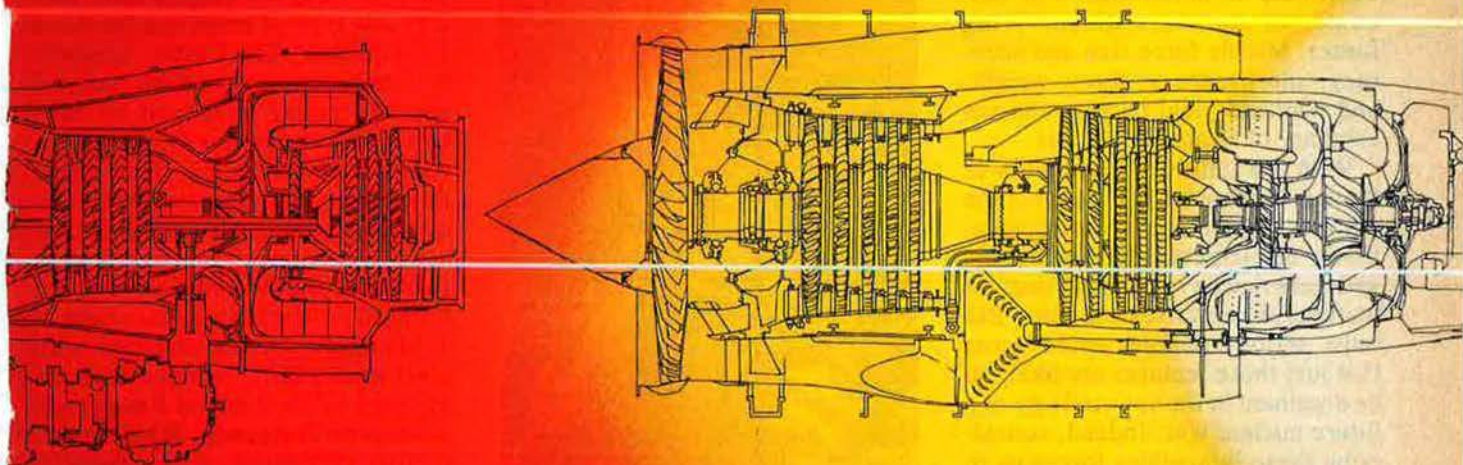
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Traditionally, planning for nuclear conflict has been concentrated on the requirements of a short war. Now the focus is beginning to shift to problems of protracted crises and the military/political environment following limited strategic or theater nuclear use. Affected are training, logistics, personnel, intelligence, and above all . . .

Command and Control for a Long War

BY PAUL BRACKEN

MOST parochial analyses of nuclear war posit an image of a one- or two-strike campaign lasting only a few hours. In this view, attention is naturally drawn to strategic force characteristics that contribute to deterrence, war outcome, or numbers of surviving forces. Missile force size and accuracy, silo hardness, throw-weight, and warhead yield become the vocabulary of strategic analysis.

With this static description of war there is little or no discussion of the motives, information, communications, implementation, mistakes, and fears that have been the singular features of past crises and wars. But most serious people would agree that just these features are likely to be dominant in the *how* and *why* of a future nuclear war. Indeed, considering these intangibles forces us to think through the process of central war from initiation to termination—something rarely done and probably impossible with the vocabulary of parochial analysis. This may explain the common tendency of considering strategic conflict between the United States and the Soviet Union as an affair of very short duration, even if it were controlled in intensity or targeting limitation.

By advancing beyond the restrictive vocabulary of parochial analysis, it seems possible, even likely, that a long crisis or war may be the prototype of central war. Barring a bolt-from-the-blue surprise attack, there is very likely going to be a long period of acutely worsening relations, minor and major provocations, and hostile military actions prior to a nuclear showdown. This



US command and control systems will have to be capable of managing military and political operations on an immense scale for weeks or months at a time, in contrast to the more limited requirements of a short war.

could include a sequence of minor acts that culminate in some crisis involving Soviet military force, which would demand American response.

According to current American nuclear weapons employment policy, this type of crisis can be taken even further. The Carter Administration recently issued its national security policy statement on telecommunications needs, Presidential Directive/NSC-53. This directive states that the nation's telecommunications must provide "responsive support for operational control of the Armed Forces, even during a protracted nuclear attack." It also calls for coordination with civil emergency communications systems by the Federal Emergency Management Agency. What this directive recognizes is the requirement for integrated and enduring command and control that spans military forces, civil defenses, intelligence activities, and diplomacy. In short, massive one- and two-strike nuclear campaigns divorced from political and civil-defense activities will no longer be the sole determinants for shaping command and control.

Furthermore, the very notion of limited or selective nuclear options is premised on the possibility of terminating nuclear conflict short of massive salvaging. As these options have been officially incorporated into American operational nuclear doctrine by former Secretary of Defense James Schlesinger, it behooves planners to consider what happens following a limited nuclear attack. It is at just this point that political leaders will face the mo-

ment of truth. The slogans and shibboleths of decades past may be scrapped in a moment by the political shock of nuclear war, causing a nuclear deescalation or stalemate of one sort or another.

For example, a Red Army partial advance into Western Europe could be met by a NATO battlefield nuclear response that employed a few tens of weapons. Following Soviet reprisal attacks, a threat of mutual devastation might lead both sides to accept some kind of temporary armistice, or at least a nuclear cease-fire. Regardless of details, one thing seems certain. It would be impossible to return to a peacetime *status quo ante*. With thousands of unused nuclear weapons remaining in American and Soviet arsenals, the foundations of world geopolitics would have undergone an irreversible transformation. Even if no nuclear weapons had been used, the effect on world order of such a prolonged crisis would surely invalidate past thinking about nuclear diplomacy, and even the likelihood of ultimate survival.

Prolonged nuclear crises of this sort can usefully be considered as wartime situations. With the quick striking power embodied in modern strategic armaments, it is difficult to imagine any other alternative. Such crises may be analogous to the period of "phony war" that followed the invasion of Poland in 1939 and preceded the German invasion of France and the Low Countries in 1940. There, a technical state of war existed. Both the Axis and Allies built up their forces as fast as possible and maintained wartime alert postures. Limited fighting took place along the borders, but both sides searched for an alternative to all-out war.

A prolonged nuclear crisis that might include the use of battlefield or limited nuclear options is likely to exercise its greatest strains on strategic command and control. Because of the intensity of the crisis, American nuclear forces might have to operate in super-alert conditions from a few weeks to perhaps many months. If nuclear weapons had actually been used and some kind of cease-fire agreed upon, the following period is unlikely to see our strategic forces return to routine peacetime conditions.

On the contrary, American strategic forces will probably be called upon to monitor and enforce the cease-fire, while guarding against enemy surprise attacks. This means operation of Strategic Air Command (SAC) missiles and bombers along with ballistic missile submarines at very high alert conditions for months on end. The command and control demands for

"... a prolonged crisis would surely invalidate past thinking about nuclear diplomacy, and even the likelihood of ultimate survival."

this process will not be limited to delivering authenticated emergency war orders in timely fashion, but will also include politically directed maneuvers, threats, and coercive actions. This marks a radically different criterion by which to judge command and control system adequacy.

Usually a worst-case test for command and control consists in its ability to survive a large nuclear attack. But here, a very different requirement is being placed on command and control—the ability to implement political direction of strategic forces for prolonged periods under stressful conditions short of massive attack. From the perspective of American political leaders, it might well be the case that command and control of nuclear forces would be aimed at war avoidance rather than prosecution. It could involve exploiting the entire American strategic system in a controlled manner to prevent dangerous enemy actions, protect allies, and cover attacks on the homeland.

The particular crisis that required initiating a prolonged alert could come about from Soviet action in an area where American conventional forces were weak, or from the escalation of some local confrontation to another geographic area. During the past thirty years, there have been many occasions where the potential for direct Soviet-American military hostilities has been large. The Cuban missile crisis, the 1973 Yom

Kippur War, and the recent invasion of Afghanistan are all examples of superpower interactions that contain the seeds of potential escalation.

Although the exact moves in a crisis are difficult to foresee, a very likely possibility is a Soviet intent to demonstrate seriousness about the level of danger being faced. A distinct possibility is Soviet reinforcement of its garrisons in Eastern Europe. Suppose a major crisis evolved in the Middle East. It would be a useful educational exercise for American political leaders to ask themselves what their response would be if the Soviets moved fifty divisions from western Russia into Eastern Europe. A slow-motion reinforcement might take many weeks, and indeed the Soviet Union itself might not want to surge such a force to forward positions for fear of triggering a completely uncontrollable situation. The United States would be under enormous pressure to respond with caution, but it would clearly be essential to honor its NATO commitment.

Strategic Reeducation

American political leaders might well undergo more strategic education in such a period than during the entire postwar era. And military commanders might have many unusual constraints placed on their actions. SAC bombers would likely be ordered to implement airborne alert procedures for what could turn out to be months in duration. Launch control crews would be under great stress because of canceled leaves and double and triple shifts. Fleet ballistic missile submarines would be flushed from port and placed on station for periods lasting well beyond their normal sixty-day crew rotations. In this kind of extreme crisis, national opinion would almost surely support the President. It is even likely that a mobilization of America's defense potential would be undertaken to bolster strategic striking power while investing in substantial civil-defense programs.

This kind of super-alert strategic posture would demonstrate American nerve. It would also be used to maneuver a favorable termination to the extended crisis. But to accomplish this goal the US alert must



In a prolonged nuclear crisis, US strategic forces might have to operate under super-alert conditions for very long periods, placing a tremendous strain on aircrews, support people, facilities, and communications.

be more enduring than a competitive Soviet alert. The Red Army could probably maintain a reinforced striking posture in Eastern Europe for a considerable time. Three, four, six, and even ten months could conceivably go by with tremendous demands placed on SAC and the US Navy, as well as on their Soviet counterparts. Which nation would break first under the strain?

Major urban evacuation might be ordered in the Soviet Union. In this event a similar evacuation would probably be ordered in the United States, if it did not take place spontaneously. Civil-defense actions of this type deserve special attention because there is really no turning back after wholesale urban evacuation. The economic and social disruption would almost surely cause a turning point in the crisis, whether it be by some settlement, or a nuclear strike on the offensive forces of the other side. But even here lies a question of endurance, for once evacuation was undertaken, how long could each nation operate with empty cities?

Most of the recent studies of Soviet and American civil defense have looked only into the time needed to protect a sheltered population from nuclear fallout after an

attack—typically on the order of two to three weeks. In thinking through an extended crisis, an equally relevant question is how long each nation could stay evacuated before actual conflict started. The first side to deevacuate might undergo a potentially crippling negotiating disadvantage because of the super-alert posture of its opponent's strategic forces.

The command and control aspects of a prolonged crisis pose their greatest problems in the centralized management of operations on an immense scale. Detailed real-time assurances from the military to the President on relative vulnerabilities, operating patterns, and indications of endurance breakdown would be required for successful political control and negotiations. Immediate warning of enemy evacuation would seem mandatory, as would information on the condition of an urban evacuated nation.

If a conventional or limited nuclear war had started, then demands on strategic command and control would be that much greater. En-

forcing and monitoring any cease-fire would be a primary goal for command and control, as this could be achieved only by continued alert operation of the surviving missiles, bombers, and submarines. Rapid shifts of military power to different world areas might be demanded to offset threatening Soviet maneuvers.

After a few nuclear weapons are used, an enormous credibility will be attached to nuclear diplomacy. Behavior that today is considered bizarre or outrageous will no longer be so "unthinkable." One thus might find attempts to coerce or blackmail nonnuclear nations into submission by shifts of military power to their borders. This could be for the purpose of aiding post-attack recovery or simply to acquire a coveted geographic position, such as proximity to major oil fields or transportation routes. American strategic forces must be capable of operating successfully in this environment, even if both weapons and command and control had been degraded by earlier limited nuclear attacks. In any case, an unprepared

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government will have poor prospects of resisting the threats and maneuvers of a prepared government.

Soviet-American Asymmetries

The requirements for operating throughout a very long period of intense crisis, perhaps following some form of limited nuclear attack, put stressful new demands on strategic forces. For one- and two-strike wars with massive arsenal salvos, some combination of redundancy, hardening, and mobility are needed in command and control, along with the ability to get out an emergency war order.

In a prolonged crisis the intensity of violence could be considerably lower, but forces would have to be maintained for months rather than hours. Each nation might be under great pressure to keep as many fleet ballistic submarines (SSBNs) on station as possible. Submarines in port would be lucrative targets that could tip the balance of power if destroyed. A strong US advantage may thus lie in the American practice of keeping substantial numbers of missile submarines at sea. It is typically reported that about fifty percent of American SSBNs are at sea in peacetime, compared to only about fifteen percent of Soviet ballistic missile submarines.

Although both submarine forces could be surged from ports during a crisis, the US Navy's experience with longer-duration operations at sea would indicate a markedly greater endurance than the Soviet force. Furthermore, although general Soviet naval exercises have grown considerably in scale and complexity over the last decade, major difficulties caused by equipment breakdowns and at-sea replenishment problems still seem to plague their ability to operate task forces for long periods at sea.

A more subtle asymmetry involves the fields of electronic warfare, spoofing, technical intelligence collection and fusion, and electronic countermeasures. When strategic forces are postured for one- and two-strike spasm responses, it is unlikely that operational patterns can be observed by an enemy for purposes of detecting and exploiting vulnerabilities. Peacetime practices and exercises

CRISIS CIVIL DEFENSE—A US EDGE?

A months-long crisis with super-alert strategic forces would necessarily involve the threat or use of nuclear weapons. Whether in a tactical nuclear war in Europe or by limited nuclear options against homelands, the role of emergency civil-defense measures becomes extremely important. Urban evacuation will be an omnipresent political-military option throughout such a crisis. Used in the context of a prolonged national emergency, it is important not only for saving lives, but as an option that will itself influence the length and character of the crisis. Following a Soviet-initiated evacuation, or a war in Europe, both nations might have to be operated with evacuated cities.

Many people would give an edge to the Soviet Union on this score because of its greater investment in, and preparation for, civil defense. This might be an unjustified conclusion. For the kind of crises discussed here a considerable element of unpredictability must be recognized. Neither side could be assured of a time and place of its own choosing. For this reason, it is necessary to consider several civil-defense asymmetries.

The Soviet Union is at a marked geographic disadvantage when it comes to implementing unscripted civil-defense plans. It is useful to recall that her major southern warm-water port, Odessa, is at about the same latitude as Duluth, Minn. Most of the urban Soviet Union lies well north of this latitude. Winter is a notoriously bitter period there, and Soviet leaders might have to confront the option of sending a hundred million citizens into the long Russian winter. Judged by historical standards, their prospects would be nasty and short. Here is a case where "General Winter" would favor the West.

Directly relevant to geographic asymmetry is the fact that during the 1970s the United States has undergone one of the most massive industrial dispersions in history. This was a program not ordered by any civil defense or federal agency in Washington, and its execution was independent of any centralized policy or study. It was known as the Sunbelt shift, and it continues today. Millions of Americans are moving to warmer climates in the southern United States and this can only facilitate crisis evacuation capability because of the more benign climate.

During the 1970s, Sunbelt industrial employment has undergone a major shift away from easily targeted urban areas to dispersion in the suburbs. On the other hand, indications point to a growing concentration of Soviet industry at the microscopic level as centralized planners there attempt to achieve ever-growing economies of scale. This is especially apparent for the new industrial complexes in Siberia and the Far Eastern provinces.

A final asymmetry in crisis civil-defense capability lies in the transportation structures of each nation. The Soviet Union has only a tiny fraction of the passenger cars available in the United States. Fewer than 250,000 miles of highway are paved, compared to nearly 2,000,000 in the US. Soviet roads are nearly impassable in winter, as well as during the spring thaw and fall rainy seasons. In these circumstances, it could be catastrophic to attempt prolonged urban evacuation as a demonstration of crisis resolve.

Civil-defense asymmetries favoring the United States will be useless if they are not realized and appreciated. On this point the Soviet Union appears to have a major advantage, for civil defense is a legitimate topic of concern there. Crisis evacuation as a result of a prolonged national emergency is especially important because it could well be forced on the United States. Unless greater American attention is devoted to civil defense, Soviet actions could offset many of the benefits purchased by our strategic forces.

can be observed and analyzed, but they generally are very different from watching "the real thing." In a long crisis, however, it may be possible to observe enemy operational patterns under very realistic conditions. Knowledge is power. Significant vulnerabilities might be uncovered, and the enduring nature of the crisis might be exploited to build up useful knowledge if hostilities started or renewed.

Each side would fear deception—that any indication of a lull in the crisis might be a prelude to a carefully studied attack of large proportions. Quite probably this would force commanders to change

operating procedures frequently in order to confuse enemy observers. This tactic is certainly not new to SAC; throughout the '50s and early '60s operational procedures for bombers often were mixed and alternated in order to keep the Soviets guessing about our true intent. Flexibility of this kind is intrinsic and unique to a manned bomber penetrating force and bespeaks its great worth for handling such a wide range of crises.

Strategic force survivability and endurance are today much more dependent on timely analysis of early warning signals, communications intelligence, and information



About fifteen percent of Soviet ballistic missile submarines such as this Yankee-class SSBN are at sea in peacetime, compared to fifty percent of their US counterparts. The US also keeps its SSBNs at sea for much longer periods and hence, in this respect, would be better prepared for a long-duration crisis.

processing than at the time of the Cuban missile crisis. A prolonged future crisis might see extensive jamming and spoofing in order to elicit enemy operational patterns or to wear down the endurance of an alert force. Although American prowess in electronics, computers, information processing, and the like are recognized, major Soviet developments are constantly taking place. Furthermore, much of America's ability is in planned or prototype systems, rather than actually deployed hardware and software.

A final asymmetry deals with what is probably the most neglected and important aspect of the entire strategic equation: the people who operate the forces. The tremendous stresses of prolonged nuclear alert under wartime conditions will place extraordinary demands on the people of SAC and the naval fleets operating missile submarines. This is where previous training, preparation, and forethought will be put to the ultimate test. People are very much a part of command and control, and the personnel who operate the US triad will be matched against their Soviet counterparts.

Budgetary scrimping on realistic combat training will be exposed, with potentially disastrous consequences for national security. The historical emphasis placed on realistic training by SAC and the US

Navy could go a long way toward bolstering national security in a prolonged crisis—but this can happen only if training budgets are maintained and expanded where needed.

Some Command and Control Implications

Survival following massive attack and endurance during a lower-intensity protracted crisis may produce both different, and usual, operating needs. For example, rethinking the defense readiness condition (DEFCON) system may be useful in full preparation for long wars. The present DEFCON system for alerting American military forces appears to be oriented to large-scale surprise attacks. A modified DEFCON system might well be needed if prolonged operation in a super-alert posture is considered important. Some combination of high DEFCON alert conditions is required, with the need to maintain this operational mode for periods lasting well beyond that usually imagined. A revised system might include civil-defense information and would itself be a recognition of the coordination demanded by a long national emergency.

Another command and control requirement for operating in a long crisis is the need to communicate with submarines without endan-

gering their survival. This, of course, reinforces the case for prompt deployment of an extremely low frequency (ELF) transmission system. During such a crisis the last thing desired is to operate the fleet ballistic submarines near the ocean surface in order to communicate with them. This is a case where prolonged enemy observation of operating procedures in order to exploit vulnerability is not only possible, but likely. The ELF system circumvents this difficulty by making it possible to communicate with deeply submerged submarines. It has many other desirable features as well. However, currently proposed ELF candidate systems are all soft and easily targeted in even a small nuclear exchange. Although backup systems to land-based VLF and ELF systems exist, reconsidering a super-hardened ELF (SHELF) system may be in order. If a prolonged emergency following a limited nuclear attack is taken as a serious possibility, then it is best to say so outright. For these scenarios a SHELF system has a great deal to offer in terms of survivable reliability and the ability to communicate with strategic forces around the world.

The special demands placed on command and control systems by a protracted nuclear crisis must be overlaid on a core system capable of retaliating after even the most massive strategic attacks. These twin considerations are the minimum standards for command system design. Traditionally, concern has centered on short violent nuclear campaigns of the one- and two-strike variety. But a new realization of the need for an enduring control system is now emerging—a system whose capabilities can be assessed over months rather than hours.

This new recognition must be extended to training, logistics, and doctrine if it is to achieve the goals set by recent high-level political directives. And, most important, these diverse elements must be synthesized in the context of goals that overlap with civil defense, intelligence, and political direction of America's strategic forces. Only with full coordination of all elements of national security policy can a true nuclear deterrent be maintained. ■

Air Force Logistics Command is doing its best to stretch dangerously thin reserves of equipment and supplies through imaginative use of computers, management, substitution, and rapid transport.

The Languishing Link in Combat Readiness

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

IT IS a fair assumption that Soviet planners read the Department of Defense Annual Report, a document obligingly placed on sale by the Government Printing Office. Those planners, then, will not have overlooked the Secretary of Defense's admission that our logistic support for combat readiness is in need of attention as well as a lot of money.

It is an old story, of course, and one that is hardly worth repeating in ordinary times. The trouble is these are not ordinary times. If we have serious intentions about taking a stand in Southwest Asia and the Persian Gulf, or anywhere else for that matter, then we had better look to our logistics. Even a casual look can be disquieting.

Take fuel, for instance. The Air Force is the principal consumer of petroleum in the Defense Department and thus the largest single user in the nation. In the early seventies, before the Yom Kippur War, the oil embargo, and OPEC price fixing, the Air Force used 150,000,000 barrels of oil a year. It is now planning its operations around a consumption of 95,000,000 barrels, another way of saying flying hours have been cut approximately in half since the days of cheap and plentiful oil. And because storage of petroleum was never a very urgent consideration in those good old days, the fuel stocks on hand are approaching the minimum war reserve level. While there are vast reserves of oil trapped in Rocky Mountain shale, there is, as yet, no serious effort under way to get at this resource, although there has been, at Air Force urging, a beginning.

The supply of oil is just one of the problems facing the Air Force Logistics Command as it attempts to make up shortages with computer technology, skillful management, and high-speed transport. To a remarkable extent the effort is successful, but only because the demands on the system are peacetime demands and, as we have noted, greatly reduced demands at that.

One of the comfortable myths of this bountiful land of ours is that technology, industrial efficiency, and good old American ingenuity will get us out of any bind. Franklin Roosevelt's impossible demand for 50,000 airplanes a year was achieved in a great burst of patriotic activity, together with, it is fair to add, a minimum of government intrusion into the production process. As a result, our Air Force became almost extravagantly equipped. Airplanes, in 1944, were often discarded as war-weary when all they needed was a little fixing, like the legendary Texan whose Cadillac's ashtrays were full. Why bother when it is so easy to get a new one?

Those days are gone forever. There is no hot production line turning out airplanes, engines, or anything else at what could be called, even with the wildest exaggeration, a mass rate. Nor is there any prospect of that happening in any circumstance short of a national emergency and a consequent reordering of our priorities. Unless matters reach that stage, long-lead-time items, made even longer by competition with the commercial aircraft industry for such scarce capabilities as heavy presses and forges, effectively put a lid on rapid expansion of military aircraft production.

Our only ready source of replacement airplanes is the boneyard at Davis-Monthan AFB, where sophisticated storage techniques and Arizona's generally dry climate preserve

airplanes extraordinarily well. That same boneyard is also an important source of parts in the Logistics Command's continuing struggle to keep old birds flying.

This business of logistics has always been a frustrating one and never, perhaps, more so than now. There are some wonderful new munitions coming along, just down the road a few years. They are part of the reason there are now munitions shortages, for if trouble will wait until the new good stuff is ready, then it is better to hold off. The problem is, who knows whether trouble will wait? And now, even if the decision is to delay no longer, it will take a few years to build up the stocks of munitions, spare parts, and everything else needed for true combat readiness.

Meanwhile, the people in the Log Command are not just sitting around feeling sorry for themselves. They recognize the fact that any war we get involved in will find us going with what we have. The Aircraft Battle Damage Repair Program—there is, happily, no acronym—is a new and imaginative effort to make what we have look like more than we have by cutting down the time it takes to get a wounded airplane back in action. Fast battle damage repair teams are being trained against the day the bullets fly.

Repairing damaged airplanes quickly is the modern version of aircraft replacement. That, along with the best possible inventory management, will have to serve as our answer to superior numbers. ■

After years of meeting its "people needs" handily, the Air Force is now faced with declining enlistments and reenlistments. The crunch is serious, and so are the Hq. USAF actions in response.

Fine-Tuning Enlisted Incentives

BY ED GATES, CONTRIBUTING EDITOR
CARTOONS BY JACK TIPPIT

BEHIND-the-scenes action on several difficult enlisted manpower problems is increasing at Air Force Headquarters. Favorable policy changes, affecting various groups within the 460,000-member airman/NCO force, are being laid on with regularity. More are in the works.

Together with an apparent new awareness by Congress and the Administration that compensation and benefits must be improved, and soon, the prospects for a better life in uniform have also improved.

