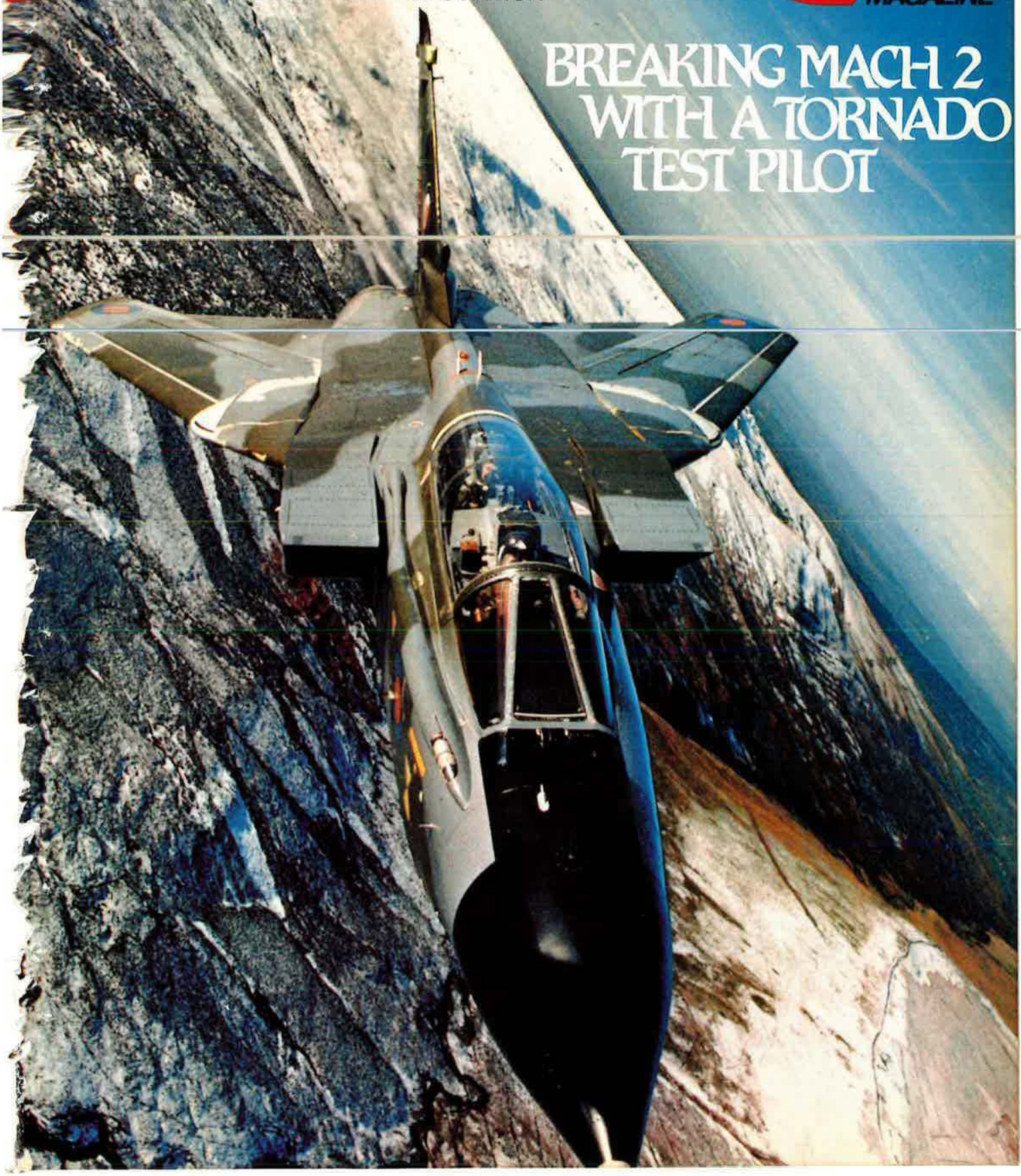
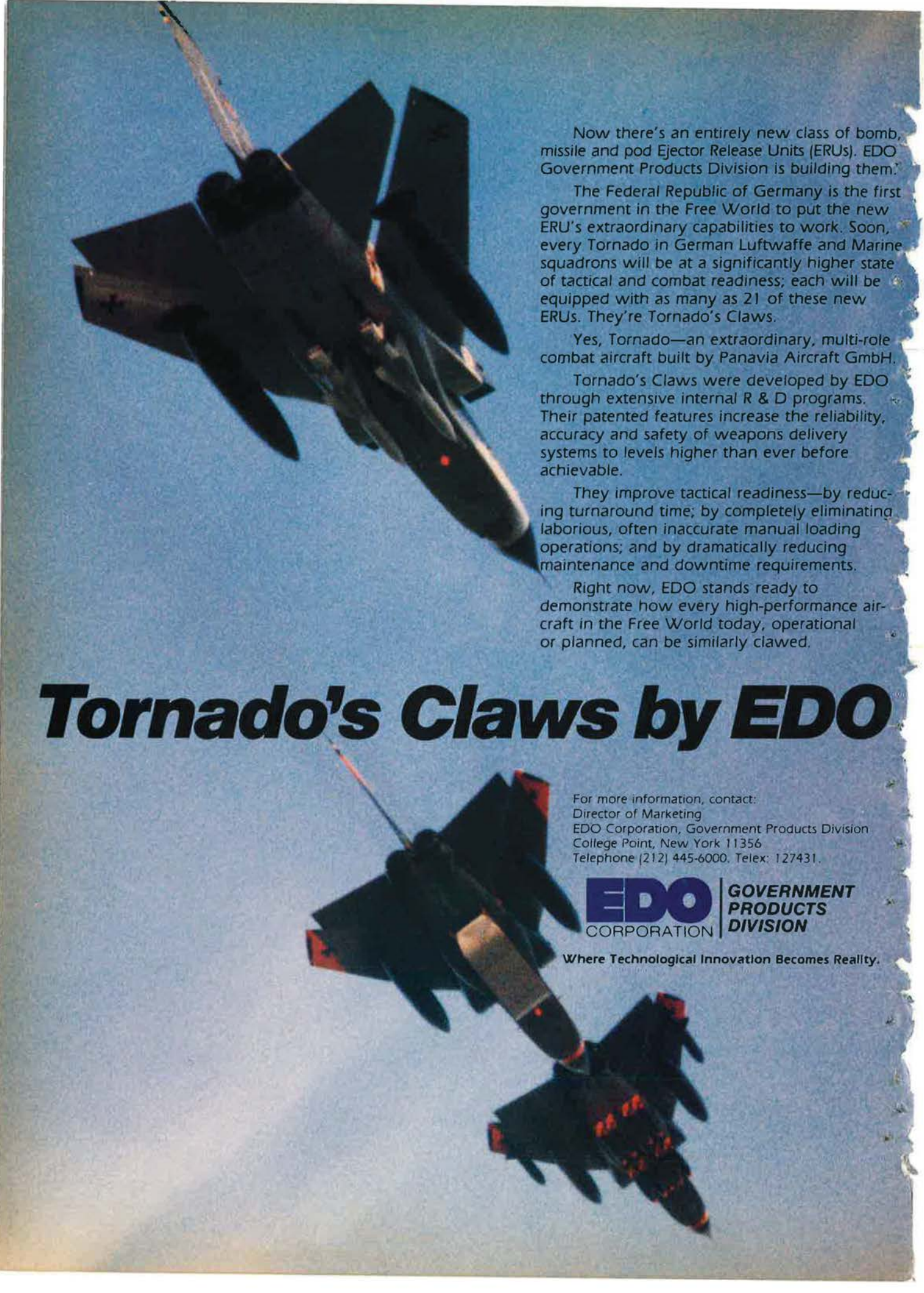
JUNE 1980/$1