Actual and expected internal USAF changes impact sharply on promotions, compensation, assignments, tenure, retraining, and related enlisted personnel projects. They aim to increase job satisfaction, thereby improving recruiting, retention, and readiness.

All of these changes fit into TOPCAP, the overall personnel blueprint that guides the management of the airman force. TOPCAP, barely tampered with during its first nine years, is being looked at thor-

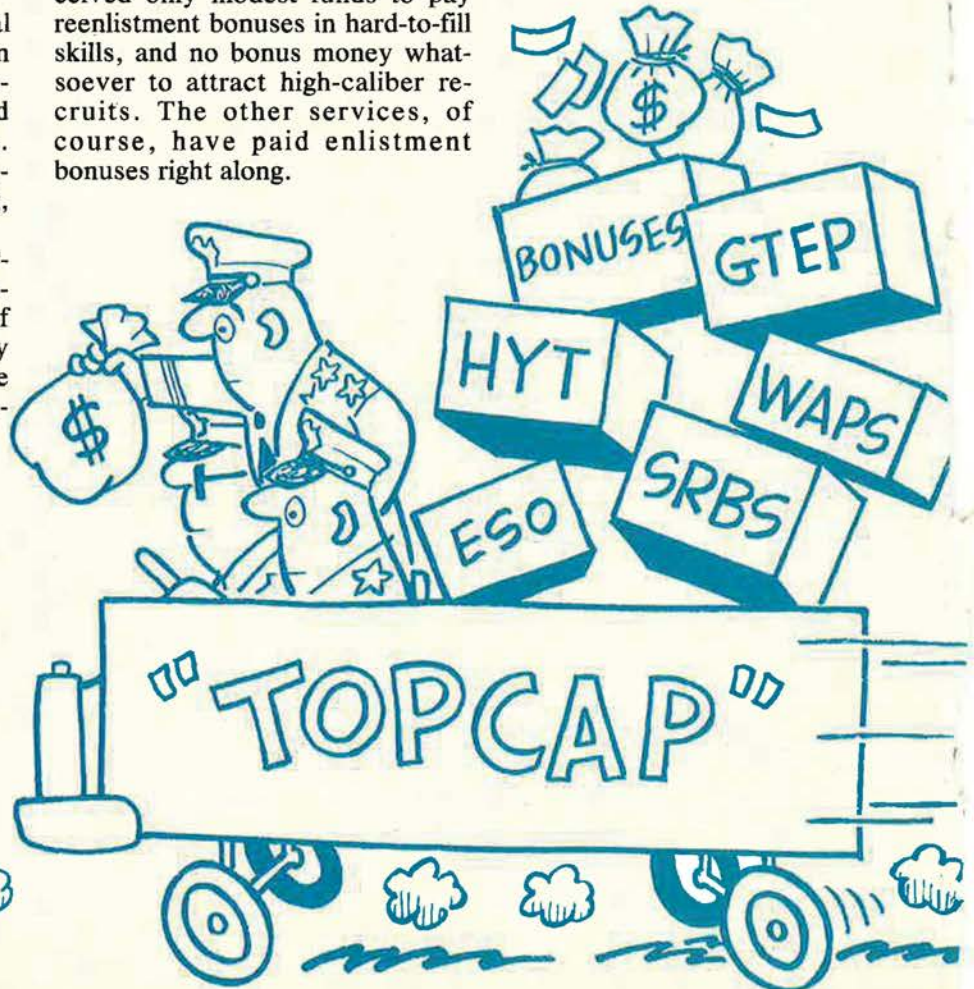
oughly, and important alterations may be made.

The most significant, from the viewpoint of a typical member, is the bonus action. With straight pay increases lagging behind the rise in living costs, many quarters are counting on enlistment and reenlistment bonuses to dig the services at least partway out of their manning doldrums. That's because lump-sum bonuses are "up front" money with real pulling power.

The Air Force has for years received only modest funds to pay reenlistment bonuses in hard-to-fill skills, and no bonus money whatsoever to attract high-caliber recruits. The other services, of course, have paid enlistment bonuses right along.

The Air Force's problem is that it met recruiting quotas handily year after year, while the other services did not. Similarly with reenlistments, USAF outperformed the others. So the government applied a helping of grease to the squeaking wheels—the Army, Navy, and Marine Corps. In FY '78, for example, the Army spent more than \$50 million in re-up bonuses, double the Air Force allocation.

But times change. The Air Force, now suffering disturbing retention and recruiting woes, needs large infusions of bonus money payable to recruits as well as to selected reenlistees. After overcoming initial Defense Department resistance, the Air Force recently won DoD and Administration approval to pay \$1,000 to \$2,000 bonuses to enlistees in a few critical skills. About 1,900 are expected to begin collecting later this year if the congressional appropriations committees do not object. For FY '81, which



"TOPCAP [is] the overall personnel blueprint that guides the management of the airman force."

begins next October, the Pentagon budget contains more than \$3 million in USAF first-enlistment bonus money. Though a slim sum, it's a breakthrough nonetheless. As one Air Staffer puts it, "It's a foot in the door."

The initial skills eligible for an enlistment bonus, all combat-related and tough to fill, are radio communication analysis, voice processor-linguist, and air traffic controller.

Undoubtedly, much larger doses of first enlistment bonus money must surface in succeeding years if the Air Force is to compete in a dwindling manpower pool with the other services and the civilian sector. The Army has numerous attractions to throw at potential recruits in the combat arms. Besides bonuses, it offers extra post-service education money. The Navy recently began offering \$1,500 enlistment bonuses to four-year recruits who complete training in eleven shorthanded skills.

More and Larger SRBs

So, the competition for new manpower is intensifying, and the President's recent call for draft registration is not seen nudging very many youths in the direction of recruiting offices. The Air Force is hurting particularly among members who have completed a hitch or two. Its second-term reenlistment rate nose-dived last year, to sixty percent; as recently as 1972 the figure was seventy-eight percent.

The service, accordingly, is pouring in more re-up bonus money for Selected Reenlistment Bonuses (SRBs), as the Air Force calls them. Just three years ago the Air Force paid out less than \$1 million in second-term SRB funds. This year the figure should hit \$8 million. USAF's total SRB budget this year has risen to \$37 million, and the FY '81 projection is nearly \$48 million. DoD-wide, SRB outlays will be fifty percent higher in FY '81 than now, according to Richard Danzig, the Principal Deputy Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics.

USAF currently pays an SRB to about 4,000 NCOs in nearly 100 different skills, in jobs ranging from computer operator to missile warning repairman to flight en-

gineer. SRB recipients are expected to number 5,000 later this year.

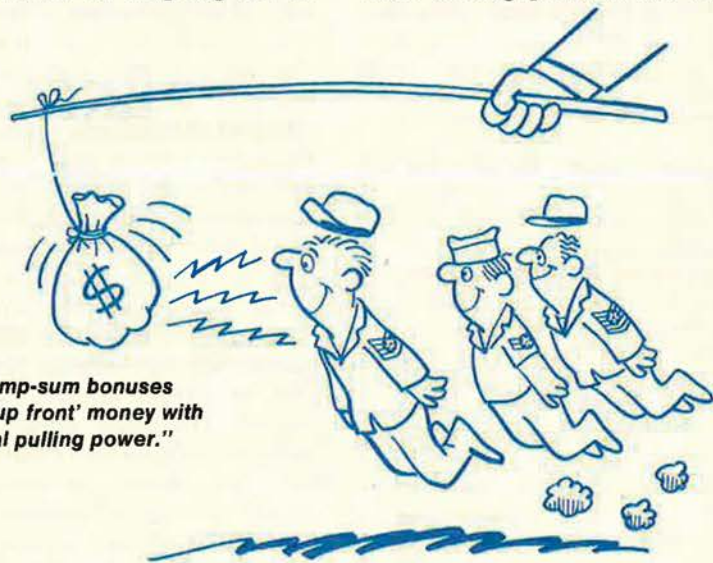
Among skills in trouble from slumping second-term reenlistments are processing specialist, safety specialist, air traffic controller, and integrated avionics specialties. "Not so long ago," a Hq. USAF expert in enlisted accessions told AIR FORCE Magazine, "once a guy made his first reenlistment he was almost a cinch to stay a full career. No more. Many, though they have nine or ten years of service, are in big demand outside, where the pay and benefits are outstanding. We have to fight to keep them. . . ."

The SRB ceiling is \$15,000, but only a few Navy nuclear people draw that amount. The maximum that USAF members may receive is \$12,000, though the average payment is \$5,000 to \$6,000. That's not bad; it's an attractive incentive to dangle in front of a fully trained specialist who is weighing the fu-

The bonus overhaul package, in addition, would raise the previously mentioned first-enlistment bonus ceiling from \$2,000 to \$3,000.

Meanwhile, the Senate early this year, as part of a broad pay-benefits bill, approved SRBs for enlisted people in the critical ten-to-fourteen years' service bracket. This measure, however, does not raise the \$15,000 SRB maximum (\$12,000 for USAF members) or extend the bonus law beyond September 30, 1980, its current expiration date. Air Force wants the authority extended permanently, and there is some expectation that the House will soon crank in these improvements.

Besides the bonus action, the Senate-approved measure would lay on a variable housing allowance, boost PCS and TDY mileage rates, increase flying pay, and make other improvements (see "The Bulletin Board"). Some quarters see the surprise Senate action as a favorable turning point in the military



ture. Still, today's monetary realities clearly dictate that larger bonuses will be essential in the near future.

The Pentagon, accordingly, has put together a legislative package boosting the SRB payment lid to \$20,000 and raising the years of service during which a member can receive a bonus from the present ten to fourteen. The ten-to-fourteen span "is a critical decision point," according to Headquarters authorities. They see the change paying dividends in retaining experience and expertise and reduced replacement training costs.

community's battle to win pay-benefits concessions and arrest the deteriorating manpower situation.

Refining the WAPS

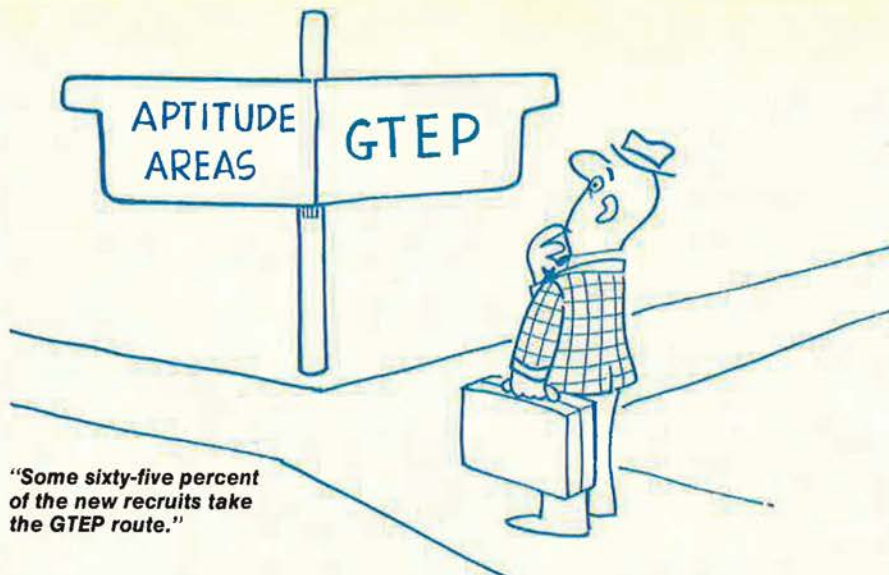
Coming under close Hq. USAF scrutiny is the enlisted promotion program, known officially as the Weighted Airman Promotion System (WAPS). It has been in operation, as a key element in the TOP-CAP structure, since the early 1970s. Authorities report that although changes are pending, a major overhaul of WAPS is not in the cards.

"It has worked well," one per-

sonnel expert said of the WAPS. He recalled that in the late 1960s a House Armed Services subcommittee, bombarded with horror stories of service members enduring ten, twelve, and even more years in grade, jumped all over the services. Come up with an equitable system that lets people know where they stand, the lawmakers declared.

USAF's response was the WAPS project with points awarded for test scores, performance reports, and time in service. Total points accumulated determine a member's standing within his skill. "WAPS is objective, quantifiable, and visible," officials said recently in reaffirming their support.

The basic trouble was that promotions were dispensed mainly to fill skill vacancies. Many skills had very few vacancies, the result being a high level of promotion stagnation in many fields. For example, in the 1971 promotion program 3,473 aircraft mechanics vied for E-8, but only 135, or four percent, were chosen. That's all the vacancies there were. Yet in skills with substantial



vacancies, up to twenty-eight percent of the competitors were promoted.

Then in 1972 the Air Force began distributing promotion quotas under the Equal Selection Opportunity (ESO) principle. Thus, within the airman force in grades E-5 through E-9 there were no "good" or "best" promotion skills; they are all equal. Advancement chances are the same percentage-wise regardless of the skill held. The competition is strictly within each specialty, and USAF expects to keep it that way.

As it worked out when first applied in 1972, some 3,680 aircraft mechanics were eligible for E-8 and 589, or sixteen percent, were promoted. The angry letters to Congress from frustrated mechanics fell off. The change, of course, also meant reduced promotions in skills that previously had more vacancies.

Refinements rather than major overhauling are more the order of the day in airmen/NCO promotions. Headquarters, for example, recently decided that NCOs seeking redress from errors in their records when they were considered for E-8 or E-9 can receive reconsideration by supplemental boards. This should speed the process considerably, because heretofore such requests automatically went to the Air Force Board for the Correction of Military Records, an extremely slow procedure.

Another recent refinement will speed up the promotion notification process by cutting red tape in han-

dling promotion lists. A change under study would allow commanders to promote certain members they consider outstanding, even if the individuals lack the WAPS points normally required.

New and Improved Incentives

An incentive recently adopted gives airman first class (E-3) stripes to brand-new recruits who have at least a year and a half of college credits. With slightly fewer credit hours, newcomers may qualify for enlistment as E-2s, one stripe higher than normal entry. Similar lures were first offered some Civil Air Patrol and high school JROTC cadet graduates early last year. Authorities are pleased with the cadets' response and their apparent determination to remain in uniform. The stay-in rate during their first year of service is fifty percent higher than recruits in general, officials said.

A strong incentive no other service offers is the chance to work in-house for associate and applied science degrees that the Community College of the Air Force can grant.

A new program just under way offers NCOs in shortage skills additional years of active duty beyond their normal retirement time. Air Force calls this the "high year of tenure extensions" (HYT). Under TOPCAP's original guidelines, the HYT is the last year of service and an airman is permitted to remain on active duty in his current grade. Thus, members who had not risen

Cross-training Vacancies

Filling job vacancies with qualified volunteers is basic Air Force policy, and hardly a day goes by without the service beating the bushes for applicants.

In late January and early February, Hq. USAF—via messages, news releases, and other publicity—went looking for airmen to volunteer for training leading to assignments such as B-52 aerial gunners, airborne telecommunications systems operators, technical training instructors, military training instructors, recruiters, student training advisors, first sergeants, C-135 and VC-137 flight engineers, ATC nonresident career development course writers, Minuteman missile facility managers, noninvestigative staffers with the Office of Special Investigations, and space systems command and control specialists. Some of the posts carry extra pay or bonuses, such as flight pay for the aerial gunners and reenlistment bonuses for the space systems specialists.

Commissions for NCOs?

Should veteran Air Force noncoms enjoy "upward mobility" opportunities? That's the chance to advance beyond chief master sergeant (E-9).

This oft-studied and frequently explosive issue that evokes heated debate pro and con is getting a new look by the Air Staff. The service has numerous commissioning routes open to young, promising, but inexperienced college students and degree-holding airmen. However, the commission door normally remains closed to long-service NCOs. The other services, however, move some of their veteran enlisted people to warrant officer and commissioned grades with regularity.

So there is grumbling in senior enlisted circles about USAF's negative position. One prominent Air Staffer, who frequently meets with NCO groups and enlisted workshops, acknowledged that "the first question they throw at me is what is Headquarters doing about giving us a shot at a commission? It's difficult to answer," he said.

Second lieutenant's bars, of course, are not what NCOs with fourteen or sixteen years of service have in mind. A captaincy is more like it, they contend, for prestige and monetary considerations.

There are many pros and cons over the "advance-to-officer-status" controversy. Though the topic is under Hq. USAF review, officials have pretty much ruled out any resurrection of the Air Force warrant officer corps, which, after twenty-one years in the "phase-out" stage, is finally dormant. "We looked at the warrant matter thoroughly last year and did not change our position," one source said. "I don't see WOs returning," he added.

above E-3 at the four-year service point or beyond E-4 at the eight-year terminal were to be separated involuntarily.

An E-5 HYT is twenty years; he must retire then. Similarly, an E-6 must retire at the twenty-third year of service, an E-7 at twenty-six, an E-8 at twenty-eight, and an E-9 at thirty years. These rules were established almost a decade ago when retention was excellent and USAF was being told to reduce overall strength. The emphasis was on trimming the force, not building it up as is the case today.

The force-out provision for E-3s and E-4s was never implemented,



"If the projects . . . don't produce, one thing is certain: The architects at Hq. USAF will rework them, or come up with new ones, or both."

the Air Force vowing to withhold it until the government approved enlisted severance pay. Yet, despite declarations from throughout the military establishment and Congress that enlisted severance pay is necessary and important, it remains nonexistent. Early prospects for action are negative.

Several years ago, selected E-9s were allowed to serve three extra years, putting their HYT at thirty-three. Several dozen are chosen annually and elect to stay on, thus increasing service experience. Now, in view of the drop in NCO retention, E-5s through E-8s in shortage skills are being offered two-year extensions beyond their normal HYT. Those who accept the extensions should enjoy a fair crack at the promotions they have missed so far.

Headquarters has sparked a variety of related enlisted programs, all targeted to provide a payoff in the manpower department. Youths can now join the Air Force and receive "guaranteed training," retraining, a base-of-choice option, an early assignment to a foreign country, and can select from among several advanced grade recruiting options.

All new recruits now get two basic choices. They can enlist in the administrative, general, mechanical, or electronic aptitude areas. Or they can become a GTEP (Guaranteed Training Enlistment Program)

enlistee. They are guaranteed classification, training, and initial assignment into one of 140 specific specialties. But if for some reason the selected job falls through, they can elect another specialty or separate immediately. Some sixty-five percent of the new recruits take the GTEP route, authorities said.

In another development, Hq. USAF is taking a "new look" at the sensitive issue of offering commissions to veteran NCOs (see accompanying box).

Other recent enlisted management initiatives now in operation include expanded six-year enlisted options; easing several prior-service entrance requirements to help secure a 500-person increase; approval of voluntary active-duty service extensions of up to twenty-three months for personal reasons; a reduction in the number of airmen allowed to leave early to participate in the Reserve Forces; a curb on voluntary separations for miscellaneous reasons; and an expanded voluntary Reserve recall program. Such actions, authorities believe, should result in retention or recruitment of 100 to 1,000 persons. **Every one counts.**

If the projects cited in this report don't produce, one thing is certain: The architects at Hq. USAF will rework them, or come up with new ones, or both. They are in no mood to default on the exasperating enlisted manning dilemma. ■

Giving Thanks . . .

Many of the initiatives reported in this article were developed or closely monitored and massaged by a group of personnel specialists in the office of Lt. Gen. A. P. Iosue, the Hq. USAF Deputy Chief of Staff for Manpower and Personnel. These specialists work closely with the Director of the Plans Division, Col. Donald C. Metz. The group includes Lt. Col. Douglas Patterson (accessions), Maj. Jack Leonhardt (bonuses), Maj. D. L. Philbrick (retraining), Maj. Joann Neish (promotions), Maj. Al Duerbig (TOPCAP), CMSgt. Bill Hazelton (EM force management), and Richard Kisling, a retired former Chief Master Sergeant of the Air Force who is a civilian employee in the Plans Division.

DMA—The Cruise Mi

A S

The Defense Mapping Agency (DMA) is a joint organization that supports a wide range of government and civil activities. A technical revolution in the science and art of cartography has helped create automated navigation techniques that make the cruise missile a potent addition to the US strategic deterrent.

SEVERAL highly visible elements in the development of any major weapon system—cost, capability, contracts—are likely to focus public attention on the Department of Defense and the responsible military program office. Behind the scenes there are always a number of supporting organizations that are more or less silent partners in the development process.

One such silent partner that is vital to the success of the cruise missile program is the Defense Mapping Agency (DMA), a joint organization created in 1972 to provide mapping, charting, and geodetic (MC&G) support to the military services, NASA, other federal agencies, the US Merchant Marine, civil aviation, and allied governments.

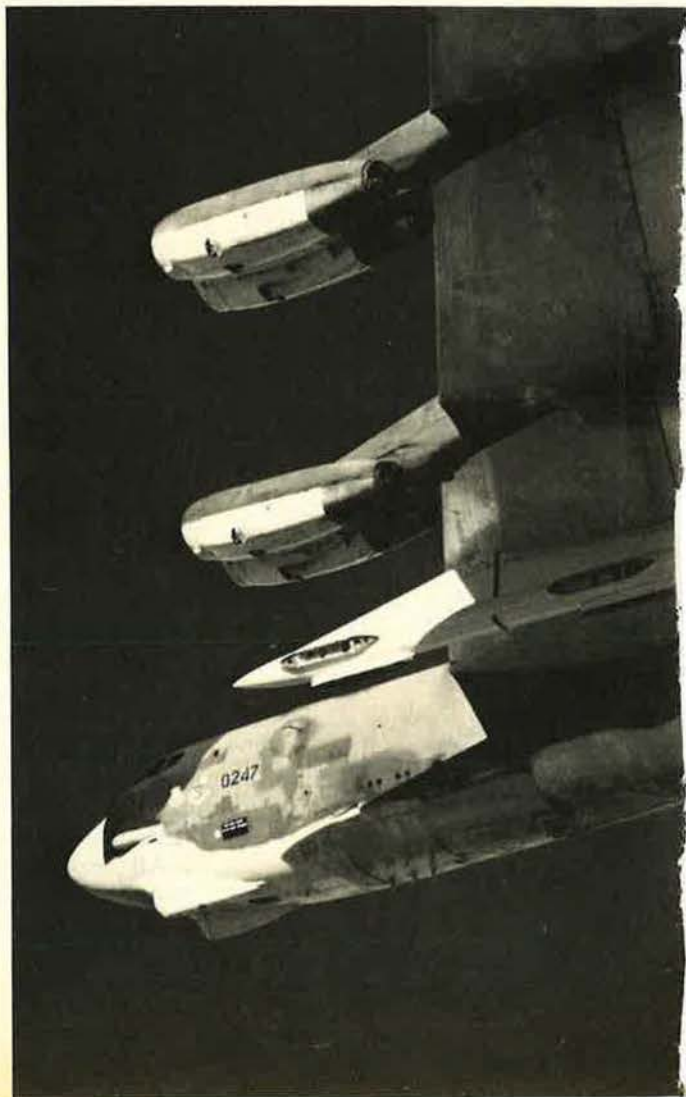
One of the cruise missile variants, the air-launched cruise missile (ALCM) is to be carried by the B-52G and will be a key element of the strategic triad's bomber leg. It will be capable of extending target coverage and diluting increasingly sophisticated Soviet defenses against penetrating bombers. Initially the ALCM will be carried externally, with the B-52 retaining its current internal load of gravity bombs and short-range attack missiles (SRAM). In the mid-1980s, the B-52G force will be armed either with twenty ALCMs or a weapons mix.

Like manned aircraft, ICBMs, or space vehicles, the ALCM and its ground- and sea-launched cousins need MC&G products for mission planning and operations—products supplied only by DMA and generally developed concurrently with the missile itself. These supporting products are not the conventional printed charts or punch cards familiar to aircrews and launch control officers, but rather digital data required by the mission planners and the missile's guidance system.

The ALCM and other cruise missile versions fly at varied altitudes on a preplanned evasive flight path, often just above treetop level for hundreds of miles. The missile's inertial guidance system uses steering information from an onboard computer, which must be updated periodically to keep the missile on course. Supplying the required digital data is one of DMA's newer and most demanding missions. This data falls into three categories: Terrain Contour Matching (TERCOM) "maps," Digital Terrain Elevation Data (DTED), and Vertical Obstruction Data (VOD). Much of the information from which the data is derived is collected by satellite-borne devices.

The most critical category of DMA support for the cruise missile program is TERCOM data used to correct navigation errors resulting from the missile's launch position and its own inertial system. At predetermined points along its flight path, the missile compares its radar altimeter readings to its known height above sea level to compute the profile of the terrain below. This "sensed profile" is compared with a digital map of the surrounding area provided by DMA. Locating itself within the map, the missile computer determines its true position, velocity, and heading and makes course corrections. Repeating this process several times, the missile navigates to the target with great accuracy.

For more than five years, DMA has been working on TERCOM with the weapon developers. Two technologies are involved: digitized photographic measurement techniques for generating ground elevation data, and digital computer technology, which has increased the speed and flexibility of computers while reducing their size. Together these two give the cruise



Missile's Silent Partner

ORT

missile the ability to rapidly compute flight-path corrections.

Producing the terrain elevation values for TERCOM maps is only one part of the DMA process. When the missile compares its sensed profile to the map, there must be one—and only one—place it will match. Large-scale topographic maps are examined to identify unique terrain features in TERCOM areas that have been selected by the missile users. For example, one point along the crest of a cliff would produce the same altimeter readings as any other point, and therefore is not unique.

The elevations of the candidate terrain are then digitized in a symmetrical grid, or matrix, and the most likely areas selected for TERCOM updates. When this is completed, DMA uses a computer program to confirm that no profile in a map can be confused with any other profile within that map.

After passing these tests, the map is given to the mission planner, who must go through an intricate process,

using the mission planning capability of the Joint Cruise Missile Project Office, in laying out the missile's flight path. The route must cross areas covered by TERCOM maps to ensure navigation accuracy. It must also take advantage of terrain masking to avoid known defenses, and ensure that the missile is programmed to fly above or around abrupt changes in terrain elevation.

The second category of support for cruise missiles—terrain data covering vast areas—is available only from DMA. This Digital Terrain Elevation Data (DTED) was developed in the early 1970s under the Digital Landmass System (DLMS) program to provide terrain representations for manned aircraft simulators.

Finally, DMA provides Vertical Obstruction Data (VOD). During low-level portions of its flight to a defended target, the cruise missile may fly below the elevation of some structures. The navigation system must be programmed to avoid them and at the same time follow a flight path low enough to escape detection by enemy radar while maneuvering to avoid antimissile defenses.

The DMA Structure

As a silent partner in cruise missile development, the Defense Mapping Agency is one of the few Department of Defense entities that has increased its manpower in highly technical areas during recent years.

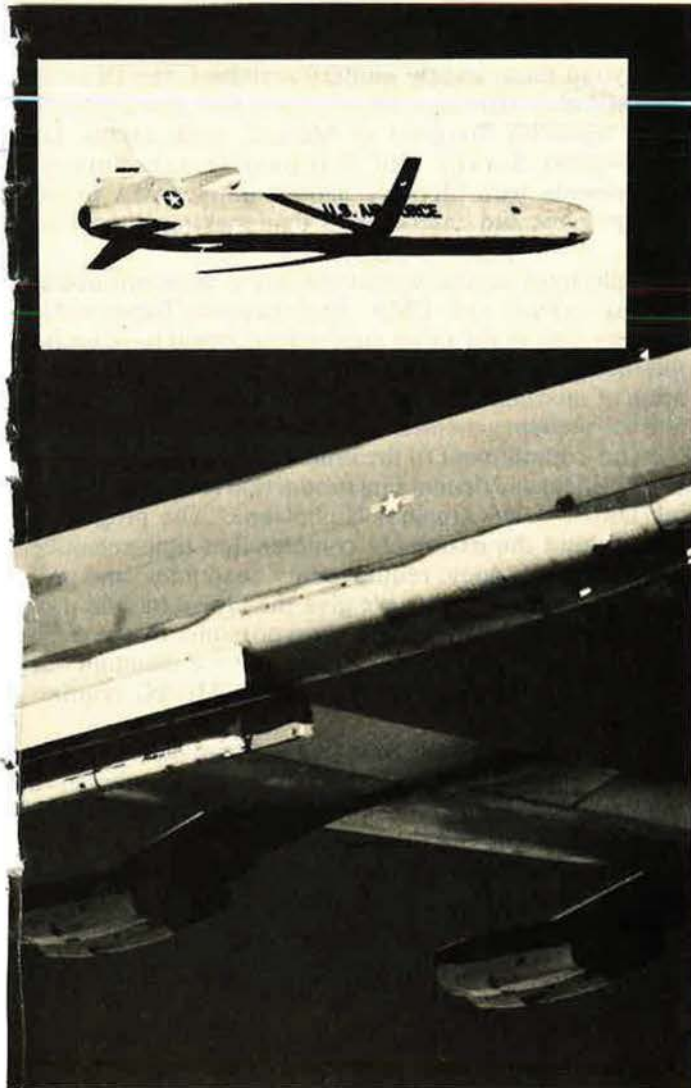
The Director of DMA, Air Force Maj. Gen. William Nicholson III, reports to the Secretary of Defense through the Under Secretary for Research and Engineering and the Deputy Under Secretary for Policy Review. DMA's directorship rotates among the services on a three-year cycle, as does the position of deputy director, currently held by Rear Adm. Edward A. Wilkinson, Jr., USN. The DMA Project Officer for the cruise missile program is Lt. Col. Ray Hibbs, Jr., USAF.

The Director runs an agency of 8,300 people in some forty locations around the world, and is also program manager and coordinator of all DoD mapping, charting, and geodetic resources and activities, such as the Naval Oceanographic Office in Bay St. Louis, Miss. DMA is budgeted at about \$300 million annually and has a capital investment in facilities and equipment of \$260 million.

DMA's most important customers are the Joint Strategic Target Planning Staff and the Strategic Air Command. Currently, the Agency is giving top priority in support of the cruise missile program.

Besides the essentiality of DMA data in getting the cruise missile to its target, other critical information supplied by the Agency involves launch region gravity data and target coordinates at termination of the flight.

A General Dynamics-developed air-launched cruise missile leaves the bomb bay of a B-52 during a test flight. It and the Boeing ALCM (inset) involved in the competitive fly-off both use terrain guidance data supplied by the Defense Mapping Agency.



For the bomber force, DMA provides aeronautical charts for en route navigation as well as air target charts for the final approach. These charts contain precise location coordinates for updating inertial navigation systems as well as targets data. Included are radar-significant features to enable aircrews to predict what will appear on their radarscopes.

DMA-supplied data is also used in simulators to provide SAC crews with realistic training in radar navigation. Such simulation techniques are not restricted to SAC but are in use or in the planning stage for tactical and airlift forces as well.

Where the Air Force and Army may have to work in tandem, DMA's Joint Operation Graphics come into play. Two distinct sets of maps of the same area are prepared, one for aircrews and one for ground operations. The two sets of maps contain a command grid and enough other common information to make joint operations possible. DMA also supplies ground forces with digitized terrain elevation data to enable ground unit radars to locate and target the source of incoming mortar and artillery fire.

For the Navy, DMA support includes Fleet Ballistic Missile/Antisubmarine Warfare Charts, electronic navigation charts, nautical, and port and harbor charts. Nautical navigation and port and harbor charts produced by DMA are also important to the nation's merchant marine.

In the past, DMA charts of the moon guided astronauts on the Apollo lunar landing missions. For the future, charts are being especially prepared for Space Shuttle program use.

DMA's Varied Components

In servicing its varied clientele, DMA maintains 66,000 line items in its catalog, and in any given year it prints 100,000,000 copies of maps and charts.

The Agency has two production centers. The first of them, the DMA Aerospace Center (DMAAC) in St. Louis, Mo., has most of the responsibility for supporting the cruise missile program. Its 3,400 people also provide mapping, charting, and geodetic products and services to the whole range of US agencies and allied governments mentioned above. DMAAC produces aeronautical charts, air target materials, digital data, point position data bases, flight information publications (FLIP), space mission charts, and a wide spectrum of technical data relevant to the earth and its aerospace environment essential to navigation and TERCOM.

The DMA Hydrographic/Topographic Center (DMAHTC) at Brookmont, Md., produces much of the Digital Terrain Elevation Data used in planning cruise missile missions. The Center is staffed by about 3,600 people and has subelements in more than twenty other locations. It produces maps, charts, and other data needed for strategic and tactical land, sea, and air operations as well as other materials for precise navigation on the world's oceans.

In addition to the two production centers, DMA has three other components. The newest is the Office of Distribution Services (ODS), whose 400 employees are the point of contact for tens of thousands of customers who use DMA products.

The Defense Mapping School (DMS) at Fort Belvoir,



Maj. Gen. William L. Nicholson III, former Vice Commander of the Fifteenth Air Force, became Director of DMA on July 1, 1979.

Va., has approximately 190 military and civilian personnel who train men and women of the armed forces and other government agencies. Subjects range from basic map courses to geodetic surveying and terrain analysis, and advanced seminars in MC&G organizational management. Mobile training teams visit as many as fifty locations in the US and overseas each year.

Overseas, DMA has the Inter-American Geodetic Survey (IAGS), founded in 1946 to assist Latin American cartographic agencies in performing surveys and producing maps and charts. About 100 persons are assigned to the IAGS headquarters in the Canal Zone, Republic of Panama. Field projects have permanent resident staffs in most of the Latin American countries, bringing the IAGS total to 150 people.

Beyond these largely military activities, the Director of DMA also maintains coordination with other government agencies involved in MC&G, such as the US Geological Survey and National Ocean Survey. Agreements with fifty-five nations allow DMA to exchange maps and charts rather than making all of them itself.

While most cruise missile activity is concentrated at the Aerospace and DMA Hydrographic/Topographic Centers, any of the other components could have cruise missile responsibilities in the future as the present generation of missiles becomes operational in the early 1980s and subsequent generations are developed for the 1990s.

"Our commitment to the cruise missiles results in the most critical and demanding production assignments facing DMA," says General Nicholson. "The program's priority and the extremely complex and time-sensitive issues of technology, requirements, resources, and production all demand that we give the cruise missile program the highest level of attention possible. At the same time, we must continue to ensure that we maintain our high standard of support to the other MC&G requirements of our customers.

"By combining dedication and the mapmaker's skills with the technologies of the late 1970s, the people of the Defense Mapping Agency are making a major contribution to the defense of the United States."

In the cruise missile program, as it has for other aerospace weapon systems, the Defense Mapping Agency will continue to play an often silent but integral role from research and development through test and evaluation into operational employment. ■

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The battleship USS *Utah*, representing an enemy fleet, approached the California coast in an area measuring more than 100,000 square miles. Could the Air Corps find it? That was the purpose of Coastal Frontier Defense, Joint Exercise No. 4 . . .

Mission: Find the USS UTAH!

BY DeWITT S. COPP

Editor's Note: This article is an excerpt from the book, A Few Great Captains, to be published by Doubleday & Co. on April 11. The book is the first of a two-volume work on the development of US air-power, written under the auspices of the Air Force Historical Foundation. See p. 70 for a review.

SINCE 1931 there had been no joint maneuvers between the Air Corps and the Navy in which the former attempted to bomb the latter's ships. The 1931 effort, referred to as the *Mount Shasta* incident, had turned into something of a de-

bacle for the Air Corps, and the War Department had not been anxious to pursue such exercises further. Neither, for that matter, had the Navy, particularly since the state of the art had come a long way since Billy Mitchell's day. Air Corps pilots believed, correctly or not, that a goodly portion of the War Department's continued reluctance to permit its planes to go after the Navy's shipping was in deference to the Navy's wishes.

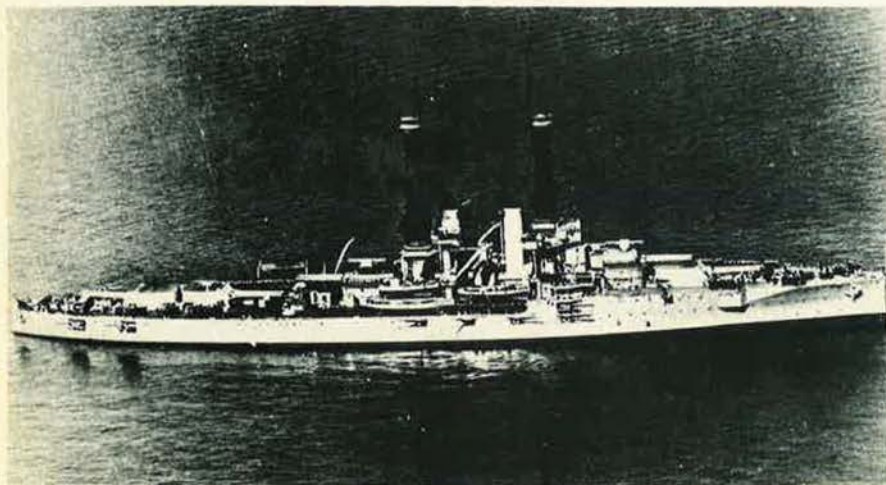
In the fall of 1936, the President changed all that. He wanted to know for his own private information just what Army land-based

bombers could do against a fleet. In the 1936 exercise he didn't find out, because although Air Force units and Navy elements carried out a joint exercise, it did not include the acid test. That was reserved for the exercise to come.

Before the parameters for the next test were ironed out by the Joint Army-Navy Board, Andrews submitted a list of considerations to Malin Craig that he felt should be weighed before a decision was reached. The principal one was that the exercise should be held on the East Coast because of facilities, good communication, and the possession of a small, radio-controlled boat that the bombers could use for practice. Additionally, the West Coast at the time of year selected for the exercise was usually fogged in, making it inferior for training purposes.

On July 10, 1937, after a meeting

The battleship USS Utah, placid on a calm sea, decks covered with bluejackets. On August 13, 1937, Air Corps B-17s of the 2d Bombardment Group found Utah 285 miles off the California coast. Lead pilot was Capt. Caleb V. Haynes, with 1st Lt. Curtis E. LeMay as lead navigator. A little more than four years later, the Utah was sunk with heavy loss of life at Pearl Harbor. (USAF photo)





An early B-17C, of later vintage than the Y1B-17s of the 2d Bombardment Group which intercepted the battleship *USS Utah* off the California coast. The first Y1B-17 of the 2d Group reached home base at Langley Field, Va., on March 1, 1937. Group commander was Lt. Col. Robert C. Olds. Olds required every pilot to be fully proficient in instrument landings and takeoffs before he received clearance to fly the B-17. (Photo by Rudy Arnold of Floyd Bennett Airport)

with Roosevelt, Craig and Admiral William D. Leahy announced in a secret memo that the exercise would be held on the West Coast. The target would be the battleship *Utah*. The area involved would cover a tract of over 100,000 square miles, extending 300 miles outward from the coast, westerly from San Francisco and Hamilton Field in the north, and to the south on a parallel line out from San Pedro Bay. The time set for the contest was from noon August 12 to noon August 13. No bombs could be dropped after dark on the twelfth or after noon on the thirteenth.

As Delos Emmons, who had been named as Commander in Chief of Air Forces, put it: "A more unpropitious time for this mission could hardly have been selected. We can expect unfavorable fog conditions off the coast of southern California during the month of August. The probabilities are that this fog will extend out to the limit of the problem."

To Andrews and his staff the exercise was a stacked deck. Their forces, the Blue, would be made up of thirty B-10s, four B-18s of the 7th and 19th Bombardment groups and seven of Bob Olds's B-17s. There would also be thirty Navy patrol

planes to be used for scouting, but the Blue defenders would have no ships except for rescue. The attacking force, the Black, would supposedly consist of two battleships, one aircraft carrier, and nine destroyers, all represented by the *Utah*. The bombs to be dropped were fifty-pound Navy water bombs, never used before by the Air Force.

Further, Navy reconnaissance planes could not start looking for the *Utah*, whose purpose was to attack the West Coast somewhere within the target area, until noon of the twelfth. As soon as they located the *Utah*, they were to flash the word to the Army planes, which would then fly out and attack the target.

The Game Begins

Emmons established two chains of operating bases, one along the coast and the other farther inland, because he knew the chances were that the coast fields would be fogged in. His B-10s had a radius of action of only 300 miles. On one score, the Air Force was able to hoodwink the Navy. When the latter asked how fast the Army planes could fly, instead of giving the correct airspeed, the airman's response was 190 mph.

Otherwise, it had been reasoned, the Navy would keep the *Utah* so far out to sea that there wouldn't be time for search and attack.

From the point of view of Lt. Curtis LeMay, the *Utah* mission began when Colonel Olds's B-17 unit began practice-bombing targets in the shape of battleships. The crews were enthusiastic about clobbering the targets but they realized they were pretty useless when compared to the real thing because they were stationary. Even going after the radio-controlled boat did not really afford what was necessary, but they worked to perfect their precision. On that score, it was LeMay who was going to be called on to show how well he had perfected his. He was named the principal navigator, in the lead plane, flown by Capt. Caleb V. Haynes. Andrews and Olds would also be on board.

In their practice bombing they had been using sand-filled, powder-charged bombs. Upon reaching the coast, they were anxious to try out the Navy's water bombs, but somehow the Navy suddenly found it had an unexpected shortage, and it wasn't until several days before the exercise was to begin that Emmons was able to lay hands on a supply for his bombers.

High noon of August 12 found the entire West Coast socked in solid with fog, extending outward an estimated 200 miles. The crews waiting at Oakland, at Monterey, at Hamilton, could only sit and wait . . . and wait. There was absolutely nothing to go on, but Lucky Emmons guessed that the *Utah* would enter the target area at the northwest corner, make a feint at San Francisco and head for San Pedro Bay to attack the aircraft factories around the Los Angeles area.

At 3:37, Navy patrol planes signaled that they had located the *Utah*. She was 300 miles southwest of San Francisco, but by the time



Lieutenant LeMay earned his pilot's wings on October 12, 1929, at Kelly Field, Tex. He is shown (center) in this photo at the National Air Races in Chicago, 1930, with two unidentified colleagues of the 1st Pursuit Group from Selfridge Field, Mich. At the time of the Utah interception, LeMay had just transferred from pursuit aviation. Although junior in rank and in bomber experience, he was a much-sought-after navigator. His navigational skills were crucial to the Utah interception. (USAF photo)

the message was forwarded through the 1st Naval District Headquarters to Emmons, at Hamilton Field, it was after 4:00 o'clock. The B-17s and the B-18s scrambled. There was no point in the B-10s' taking off; they had neither the speed nor the range.

Position Error Found

A few minutes after Olds's squadron was airborne, a Navy patrol plane signaled the *Utah* was forty miles farther east than first claimed. Three additional reports confirmed the sighting. LeMay made his calibrations, and when the flight was over the designated site, Haynes took his Fortress down through the fog while the other six ships stayed on top, circling. They broke out at about 700 feet, and there was no ship in sight—just a large amount of empty sea and the light fading fast. LeMay swallowed hard on that one and began giving headings for a square search pattern. Nothing. And then it was dark and they had to go home.

Bob Olds came back from the cockpit and looked down at the Lieutenant. "Are you sure you knew where that boat was supposed to be?" he asked.

LeMay stared back at him and said that he was. He took a celestial sighting that indicated to him that his error could have been no more than a mile or two from the exact location given. To prove that he knew what he was talking about, he told

the unsmiling colonel the course to San Francisco and the exact time they would be over it.

Olds said, well, they still had tomorrow morning, and then added, "I want the *Utah*. You'd better find it for me."

Ten minutes before his estimated time of arrival, LeMay went up to the cockpit and stood between Haynes and Olds and waited. With the fog, they'd never see the city, but they'd see the glow of its lights, that is, if San Francisco was where it was supposed to be. It was, right on the money! Olds crumpled up the slip of paper LeMay had given him with the ETA and said, "By God! You were right. Then, why didn't we find the *Utah*?"

Andrews had the answer. "It turned out," he said, "that all these reports by Naval patrol planes were incorrect. They were not corrected by the Navy until 9:30 that night." Just a small error, said the Navy, only one degree off. Just a matter of sixty miles! No one in the Air Force, from Andrews on down, was about to believe for a second that the error hadn't been intentional.

The B-17s couldn't get into Oakland that night. Nor could they land at Mather Field, for its runways were too short and it had no runway lights, so they put down at Sacramento Municipal Airport.

It was 11:00 o'clock, and the crews worked on their planes to have them fueled and ready for the

morning. They got their food at a hot-dog stand and then lay down on the hangar floor for some much-needed sleep.

It was Olds who woke LeMay, saying, "Get up, LeMay. Let's go have a cup of coffee." Over the coffee he informed the Lieutenant that he had been right all along. The Navy had admitted its error. From then on, Bob Olds never questioned his chief navigator's accuracy.

Anticipating Errors

Andrews soon arrived with the announcement that again the coast was fogged in, that the Navy planes that were supposed to keep contact with the *Utah* during the night had been unable to do so and would not be able to take off and go hunting for some time. By 9:00 o'clock, with no word on the *Utah's* location, Emmons decided to get his planes airborne. Andrews climbed aboard with Olds, and Haynes took off. Once he had the Fortress trimmed up and cruising, the big North Carolinian made an announcement in his deep, heavily accented drawl. "If I'm going to command this flight, I want to be in command. If too many people give commands, everything will be screwed up."

Andrews laughed and said, "That's all right. Come on, Bob."

After his passengers had departed the cockpit, Haynes latched the door, but he'd no sooner done so than Andrews came through to him on the intercom. "There's just one order I want to give you," he said. "You are not to fly below one thousand feet."

It was not until 11:00 o'clock that a Navy plane signaled the *Utah's* location. Had they remained on the ground until the position report arrived, there would have been no chance to find the ship, and had they followed the exact course calibrated by LeMay from the information

given, they still wouldn't have found the target.

At ten minutes of twelve, Haynes contacted his radio operator. "Sergeant, did you hear that order that I was not to go below a thousand feet?" he asked.

"Yes, sir," came the reply.

"Can you tell whether I'm above or below a thousand feet?"

"Yes, sir. There's an altimeter right here."

"If there's an altimeter right there, Sergeant, I can't very well go below one thousand feet, can I?"

The Sergeant got the message. "Oh, I see what you mean, sir." He then swung around, his body blocking the instrument, and began a conversation with the two ranking officers. Haynes passed the word to his squadron, and down they went through the fog, spreading out in a line abreast in a last try at what appeared to be the impossible. They broke into the clear, and there, in what LeMay described as "the greatest happenstance in the world," lay the *Utah*. She was 285 miles from shore, her crew

DeWitt S. Copp was an Army Air Forces pilot during World War II. He has written numerous books and films on military and civilian aviation. His Strategic Air Command drama, The Long Flight, was featured on NBC Television. Mr. Copp has served in Europe and the Far East as a newspaper and magazine correspondent. In researching A Few Great Captains, he used many previously untapped sources, including personal diaries, newly declassified documents, and interviews with many of the characters in the book. He and his wife Susan live in Manchester, Vt.

sprawled all over the decks, sailors taking their ease. The air crackled with the excited chatter of the B-17 crews. Even the crews of the B-18s, which wouldn't arrive in time to attack, were cheering. Below, on the battleship, the scene was one of disorder, a wild scattering of seamen making for hatches.

LeMay, who was now up in the nose section with bombardier Lt. Doug Kilpatrick, saw the first water bomb hit the *Utah's* deck, a joyous sight. In the last five minutes of the exercise, three direct hits were made on the battleship. There were many near misses, and had they been real bombs they would have gutted her.

Caleb Haynes, with a cheering Bob Olds, climbed his Fortress

back on top of the fog deck and, with his jubilant squadron, headed for home. LeMay had never seen anyone grin like General Andrews. He had completely forgotten his orders to Haynes about staying above a thousand feet. They were all literally floating on air, but Curt had made another observation, which he called to Olds's attention. By his calculations, from the point of interception to the point at which they crossed the California coast, he proved that once again the Navy had given them a position report on the *Utah* that was one degree, or sixty miles, off the mark. Had they remained on top of the fog instead of going down to have a look, not only would they have arrived too late at the location given, but also there would have been no *Utah* there.

Aside from the Navy's seeming inability to give accurate position reports, its brass attempted to wipe the bomb water off its collective face by maintaining the successful attack hadn't proved a thing. It had been a sneak attack and the *Utah* had had no chance to maneuver.

Andrews Is Vindicated

Since the exercise had been laid on by order of the President, Andrews said, if the point hasn't been proved, get your ship out in the open sea, and let it take all the evasive action it can. We'll bomb from all altitudes. Olds angrily put the challenge more bluntly. "All right, God damn you! Get out from under those clouds. We'll bomb you from altitude and see what happens!"

The Navy was boxed in on this one. If the exercise had not proved



Left, above: Air Corps Douglas B-18 bombers also took part in water-bombing the USS Utah. The B-18 saw only limited coastal patrol service during World War II.

Left: Air Corps Martin B-10 bombers over San Antonio, Tex., January 24, 1940. Similar aircraft took part in the second interception and water-bombing of the USS Utah on August 14, 1937. (USAF photos)

what the Air Force could do, what had it proved?

Andrews's request that the *Utah* make itself available for another day of tests had to be granted.

This time the weather was clear.

The *Utah* took evasive action. The B-10s, the B-17s, and the B-18s dropped their water bombs from 8,000 to 18,000 feet. There were thirty-seven hits on the battlewagon, about twenty-three percent of the total dropped, enough to have sunk her many times over.

Although the Navy could do nothing to discount the action except to insist that its results be kept secret, a report on the previous day's exercise was notable for its omissions. A confidential memo from the Senior Naval Commandant at San Francisco to the Chief of Naval Operations dated August 31, 1937, noted: "The *Utah* was intercepted by 7 B-17's and 3 B-18's of the 2nd Bombardment Group on August 13, 1937. The airplanes arrived over the *Utah* at 1155 hours. The exercise ended at 1200, and the planes returned to bases. The ceiling over the *Utah* was 400 feet. No bombing was possible."