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

BREAKING MACH 2 WITH A TORNADO TEST PILOT





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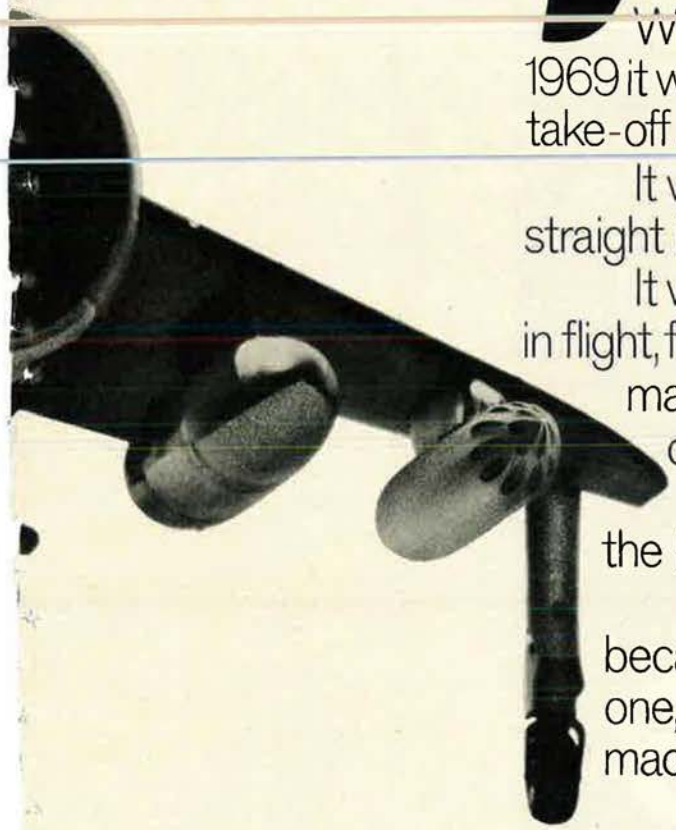

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This Month

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ABOUT THE COVER

The Panavia Tornado, product of a multinational consortium that has worked well in practice, here roars toward the reader as a preview for the pilot report by John David Eagles, Chief Test Pilot of British Aerospace, beginning on page 48. Eagles tells firsthand the sensations of Tornado-flying. (Crown Copyright)

Departments

AN EDITORIAL

Reflections on a Failed Mission

AS THIS is written, we are just completing thirty-five years of observing and commenting on the Washington scene, primarily from the viewpoint of national defense but with due regard, we trust, of the fact that defense and military affairs do not exist in a vacuum but rather are the product of the interaction of countless countervailing forces.