In an account he gave at the Army

War College in October, Andrews described Joint Air Exercise No. 4, as it was called, and drew attention to the superiority of the B-17 over all other GHQ Air Force bombers. It was his constant theme now, wherever and to whomever he spoke. "The airpower of a nation," he concluded his lecture, "is essentially what it actually has in the air today. That which is on the drafting board are the statistical tables of resources and manpower and can only become its airpower five years from now, too late for tomorrow's employment."

Malin Craig sent a letter of commendation to Andrews and his staff, praising the efficiency and dependability of GHQ Air Force, and in a personal note to its commander reiterated, "Again, this old swivel-chair general is proud of you and your staff and the work you did in connection with Coastal Frontier Defense, Joint Exercise No. 4."

The Word Gets Out

The secrecy of the action, determinedly insisted upon by the Navy and agreed to by the War Department, came unstuck when Newscaster Boake Carter, somehow in

possession of evidence, stated on his nightly broadcast: "I've got some pretty important news. The Air Corps can not only find battleships with Flying Fortresses, it can put bombs on them, enough bombs to sink them. What's more, it can put bombs on a towed sled that's only about one-third the size of a ship. I know what I'm talking about. I've got photographs right here in front of me to prove it."

The Navy brass were furious over the leak and informed the Army brass. Craig had specifically stated to Andrews that "there will be no publicity about the matter that can be avoided, as the President stated the exercise was for the information of himself, the Secretary of War and the Secretary of the Navy." Now the American public had been let in on the secret, and there was outrage in high places. GHQ Air Force was queried in no uncertain terms: What did it know about the leak? Who was the culprit? At Langley, straight-faced officers shook their heads. No one had a clue. But Curt LeMay would never forget the grin on the Air Force Commander's face when they had clobbered the unsuspecting *Utah*. ■



The 2d Bombardment Group intercepts the Italian liner *Rex*, more than 700 miles from New York, on May 12, 1938, in a situation similar to interception of the *USS Utah* nine months earlier. Pilot of the lead Y1B-17 was Capt. Caleb Haynes, again with 1st Lt. Curtis LeMay as lead navigator. The *Rex* and *Utah* intercepts so far at sea prompted Navy brass to prevail on Army leaders to restrict Air Corps flying to 100 miles from shore. (USAF photo by Maj. George Goddard)

SCIENCE/SCOPE

For the first time a new microwave sensor will allow military weather satellites to "see" through clouds to monitor meteorological conditions below. The instrument will scan a 1300-kilometer field of view every 1.9 seconds from an altitude of 450 nautical miles, sensing microwave radiation energy reflected from ice, land, and clouds. It will detect rainfall, ice masses, ocean wind speeds, soil moisture content, and other conditions, and relay compiled data within minutes nearly anywhere in the world. The information will help commanders of land, sea, and air forces in their planning of operations that depend on accurate weather forecasts. Hughes, under a U.S. Air Force contract, is to build one prototype and develop computer software for ground processing.

Two new TV-cameras-on-a-chip will serve as eyes for machines in a wealth of commercial and industrial applications. The devices, made possible by advanced charge-coupled technology, are called Hughes Omneye™ imagers. One chip consists of 1,024 light-sensing picture elements, the other of 10,000 picture elements for higher resolution. Typical uses would be on assembly lines to help machines size, orient, and identify parts and objects. Compared to standard vidicon cameras, the devices are more reliable and rugged, and need less voltage and power.

A high-repetition-rate laser rangefinder will improve the accuracy of a variety of anti-aircraft guns mounted on pedestals, tanks, or ships. Firing between 10 and 20 pulses per second, the GAQ-4 laser rangefinder can provide range information from 300 to more than 10,000 meters and discriminate between targets as little as 20 meters apart in range. Hughes has sent four preproduction units to Selenia Industrie Elettroniche of Rome for field demonstrations. The Italian firm is licensed by Hughes to produce the system.

Energy and labor costs are being cut by an estimated \$250,000 annually at a U.S. Air Force test complex equipped with a Hughes facilities management system. The system regulates the heating, ventilating, and air conditioning in 42 buildings at the Arnold Engineering and Development Center in Tennessee. It also controls a large pumping complex and performs certain fire and security functions. The computerized system is able to monitor the site using the technique of time division multiple access, in which a single transmission line carries thousands of different command signals in sequence at a rate of 1 million bits per second.

Pilots will experience the sights, sounds, and feel of flying in combat in a new Hughes simulator. The system will help train pilots of the U.S. Navy and Marine Corps F/A-18 Hornet strike fighter. It includes two 40-foot domes, each surrounding a simulated cockpit. Projected onto the domes will be computer-generated pictures of sky and earth, maneuvering aircraft, missiles, and gunfire. The images will move in response to the pilots' actions as they "fly" the trainer. An instructor at a separate console can pose tactical problems, monitor the mission, and evaluate performances. Besides honing pilots' skills safely, the system will save money and fuel.

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Airman's Bookshelf

The First Team

A Few Great Captains: The Men and Events that Shaped the Development of U.S. Air Power, by DeWitt S. Copp. The Air Force Historical Foundation; Doubleday & Co., Inc., Garden City, N. Y., 1980. 562 pages, with index, notes, and photographs. \$17.50.

Taking his title from George C. Marshall's aphorism that "an army produces only a few great captains," DeWitt S. "Pete" Copp has written an extremely readable volume built around the dreams and accomplishments of Army aviators who were the founders of today's USAF. Beginning with the earliest flyers—Foulois, Milling, Selfridge, and Arnold—the author has provided an engrossing account of the struggle by khaki-clad airmen for recognition of their theories, aircraft, and potential.

While concentrating on the relatively familiar Arnold, Spaatz, Eaker, and Andrews, Copp furnishes carefully drawn vignettes of such less well-known participants as Bert Dargue, Horace Hickam, Hugh Knerr, Claire Chennault, Jimmy Doolittle, and George Kenney. The portraits of leadership are limned in clear, sharp, biographic detail. They offer a needed analysis of the attitudes toward airpower of Army Chief of Staff Douglas MacArthur, Assistant Secretary of War Louis Johnson, and Assistant Secretary of War for Air F. Trubee Davison. This volume ends with the beginning of World War II in Europe in September 1939. The projected second volume will cover the story through World War II.

The author has thoroughly researched official records, personal recollections, reminiscences, and diaries. (Some significant collections of papers such as those of Dargue, Kenney, and Westover have come to light since Copp completed his re-

search.) One of the main strengths of the book is that the author has brought the aviators to life, along with their wives and families, to produce administrative and organizational history replete with living, vibrant characters.

The familiar stories are all here but are freshly told within a framework that concentrates on the struggle for identity and sovereignty that marked the disappointing progress of Army aviation prior to World War II. Among the landmark events recounted are the 1929 refueling-record flight of the *Question Mark* and the interception of the liner *Rex* by the new B-17s in 1938, this latter story told with more drama and excitement than it has been before. He chronicles the Alaskan B-10 flight of 1934 as well as competition with the Navy represented in the *Utah* and *Mount Shasta* "bombings."

At the same time, the internecine struggle within the Army that dominated three decades receives detailed yet balanced treatment. Political battles at both ends of Pennsylvania Avenue are outlined, although this reviewer feels that the impact of public opinion is slighted in the narrative. This era was one of direct communications, probably unacceptable in today's institutions. When Assistant Chief of Air Corps Brig. Gen. Oscar Westover, concerned over the excessive number of accidents that threatened to terminate the airmail experiment, wired his zone commanders "THERE WILL BE NO MORE ACCIDENTS," he should not have been surprised at the reply: "THERE WILL BE NO MORE FLYING."

Devoting one-sixth of the volume to the seventy-eight-day airmail fiasco seems excessive. More serious is the author's undisguised admiration for Frank Andrews, which threatens to convert the last half of the volume into the story of "one great captain." Although the author generally accords equal coverage to both Washington

and the "field" sides of most problems, his admiration for his hero appears to restrict his account of the tribulations of the GHQ Air Force to the perspective of its commander, Maj. Gen. Frank Andrews.

The serious scholar will go into a flat spin because sources for the numerous direct quotations normally are not cited. Lack of specific identification of most sources is a further shortcoming. Some factual errors persist, and the volume would have benefited from tighter editing to delete some "hangar-flying," which is extremely interesting but often irrelevant to the main theme.

These minor criticisms should not detract from this volume's extremely important contribution to aviation history. Its easy-flowing narrative, concentration on the issues, and rich human portraits provide a book which those of us involved in institutional history should envy. Copp's scholarship fills a void. It highlights the absence of good biographies of Arnold, Spaatz, Eaker, Kenney, Dargue, and Andrews, particularly when competent biographers have chronicled the careers of Marshall, MacArthur, Eisenhower, King, Nimitz and Halsey, among the leading World War II figures.

The Air Force Historical Foundation, which sponsored and financed this venture, and the author are to be congratulated on this intriguing account. It is a volume that should be read by every airman, civilian, and officer of today's Air Force. It will whet their appetites for the appearance of the second volume. I wish I'd written it.

—Reviewed by Maj. Gen. John W. Huston, Chief, Office of Air Force History. (An excerpt from *A Few Great Captains* begins on p. 64 of this issue.)

S. L. A. Marshall's Memoir

Bringing Up the Rear: A Memoir, by S. L. A. Marshall, edited by Cate Marshall. Presidio Press, San Rafael, Calif., 1979. 310 pages, including index and photographs. \$12.95.

When Brig. Gen. Samuel Lyma Atwood Marshall, US Army Reserve (Ret.), died in December 1977, he left behind a legacy of half a century describing, analyzing, and sharing the trials and triumphs of the American fighting man.

Known to one and all as "Starr



February, 1978



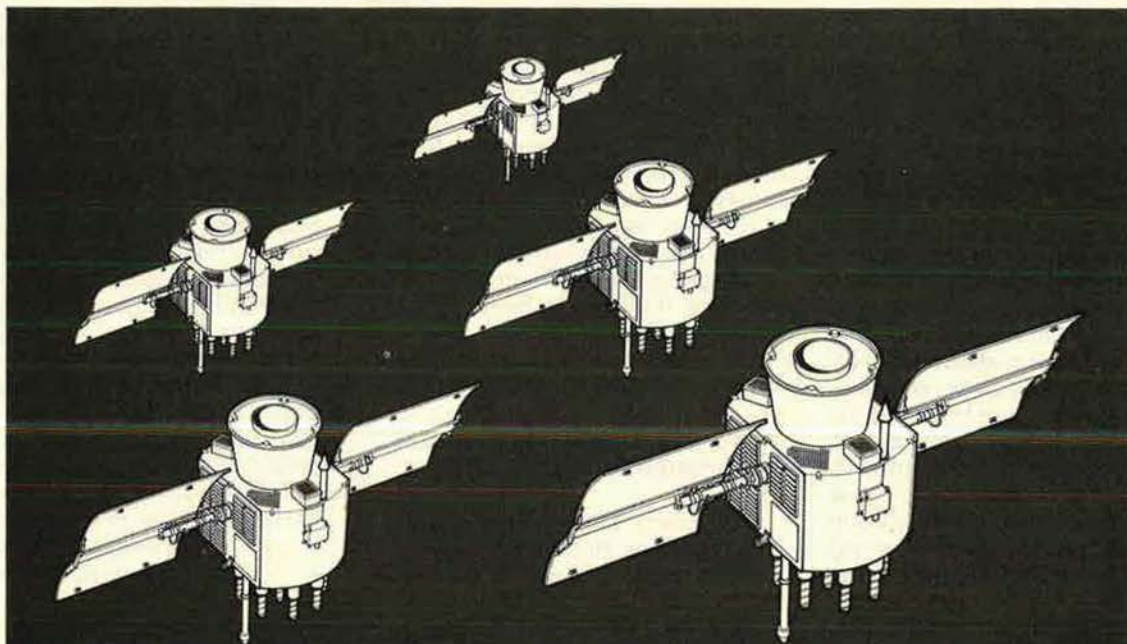
May, 1978



October, 1978



December, 1978



Now there's a fifth star in the constellation that's making navigation history.

February, 1980



The fifth of an eventual system of 24 Navstar satellites is now in place, switched on and orbiting some 11,000 miles above Earth. All five were built for the Department of Defense's Global Positioning System (GPS) by Rockwell International, which has a contract for the first 12 Navstar satellites. GPS is a navigation concept that has already proved its almost pinpoint accuracy and unparalleled convenience.

To date, the system has been tested successfully in many operations including: "blind" aircraft rendezvous for simulated inflight refueling, ship navigation at sea, nap-of-the-earth helicopter flights, ship/aircraft ASW simulations, precision approach guidance for instrument landings and in maneuvers using truck-mounted manpack position locaters.

As the name implies, GPS will provide a common positioning capability over the entire globe, greatly improving the navigation capabilities of America's armed forces around the world. When fully operational in the 1980s, at least four Navstar satellites will always be accessible to all users on land and sea, in the air, and in Earth orbit. GPS will enable them to calculate their positions with accuracy to within 30 feet or less, their velocities to within a fraction of a mile per hour,

and the exact time. All instantaneously, in any weather, anytime, anywhere on Earth.

Someday, GPS technology could provide precise and constant navigational data to airlines, general aviation, the merchant marine — even pleasure boats.

The Space Systems Group of Rockwell International is proud to be one of the prime contractors to the Space Division of the U.S. Air Force — the lead service of the Department of Defense for Navstar satellite development. We're also proud to be building the reusable Space Shuttle orbiters that will launch GPS Navstars and other space systems in the 1980s and beyond.

Navstar is our kind of involvement, one of many Rockwell International projects designed to bring the benefits of space down to Earth.



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Airman's Bookshelf

from his four initials, Marshall had won a battlefield commission in World War I, making him at seventeen the youngest officer in the AEF. This was the first of four American wars—and many other clashes in Latin America, Spain, Africa, and the Middle East—which he witnessed, wrote about, and evaluated. His primary interest was the individual fighting man, and, as army officer, war correspondent, military historian, and official and unofficial observer, Marshall never swerved from his devotion to the soldier or from his dedication to writing and speaking about him with vigor, sympathy, and gutty realism.

Marshall's output was tremendous: twenty-four published books before he died, and a vast number of articles, lectures, and speeches. While these dealt almost exclusively with ground warfare, they are of value and interest to the airman as well, for they tell of men in combat, of triumph and defeat, of fear, exhaustion, and death, and, above all, of courage in the face of adversity.

Whether describing the long retreat of the Eighth Army in Korea, the ambush of a patrol in Vietnam, the World War II capture of a Pacific atoll or the defense of Bastogne, or the 1956 Sinai campaign, Marshall was always the consummate humanist, analyst, and critic, calling the shots as he saw them, with keen perception and understanding.

During World War II, Marshall introduced a unique method of learning the truth about battles through group interviews of participants immediately after the action. By questioning units as a whole, he sought to overcome individual perspectives and to draw a balanced picture of events as they had actually happened. As an Army historian in the Central Pacific and Chief Historian in the European Theater, and in every other war in which he later participated, he developed and improved this technique in order to write vivid battle history and persuasive combat analysis.

Marshall's view of history was essentially functional. Believing that knowledge of past events was useful only as the basis for sound future actions, he offered his own findings as a means of correcting mistakes and

avoiding further errors. He was, in many respects, an operations analyst rather than a historian, but he understood the historian's craft better than most, and no one outdid him in his ability to penetrate the fog of battle.

General Marshall's final book, finished in draft before he died and edited by his widow, is different from most of his other publications in that it is about himself. It is not, strictly speaking, an autobiography, but rather an impressionistic, anecdotal collection of reminiscences, some of it reprinted from earlier publications.

A lively, colorful, and unashamed memoir of a vigorous life, *Bringing Up the Rear* describes people, places, and events as Marshall remembered them. Like everything else he wrote, it is outspoken, unflinching, and highly readable. It offers a personal glimpse of an amazing man.

—Reviewed by Dr. Stanley L. Falk, Chief Historian, USAF.

Terrorism: Conclusions and Recommendations

Terrorism; Threat, Reality, Response, by Robert H. Kupperman and Darrell M. Trent. Hoover Institution Press, Stanford University, Stanford, Calif., 1979. 450 pages including index. \$14.95.

Rather than the nuclear age of Armageddon, this is the Age of Terror. International terrorists daily manipulate millions of people to achieve their nefarious ends. As this book's dust jacket notes, "We have become hostage to the mad schemes of terrorists and to their all-too-real abilities to fulfill them." For the American people, the most recent case is Iran, where terrorists abetted by madmen cloaked in government guise have held hostage for months our embassy, more than fifty Americans, and the US government itself.

Kupperman and Trent have created a landmark work. It is most useful for clarity in two areas: understanding the dimensions and characteristics of international terrorism, and pointing to avenues of action to combat its depredations. Both authors have dealt personally at senior levels of the US government with national security and crisis management problems. In their view, the physical consequences of major terrorist acts "are no different from natural disasters or large industrial accidents—but they have, of course, far greater political consequences."

Acknowledging the possibility of physical and political trauma, the authors identify and place into perspective the "important technological and management issues that must be addressed by every government as well as industry if terrorism is to be kept within tolerable bounds." Therein lies the real value of the book: a primer for persons and organizations facing the possibility of coping with terrorist acts. In these days, that encompasses just about every organization of consequence, anywhere in the country.

The book is well-organized. It will be useful in a crisis management center during a crisis, or, better yet, in a more leisurely study before a crisis hits. That is why the authors place great stress on prevention; the organization prepared to cope with terrorism may well be bypassed by the terrorists in favor of aiming against someone more lax.

Four words best summarize the book: Prevention, Control, Containment, and Restoration. If the authors' prescriptions in each of those areas are followed, the official facing potential terrorism can minimize its effects.

—Reviewed by F. Clifton Berry, Jr., Executive Editor.

New Books in Brief

A-20 Havoc at War, by William N. Hess. The combat record of the Douglas A-20 Boston Havoc and its successor, the A-26 Invader, stretches out over twenty-five years. From night fighter, minelayer, and low-level gunship to skip bomber and counterinsurgency—the story of the two aircraft is here in a fast-paced narrative with photos and line drawings. Charles Scribner's Sons, New York, N. Y., 1980. 128 pages. \$17.50.

Air Base Defense in the Republic of Vietnam, 1961–1973, by Roger P. Fox. A former air base security officer explores the unique problems of defending air bases against surreptitious ground attack during the Vietnam War. The volume, part of a series on the war, covers intelligence, reconnaissance, security equipment, weapons procurement and maintenance, communications, and command and control. Office of Air Force History, 1980. Available from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. 278 pages. \$5.

Air Forces of the World, by Barry C. Wheeler. From Afghanistan to Zambia, the world's airpower is described

in facts, figures, and photos. Each nation's air force is described with details on strength, combat and transport equipment, operational bases, and organization. An addendum includes developments between the time of writing and publication. Index. Charles Scribner's Sons, New York, N. Y., 1980. 112 pages. \$11.95.

Air War Southeast Asia, 1961-1973, by Myron J. Smith, Jr. Books, monographs, scholarly papers (including unpublished theses from the Air University), magazine/journal articles (many from AIR FORCE Magazine), documents, general works as well as doctoral/master's theses as they pertain to the Vietnam War are cataloged in this annotated bibliography. Entries are alphabetized to clarify subject matter. Also included is a guide to service- and industry-produced 16-mm film on SEA-connected themes, complete with details on borrowing, etc. Scarecrow Press, Inc., 52 Liberty St., Metuchen, N. J. 08840, 1979. 298 pages. \$15.

Avenger at War, by Barrett Tillman. Underpowered and burdened with equipment it seldom used, the Grumman Avenger torpedo-bomber was not considered the best aircraft of World War II. Still, almost 10,000 were produced between 1942 and 1945—more than any other US Navy aircraft except the Corsair and the Hellcat. Its greatest contribution was in the Atlantic, the author believes, where it helped defeat the U-boat wolfpacks. This volume includes personal experiences from those who flew the Avenger. 150 photos. Charles Scribner's Sons, New York, N. Y., 1980. 128 pages. \$17.50.

The Battle of Leyte Gulf, by Adrian Stewart. Leyte Gulf was the last of the great naval battles, not just of World War II, but of history. The three-day battle destroyed the Japanese fleet as an effective fighting force and paved the way for the American invasion and recapture of the Philippines. Photos. Charles Scribner's Sons, New York, N. Y., 1980. 223 pages. \$14.95.

Buying and Owning Your Own Airplane, by James E. Ellis. The author concentrates on the "little things" that can make or break owning an aircraft. The book is geared to prospective owners who have little prior knowledge and "not a lot of money." Iowa State University Press, Ames, Iowa 50010, 1980. 172 pages. \$11.95.

The Citizen Soldier and US Military Policy, by James B. Whisker. The author argues in favor of a government-sponsored civilian marksmanship program to furnish skilled manpower to the military services in time of war. Much of the book is a reprint of the Arthur Little Report, a study done for the Army in 1965, which supported the civilian marksmanship concept. Bibliography, notes. North River Press, Inc., Ottawa, Ill., 1979. 110 pages. \$4.50.

Decision on Palestine: How the US Came to Recognize Israel, by Evan M. Wilson. The author, a retired foreign service officer with thirty years' experience in the Near East and South Asia, explores conflicting pressures on the US government regarding the Palestine question and the recognition of Israel. Photos, appendices, notes, index. Hoover Institution Press, Stanford University, Calif., 1979. 244 pages. \$14.95.

A Guide to the Study and Use of Military History, edited by John E. Jesup, Jr., and Robert W. Coakley. Specialists examine the nature of military history, its value, the literature available on various periods and topics, and the official military history establishments in this country and abroad. Center of Military History, US Army, Washington, D. C., 1979. Available from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. 507 pages. \$6.50 paper; \$11 cloth.

Lancaster at War—2, by Mike Garrett and Brian Goulding. Here is a totally new collection of Lancaster stories and photos that complements—but does not duplicate—the earlier volume. Compiled over several years, the book takes a closer look at the men who flew the "Lanc" and the men and women who kept it in the air during World War II. Charles Scribner's Sons, New York, N. Y., 1980. 160 pages. \$17.50.

MiG Pilot, by John Barron. Why did a man who evolved through the Soviet system to become a member of its military elite decide to fly his highly classified MiG-25 to Japan and asylum? Through interviews with the author, MiG pilot Viktor Belenko answers the question and, in so doing, reveals intriguing new perspectives on Soviet society, as well as on Soviet military life and attitudes. McGraw Hill Book Co., New York, N. Y., 1980. 224 pages. \$10.95.

Soviet Combat Troops in Cuba: Implications of the Carter Solution for the USSR, by Mose L. Harvey. Here is an examination of the Soviet combat troop problem in light of continuing Soviet assertiveness that has increasingly marred US-USSR relations since mid-1972. Advanced International Studies Institute, 4330 East-West Highway, Washington, D. C. 20014. 51 pages. \$4.

Tomorrow at Dawn!, by J. G. de Beus. During the first eight months of World War II, a highly placed German officer consistently provided information to the Netherlands military attaché in Berlin about Hitler's plan for attack. Unfortunately, the attaché's commander refused to believe in the reports' authenticity. The author, secretary of the Netherlands legation in Berlin at the time, has reconstructed this account from his own experiences and postwar testimony. W. W. Norton & Co., New York, N. Y., 1980. 191 pages. \$9.95.

West to the Sunrise, by Grace Harris. The author set a still unbroken record at the National Air Races in Ohio in 1948 and 1949. She joined the Sports Car Club and began a six-year career of auto racing, winning the championship of the women's division for three consecutive years. She is the first FAA-rated woman balloon pilot in the US. And she has written her story, also a tale of aviation itself, from Pearl Harbor to the present. Iowa State University Press, Ames, Iowa. 1980. 209 pages. \$12.50.

World Civil Aircraft Since 1945, by Michael Hardy. Civil aircraft are listed alphabetically and by nation in this handy reference to the world's civil aircraft from 1945 through 1970. Photos, specifications, and index. Charles Scribner's Sons, New York, N. Y., 1980. 128 pages. \$10.95.

World Military Aircraft Since 1945, by Robert Jackson. Companion volume to *World Civil Aircraft*, this book charts the changing course of military aircraft development since World War II. Photos, specifications, armament details, and operational history for more than 400 aircraft make the book comprehensive. Aircraft are listed alphabetically and by nation and the book includes combat details for every type of military aircraft in service since 1945. Charles Scribner's Sons, New York, N. Y., 1980. 160 pages. \$10.95.

—Reviewed by Robin Whittle



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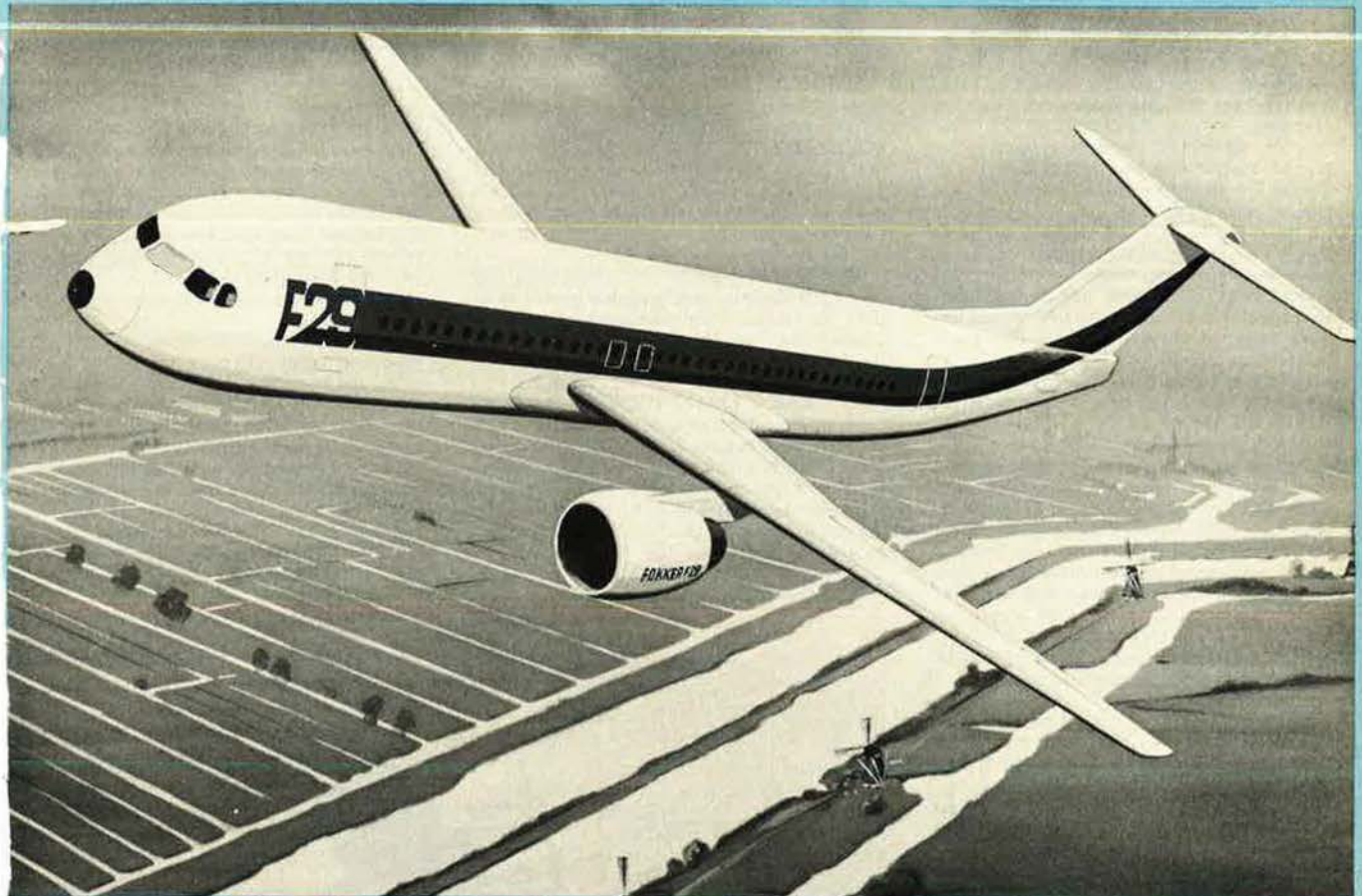
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JANE'S

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APRIL 1980



Artist's impression of the Fokker F29 twin-turbofan short/medium-range transport

FOKKER

FOKKER BV: Head Office and Main Factory: PO Box 7600, 1117 ZJ Schiphol-Oost (Amsterdam Airport), Netherlands

FOKKER F29

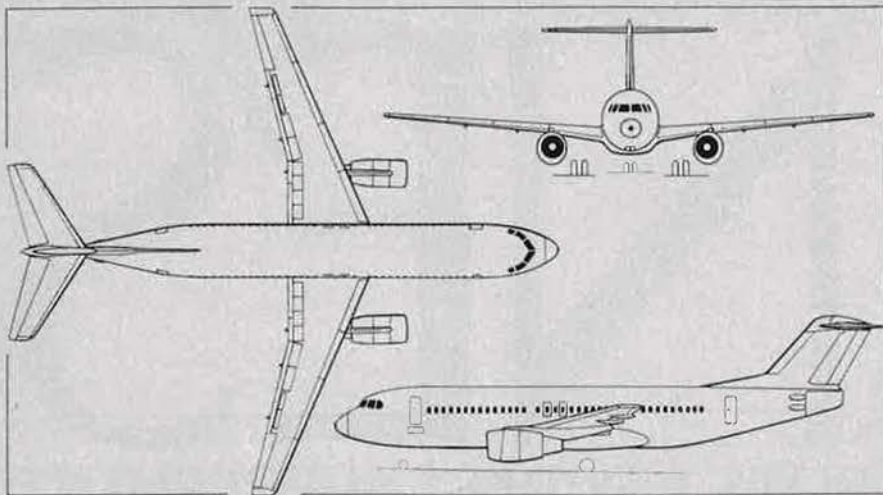
As a further development of the F28 Fellowship, Fokker has for some time been studying various proposals for a 'stretched' version, with a new wing of increased span and more efficient section, and having a lengthened fuselage. Initial studies led

by early 1979 to a 'Super F28', with seating for 115-130 passengers and retaining the rear-engined configuration of the F28.

Further studies during that year, however, led to the belief that market requirements would be served better by an aircraft with somewhat greater seating capacity, arranged in a six-abreast layout, instead of five-abreast as in the Super F28 proposal. These conclusions have resulted in the design of a totally new and larger aircraft, designated F29, with a wide-body fuselage and pod-mounted underwing

engines. Passenger capacity is increased to 132 (standard) and 150 (maximum), in a 'double bubble' fuselage identical in cross-section to that of the Boeing 737.

The largest aircraft ever designed by Fokker, the F29 will have two new-generation high bypass turbofan engines, offering a fuel consumption some 25% lower, and direct operating costs per seat/mile at least 10% better, than the current generation of 100/200-passenger twin-turbofan transports. Subject to an early go-ahead, the F29 could be available



Fokker F29 airliner (two new-generation turbofan engines) (*Pilot Press*)

for delivery to customers in the mid-1980s. Detail design was still being finalised in January 1980; the following description applies to the F29 as envisaged at that time:

TYPE: Twin-turbofan short/medium-range transport.

WINGS: Cantilever low/mid-wing monoplane. Sweepback 21° at quarter-chord. Dihedral from roots. Two-segment Fowler-type flaps over approx three-quarters of each half-span. Multi-section lift dumpers/spoilers forward of flaps. Four-segment full-span leading-edge slats on each wing.

FUSELAGE: Semi-monocoque pressurised structure, of 'double bubble' section identical to that of Boeing 737. Petal-type airbrakes form fuselage tailcone when closed.

TAIL UNIT: Cantilever T tail, generally similar to that of Fokker F28, with sweepback on all surfaces. Double-segment rudder.

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Nose unit retracts forward, main units inward into wing centre-section/fuselage fairing.

POWER PLANT: Two turbofan engines in the 84.5/89 kN (19,000/20,000 lb st) class, such as the Rolls-Royce RB.432-05 or CFM International CFM56-3, mounted in underwing pods.

ACCOMMODATION: Crew of two or three on flight deck. Six-abreast seating in main cabin, with single aisle, for 132 passengers at 86 cm (34 in) pitch, or a maximum of 150 passengers at 74 cm (29 in) pitch. Passenger/service door at front and rear of cabin on each side. Underfloor cargo hold, accessible via one door forward and one aft of wing on starboard side. Two overwing emergency exits on each side.

AVIONICS AND EQUIPMENT: Flight deck will be equipped with latest digital avionics.

DIMENSIONS, EXTERNAL:

Wing span	33.91 m (111 ft 3 in)
Wing aspect ratio	10
Length overall	approx 38.00 m (124 ft 8 in)
Height overall	11.10 m (36 ft 5 in)
Wheel track	7.10 m (23 ft 3/2 in)
Wheelbase	12.60 m (41 ft 4 in)

DIMENSIONS, INTERNAL:

Passenger cabin:	
Length	approx 25.00 m (82 ft 0 in)
Max width	3.52 m (11 ft 6 1/2 in)
Max height	2.18 m (7 ft 2 in)
Cargo hold volume	31.5 m ³ (1,112.5 cu ft)

AREA:

Wings, gross	115.0 m ² (1,237.8 sq ft)
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WEIGHTS (estimated):

Weight empty, equipped	33,452 kg (73,750 lb)
Max payload	16,048 kg (35,380 lb)
Fuel load	21,319 kg (47,000 lb)
Max T-O weight	58,200 kg (128,310 lb)
Max landing weight	55,300 kg (121,915 lb)

PERFORMANCE (estimated):

Max operating Mach No. (MMO)	0.75
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Max operating speed	330 knots (611 km/h; 380 mph) EAS
Max cruising altitude	10,670 m (35,000 ft)
Balanced T-O field length at S/L, ISA + 15°C, for 500 nm (925 km; 574 mile) range	1,370 m (4,500 ft)
Range with 132 passengers	1,500 nm (2,780 km; 1,725 miles)

OPERATIONAL NOISE CHARACTERISTICS:
Will comply with FAR Pt 36 St 3 and ICAO Annex 16

LOCKHEED

LOCKHEED AIRCRAFT SERVICE COMPANY (A Division of Lockheed Corporation); Head Office and Works: Ontario International Airport, Ontario, California 91761, USA

After 28 years of production, during which well over 1,500 examples have been delivered to 44 nations, the Lockheed Hercules continues to appear in new forms. The following notes update entries in the 1979-80 edition of *Jane's*:

LAS C-130 CONVERSIONS

Latest Hercules conversion by Lockheed Aircraft Service Company is the EC-130E electronic surveillance version built for the USAF, to replace EC-121s. Large blade antennae have been added above the dorsal fin and under each outer wing. Smaller antennae include a horizontal blade on each side of the rear fuselage. Bullet-shaped canis-

ters outboard of each underwing antenna and at the extreme tail of the aircraft house trailing wire antennae which extend several hundred feet behind the EC-130E in flight.

LOCKHEED-GEORGIA COMPANY (A Division of Lockheed Corporation); Head Office: 86 South Cobb Drive, Marietta, Georgia 30063, USA

LOCKHEED MODEL 382 HERCULES

C-130K. This is the original designation of the Lockheed Hercules as supplied to the Royal Air Force. Basically similar to the C-130H, except that much of the avionics and instrumentation is of UK manufacture; a total of 66 were supplied, the first of them entering service in April 1967 with the RAF designation **Hercules C, Mk 1**. One of these aircraft was modified subsequently by Marshall of Cambridge (Engineering) Ltd for use by the RAF Meteorological Research Flight, and following conversion this became redesignated **Hercules W, Mk 2**.

Under a programme planned currently to extend into 1982, thirty of the aircraft are each being lengthened by 4.57 m (15 ft 0 in), equivalent to commercial L 100-30 standard, and the first of them was completed during 1979. This modification increases payload capacity to seven cargo pallets instead of five, or 128 troops instead of 92, or 92 fully-equipped paratroops instead of 64, or 93 stretcher patients (and six attendants) instead of 70. After conversion these aircraft are being redesignated **Hercules C, Mk 3**.

LOCKHEED MODEL L 100-50 REGIONAL AIRFREIGHTER

Lockheed-Georgia was working in early 1980 on the development of a new high-capacity version of the L 100 Hercules. Intended for short to medium range operation, this has been designated L 100-50. Its additional capacity results from lengthening the basic L 100 airframe by 11.18 m (36 ft 8 in), which is achieved by the insertion of a plug 6.10 m (20 ft 0 in) long forward of the wing, and another 5.08 m (16 ft 8 in) long aft of the wing. This provides a cargo compartment length of 26.54 m (87 ft 1 in), including the ramp, and a bulk volume capacity of 225.06 m³ (7,948 cu ft).

This new version of the Hercules L 100 will be capable of transporting most common unit load devices, and is suitable for interline operation with wide-body freighters. To facilitate loading operations a new side cargo door, measuring 2.90 x 2.74 m (114 x 108 in), is provided at the forward end of the cargo compartment, this being additional to the main loading door and ramp at the rear of the fuselage. It makes possible the accommodation of nine pallets each 2.44 x 3.17 x 2.62 m (96 x 125 x 103 in), or ten each 2.24 x 3.17 x 2.62 m (88 x 125 x 103



Lockheed EC-130E electronic surveillance version of the Hercules, which has replaced the Lockheed EC-121

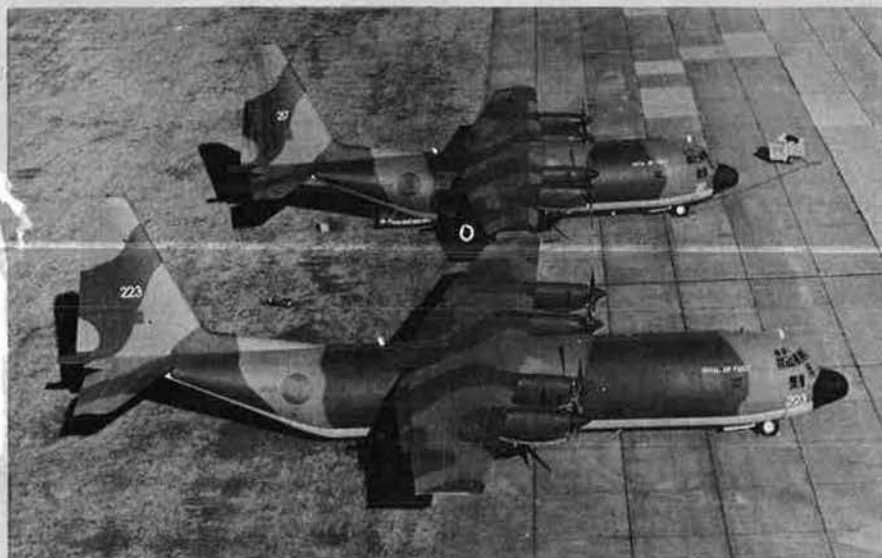
in), plus an additional pallet on the ramp, and providing a total palletised volume of 193.41 m³ (6,830 cu ft) or 192.27 m³ (6,790 cu ft) respectively.

Operating weights, as estimated, will ensure that this aircraft will meet FAR 36, Stage III noise standards.

Max operating weight empty	38,635 kg (85,175 lb)
Max payload	30,316 kg (66,835 lb)
Max zero-fuel weight	68,951 kg (151,010 lb)
Max ramp weight	79,887 kg (176,120 lb)
Max T-O weight	79,379 kg (175,000 lb)
Max landing weight	74,843 kg (165,000 lb)

LOCKHEED MODEL L 400 TWIN HERCULES

Lockheed Corporation announced on 8 January 1980 that design and development of a new L 400 Twin Hercules transport was to begin immediately. It was planned for the first flight to be made in the



The fuselage stretch of the RAF's Hercules C. Mk 3 is shown clearly in this photograph of the prototype, taken in company with an unmodified C. Mk 1

Spring of 1982, and this to be followed by a nine-month engineering flight test and FAA certification programme, with initial customer deliveries scheduled for January 1983.

Lockheed-Georgia has been carrying out engineering studies for a lightweight twin-engine Hercules for some time, and it is planned to build these on the company's C-130/L 100 production line. L 400 construction will be additional to the three-per-month production rate of the C-130/L 100 which Lockheed expects to continue into the foreseeable future. This aircraft will have a cargo compartment the same size as that of a C-130, and be able to carry 10,206 kg (22,500 lb) of cargo over a range of 500 nm (927 km; 576 miles). Structural changes by comparison with the C-130 will affect parts of the wings, the power plant, and main landing gear; the new aircraft is also to have simplified systems and instrumentation. Many components and spares will be common to both versions, and the L 400 is intended to use C-130 ground handling and test equipment, as well as training programmes. Fuselage and tail unit are to be substantially the same as those of the C-130, except that the flight deck is being revised for operation by a two-man crew.

Changes to the wing include a reduction of 6.86 m (22 ft 6 in) in the span of the centre-section. The existing outer wing panels are to be retained and a new constant-chord wingtip, 1.37 m (4 ft 6 in) long, will be fitted outboard of each aileron. Considerably lower gross weight allows simplification of the landing gear, and the two tandem wheels on each side of the C-130 are being replaced by a single wheel on each main unit. The L 400 will be powered by advanced Allison turboprop engines, and will incorporate the water/alcohol injection system which Allison developed for the T56-A-14 engines of the

US Navy's P-3 Orion. Providing additional power at higher ambient temperatures, it is anticipated that, in conjunction with new 4.27 m (14 ft 0 in) diameter propellers being developed by Hamilton-Standard, this aircraft will have excellent twin-engine performance. The Twin Hercules will be marketed at a price significantly lower than that of the four-engine C-130H or commercial L 100-30. Operators will not only make savings in overall operating costs, but reduced fuel consumption will be an increasingly important factor over the lifetime of the aircraft.

The description of the C-130H applies also to the L 400, except as detailed below:

TYPE: Short-range civil or military transport.

WINGS: Generally as for C-130H, except span of centre-section reduced and new constant-chord wingtips fitted.

FUSELAGE AND TAIL UNIT: Generally as for C-130H, except for changes in flight deck.

except crew of two on flight deck. Flight deck and main cabin pressurised and air-conditioned. Standard loads could include 2½-ton truck and 105 mm howitzer; 155 mm howitzer and its high-speed tractor; five pallets each 1,814 kg (4,000 lb); four containers each 2.4 × 2.4 × 3.0 m (8 × 8 × 10 ft); troops (max) 92; paratroops (max) 64; litters 74 and 2 attendants.

SYSTEMS: Air-conditioning and pressurisation systems. Two independent hydraulic systems, powered by engine-driven pumps, each with an electrically-operated auxiliary backup pump. Electrical system supplied by two engine-driven 60/90kVA generators. Auxiliary generator driven by APU, which can be operated in flight.

AVIONICS: Standard avionics include radar, flight director, gyro/magnetic compass, VHF nav/com, but a wide range of options is available to customer's requirements.

DIMENSIONS, EXTERNAL:

Wing span	36.48 m (119 ft 8¼ in)
Wing chord at root	4.88 m (16 ft 0 in)
Wing chord, mean	3.93 m (12 ft 10¾ in)
Wing aspect ratio	9.63
Length overall	29.81 m (97 ft 9½ in)
Height overall	approx 11.58 m (38 ft 0 in)
Tailplane span	16.05 m (52 ft 8 in)
Wheel track	4.36 m (14 ft 3½ in)
Wheelbase	10.55 m (34 ft 7¼ in)
Propeller diameter	4.27 m (14 ft 0 in)
Propeller ground clearance	1.89 m (6 ft 2½ in)

DIMENSIONS, INTERNAL:

Cargo compartment:	
Length excl ramp	12.50 m (41 ft 0 in)
Length incl ramp	15.55 m (51 ft 0 in)
Max width	3.05 m (10 ft 0 in)
Max height	2.74 m (9 ft 0 in)
Floor area, incl ramp	49.54 m ² (533 sq ft)
Volume, incl ramp	127.4 m ³ (4,500 cu ft)

AREAS:

Wings, gross	136.81 m ² (1,472 sq ft)
Fin	20.90 m ² (225 sq ft)
Rudder, incl tab	6.97 m ² (75 sq ft)
Tailplane	35.40 m ² (381 sq ft)
Elevators, incl tabs	14.40 m ² (155 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty	23,971 kg (52,847 lb)
Operating weight empty	24,449 kg (53,900 lb)
Max payload	11,385 kg (25,100 lb)



Artist's impression of the L 400 Twin Hercules, of which a prototype is to be built for first flight in Spring 1982

LANDING GEAR: As for C-130H, except single wheel on each main unit.

POWER PLANT: Two 3,661 kW (4,910 shp) Allison turboprop engines, each driving a Hamilton-Standard four-blade constant-speed fully-feathering reversible-pitch metal propeller. Water-alcohol injection system. Fuel in two main and two auxiliary integral wing tanks with total capacity of 13,241 kg (29,192 lb).

ACCOMMODATION: Generally the same as C-130H,

Max ramp weight	38,329 kg (84,500 lb)
Max T-O weight	38,102 kg (84,000 lb)
Max wing loading	278.6 kg/m ² (57.07 lb/sq ft)
Max power loading	5.20 kg/kW (8.55 lb/shp)

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

Cruising speed	250 knots (463 km/h; 288 mph)
Max rate of climb at S/L	488 m (1,600 ft)/min
Rate of climb at S/L, one engine out	114 m (375 ft)/min
Service ceiling	8,230 m (27,000 ft)

Service ceiling, one engine out 2,620 m (8,600 ft)
 Min ground turning radius 21.18 m (69 ft 6 in)
 T-O run 808 m (2,650 ft)
 Landing run 503 m (1,650 ft)
 Range with 10,206 kg (22,500 lb) payload, 5% fuel reserve plus 30 min loiter 500 nm (927 km; 576 miles)
 Ferry range with max fuel, 408 kg (900 lb) payload, 5% fuel reserve plus 30 min loiter 2,980 nm (5,522 km; 3,432 miles)

TWIN CAT

TWIN CAT CORPORATION; Address: c/o Chesapeake Airways, Salisbury, Maryland, USA

Twin Cat Corporation was formed in 1979 to market kits for the conversion of the Gulfstream American Ag-Cat to twin-engine configuration. The project was initiated by Mr Sam Goldman, President of Chesapeake Airways, who some years ago originated the Turbo Albatross conversion of the Grumman SA-16 amphibian built by Conroy Corporation. His associate in Twin Cat Corporation is Mr G. Thomas Peterson, owner and operator of the airport at Plains, Georgia, and a former chief test pilot at the General Aviation Division of Rockwell International.

TWIN CAT (GULFSTREAM AMERICAN) TWIN CAT

Re-engining of the Grumman/Gulfstream American G-164A Ag-Cat was initiated originally to overcome the scarcity of Pratt & Whitney R-1340 radial aircooled engines which power the single-engined

version from Gulfstream American Corporation. Basically, it consists of removing the single R-1340 engine of the standard Ag-Cat, replacing this with a glassfibre nosecone fairing. Mounting of the two Lycoming engines is essentially simple, requiring no cutting or welding. They are close-mounted against the sides of the forward fuselage, on a platform which is bolted to the main longerons; this limits the asymmetry when flying with one engine inoperative. Each engine is canted slightly outward

can be used to carry either fuel or agricultural chemicals.

Type approval for the single-engined Ag-Cat has been extended to the Twin Cat by the issue of an FAA Supplemental Type Certificate under CAM Pt 8. Most of the test flying for the STC was done by former Lockheed test pilot Herman ('Fish') Salmon, and the Twin Cat was also evaluated by several experienced agricultural pilots. FAA approval was based on minimum criteria which included the



Prototype AV-8B Advanced Harrier V/STOL combat aircraft, converted from an AV-8A



Twin Cat agricultural aircraft, a twin-engined conversion of the well-known Grumman/Gulfstream American Ag-Cat (Howard Levy)

version. A twin-engined layout was chosen to provide an additional safety factor. At first, it was planned to use a pair of Continental IO-520 or Tiara horizontally-opposed engines, but further study led to selection of the Lycoming TIO-540 turbocharged flat-six as being a more convenient choice. In addition to its ready availability, and a TBO of 2,000 hours compared with 1,000 hours for the R-1340, the TIO-540-A2, which powers the prototype conversion, delivers its full 231 kW (310 hp) at altitudes of up to 4,570 m (15,000 ft) and in temperatures as high as 38°C (100°F). Its critical altitude is 5,485 m (18,000 ft), compared with only 1,070 m (3,500 ft) for the R-1340. Fuel consumption of the Twin Cat, which in 'production' kit form utilises the TIO-540-J version of this engine, is virtually the same as that of the single-engined version.

Design of the conversion was undertaken by two independent engineering consultants, with assis-

and downward, which is claimed to improve the airflow over the wings, thereby improving stall performance by some 10.5 knots (19.5 km/h; 12 mph) compared with the single-engined Ag-Cat. The twin slipstreams also aid the dispersal of chemical. At reduced T-O weight, the Twin Cat can take off on one engine, from a standing start. Using both engines, take-off distances and rates of climb are approximately 20% better than those of the standard Ag-Cat.