By and large, we must confess, it has been three and one-half decades of taking the dim view. This, we suppose, is a built-in hazard of the occupation. By its very nature, the military world is not a subject that lends itself to optimism. Quite the reverse, in fact. It is a world of worst cases, of selecting the lesser of several evils, a world wherein violent death and destruction cannot be excluded and are, in fact, more often than not essential to success.

At the same time, it is also a world of planning for events that never happen and where the not happening may be in itself the true measure of ultimate effectiveness. In a democracy, the military is a world of anomalies wherein the noblest values of individual freedom are defended by a social structure that internally is autocratic, hierarchical, bureaucratic, and undemocratic. It is a world of orders given and orders followed, even unto death. Above all, it is a world in which much depends upon sheer luck—bad as well as good. The phrase "fortunes of war" is an apt one.

All of the above, and more, it seems to us, came together in a tragic and ill-fated way in the failed attempt to rescue the American hostages held prisoner in Tehran. While not a military operation in the technical and diplomatic sense, it was classically military in the planning, in the execution as far as it went, and in the very decision to end it so sadly and frustratingly in the desert sands. Only a military organization could have planned it. Only a military organization could have carried it out. Only a military organization could have canceled it. It was classically military, even in the fact that the responsibility for failure was taken stoically by the highest military leadership.

By the time this commentary is read it is unlikely that much will have been added to the public record of the rescue. No matter. Risk taking is strongly in the American tradition, both civilian and military. The men who took part in the mission knew the risks and accepted them voluntarily. That things didn't go right takes nothing from their heroism.

Searching for scapegoats likewise is in the American tradition. Americans are traditionally so confident in themselves, in their technology, in their equipment, in their planning, that when things go wrong it must be someone's fault, someone who must be searched out, pinpointed, and punished in some fitting manner. The examination of what happened in Iran must be exhaustive to be sure. Much will be learned thereby that will have application for the future. But little purpose will be served in confusing the need to find out what went wrong with finding out who did wrong. Responsibility should not be confused with blame.

In our view, if anything was marginal in preparing for the mission it was in the plan itself and in the decision to make a rescue attempt at all. Certainly the pressure to "do something" was building, pressure exacerbated by the political facts of life in a Presidential election year. There was also the pressure of time in the sense that the best combination of weather and the length of the desert night permitted only a relatively short period in which to carry out the operation with maximum safety. The plan itself was complicated and, in the view of some, risky. Certainly a lot had to go right for it to succeed—the first rendezvous in the desert between the six Air Force C-130 transports flying in via Egypt and the eight Navy RH-53D helicopters coming in from the carrier *Nimitz*, the airlift to the mountain assembly point near Iran, the ground assault on an occupied and guarded embassy in the middle of a hostile city, the helicopter withdrawal of both prisoners and rescuers with the attendant mortal risk to friend and foe alike, and eventually the long flights back to safety.

Yes, a lot had to go right, but on the face of it the strongest links in the expected chain of events would appear to be the airborne legs. The aircraft involved had been proven over and over again, in combat as well as routine service. Most likely to go wrong, again on the face of it, would seem to be the almost spy-fictional assault in Tehran itself. If that went well, everything else should. Or so it would seem.

But the strongest link broke, under pressure of mechanical malfunctions that were individually minor but collectively fatal—a cracked rotor blade, a broken gyroscope that failed in the midst of a sandstorm, a cracked nut that caused a hydraulic failure. Result, three out of eight helicopters knocked out of an operation that needed a safe minimum of six, according to the plan.

The decision to abort based on this arithmetic was taken quickly. Then the last, most bitter, most tragic bit of bad luck—the helicopter collision, on the ground, with a C-130 loaded with bladders of fuel—and the discouraging withdrawal, leaving behind all the helicopters, the blazing aircraft, and the burned bodies of eight Americans.

Whether it all would have worked had there been no mechanical failures we will never know. What we should know—and this is a lesson that applies to every plan, large or small, simple or complicated—is that there is such a thing as bad luck, which no amount of planning or rehearsal can eliminate entirely and with surety.

The aborted rescue of the prisoners was, in our judgment, just that—a piece of bad luck.

—JOHN F. LOOSBROCK, EDITOR IN CHIEF

The New Collins AN/ARC-190/728U airborne HF. A strong defense against high costs.

You're looking at the next generation in airborne HF, the new Collins AN/ARC-190/728U. Selected by the U.S. Air Force for its HF modernization program, AN/ARC-190 follows in the tradition of such outstanding radios as the AN/ART-13, AN/ARC-58 and AN/ARC-94/102 (618T).

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AIRMAIL

The Scenario Has Changed

I am alarmed, to say the least, at reading in Edgar Ulsamer's "A Solid Case for MX" (April 1980) the following brief paragraph:

"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 the virtual annihilation of both sides' civilian population."

What is Mr. Ulsamer telling us? Not too many years ago, we were told that our strategy of deterrence would prevent the Soviets from using *any nuclear weapons* against us (and perhaps our allies as well); that as long as we maintained a force capable of destroying the Soviet Union, even if they struck first (a force we surely have), they would be deterred. Mr. Ulsamer seems to be saying something *very different:* that strategic deterrence isn't going to prevent anything less catastrophic than "virtual annihilation."