Empty weight of the Twin Cat is about the same as that of the Ag-Cat, the extra weight of the twin-engine installation being offset by deleting the 24.5 kg (54 lb) counterweight in the rear fuselage of the single-engine version. On the Twin Cat prototype (N8761H), which flew for the first time in 1979, the nose compartment remained empty, but the conversion kit provides for an 85 US gallon tank to be accommodated in this position, counterbalanced by a 40 US gallon tank in the rear fuselage. These tanks

ability to take off, from a 610 m (2,000 ft) runway with a 15 m (50 ft) obstacle, at a speed of 52 knots (97 km/h; 60 mph) and a max gross weight of 2,948 kg (6,500 lb); to accelerate to 70 knots (129 km/h; 80 mph) after unstick, throttle-stop the port engine, dump load, wait 3 seconds before feathering the propeller, clear the obstacle, and either land straight ahead or circle for landing. The STC permits operation of the Twin Cat at normal and maximum take-off weights of 2,041 kg (4,500 lb) and 2,948 kg (6,500 lb) respectively, at the pilot's discretion. A quick-dump facility allows the load to be jettisoned in 1½ seconds in an emergency, to reduce gross weight from 6,500 to 4,500 lb.

Conversion kits became available from Twin Cat Corporation in early 1980.

TYPE: Twin-engined agricultural biplane.

WINGS: As for Ag-Cat.

FUSELAGE: As for Ag-Cat, except for replacement of single nose-mounted engine by a glassfibre nosecone, and mountings for twin-engine power plant.

TAIL UNIT AND LANDING GEAR: As for Ag-Cat.

POWER PLANT: Two 268.5 kW (360 hp) Lycoming TIO-540-J flat-six turbocharged engines, derated to 231 kW (310 hp) and close-mounted on each side of forward fuselage. Each engine drives a Hartzell RC8468-6R three-blade fully-feathering propeller. Provision for fuel tank of 322 litres (71 Imp gallons; 85 US gallons) capacity in nose compartment, and second tank of 151.5 litres (33 Imp gallons; 40 US gallons) in rear fuselage aft of cockpit.

ACCOMMODATION, SYSTEMS, AND EQUIPMENT: As for Ag-Cat, except for effect of twin-engine installation on forward/downward view from cockpit. Additional fuel tanks can be used instead for chemicals.

DIMENSIONS, EXTERNAL: As for Ag-Cat, except for length overall and:

Propeller diameter	2.13 m (7 ft 0 in)
Propeller ground clearance (tail up)	0.46 m (1 ft 6 in)

WEIGHTS:

Weight empty	1,588 kg (3,500 lb)
Normal T-O weight	2,041 kg (4,500 lb)
Max T-O weight	2,948 kg (6,500 lb)

PERFORMANCE (at normal T-O weight):

Max cruising speed at 4,270 m (14,000 ft)	130 knots (241 km/h; 150 mph)
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Operating speed 91 knots (169 km/h; 105 mph)
 Stalling speed:
 in 30° turn 54 knots (100 km/h; 62 mph)
 power off 49 knots (91 km/h; 56 mph)
 power on 43 knots (79 km/h; 49 mph)
 Climbing speed, one engine out 65 knots (121 km/h; 75 mph)
 Rate of climb:
 at S/L, two engines 488 m (1,600 ft)/min
 at S/L, one engine out 122 m (400 ft)/min
 at 1,525 m (5,000 ft), one engine out 46 m (150 ft)/min

MCDONNELL DOUGLAS

MCDONNELL AIRCRAFT COMPANY (A Division of McDonnell Douglas Corporation); Headquarters: Box 516, St. Louis, Missouri 63166, USA

AV-8B ADVANCED HARRIER

The accompanying three-view drawing shows details of the AV-8B Advanced Harrier in its production configuration. There are a number of external changes which can be noted by comparison with the drawing of the AV-8B that appeared in the 1979-80 *Jane's*. They include the new front fuselage with raised cockpit, and redesigned windscreen and canopy; these improvements combine to provide a better view forward, to the side, and over the shoulder. Other visible changes include the introduction of flap slot closure doors, deletion of fairings for the outrigger wheels when retracted, lengthened fuselage, and a modified tail unit that has a taller Sea Harrier fin and new tailplane planform with straight leading-edges and reduced sweep trailing-edges.

The US Marine Corps still plans to acquire 336 AV-8Bs to replace its AV-8As and A-4 Skyhawks, and in a changing climate of military procurement this now seems more likely to become reality than it

did a few months ago. Although high on the priority lists of both US Navy and Marine Corps requirements, the AV-8B was not included in the US 1980 budget. Although Congress has approved \$180 million of development funding, this is unlikely to be allocated unless production is in prospect. Even if the 1981 budget includes funds for this eventuality, it seems improbable that production AV-8Bs can enter USMC service before 1985.

DOUGLAS AIRCRAFT COMPANY (A Division of McDonnell Douglas Corporation); Headquarters: 3855 Lakewood Boulevard, Long Beach, California 90846, USA

MCDONNELL DOUGLAS DC-8 SRS 71, 72, and 73

In the 1979-80 edition of *Jane's*, a brief paragraph gave preliminary details of the Douglas Aircraft Company's plans, announced in the Spring of 1979, concerning a programme to re-engine DC-8 Srs 61, 62, and 63 aircraft with General Electric/SNECMA CFM56 or Pratt & Whitney JT8D-209 turbofan engines. Since that time, engineering design for the DC-8/CFM56 conversion has been in progress, and it was anticipated that this would be completed during May 1980. The first modification will be that of a DC-8 Srs 61, and FAA certification of the resulting Srs 71 is anticipated by the end of 1981. By that date a DC-8 Srs 63 will also have been converted to the new power plant, and certification of this Srs 73 aircraft is programmed for April 1982. It is planned also to carry out similar conversions to the Srs 61F/61CF, 62F/62CF, and 63F/63CF Jet Traders. At the beginning of February 1980, the company had received 56 firm orders and 44 options for conversions in this range.

Douglas states that DC-8 Srs 61, 62, and 63 aircraft re-engined with the CFM56-1B engine, as Srs 71, 72, and 73 aircraft respectively, are expected to

be the quietest large four-engine transports when they enter service, offering airport communities a true noise reduction of the order of 70%. This means that these aircraft will not only be able to meet the requirements of FAR 36-7 and -8, but will offer protection against future, more stringent regulations.

Of significance is the fact that this considerable improvement in environmental noise pollution is gained without loss of aircraft performance. On the contrary, the company claims that the DC-8 Super Seventy series with CFM56 engines offers significant performance improvements, including reduced take-off run, increased range, plus fuel savings over a 3,000 nm (5,560 km; 3,455 mile) route of as much as 7,711 kg (17,000 lb), 3,856 kg (8,500 lb), and 4,990 kg (11,000 lb) for the DC-8 Srs 71, 72, and 73 respectively.

Only limited specification figures for these conversions had been released by 1 February 1980, and these follow:

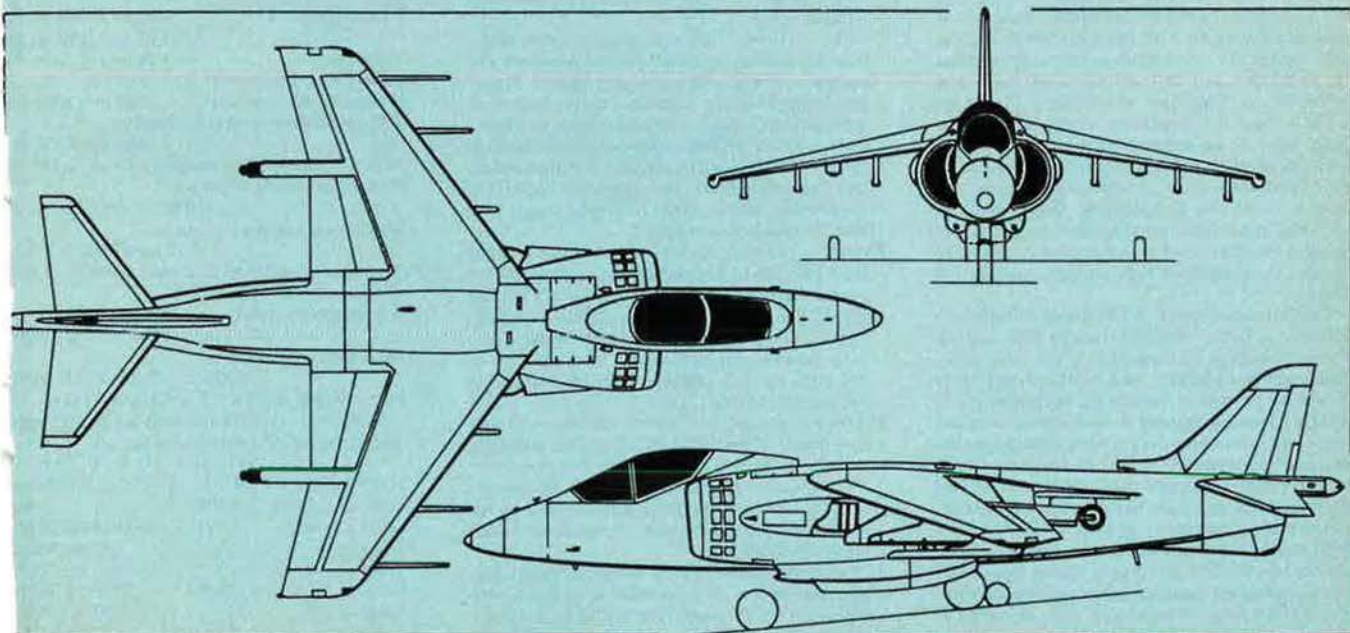
WEIGHTS AND LOADINGS (estimated, A : Srs 71; B : Srs 72; C : Srs 73; D : Srs 71F Jet Trader; E : Srs 72F; and F : Srs 73F):

Operating weight, empty:	
A	73,799 kg (162,700 lb)
B	69,218 kg (152,600 lb)
C	75,115 kg (165,600 lb)
Cargo capacity:	
A, C	30,239 kg (66,665 lb)
B	19,314 kg (42,580 lb)
Fuel capacity:	
A	71,093 kg (156,733 lb)
B	70,734 kg (155,942 lb)
C	73,773 kg (162,642 lb)
Max zero-fuel weight:	
A	101,605 kg (224,000 lb)
B	88,451 kg (195,000 lb)
C	104,326 kg (230,000 lb)
Max T-O weight:	
A, D	147,418 kg (325,000 lb)
B, E	151,953 kg (335,000 lb)
C	158,757 kg (350,000 lb)
F	161,025 kg (355,000 lb)
Max landing weight:	
A, B	108,862 kg (240,000 lb)
C	111,130 kg (245,000 lb)
D, E	117,027 kg (258,000 lb)
F	124,738 kg (275,000 lb)
Max wing loading:	
A, D	550.2 kg/m ² (112.69 lb/sq ft)
B, E	558.8 kg/m ² (114.45 lb/sq ft)
C	583.8 kg/m ² (119.58 lb/sq ft)
F	592.2 kg/m ² (121.28 lb/sq ft)

PERFORMANCE (estimated at max T-O weight with CFM56-1B engines):



US Marine Corps plans to acquire 336 AV-8Bs to replace its AV-8As and A-4 Skyhawks



AV-8B Advanced Harrier in its latest proposed production configuration (Pilot Press)

Max level speed, all versions
521 knots (966 km/h; 600 mph)
Cruising speed, all versions
Mach 0.80

AÉROSPATIALE

SOCIÉTÉ NATIONALE INDUSTRIELLE
AÉROSPATIALE; Head Office: 37 boulevard de
Montmorency, 75781 Paris Cédex 16, France

AÉROSPATIALE TB 30 EPSILON

The Epsilon programme was launched by the French Air Force in March 1978, to reduce training costs by comparison with the all-through jet sequence which it had pioneered in the 1950s. Current practice is for student pilots to undergo an initial 17 h of grading or primary training on CAP 10 light piston-engined aircraft, then 130 h of basic instruction on Magisters, followed by advanced training on Lockheed T-33As or the new Franco-German Alpha Jets.

The Air Force calculated that it could achieve major fuel economies, and cut costs by 15%, by using a relatively high-performance piston-engined type instead of a Magister for the first 70 h of basic training.

Epsilon was envisaged as being very different from a civilian club trainer. While being safe for a pilot with no experience, it had to be sufficiently representative of a combat aircraft to provide everything from elementary training to basic instruction in blind flying, visual and instrument navigation, night flying, and medium-altitude aerobatics. This implied tandem seating, a comparatively high power:weight ratio, high wing loading, and high manoeuvring speed rather than ability to perform tight turns.

Basic requirements were expressed in terms of a maximum speed in level flight of 190 knots (352 km/h; 218 mph) at S/L, initial rate of climb of 1,500 ft (457 m)/min, T-O run of less than 500 m (1,640 ft), and endurance of 3 h, with 45 min reserves, at 5,000 ft (1,525 m) with a crew of two. An unsupercharged engine of 224 kW (300 hp) was specified.

Other characteristics required by the specification included a clean stall, after adequate warning, without the use of leading-edge slats; a clean spin with pull-out in 1½ turns after six turns; ability to meet FAR Pt 23 requirements in the Aerobatic category, with g limits of +7 and -3.5; easy maintenance and operation; and a life of 10,000 flying hours on training duties.

Aérospatiale had already studied the aerodynamics and economics of an aircraft in this category when it received details of the specification from the Direction Technique des Constructions Aéronautiques (DTCA) in June 1978. This enabled it to submit a tender five months later, and to announce during the 33rd Paris Air Show, in June 1979, receipt of a development contract for two flying prototypes and two airframes for static and fatigue testing. Company designation of the design is TB 30, and the programme name Epsilon (the Greek letter ϵ) has been adopted for the aircraft.

The development programme is being handled by the Aircraft Division of Aérospatiale, as prime contractor, with the Engineering Department at Toulouse responsible for the entire program. Design and manufacturing have been subcontracted to Socata, the company's light aircraft subsidiary at Tarbes.

The first prototype (F-WZV0) underwent vibration tests at Tarbes in mid-November 1979, and left the paint shop on 10 December in the same white finish, with black trim, as the CAP 10s of the EFIPN (École de Formation Initiale du Personnel Navigant) at Clermont Ferrand-Aulnat. Ground run-ups began on 13 December, followed by ground ejection testing of the canopy by means of detonators. A 52 min first flight was made on 22 December by test pilot Marc Yoh and flight engineer Claude Durand.

Assembly of the second Epsilon has started, with flight testing scheduled to begin in June. It will be identical to the first prototype, except that it will carry production standard avionics from the start. The airframe for static testing was delivered to CEAT (Centre d'Essais Aéronautiques de Toulouse) in January. The French Air Force is ex-



Aérospatiale TB 30 Epsilon military primary flying trainer

pected to place an initial order for 50 Epsilons. Aérospatiale's market studies indicate a potential international market for 300 to 400 aircraft of this type. Production aircraft are expected to enter service by the Spring of 1983.

TYPE: Two-seat military primary flying trainer.

WINGS: Cantilever low-wing monoplane. Wing section RA 1643 at root, RA 1243 at tip. Thickness/chord ratio 16% at root, 12% at tip. Dihedral 5° from root. Incidence 2°. All-metal light alloy structure, with single main spar and rear auxiliary spar, built in two panels attached directly to sides of fuselage. Press-formed ribs and heavy-gauge skin without stringers. Electrically-actuated light alloy single-slotted flaps. Light alloy mass-balanced ailerons, covered with polyester fabric. Controllable trim tab in port aileron.

FUSELAGE: Light alloy semi-monocoque structure of four longerons, frames, and heavy-gauge skin, without stringers.

TAIL UNIT: Cantilever single-spar light alloy structure. Fixed surfaces metal covered; elevators and rudder covered with polyester fabric. Fixed-incidence tailplane mid-set on fin. Balanced elevators and rudder, with controllable trim tabs.

LANDING GEAR: Hydraulically-retractable tricycle type, with single wheel on each unit. Inward-retracting main units and rearward-retracting nosewheel. Independent hydraulic single-disc brake on each main wheel.

POWER PLANT: One 224 kW (300 hp) Avco Lycoming AEIO-540-L1B5D flat-six engine, equipped to permit inverted flight and driving a Hartzell HC-C2YR-4-F/FC 8475-6 two-blade constant-speed metal propeller, with spinner. Fuel in two wing leading-edge tanks, with total capacity of 210 litres (46 Imp gallons). Refuelling points on wing upper surface.

ACCOMMODATION: Two seats in tandem, with rear seat raised 70 mm (2.75 in). Seats are manually adjustable, up and down, and rudder pedals are mechanically adjustable fore and aft. Rearward-sliding two-section Plexiglas canopy, with emergency jettison system. Baggage compartment aft of cabin.

SYSTEMS: Hydraulic system for actuating landing gear and brakes. 28V electrical system includes engine-driven alternator, battery for engine starting and emergency use, and external power receptacle on port side of fuselage aft of wing.

Cabin heated and ventilated. Windscreen demister.

AVIONICS AND EQUIPMENT: Radio com and blind-flying instrumentation standard. Second prototype will have VHF, UHF, automatic VOR, and a transponder, with Tacan to be added later.

DIMENSIONS, EXTERNAL:

Wing span	7.35 m (24 ft 1¼ in)
Wing chord at root	1.46 m (4 ft 9½ in)
Wing chord at tip	0.92 m (3 ft 0¼ in)
Wing aspect ratio	6
Length overall	7.40 m (24 ft 3¼ in)
Height overall	2.50 m (8 ft 2½ in)
Tailplane span	2.75 m (9 ft 0¼ in)
Wheel track	2.30 m (7 ft 6½ in)
Wheelbase	1.80 m (5 ft 10¾ in)
Propeller diameter	1.98 m (6 ft 6 in)
Propeller ground clearance	0.25 m (10 in)

AREAS:

Wings, gross	9.00 m ² (96.88 sq ft)
Fin	1.08 m ² (11.63 sq ft)
Tailplane	1.74 m ² (18.73 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	828 kg (1,825 lb)
T-O and landing weight (aerobatic)	1,150 kg (2,535 lb)
Max T-O and landing weight (1.175 kg (2,590 lb)	
Max wing loading (aerobatic)	128 kg/m ² (26.17 lb/sq ft)
Max power loading (aerobatic)	5.13 kg/kW (8.45 lb/hp)

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

Never-exceed speed	281 knots (522 km/h; 324 mph)
Max level speed at S/L	190 knots (352 km/h; 218 mph)
Max cruising speed (75% power) at 1,830 m (6,000 ft)	180 knots (333 km/h; 207 mph)
Stalling speed, flaps down, power off	61 knots (113 km/h; 70 mph)
Max rate of climb at S/L	548 m (1,800 ft)/min
Time to 1,525 m (5,000 ft)	3 min
Service ceiling	6,100 m (20,000 ft)
T-O run	293 m (960 ft)
T-O to 15 m (50 ft)	465 m (1,525 ft)
Landing from 15 m (50 ft)	575 m (1,890 ft)
Landing run	250 m (820 ft)
Endurance	3
g limits	+7; -3.

TO EXPAND HORIZONS, EXPAND YOUR CLASSROOM BEYOND THE HORIZON.



To expand his or her horizon, the student goes to school. With an electronic classroom, your school goes to the student.

So it's possible to reach students who cannot get to your classroom. This eliminates the cost of travel, room and board.

It's also possible to reach a lot more students, without adding more teachers or more buildings. And this fights the rising costs of education.

But what makes it all possible is advanced communications technology from the Bell System.

Here's how it works at the Air Force School of Systems and Logistics.

The teacher speaks, writes on the blackboard, advances slides.

The speaker's voice, which goes out over a phone line, is heard at remote classroom locations. The blackboard writing also goes out over phone lines, and is reproduced on TV monitors. At the teacher's command, duplicate slides are advanced at the remote locations.

There is an interchange with the teacher because students at any location can ask questions. Experts can be patched in from outside the classroom. And a tape machine records both video and audio work for students who missed the class.

The Air Force School of Systems and Logistics now teaches from two separate classrooms to nine remote locations. Studies show that the level of learning is as high as if the teacher were there in person.

Bell's advanced communications technology is changing ideas about the nature of learning. It's becoming clear that much of what we call education is information management and communication, and that's our business — the knowledge business.

Call your Bell System Account Executive and find out how we can work for you.

The knowledge business



20% Dividend Paid for 1978 Reduces Net Cost to All-Time Low

Three Low-Cost, High Benefit Plans to Choose From

NOW AVAILABLE TO

CURRENT BENEFIT TABLES

Insured's Attained Age	STANDARD PREMIUM: \$10 per month	HIGH OPTION PREMIUM: \$15 per month	HIGH OPTION PLUS PREMIUM: \$20 per month
	Basic Benefit*	Basic Benefit*	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 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 members of the Air Force Association are eligible to apply for this coverage provided they are under age 60 at the time application for coverage is made.

*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 Ohio, 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 Insurance Company may, however, make a brief report thereon to the Medical Information Bureau, a nonprofit membership organization of life insurance companies, which operate 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 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 which 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 insurance companies to whom you may apply for life or health insurance, or to whom a claim for benefits may be submitted.

ALL AFA MEMBERS (under age 60)



APPLICATION FOR AFA GROUP LIFE INSURANCE



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			Height	Weight	Social Security Number
Mo.	Day	Yr.			

This insurance is available only to AFA members

I enclose \$13 for annual AFA membership dues (includes subscription (\$9) to AIR FORCE Magazine). Please send membership application.

I am an AFA member.

Name and relationship of primary beneficiary

Name and relationship of contingent beneficiary

Please indicate below the Mode of Payment and the Plan you elect:

Mode of Payment

Standard Plan

Plan of Insurance

High Option Plan

High Option PLUS Plan

Monthly government allotment (only for military personnel). I enclose 2 month's premium to cover the necessary period for my allotment (payable to Air Force Association) to be established.

Quarterly. I enclose amount checked.

Semi-Annually. I enclose amount checked.

Annually. I enclose amount checked.

Member Only	Member And Dependents
<input type="checkbox"/> \$ 10.00	<input type="checkbox"/> \$ 12.50
<input type="checkbox"/> \$ 30.00	<input type="checkbox"/> \$ 37.50
<input type="checkbox"/> \$ 60.00	<input type="checkbox"/> \$ 75.00
<input type="checkbox"/> \$120.00	<input type="checkbox"/> \$150.00

Member Only	Member And Dependents
<input type="checkbox"/> \$ 15.00	<input type="checkbox"/> \$ 17.50
<input type="checkbox"/> \$ 45.00	<input type="checkbox"/> \$ 52.50
<input type="checkbox"/> \$ 90.00	<input type="checkbox"/> \$105.00
<input type="checkbox"/> \$180.00	<input type="checkbox"/> \$210.00

Member Only	Member And Dependents
<input type="checkbox"/> \$ 20.00	<input type="checkbox"/> \$ 22.50
<input type="checkbox"/> \$ 60.00	<input type="checkbox"/> \$ 67.50
<input type="checkbox"/> \$120.00	<input type="checkbox"/> \$135.00
<input type="checkbox"/> \$240.00	<input type="checkbox"/> \$270.00

Names of Dependents To Be Insured	Relationship to Member	Dates of Birth			Height	Weight
		Mo.	Day	Yr.		

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 _____

Application must be accompanied by a check or money order. Send remittance to:
Insurance Division, AFA, 1750 Pennsylvania Avenue, NW, Washington, D. C. 20006

The Bulletin Board

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

Compensation Improvements Backed

Is the government at long last seeing the light on the military pay-benefits issue? Are congressional and Administration leaders now ready to put up the extra cash needed to sweeten people programs so the services can compete successfully for new members and retain enough experienced ones?

Recent events suggest a qualified "yes" with regard to the lawmakers, something less positive for the Administration. Military officials point out the extraordinarily heavy focus service leaders have directed on the need for improved pay and benefits. "They've got more lawmakers interested and on our side," one Air Force authority said, a statement borne out by the Senate's passage in February of the Nunn-Warner bill—named for Sen. Sam Nunn (D-Ga.) and Sen. John Warner (R-Va.).

That measure, among other things, provides a variable housing allowance, something the Air Force and AFA have sought unsuccessfully for years. It will pay the full difference between average local housing costs and 115 percent of a member's BAQ. The Nunn-Warner plan will help eighty-seven percent of the USAF people in high-cost areas in the US, Hq. USAF stated.

The measure also provides (1) a twenty-five percent boost in officer and enlisted flight pay, (2) a ten percent increase in subsistence allowances for all members, (3) reenlistment bonus eligibility for enlisted people with up to fifteen years' service, (4) a rise in the PCS reimbursement rate from ten to 18.5 cents a mile, and (5) an increase of fifteen percent in sea pay. Air Force took the unusual step of flashing details of the Senate action to its bases and commands around the world. (Usually the service remains silent on informing

the troops until legislative action is completed.) House approval is expected.

In pushing Nunn-Warner, the legislators bypassed a bill raising basic pay 3.4 percent across the board, but many Air Force people figure to come out better anyway. Also, the lawmakers avoided demands from civilian employees for a similar pay raise.