I find this totally unacceptable. If our strategy of deterrence (and yet another multibillion-dollar weapon system, the MX) gives us no more security than that, why should we support it? If we must accept, under our present strategy and with the MX in place, destruction up to the level of virtual annihilation, then we have virtually no security at all, do we? Or have I, somehow, completely missed out on something?

This is much too serious an issue for us to play "Catch-22" games. The lives of all of us may be at stake. Where do we stand?

Lt. Col. Richard H. Kraemer,
USAF (Ret.)
Austin, Tex.

• *Time, technology, and the Soviet threat don't stand still. The notion of deterrence based purely on assured destruction, especially minimum assured destruction, became an anachronism when the Soviets started to develop an unambiguous warfighting capability. They have now, or soon will have, both the ICBM accuracy and number of warheads to launch a successful first strike against the US silo-based ICBMs while at the same time retaining forces greater and more flexible than the surviving US forces. The only choice for the US thus is between a spasm response—that is, attacking Soviet cities and thus surely causing the Soviets to do the same to this country—or surrender. Since the latter US response probably will be seen as the more likely one by the Soviets, a clearly destabilizing situation exists until the very high degree of invulnerability inherent in MX/MPS provides a "disincentive" for a Soviet attack on the US's silo-based ICBMs.*
—THE EDITORS

Back to the Beginning

I really got a charge out of the "new" navigator training philosophy reported on p. 42 in your April issue ["New Horizons for Flying Training," by Maj. Gene E. Townsend]. It shows how military concepts have a way of going the full circle.

In 1952, the late Col. Charley North, USAF; Col. Al Goldsmith, USAF (Ret.); Lt. Col. Tom Duhain, USAF (Ret.), of the Observer Training Branch in the Pentagon; and Col. Mike Reid, USAF (Ret.), Staff Navigator at Headquarters, Air Training Command, participated with me in drafting the Single Observer Training Program that was put into effect late in 1952. The philosophy and actual details of the SOTP (as we called it) are so similar to the "new" 1978 navigator training program it's uncanny. Who knows, maybe soon we will have another "Senior Observer" training program established.

I would like to say "Hi" to all the gang that fought the "Battle of the Navigators" during the period 1940 to 1970.

Col. Peter P. Dawson,
USAF (Ret.)
La Verne, Calif.

Prediction Specialists

I was pleased to see the staff report on the Defense Mapping Agency (DMA) in your April issue. As a substantial user of DMA-produced air target charts I am acutely aware of the degree to which we in SAC depend on these products. DMA, specifically DMAAC, deserves recognition for their diligent efforts to provide the air target charts we need to support radar bombing. There is, however, a statement in the article that I believe requires some clarification.

The first paragraph on p. 62 states, in part, "Included are radar-significant features to enable aircrews to predict what will appear on their radarscopes." This statement evidently represents the intent of the chart makers but it isn't accurate from a user standpoint. USAF aircrews do not make their own radarscope predictions. The predictions are provided to them by nonrated specialists in radar prediction.

These Target Intelligence Specialists (AFSC 206X1) use the air target charts with certain other materials to determine what will appear on bomber/fighter-bomber radarscopes. They have one of the most difficult, demanding, technical specialties in the Air Force and seldom get credit for providing the single most critical target material in radar bombing. These dedicated men and women in SAC, TAC, PACAF, USAFE, and MAC are long overdue for some well-deserved recognition. . . .

Capt. Barry R. Truel, USAF
Shreveport, La.

Return of the Up-or-Outs

The shortage of officers in all career fields has become an item of critical interest to the Air Force. Unfortunately, attempts to rebuild the officer corps back to its required strength have met with little success, and the shortage persists. To replace this lost experience with new blood from the young lieutenants will take some time; developing an experienced officer in a specialized career field is akin to aging a fine wine—it must be done slowly. So, it would seem the Air Force is perched on the horns of a dilemma, and no way exists for its solution.

There is an as yet untapped re

source that the Air Force can draw upon, and now might be the time to suggest it; to present the case of officers who were involuntarily separated over the last six years. Under the congressional mandate to trim our military personnel during the post-Vietnam era, promotion opportunity was severely curtailed, and many good officers were forced to exit because of the up-or-out policy. Whether or not it was intended, these former officers bear the stigma that they couldn't be promoted because they did not measure up to standards, and that the Air Force is better off without them. (Knowledgeable employers always ask: "You finished fourteen years—why didn't you go for twenty?") If this same group of people were to be considered for promotion today or in the ten-year period that preceded the reduction-in-force mandate (pre-1973), the great majority of them would have been promoted; most would still be on active duty today, and the present shortage we face now would not be so acute.

Why not consider asking them to return? Legislation would be required to do this, but many former officers of the type noted would probably consider a resumption of active commissioned service in a favorable light. Minimal training would be necessary because they are already trained (in many cases, expensively so) and are highly experienced.