The Administration, meantime, has recommended sizable enlistment and reenlistment bonus increases in its FY '81 budget (see the article on the enlisted force in this issue). It's also going after a single member's COLA overseas, though Congress rejected one last year, and talking about improving educational benefits. The same budget contains a 7.4 percent military pay cap, though insiders feel there may be much stronger internal service resistance to it than has been directed at previous Presidential pay caps. "The 7.4 could come out higher," one informed source told AIR FORCE Magazine.

And when the smoke clears later this year, flying pay could be upped fifty percent, he said, not just the twenty-five percent boost provided in Nunn-Warner. AFA has provided testimony to the House, urging such action. Other insiders see numerous legislators rallying around more pay and benefits as an alternative to supporting a draft. "They're frightened at the signals from the violent reaction to the President's call for draft registration, so they'll support new programs to make the All-Volunteer Force work," the source said. Recent congressional passage of a military physician pay raise is also cited as evidence of Capitol Hill's intention to improve retention.

While there's optimism that Congress is "becoming more responsive to military members' needs," some quarters complain that the Adminis-

tration is dragging its feet on various compensation matters. And one influential agency, the General Accounting Office, continues to peck away at existing service benefits. In recent weeks, GAO has again urged the government to cut customer savings at commissaries and close down stores in big cities. It's also after the services to send military members' parcels to and from overseas by ship instead of by commercial air, thereby increasing delivery time from a few days to four to six weeks.

In related pay developments:

- Military retirees on March 1 got a six percent retired pay raise. Their previous semiannual hike, of 5.9 percent, was effective September 1, 1979.

- Former Defense Secretary Melvin Laird called for steep increases in pay and benefits—"far beyond current Administration proposals." One Laird plan would tie military pay to the consumer price index. Mr. Laird, in January 1973 as one of his last moves in the Pentagon, ended draft calls.

O'sea Kin Curb Ceiling Near

The Air Force says it is continuing to protest the congressionally imposed ceiling on military dependents overseas effective October 1. And with good reason. Officials are well aware that any large-scale curbs will shatter morale and retention. Even limited delays will be perceived in some quarters as another attack on benefits.

Unfortunately, there is little on the horizon to indicate the government will lift or ease the ceiling, which requires that no more than 325,000 command-sponsored dependents are overseas when October 1 arrives.

At the end of 1979, the Air Force had 124,404 command-sponsored kin abroad, more than one-third of the DoD-wide total. Defense at press time had not allocated the 325,000 distribution among the services. But if it slices the figure one-third Air Force, one-third Army, and one-third Navy-Marine Corps, as seems logical, Air Force could be oversubscribed and some families would be delayed going overseas.

A Hq. USAF "working group" has been set up "to monitor and, if necessary, control the flow of dependents overseas." Asked if RHIP (rank has its privileges) will figure in determining which families are shipped, Headquarters said, "Continuation of the equity now included in dependent travel directives will be followed when feasible."

Asked what USAF is doing to get the October 1 ceiling removed or raised, officials said, "We are continuing to oppose any ceiling on dependents. We continually stress to Congress the severe impact any restriction on dependents will have on readiness, retention, and morale. However, as long as there is a ceiling, the Air Force fully intends to comply with it."

Officials said the Air Force could manage the problem better by allowing a ceiling to be met as of September 30 each year rather than "during any period" as is now required. Accordingly, the service is preparing a legislative proposal to that end.

If command-sponsored kin shipments are delayed, more dependents will probably make the trip on their own even though they'll pay dearly for it and, in some cases, enter hardship status. Headquarters put the number of USAF "individually sponsored" dependents abroad at 8,600.

Larger GI Bill Payments

Despite inflation, GI Bill payment rates have remained the same since September 1977, but that's all slated to change. The Administration early this year, in sending the FY '81 Veterans Administration's \$22.7 billion budget to Congress, asked for a ten

percent hike in GI Bill benefits for Vietnam-era veterans.

About the same time, the Senate approved a fifteen percent education increase for veterans generally. To be effective next September, it would raise the monthly educational allowance for a veteran with no dependents from \$311 to \$358, and from \$422 to \$486 for a married vet with one child. Some 634,000 veterans would receive increases totaling \$376 million in FY '81, bill sponsors estimate.

The GI education rate increase bill also extends until the end of 1982 eligibility for high school, vocational, and on-the-job training benefits to help unemployed and disadvantaged Vietnam-era veterans. They are nearing the end of their ten-year eligibility period. The senators, in the same measure, reduced the government reimbursement for veterans taking flying training correspondence courses from ninety to sixty percent. This is a partial victory for the Administration, which wants to eliminate all such payments.

Earlier the House approved a bill with various GI Bill change provisions, including one aimed at nailing vets who owe Uncle Sam money for GI Bill overpayments and loan defaults. But it did not include a rate increase. So, the expectation is that a House-Senate con-

ference will weigh the Senate's fifteen percent increase.

The Defense Department, meantime, wants Congress to increase tuition-assistance from seventy-five to ninety percent of the off-duty study cost and to sweeten the Veterans Education Assistance Program. VEAP cut off GI Bill payments for youths who entered service after December 1976.

VA's FY '81 budget also contains a thirteen percent cost-of-living increase for 2,300,000 disabled veterans with service-connected disabilities, 360,000 survivors receiving Dependency-Indemnity Compensation, and 2,200,000 aged and needy vets with nonservice-connected ailments who are on the VA's pension rolls.

VA chief Max Cleland, in his budget message, spoke approvingly of a \$300 million increase in VA's medical care appropriation. But critics say the agency is actually reducing hospital beds and medical personnel and turning away some vets needing care. One blast, from Rep. Ray Roberts (D-Tex.), chairman of the House Veterans' Affairs Committee, declared there is "a steady deterioration in the quality and quantity of veterans health care."

In other veterans developments:

- VA's second annual Olin E.

AFA Believes . . .

Amen to Draft Registration

AFA, for some time, has consistently supported a return to some form of Selective Service. As our 1979-80 Policy Paper on Defense Manpower Issues (adopted unanimously at our last National Convention) makes clear:

... we realize full well that the Air Force is not experiencing the degree of recruiting and retention problems faced by the other armed services. However, our Association's concern is with the *overall* state of national security. We sincerely believe that the All-Volunteer Force—and the Air Force has always prided itself on being a volunteer service—would be immeasurably strengthened if a strong Selective Service System were in being.

Thus, we say a hearty "amen" to the President's recent declaration of the need for reviving the moribund Selective Service System. We are pleased that he has recognized this critical requirement.

His proposal is certainly modest enough—notwithstanding the instant uproar from those critics who seem to have difficulty recognizing that "buying" an armed force is neither entirely feasible nor, in a democracy, completely desirable. He is *not*, as some have accused him of doing, advocating a return to conscription. His proposal to the Congress, in bare outline, includes:

- A request for funding to register American young men under the authority he already possesses in law;
- Additional authority to register women for *noncombat* (our

emphasis) service;

- Plans to implement his program by using the facilities of the US Postal Service for registration, the IRS and Social Security computers, and the State Department facilities for overseas registration; and

- Developing new procedures for selection and training of local draft board members.

This is hardly what one would call a radical proposal, with the possible exception of the formal recognition that women are already doing an outstanding job as volunteers, and acknowledging their capability to fill many noncombat positions in time of emergency.

Since time is of the essence, we urge the Congress to quickly give the President the authority—and the funding—he seeks. Whether or not the All-Volunteer Force will survive in the long run—and, in February, AFA submitted testimony urging an across-the-board military pay raise aimed at helping attract and keep volunteers—there should be no question in the minds of reasonable Americans that registration is a minimum necessity. It's necessary both to prepare for an emergency we hope won't happen and to show the kind of resolve that might deter a potential aggressor from instigating an emergency.

Registration might be—as some critics have charged—"inconvenient." AFA believes that *not* to take this step, which shows the world that America is united in its will, would be more than "inconvenient"—it could be disastrous.

—JAMES A. McDONNELL, JR.

The Bulletin Board

Teague Award has been awarded to Leigh A. Wilson of the agency's San Francisco medical center. He designed a special shoe for patients with foot problems, a new postoperative waist belt, and a special collar for patients whose larynxes have been removed. Teague is a former chairman of the House Veterans' Affairs Committee.

• The 1980 edition of VA's booklet "Federal Benefits for Veterans and Dependents" is off the presses and available—for \$2 a copy, up from \$1.50 last year—from the Superintendent of Documents, Washington, D. C. 20402. Still a bargain, it updates all veterans benefits, explains how to apply, etc.

AFA Honors Recruiters

AFA officials in Washington, D. C., the Association's Nation's Capital Chapter, and the Iron Gate Chapter in New York City feted seven Air Force recruiters and their spouses last month. The event marked the kickoff of a new AFA program, titled the "Recruiting Team of the Year," honoring the service's top recruiters. The project is intended to provide national recognition for all Air Force recruiters.

The 1979 award winning recruiters are MSgts. Ruth L. Webb-Fuchs, Travis AFB, Calif., and Klaus Siebert, Swanton, Ohio; TSgts. Thomas D. Fluent, Kansas City, Mo., James B. Mamone, Parkersburg, W. Va., and George W. Richards, Pensacola, Fla.; SSgt. Henry R. Daniels, Jr., Sac-

ramento, Calif.; and Sgt. Clark E. Jarrett, Belleville, Ill.

Doctor Pay Going Up

Military doctors' pay, which has been massaged and improved frequently over the years and has long exceeded the compensation of all other officer groups, is about to rise again. The system in effect since 1974 is being replaced by a whole new line-up of stipends, the sum total of which aims to attract more physicians to service, and to keep them enrolled.

Congress has worked on the new arrangement for nearly two years. At press time, the lawmakers were winding up final action which, if approved by the President, will do the following:

1. Keep doctors on present general basic pay and allowances, but knock out existing special pays.
2. Pay \$9,000 annual bonuses to physicians with less than ten years' creditable service who are not in internship or initial residency training. The payment will rise to \$10,000 after ten years of service.
3. Provide a "variable special pay" of \$5,000 to \$10,000 annually, depending on years of service, regardless of a physician's status. Doctors in internship would receive \$1,200 per year.
4. Pay board-certified physicians \$2,000 to \$5,000 a year, depending on service. This would be distributed monthly.
5. Provide an "incentive special pay" of up to \$8,000 for physicians in critically short supply, such as radiologists (whose almost total rejection of military service costs the taxpayers tens of millions annually to pay civilian radiologists hired by military hospitals on a contract basis). Payment is at the discretion of the service secretaries.

Special pay provisions for dentists, optometrists, podiatrists, and veterinarians are also included in the new system. In a related move late last year, Congress increased from \$400 to \$453 the monthly stipend paid medical students who hold DoD-sponsored scholarships and are headed for service. It also guaranteed them cost-of-living increases.

There is some optimism that the increases will ease the military doctor shortage, but favorable results are by no means certain. In 1974, when the government laid on additional special doctor pays, including large annual bonuses for some of them, hopes for improved physician manning blossomed. But they apparently had no lasting impact because the services have been complaining about physician shortages for the past three or four years. So the old special pay provisions are being dropped and improved ones installed.

Overhaul CMA, the Pentagon Urges

Excessive turnover of judges on the Court of Military Appeals has had "an adverse impact on the military justice system," the Defense Department said recently in asking Congress to create a five-judge court. At present, three judges sit on the tribunal. But they're continually resigning early and sometimes only two members are available. This leads to confusion and instability in the justice system and especially upsets JAGs in search and seizure cases.

The answer, DoD's Assistant General Counsel Robert L. Gilliat told Congress, is a five-member court with each appointee given a fifteen-year term; some CMA judges have received shorter tenure. The Pentagon also wants the CMA brought out from under the Defense Department and made an independent body, to remove any suggestion that it might not be neutral. Finally, Mr. Gilliat testified, the US Supreme Court should be allowed to review CMA decisions. Should that come about, the CMA could no longer be characterized as "the serviceman's court of last resort."

Another Spouse Bill Launched

Rep. Patricia Schroeder (D-Colo.) has drawn the wrath of many military men in recent years over her spouse bills. They are designed to provide service wives divorced after lengthy marriages up to fifty percent of the member's retired military pay. Though the measures haven't gotten

Chief of Staff Gen. Lew Allen, Jr., Air Force Secretary Hans M. Mark, and acting Secretary (Manpower, Reserve Affairs and Installations) Joe F. Meis sign over seventy-nine acres of Eglin AFB, Fla., to the Air Force Enlisted Men's Widows and Dependents Home Foundation. A 200-unit facility, to be called Bob Hope Village, is to be built on the site.



far on Capitol Hill, another lawmaker, Rep. Joe Fisher (D-Va.), has joined her fight. He recently introduced H.R. 6270, which would reward such divorcees with a portion of the retired pay, provided a court ordered payment and the ex-spouse applied for it.

Fisher's stand is interesting in view of the fact that his northern Virginia district (Arlington, Fairfax County, and Alexandria) is honeycombed with active-duty and retired servicemen, many of whom strongly oppose any attempts to bite into their retired pay. Other new bills of interest include:

H.R. 6153 (Rep. David E. Satterfield,

D-Va.) would raise the special pay for Veterans Administration physicians and dentists, in much the same way military medical pays are rising (see above).

H.R. 6155 (Rep. Bob Wilson, R-Calif.) would increase the money the government may pay for treatment of handicapped dependents of US service members.

H.R. 6421 (Rep. Austin J. Murphy, D-Pa.) would raise to forty-five the maximum age for original commissioning in the services.

S. 2127 (Sen. Gary Hart, D-Colo.) would lower the minimum number of

students that must be in a high school junior ROTC unit.

Short Bursts

USAF's suggestions awards program proved a winner last year when total savings hit \$72 million, up from \$44 million in FY '78. Authorities, naturally pleased, are urging even greater participation this year. But we continue to wonder why, if the suggestions awards project is as important as authorities say it is, USAF retirees, Reservists, and Guardsmen are not given any award money. What happened to the "total-force" policy?

Ed Gates . . . Speaking of People

Coming to Grips With the Claims Issue

As noted elsewhere in these pages (e.g., "The Bulletin Board" and the article about enlisted careers), Congress and the Administration are at long last showing signs of coming to grips with the military compensation and benefits issues that until now have received short shrift.

This apparently includes less publicized but frequently vital matters of concern to part of the membership, such as personal claims against the government. Big bucks are sometimes involved, bucks that on occasion are unfairly denied the man or woman in uniform.

The Air Force's Judge Advocate General, Maj. Gen. Walter D. Reed, put the matter in perspective recently when he testified on bills that would raise the \$15,000 individual claims limit to \$25,000 and, in the case of claims arising out of evacuations from abroad, to \$35,000 or \$40,000. He appeared before a House Judiciary subcommittee that was just getting around to conducting hearings on financial relief to US service members who suffered catastrophic losses when they were evacuated from Iran more than a year ago. General Reed spoke for all the services and the Defense Department.

Claims for loss or damage of personal property owned by service members and DoD civilians is big business. Last year, 59,318 claims submitted by USAF people were approved, and Defense-wide nearly 185,000 claims were paid. Most of them, of course, were for less than the \$15,000 limit. In any case they represented carloads of battered furniture, damaged stereos, lost antiques, stolen jewelry, and other valuable possessions gone astray.

The case for increasing the claims ceiling seems compelling. Rising costs for repairing and replacing property that is likely to fall apart after about the third move is just one reason. Another is the fact that military personnel run into real problems when attempting to secure private insurance to protect themselves from the inevitable losses and damages.

Protection, General Reed explained, may come in the form of a government bill of lading (GBL) or by buying insurance. But the increased-value GBL is only available domestically, it costs the member \$5 per \$1,000 of value, and he may wind up having to sue the carrier to collect.

As for insurance, the so-called "trip-transit" policies are not available for domestic moves, and various international carriers don't provide them. Where available the exclusions are numerous and the cost is high. Personal property "floaters," though available, do not insure against damage due to the hazards of transportation and are too expensive for many military members. General Reed added that overseas insurance against the increased risks of loss brought on by political unrest, civil disorders, and forced abandonment of personal property is simply unavailable.

"Many of our Iranian evacuees who thought they had insurance against such risks were shocked and dismayed when they later

were informed by their insurance carriers to the contrary," the JAG said.

The increased risks of property loss abroad—evidenced by events last year in Iran, Pakistan, and Libya—is the third reason the \$15,000 claims ceiling should be increased, the Pentagon contends. Congress, it should be noted, hiked the claims lid from \$6,500 to \$10,000 in 1964, and in 1973 boosted it to the present level.

The new legislation would raise the cap to \$25,000 for routine claims. For overseas evacuation situations the Pentagon recommended \$35,000, but the committee settled for \$40,000. And coverage would be retroactive for claims occurring after December 31, 1978. General Reed said there have been no claims for damage or loss incident to service in Iran before that date that topped the present \$15,000 maximum. But there were at least 179 claims exceeding \$15,000 after that date. So, these people may soon have considerable cash coming their way.

Defense-wide, 1,294 "Iran evacuation claims"—488 USAF, 654 Army, and 152 Navy and Marine Corps—were settled as of this past December 31. Payments amounted to just over \$7 million, an average of \$5,465 per recipient. However, some \$5.3 million of the \$7 million figure came out of Iranian funds on deposit in the US for military goods and services.

Pentagon officials at the hearings stressed that approval of the new claims ceilings would add only negligible costs to the claims program. For example, only nine yet unpaid Iran evacuation claims exceed \$35,000; six of them, all submitted by USAF members, are for \$40,000.

For the entire Defense Department claims program, the requested new ceilings would probably cost the government less than an additional half million dollars a year. As General Reed noted, last year only sixteen non-Iranian claims submitted by USAF members exceed \$15,000. If a \$25,000 ceiling had been in effect then, USAF's outlay would have increased only \$92,000 (compared to the \$18.6 million actually spent). Thus, Congress should not be concerned about the cost factor. It should be concerned about adequately protecting the military community and passing the legislation without further delay.

As General Reed noted, "To require our Defense Department personnel to risk the catastrophic loss of their property in circumstances that are incident to their service, but without the ability to secure adequate insurance payments or other compensation when losses occur, is clearly inequitable.

"It is only proper that the Congress . . . assume this responsibility. The added costs would be relatively small, but the benefits, in terms of improved morale and a further inducement for entering and continuing membership in the armed forces, would indeed be great." The subcommittee, apparently agreeing, approved the measure. Now it's up to the rest of Congress. ■

The Bulletin Board

Here's progress. **Obstetric and gynecologic services have been restored at the Reese AFB, Tex.,** hospital, following a six-year absence. The former OB/GYN facilities have also been refurbished, new equipment installed, and twenty-two additional nurses and other specialists have been added to the staff, the base reports. In addition, doctors from the nearby Texas Tech Medical School will dispense care to the Reese patients.

Next month, a special Hq. USAF board will consider various **nonrated officers for flying training.** Nothing

unusual about that, except that ninety of these people had been chosen for pilot school nearly four years ago while they were AFROTC seniors but were suddenly bounced from the UPT list because USAF had far more flyers than it needed. The April board is slated to tap twenty-five of the ninety for UPT entry.

About 250 "**career-broadening opportunities**" at 141 AFROTC units are opening up in the summer of 1981, including thirty-seven Professor of Aerospace Studies billets. The rest are assistant prof spots. Interestingly, the Air Force does not have the final say on these assignments; it defers to the schools.

The JAG office at Hq. USAF reports that the service has received "**very few**" **whistleblower complaints**—employee charges of wrongdoing in government—since the authority was given legal status last year. But

whistleblowing "may well increase as the availability of this avenue of redress becomes more widely known," a JAG report states.

Both USAF and Army have new Assistant Secretaries for Manpower, Reserve Affairs and Installations. USAF's is **Joseph C. Zengerle**, thirty-seven, a West Pointer, lawyer, and once special aide to the US commander in Vietnam during the Tet offensive. He's the youngest political appointee ever to hold the top USAF personnel executive post. Army's new appointee is **Dr. Robert H. Spiro**, sixty, a historian, President of Jacksonville (Fla.) University, a World War II naval officer, and now a rear admiral in the Naval Reserve. They are responsible for direction, guidance, and supervision over all military and civilian personnel, the Reserve components, and facilities of their respective services. ■

Senior Staff Changes

PROMOTIONS: To be **Major General:** George C. Lynch; John T. Randerson.

To be **Brigadier General:** Donald O. Aldridge; James T. Boddie, Jr.; Thomas C. Brandt; William J. Breckner, Jr.; America P. Bruno; Duane H. Cassidy; William M. Constantine; James F. Culver; Charles J. Cunningham, Jr.; Lewis G. Curtis; James C. Dever, Jr.; William L. Doyle, Jr.

Richard H. Dunwoody; Archer L. Durham; Duane H. Erickson; Edward N. Giddings; Donald W. Goodman; William A. Gorton; David M. Hall; Charles R. Hamm; Elbert E. Harbour; Winfield S. Harpe; Harley A. Hughes; John P. Hyde.

Richard A. Ingram; Avon C. James; Buford D. Lary; Albert J. Lenski; Leland K. Lukens; Sheldon J. Lustig; James P. McCarthy; Richard L. Meyer; Monte B. Miller; Joseph D. Mirth; George L. Monahan, Jr.; Joe P. Morgan.

David L. Nichols; William E. Overacker; Maurice C. Padden; Gerald W. Parker; Walter H. Poore; Allen K. Rachel; Bernard P. Randolph; Bealer T. Rogers, Jr.; Thomas W. Sawyer; John A. Shaud; Robert D. Springer; C. C. Teagarden; Larry N. Tibbetts; Marion F. Tidwell; Jerry W. Tietge; William T. Tolbert; William T. Twinting; Regis F. A. Urschler; Wilma L. Vaught; Paul D. Wagoner.

RETIREMENTS: M/G Rufus L. Billups; B/G George J. Kertesz; M/G George W. Rutter; M/G Benjamin F. Starr.

CHANGES: Col. (B/G selectee) William J. Breckner, Jr., from Cmdr., 82d FTW, ATC, Williams AFB, Ariz., to DCS/Log., Hq. ATC, Randolph AFB, Tex., replacing M/G Lawrence D. Garrison. . . . B/G Theodore D. Broadwater, from Exec. Dir., Supply Ops., DLA, Alexandria, Va., to Dir., Log. Plans & Prgms., DCS/L&E, Hq. USAF, Washington, D. C., replacing retiring M/G Rufus L. Billups. . . . Col. (B/G selectee) America P. Bruno, from Dep. Prgm.

Mgr. for Log., Hq. AFLC, Wright-Patterson AFB, Ohio, to Vice Cmdr., Ogden ALC, AFLC, Hill AFB, Utah, replacing B/G Cornelius Nugteren.

Col. (B/G selectee) Lewis G. Curtis, from Dir. of Maint., Ogden ALC, AFLC, Hill AFB, Utah, to Special Asst. to Cmdr., San Antonio ALC, AFLC, Kelly AFB, Tex. . . . Col. (B/G selectee) Richard H. Dunwoody,

from Cmdr., 1st SOW, TAC, Eglin Aux. Fld. 9, Fla., to Cmdr., 554th Ops. Support Wg., TAC, Nellis AFB, Nev. . . . Col. (B/G selectee) Archer L. Durham, from

Cmdr., 436th MAW, MAC, Dover AFB, Del., to Cmdr., 76th MAW, MAC, Andrews AFB, Md., replacing retiring M/G Benjamin F. Starr.

B/G Jack I. Gregory, from Cmdr., Tac. Trng., George, TAC, George AFB, Calif., to Asst. DCS/Ops. for Cont. & Spt., Hq. TAC, Langley AFB, Va., replacing B/G John L. Pickitt. . . . Col. (B/G selectee) Leland K. Lukens, from

Cmdr., 52d TFW, USAF, Bitburg AB, Germany, to Dir. of Aerospace Safety, Hq. AFISC, Norton AFB, Calif., replacing retiring B/G Garry A. Willard, Jr. . . . Col. (B/G selectee) Richard L. Meyer, from Cmdr., 49th TFW, TAC, Holloman AFB, N. M., to Cmdr., Tac. Trng., George, TAC,

George AFB, Calif., replacing B/G Jack I. Gregory.

Col. (B/G selectee) Monte B. Miller, from Chief, Med. Insp. Div., Hq. AFISC, Norton AFB, Calif., to Cmdr., Malcolm Grow USAF Med. Ctr., MAC, Andrews AFB, Md., replacing B/G William H. Greendyke. . . . B/G John L. Pickitt, from Asst. DCS/Ops. for Cont. & Spt., Hq. TAC,

Langley AFB, Va., to Asst. DCS/Plans, Hq. TAC, Langley AFB, Va. . . . B/G Robert A. Rosenberg, from Staff Officer, NSC, Washington, D. C., to ACS/Studies & Analyses, Hq. USAF, Washington, D. C., replacing M/G Jasper A. Welch. . . . Col. (B/G selectee) Jerry W. Tietge, from

Cmdr., 20th TFW, USAF, RAF Upper Heyford, U. K., to Cmdr., 86th TFW, USAF, Ramstein AB, Germany, replacing M/G Harry Falls, Jr. ■



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AFA News

By Vic Powell, AFA AFFAIRS EDITOR



Allen Donovan, center, recently received a Jimmy Doolittle Fellow Plaque during ceremonies in Los Angeles. Presenting the plaque is Ed Stearn, right, President of California State AFA, and Lt. Gen. Jimmy Doolittle, USAF (Ret.). The plaque represents a \$1,000 contribution to the Aerospace Education Foundation, an AFA affiliate, by the Aerospace Corp. on behalf of Mr. Donovan. Funds from these contributions are used to finance reproduction of Air Force education courses by the Foundation for public use.