This seems like a good idea, but its implementation may be a bit thorny. First, there is the problem that, although these former officers may have been unfairly treated, their separation was decreed by public law, a law that was designed to weed out those who really deserved it. This law helps assure a quality force and might best be kept on the books. Second, there is the requirement that the officer corps has to maintain the highest possible standards, and we must continually attempt to identify and pursue this ideal. I suggest that, for the most part, those officers who were involuntarily separated meet and exceed the commonly established criteria that define the professional officer; inviting them to return would not compromise the quality of the officer corps in the least.

With respect to the legislation required, I propose the introduction of a bill that would identify a period of time over which officers who were involuntarily separated might be given another look (1973 through 1979, for example). A board of officers might be established to screen the records of these individuals and reevaluate their separation. If a person were selected to return, he would then be made an offer to continue his service (providing, of course, physical standards and other criteria could still be met). If he (or she) were to accept, he could return to active duty in his former grade and be allowed to compete for promotion with his peers.

This, then, is one approach to a partial solution of the officer shortage. Besides national security considerations, it's a good and fair thing to do.

James P. Qualey, Jr.
Colorado Springs, Colo.

Not Going Anywhere Yet

I look forward to receiving each issue of your excellent magazine and commend you for the high standard you maintain.

I cannot, however, resist the temptation to point out that the cover of your April issue shows an Air Force captain casually sitting in a Tweet with his emergency oxygen hose disconnected, his throttle hand casually resting on his knee, and an unsafe gear indication.

Let me guess—you were just checking to see if we would notice.

Lt. Col. Curt Bassett, USAF
Washington, D. C.

. . . I could not but help notice the glaring error in the personal equipment of the stalwart young ATC captain IP on the cover. More embarrassing possibly, as the picture ties in with an excellent article endorsing the new and professional approach to pilot/navigator training.

From the reflection in his visor he appears to be airborne in a T-37, with his student also reflected. His nomex flight suit and gloves look in excellent condition, his parachute is properly fastened, his oxygen mask is correctly adjusted, the visor is down to protect against bird strikes and protect his eyes from the sun, his chin strap is fastened, his 559th FTS patch is on straight, and his emergency bailout bottle hose is *disconnected*.

Oh well, he may be going on a low-level training mission below 10,000 feet, where he won't need oxygen anyway.

Lt. Col. Thomas D. Miller, USAF (Ret.)
Dallas, Tex.

• *In spite of the impression created by those reflections, this casually disconnected IP is still on terra firma.*—THE EDITORS

When Do We Launch?

The problem of launch on warning is really two questions: 1. warning of what? and 2. launch at what? A solution that seems to answer both questions is to launch on warning that a significant number of our missiles are about to be destroyed on the ground; launch at air defense targets in the Soviet Union and Warsaw Pact.

Any Soviet first strike at our missiles would mean that we must use them, or lose them. The better strategic choice seems to be to launch at least those missiles whose destruction is imminent. Whether we launch or not, our remaining forces will be largely air-breathing. The USSR could expect to limit retaliatory damage with an active air defense.

If our response to a Russian attack were the disruption of their air defense capability with our missiles, the exchange would be unattractive for the USSR. The Soviet Union would be unable to effectively limit damage to the rest of its military capabilities without a well-organized, well-equipped air defense.

The risk of Russian escalation to countervalue targets would be less with US retaliation against military targets than with US retaliation against Russian cities. If our existing warning systems are reliable enough, the US could use this strategy to regain a substantial amount of our missile systems' value at small cost.

Are they good enough?

Douglas R. Bohrer
Wilmette, Ill.

Military History Symposium

The United States Air Force Academy will host its Ninth Military History Symposium on October 1–3, 1980. The symposium, entitled "The Ameri-

Hometown Honors the Memory of General "Tooey" Spaatz

"Pioneer of air-to-air refueling . . . Father of strategic aerial warfare . . . First Chief of Staff of the United States Air Force." Thus will Boyertown, Pa., hail the late Gen. Carl A. "Tooey" Spaatz when it honors the eighty-ninth anniversary of his birth in that city with a "Four-Star Salute" on June 28. The town plans a full day of tribute, with the issuance of a commemorative postal cover, the dedication of a collection of Spaatz memorabilia, and a "Sound-and-Light" narrative of the General's story. Highlighting the day's events will be an aerial show and flyover. General Spaatz's career as an American airman spanned thirty-four years. He died in July 1974.

can Military and the Far East," will examine the experience of the US armed forces in East Asia and the Pacific since 1900. Program sessions include: (1) American Objectives and Strategy in the Far East, (2) American Pacification and Occupation in Asian Lands, (3) The Influence of the Orient on the American Military, and (4) The Impact of the American Military on Asian Societies.

Noted scholars taking part in the proceedings include: Akira Iriye, Roger Dingman, Norman Graebner, John Gates, Ron Spector, D. Clayton James, Frank Kierman, C. I. Eugene Kim, Alvin Coox, Theodore Ropp, and, from Japan, Sadao Asada and Ikuhiko Hata. Also, several individuals who have both first-hand military experience in the Far East and scholarly credentials, to include Gen. Richard Stilwell, USA (Ret.); Capt. Paul Schratz, USN (Ret.); Col. Roy Flint, USA; and Col. John Schlight, USAF, will deliver papers or comment.

Other noted scholars participating include Frank Vandiver, Philip Crowl, Samuel Wells, Alan Millett, Stanley Falk, William Whitson, and Brig. Gen. E. H. Simmons, USMC (Ret.).

For further information write:

Maj. Harry R. Borowski, USAF
Department of History
USAF Academy, Colo. 80840

The MIGs of March

The dramatic Keith Ferris painting of MiG-21s turning initial at Reims (March issue) shows them performing a maneuver that is proscribed, as an article of faith, in the USAF.

Turning into the echelon, as any second lieutenant pilot will tell you, can be hazardous to your health.

We learn from the painting that Soviet wingmen either are more skilled than their US counterparts, or are shorter lived.

Brig. Gen. W. L. Shields, USAF
Bellevue, Neb.

• *We agree with General Shields about the hazards of turning into echelon. The MiGs actually were in a fingertip formation with a man on the leader's left wing, not shown in the painting. They were approaching the airfield at Reims but were not, we have learned from Keith Ferris, turning initial as one might assume from the text on p. 41 of the March issue, where the cover painting is repeated. Our thanks to General Shields for raising an interesting question.*—THE EDITORS

Correction Corner

The article "New Horizons for Flying Training," by Maj. Gene E. Townsend,

AIRMAIL

referring to weapon systems operators—p. 42, column 3, line 2—is in error. The correct designation is weapon systems *officer*.

The caption under the bottom photograph in the "AFA News Photo Gallery" refers to Mr. Falcone's ". . . collection of pilot's wings." I recognize Flight Surgeon, Flight Nurse, Bombardier, Navigator, and Loadmaster wings among the ". . . sampling . . . of pilot's wings."

Robert I. Loftin
Decatur, Ga.

. . . When I got to p. 93, the caption for Joseph R. Falcone's photograph nearly caused me to blow a gasket.

Of the many wings shown, approximately twenty-five are *not* pilot's wings. The irresponsibility of the people writing this caption have helped make being a navigator what it is today.

I appreciate your taking the time to read this letter. Keep up the good work with the rest of the magazine. Now, I have to go adjust the "navigator" light on my water heater, after which, I will put on my "navigator" shades (sunglasses), and go learn about the inertial "pilot" system that will soon put me out of a job.

1st Lt. James E. Tyler III, USAF
Navigator, SAC
Altus, Okla.

Pilot Training for Navs/WSOs

I am soliciting the support of commanders and Navigators/Weapon Systems Officers (Navs/WSOs) in the Air Force to assist with efforts to change the present policy for selecting rated officers (Navs/WSOs) to enter USAF pilot training. Present regulations state that twenty-seven-and-one-half years of age is the maximum allowed to apply, while the Navy has a cutoff of thirty-one years of age. Why won't the Air Force increase its age limit?

The Air Force has reduced the number of selection boards from four to only two each year. They are selecting more officers to enter pilot training, but continue to choose the token number of approximately fifty Navs/WSOs, as they have for several years. Presently, they are selecting eight nonrated officers for each Nav/WSO. With the introduction of many single-seat aircraft into the inventory, the requirement for Navs/WSOs is decreasing. These rated officers have proven their ability in the cockpit, unlike their nonrated contemporaries. Why won't the Air Force increase the number of Navs/WSOs selected?

The Navy has seen the light and is drastically increasing the number of rated officers selected to enter pilot training. They will save training expenses by reducing the time and sorties required to train a pilot in the same type aircraft he previously flew. Why won't the Air Force adopt the Navy policies?

These questions and many more keep plaguing me and others as to why the Air Force continues with its archaic policies. There is a very large group of Navs/WSOs that entered the Air Force in the 1974–76 period when it was impossible to apply for pilot training. We had such a love for flying we chose to serve as Navs/WSOs with the understanding that we had a very good chance to enter pilot training at a later date. This dream has not become a reality.

Navigators/WSOs, and especially commanders, must let their opinions be known up the chain of command. Unless some positive changes are made, the Air Force will continue to lose quite a few very good men.

Capt. David L. Lockett, USAF
APO New York

AAC History

The Alaskan Air Command Office of History plans to produce a short history in commemoration of the Fortieth Anniversary of the Air Force in Alaska.

We would appreciate hearing from former members of AAC and its predecessor, the Eleventh Air Force. We are looking for photographs, particularly from the 1945–1950 period, documents, personal accounts, and other memorabilia that might assist us in preparing the history. We will copy and return the originals. Credit will be given.

John Haile Cloe
Command Historian
Hq. AAC/HO
Elmendorf AFB, Alaska 99506

27th TASS Becomes 23d TASS

On July 1, 1980, the 27th TASS (Tactical Air Support Squadron) at Davis-Monthan AFB, Ariz., will be deactivated nominally and accept the colors of the 23d TASS, currently located at Bergstrom AFB, Tex.