AFA's Mid-Ohio Chapter recently conducted a bus tour to the Air Force Museum at Dayton, Ohio, for veterans living in convalescent homes in the Newark, Ohio, area. Chapter members who helped with the tour include Charles E. Skidmore, Jr., left, Mid-Ohio Chapter's Director of Communications and Executive Vice President of Ohio State AFA; and Jerry Blaine, second from left, Chapter member and Protocol Officer for the Aerospace Guidance and Metrology Center (AGMC), which cooperated in producing the tour. At right are CMSgt. Franklin S. Bandy of AGMC and a reporter from the Licking Countian newspaper, which gave the tour two full pages of coverage.



The Mid-Ohio Chapter/AGMC trip to the Museum also included a tour of Wright-Patterson AFB, Ohio, headquarters of Air Force Logistics Command. The veterans praised the tour, which is part of the "Adopt a Vet" program sponsored by the Chapter to combat neglect of military veterans. Part of the group is shown here viewing a display at the Air Force Museum.



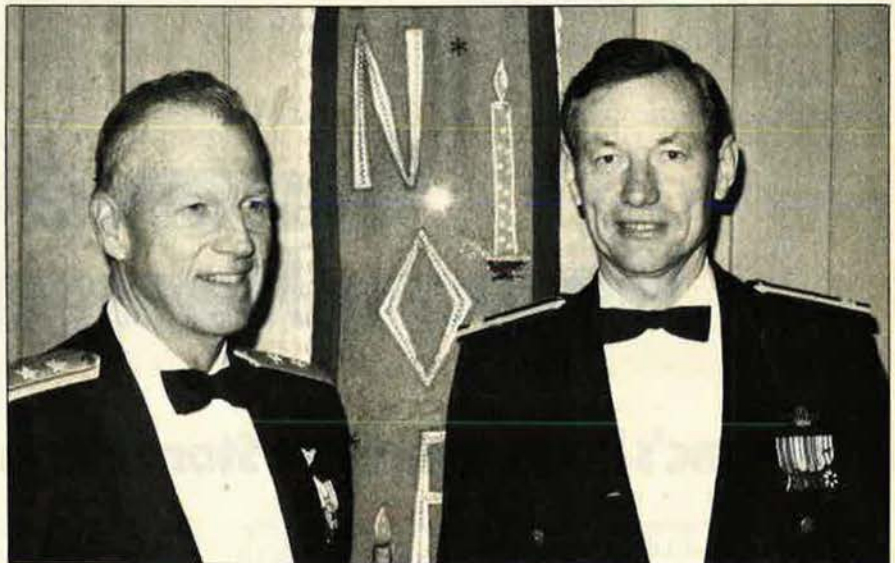
Learning of the need for fifty state flags, white gloves, and scarves for the Flag Corps at Sheppard AFB, Tex., AFA's Wichita Falls Chapter collected \$1,377 from members and friends for the project. Maj. Gen. Robert W. Bazley, USAF, Commander of Sheppard Technical Training Center, thanks Frank Jones, right, President of the Wichita Falls Chapter. A1C Greg Brown, center, of the 3700th Technical Training Wing, displays the Texas flag.

chapter and state photo gallery



Cartoonist Milton Caniff, left, recently accepted a Jimmy Doolittle Fellow Plaque for the family of the late Col. Phillip G. Cochran, the noted World War II airman and long-time AFA member who passed away last year. Colonel Cochran was the model for Caniff's "Flip Corkin" character in Terry and the Pirates, and later for "General Philerie" in the Steve Canyon comic strip. Presenting the plaque is Iron Gate Chapter President retired Col. Francis S. Gabreski, USAF's top living ace.

Maj. Gen. Jack K. Gamble, USAF (Ret.), President of Washington State AFA, left, and Col. Dale L. Reynolds, USAF, Professor of Aerospace Studies, Det. 900, at the University of Puget Sound, Tacoma, Wash., attended the Arnold Air Society/Angel Flight Dining Out held last November 30, at the McChord AFB Officers Club. General Gamble, the featured speaker, discussed the importance of strong military forces for national security.



COMING EVENTS

Fifth Annual Arizona AFA Ball, April 12, Arizona Biltmore, Phoenix, Ariz. . . . **Nevada State AFA Convention**, April 18-19, Las Vegas, Nev. . . . **Tennessee State AFA Convention**, April 18-19, Alcoa, Tenn. . . . **South Carolina State AFA Convention**, May 2-3, Sumter, S. C. . . . **Alaska State AFA Convention**, May 9-11, Anchorage, Alaska . . . **Florida State AFA Convention**, May 9-11, Tampa, Fla. . . . **Connecticut State AFA Convention**, May 10, Windsor Locks, Conn. . . . **Arizona State AFA Convention**, May 10-11, Phoenix, Ariz. . . . **Washington State AFA Convention**, May 16-17, Tacoma, Wash. . . . **California State AFA Convention**, May 16-18, Merced, Calif. . . . **AFA Golf and Tennis Tournaments**, May 23, The Broadmoor, Colorado Springs, Colo. . . . **AFA**

Nominating Committee and Board of Directors Meetings, May 24, The Broadmoor, Colorado Springs, Colo. . . . **Twenty-first Annual Dinner Honoring the Air Force Academy's Outstanding Squadron**, May 24, The Broadmoor's International Center, Colorado Springs, Colo. . . . **Ohio State AFA Convention**, May 31, Dayton, Ohio . . . **Alabama State AFA Convention**, June 6-8, Birmingham, Ala. . . . **Pennsylvania State AFA Convention**, June 6-8, State College, Pa. . . . **New York State AFA Convention**, June 13-15, Rome, N. Y. . . . **Oklahoma State AFA Convention**, June 20-21, Tinker AFB, Okla. . . . **Texas State AFA Convention**, June 27-28, Kerrville, Tex. . . . **Missouri State AFA Convention**, July 12, Whiteman AFB, Mo.



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Conrac was also selected to provide the Stores Management System for the AV-8B Harrier.

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AFA News photo gallery

The Riley Childrens Hospital of Indianapolis, Ind., recently received more than thirty military and commercial aircraft models, donated by members of AFA, NCOA, and the 9014th PARS, for a "Flight into the '80s" display. AFA member Randy Edens, left, of the Naval Avionics Facility in Indianapolis, built most of the models, and NCOA member TSgt. Richard Basore, USAF, who coordinated the project, secured others from aircraft manufacturers and airlines. The models are suspended in the main lobby and library of the hospital.



Maj. Gen. William Copey, USAF (Ret.), seated at left, and WW I fighter pilot Reginald Sinclair, seated at right, were inducted into the Blue Barons Chapter of Colorado State AFA during a recent meeting in Colorado Springs. Among those witnessing the induction were Noel A. Bullock, left, Director of Aerospace Education for Colorado State AFA, and Col. E. J. Zulauf, USAF, Commander of the USAF Rocky Mountain Region CAP Liaison Office.



Joseph R. Falcone, National Vice President for AFA's New England Region, shows a sampling of his collection of pilot's wings. He has collected US and foreign wings for thirty-four years, with the earliest dating from 1916. Mr. Falcone estimates that his collection is worth thousands of dollars, but vows, "I'll never sell it."

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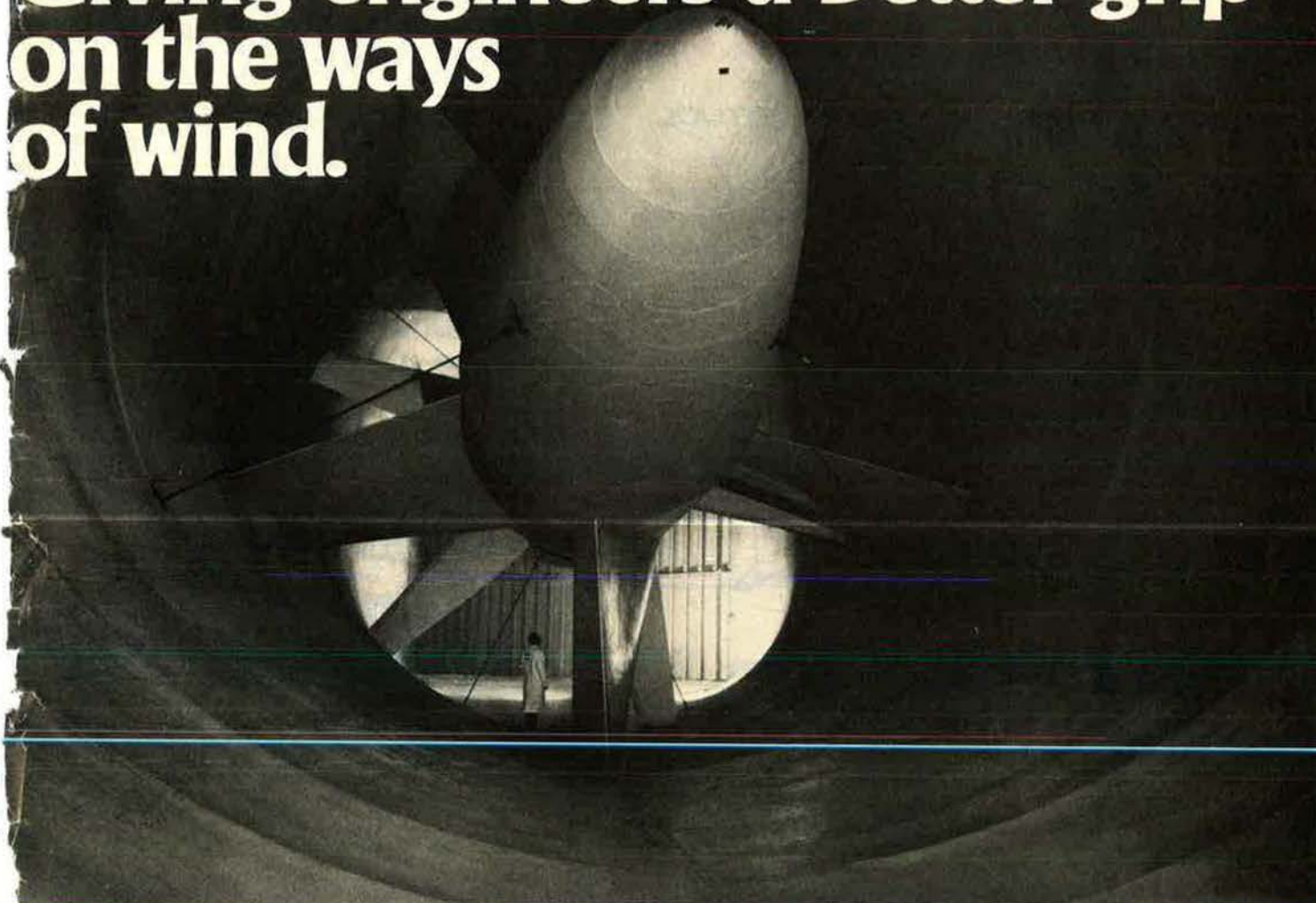
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But the tunnel's main use relates to airlifters, where Lockheed-Georgia has unmatched leadership throughout the world. Because the tunnel is so huge, Lockheed engineers are able to test models of airlifters and their components that are significantly larger than those that can be tested in any other low-speed tunnel. The larger the model, the more accurate the data that comes from tests. And ultimately that pays off in fuel economy, better short field performance, more range, bigger payloads—better airlifters.

Lockheed built this type of tunnel because low speed plays a critical role in an airlifter's performance. Low speed frequently is more difficult to handle than supersonic speeds.

If big is best in low speed tunnels, small is beautiful in the facility shown at right. It's Lockheed's unique transonic blow-down facility. It too gives Lockheed engineers a major advantage in their airlifter work.

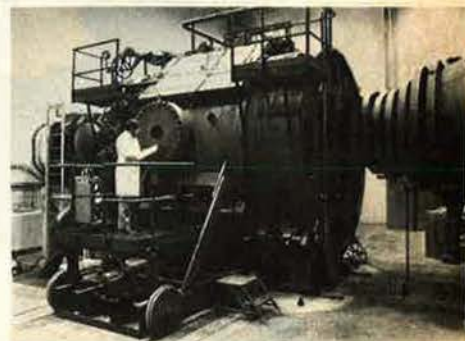
This chamber can operate at higher pressure levels than any other blow-down facility in America—pressures

12 times greater than those in the atmosphere in which we live.

This means a small model of an airlifter can be tested in conditions that more nearly simulate full-scale flight than is possible in all other blow-down chambers. It enables Lockheed engineers to work with higher Reynolds numbers than those possible elsewhere. (Osborne Reynolds was a physicist whose work in the flow of fluids has been adapted to wind tunnel tests, earning him a bit of aerospace immortality.)

The payoff in these higher Reynolds numbers is the same as in the low-speed wind tunnel—more accurate test data, better airlifters.

When it comes to designing, building and supporting airlifters, the people at Lockheed-Georgia know how. They have more airlifter experience, by far, than anyone else.



Lockheed-Georgia

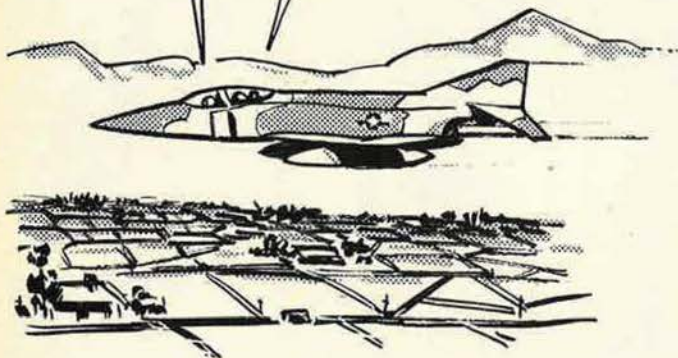
Bob Stevens'

"There I was..."

AN F-4 IS ON A LOW-ALTITUDE TRAINING MISSION -

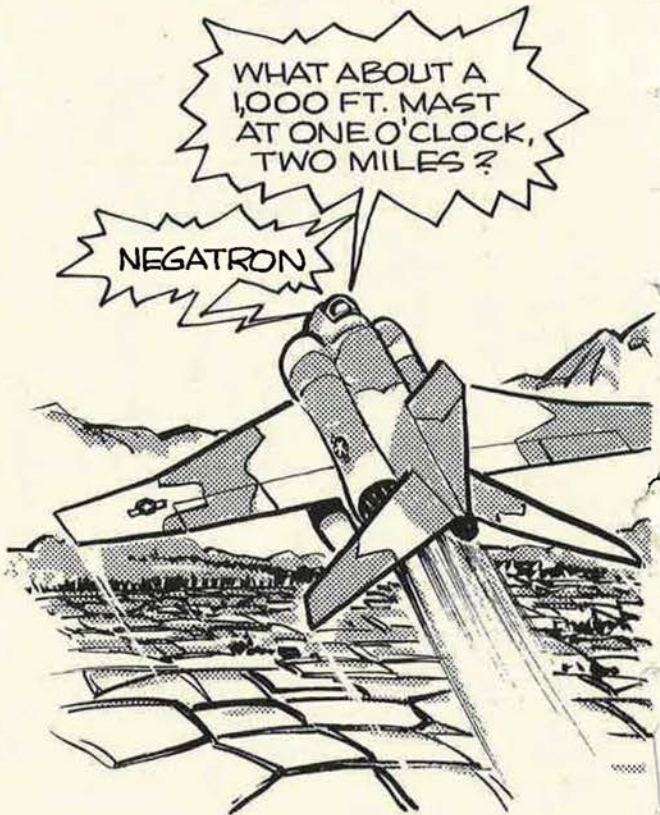
CAN YOU SEE A LARGE TOWN AT TEN O'CLOCK, FOUR MILES?

NEGATIVE!



WHAT ABOUT A 1,000 FT. MAST AT ONE O'CLOCK, TWO MILES?

NEGATRON



HOW'S ABOUT AN ABANDONED AIR FIELD, DEAD AHEAD?

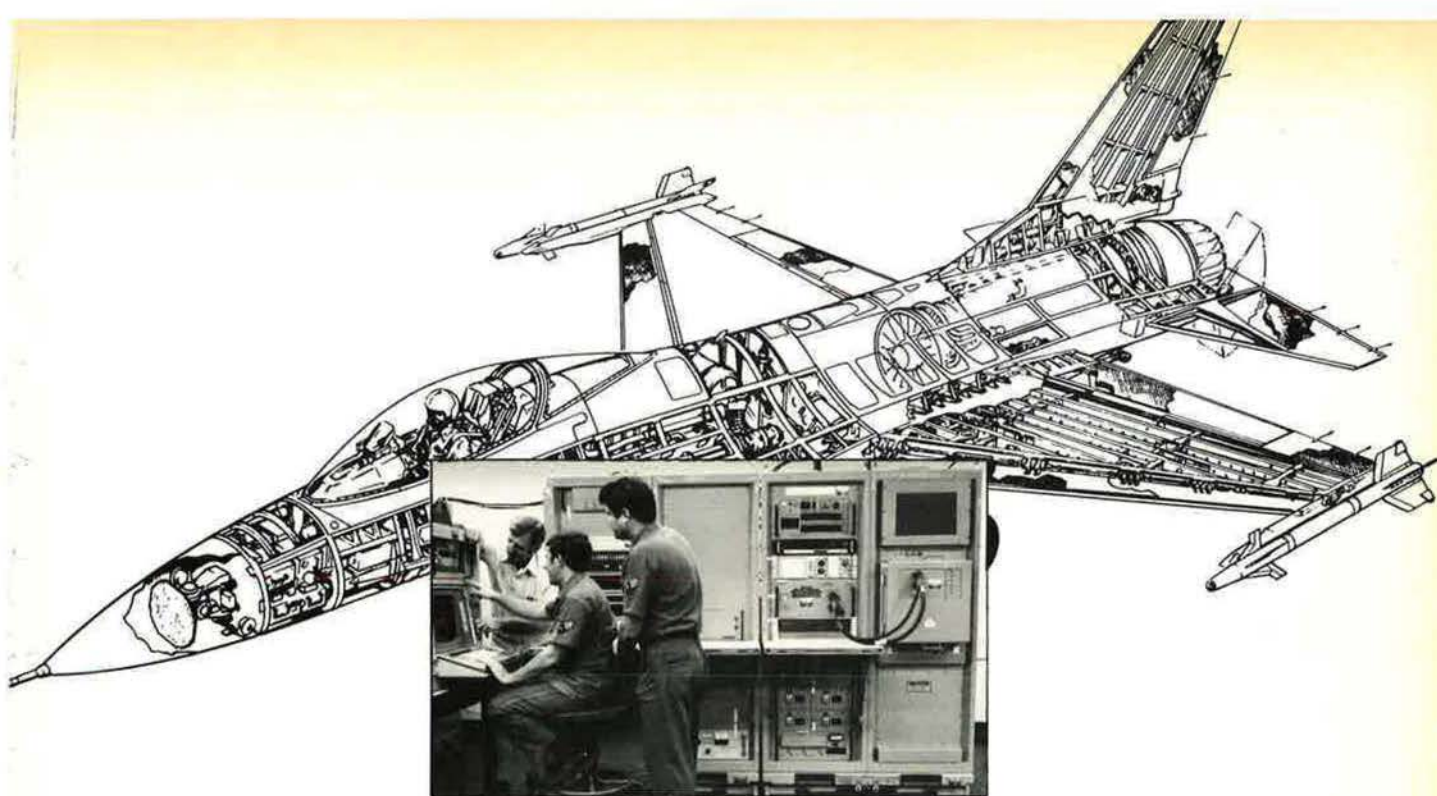
NO.



WELL, THERE'S NO DOUBT ABOUT IT... WE'RE LOST!



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F-16 Avionics Intermediate Shop (AIS): We designed it to automatically test advanced aircraft avionics LRUs across the spectrum from DC to Light.



"Testing Line Replaceable Units (LRUs) from DC to Light means literally what it says. The F-16 AIS tests aircraft avionics encompassing the spectrum of DC, audio-frequency, RF, microwave and the visible light spectrum."

H.E. Jordan, Vice President and Program Director, AIS

The General Dynamics Electronics Division AIS is providing reliable and rapid avionics checkout of F-16 multirole fighters at air bases in the U.S. and Europe. This flight-line, fault-isolation system is helping the USAF Tactical Air Command to significantly exceed its projected sortie rate for this high-performance aircraft.

The AIS was engineered to meet prescribed intermediate shop test requirements for primary and secondary LRUs aboard the General Dynamics-built F-16. Program Director Jordan says: "AIS represents the third generation in test technology. It involves the computer in stimulus and measurement generation and eliminates the need for a large quantity of conventional test equipment."

To perform its wide-ranging test tasks, AIS combines state-of-

the-art elements. With computer participation, an Arbitrary Function Generator (AFG), under the control of specialized software, synthesizes literally any waveshape from simple pulses to complex signals. For measurement, digital-processing and sampling techniques are used to extract voltage and time samples of LRU signals. A versatile software operating system featuring an on-line ATLAS interpreter supports the hardware and simplifies the overall testing task.

Jordan points out, "AIS also performs automatic photometric analysis of current-generation, head-up avionic displays. Our engineers achieved this by bringing a newly discovered technology into practical, everyday application.

"In AIS," Jordan adds, "we have designed a system not only for the worldwide support of the high-performance F-16, but with the adaptability to support other aircraft as well."

If you have engineering skills in RF, mechanical, optics, analog, digital or software architecture, you may be interested to know that we are planning now to take the third generation AIS into the fourth generation. To discuss engineering career specifics, write:

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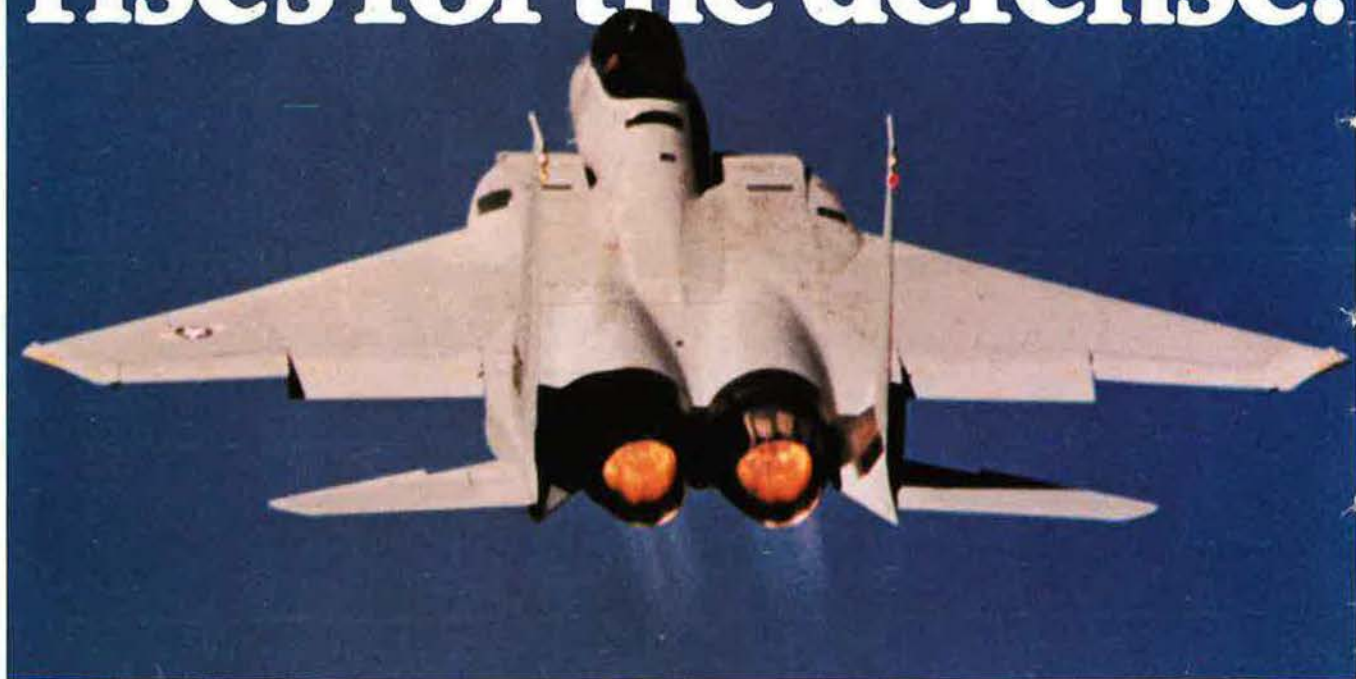
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