The 27th TASS is seeking items of memorabilia for exhibition in a showcase depicting the history of the 23d TASS since its inception. Articles

SCIENCE/SCOPE

Distinguishing between two closely spaced aircraft is one capability of a unique data-processing unit used in air defense systems. The Hughes RADEX radar extractor contains high-speed microprocessors to untangle identification codes transmitted at the same moment by aircraft flying in the vicinity of each other. The feature gives console operators a better look at tactical situations. RADEX units will be part of the U.S. Air Force's new Joint Surveillance System, now being implemented for North American defense.

Sophisticated simulators will help U.S. Army personnel learn to operate the new AN/TPQ-36 and TPQ-37 Firefinder radars without the need to fire a single mortar or artillery round. Each trainer -- designed for up to eight students -- uses a computer to emulate the way a Firefinder locates the source of enemy weapons fire by tracking shells in flight and backplotting their paths. Besides saving munitions costs, simulators are more efficient for training than real radars because they require fewer instructors, are cheaper to maintain, and cost less to build. Hughes builds the trainers as well as the actual Firefinder radars.

A new liquid-crystal reticle for a gunner's telescopic sight is significantly smaller and less expensive than the mechanical devices now used in fire control systems on military vehicles. The computer-generated crosshairs move on two axes to provide an accurate aim point for the gunner. The all-digital device has no moving parts and has a flexible format for numerical displays. Hughes is developing the reticle under contract to the U.S. Army.

Improvements to the U.S. Navy's Phoenix missile will enable the radar-guided weapon to meet anticipated airborne threats through the 1990s. The current model, the AIM-54A, now carried on the F-14 Tomcat fighter, is the service's primary long-range air-to-air weapon. The new AIM-54C incorporates a digital guidance unit that will be more flexible and reliable than the analog unit it replaces. Other changes include an inertial reference system to improve range and accuracy, a solid-state transmitter-receiver with increased capability over the existing klystron tube, and a target-detecting device developed by the Naval Weapons Center. Hughes is building 15 engineering development models of the improved Phoenix for captive flight tests and actual firings.

Now for the first time, off-the-shelf radar consoles can be adapted to any air defense need by using customizing equipment. The Hughes HMD-22 console consists of a basic display and electronics package that can be tailored by special read-only memory chips and panel switch labels. The kits determine such factors as which letter styles and distance measurements are to be used. The kits also augment self-test features to isolate faults down to a single circuit card. The approach allows systems to be built more quickly at less cost. The console is to be used in the U.S. Air Force's Joint Surveillance System.

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such as squadron patches, photos, uniform items, souvenirs, "war stories," etc., will be permanently displayed in the squadron, and donors will be recognized for their contributions. If there are any former "Nail" FACs willing to part with such treasures, please contact me with information concerning your donation.

Lt. Tim Oliver
Unit Historian
27th TASS (TAC)
Davis-Monthan AFB, Ariz. 85707
Phone: AUTOVON 361-4854

WW II POWs in ETO

I am a high school student conducting research for a paper on WW II POWs in the European Theater of Operations. I would greatly appreciate hearing from any former POWs. Also looking for any photos of Nazi POW camps, POWs themselves, and any other germane material.

Don Robinson, Jr.
8700 SW 160 St.
Miami, Fla. 33157
Phone: (305) 253-0689

386th Bomb Group

Author would like to contact former members of the 386th Bomb Group who operated the Douglas A-26 Invader.

Any material relating to "Corbin's Crusaders" would be appreciated, be it photograph, mission report, or recollection. Would like to bring back the "good old days" of aircraft like *Sky Chief, Silver Dragon, Pussy Cat,* and *Stinky.*

Any item loaned will be handled carefully and quickly returned to the donor, who will be duly credited.

John Horne
15/20-22 Speed St.
Liverpool, N.S.W.
Australia 2170

Cold and Windy

On September 8, 1944, I volunteered to go on a special secret project called Cold and Windy. Probably the main reasons I was asked if I was interested were that the B-24 was my specialty and that I had set up and commanded the first Standardization Board in the Air Corps.

I received only an inkling of what this project involved, but knew one of the officers commanding it, and that was good enough for me. I was told I would receive orders when this project was ready to activate. At Topeka, on October 6, 1944, I learned that this project had run into difficulty and would be scrapped.

During the last thirty-five years I have given a lot of thought to this project. Who was behind it, what was the projected goal, and why was it canceled?

Any readers who can give me information about this project will receive my wholehearted appreciation.

Lt. Col. Robert Freyermuth, AFRES (Ret.)
RR 2, Box 168
Muscatine, Iowa 52761

AIRMAIL

BMDT Alumni

University of Florida Billy Mitchell Drill Team Det. 150, AFROTC, is in the process of forming a BMDT Alumni Association. If you are a former Drill Team member or sponsor, please send your name, address, and year graduated to:

BMDT Alumni Association
212 Van Fleet Hall
University of Florida
Gainesville, Fla. 32611

Me-262 Jet in Combat

I have started to put together a history of the first jet fighter used in combat, *i.e.,* the Messerschmitt Me-262.

I have very few first-hand accounts of this aircraft from American aircrews in the European theater of World War II. If readers could help in this matter, I would be most pleased to hear from them, as their side of this story should be heard.

I live in East Anglia, wartime home of the Eighth US Army Air Force, and I had the honor to be involved with the opening of a museum to these brave men here on the east coast of England. Situated at the Fritton Lake country park, well over 100,000 people visited the museum in 1979.

Two former army aircrews visited the museum during the summer, when I was there, and to meet these men who had come to East Anglia, when I was but a child, made me proud indeed to be involved with its existence.

S. E. Harvey
17 Priory Rd.
Wrentham, Beccles
Suffolk, England NR34 7LR

Attention: Tailhookers

I would like to call on readers for some assistance on a project I have been working on for a good many years. I have been looking for the USAF officer who has made the most carrier arrested landings.

The Tailhook Association would like to honor an Air Force/Naval aviator with one of our "Max Trap" awards. The Navy has received many fine exchange officers from the Air Force and the Association and I feel that by honoring one we will be honoring all who have added to carrier aviation.

Ron Thomas
Executive Secretary
Tailhook Association
P. O. Box 40
Bonita, Calif. 92002
or
P. O. Box 730
Coronado, Calif. 92118
Phone: (714) 479-8525

Search for Major Kirby

I am attempting to locate an officer who flew with the 62d Fighter Squadron, 56th Fighter Group, during the period 1948–49. All I have to go on is his name, Maj. H. H. Kirby, Jr., written on the side of his F-80. I believe his crew chief at the time was Pfc. N. E. Hoffack.

I am putting together a history of the P/F-80 and wish to contact Kirby.

SSgt. Dennis R. Lindsey
3124 Del View Dr.
Del City, Okla. 73115

Eighth and Ninth in England

I am twenty years of age and trying to gather as much information as possible concerning the activities of the Eighth and Ninth Air Forces in England. As I have no status as an authorized researcher, I hope to rely on people's goodwill and interest in order to collate the type of material I require. I do not intend to write a book, but would just like the recollections to keep. The books I have read on the Eighth and Ninth Air Forces do not convey the human aspect of day-to-day life very well.

I would very much like to hear from pilots and ground crewmen who would be prepared to tell me about their stay in England, and what it was like to fly and maintain the aircraft. Anything they could tell me would be of immense interest.

Peter Fawke
108, Belgrade Ave.
Gidea Park
Romford, RM 2 6 PU, England

Norden Computer

I have been trying to locate a source to obtain an Air Force computer used on bombing missions for computing data changes for the Norden Bombsight, but having no luck. It was made of plastic (circular discs—black in color with fluorescent numbers, etc.), and readings were set and read by two lubber arms. Very simple in

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construction and use. I had one in my collection, but it has become lost since my retirement. I believe it was identified as either a C-1 or C-2 item.

If anyone has any information where I might find one, please advise.

Lt. Col. E. P. Thorne, USAF (Ret.)
4250 Galt Ocean Dr., 12R
Fort Lauderdale, Fla. 33308

AT-6 History

I would like to hear from anyone connected with the AT-6/SNJ/Harvard series of aircraft. I am cranking up on book #15, a history of this great but much neglected series of aircraft that had such an influence on military pilots for so many years. Memories, data, anecdotes, photos—anything from those who flew, crewed, or had something to do with the "Six."

I am particularly interested in stories with a Bob Stevens "There I Was" type of flavor about training in the aircraft—like the guy who pumped his wheels "down" after flipping over on his back after forgetting to put them down in the first place!

Jeff Ethell
2403 Sunnybrook Rd.
Richmond, Va. 23229

Beechcraft Planes

I am preparing a series of articles on Beechcraft military planes, and hope to expand these into a book. Presently I am most interested in Queen Air and King Air airframes used as U-8, U-21, C-6, C-25, C-21, and C-12 variants.

I would appreciate contact by anyone who has current or historical information or experience with these aircraft. All materials will be returned and credit will be given.

1st Lt. Barry W. Taylor, USAF
6426 N. E. Rodney
Portland, Ore. 97211

Voodoo Pix

Wanted: photographs/slides/negatives of the McDonnell F-101 Voodoo aircraft during USAF service in the 1950s and 1960s.

A1C Gary D. Powell
PSC Box 2265
APO New York 09194

361st Fighter Group

Former members of the 361st Fighter Group, Eighth Air Force, who wish to contact others in that WW II unit please write to their unit contact:

Glenn Fielding
1000 Clubland Pt. N. E.
Marietta, Ga. 30067

UNIT REUNIONS

AACS

Airways and Air Communications Service (AAF-USAF) Alumni, September 19–21, Great Smokies Hilton, Asheville, N. C. Reservation deadline August 15. **Contact:** Haskell E. Neal, 112 Spring St., Summerville, S. C. 29483.

All Air Forces

40th Anniversary of Battle of Britain reunion, air and ground crews, all ranks, all trades, and women's services of all Air Forces: RCAF, RAF, RAAF, RNZAF, USAF, etc. September 12–14, Toronto, Canada. **Contact:** George Penfold, Reunion Committee, Box 306, Adelaide St. P. O., Toronto, Ontario, M5C 2J4, Canada. Phone: 366-5251 (office), 444-2823 (home).

Deming Army Airfield

2d reunion, September 5–7, Deming, N. M. For information send two 15¢ stamps. **Contact:** DAAF 1980 Reunion, 402 South Tin, Deming, N. M. 88030.

IOC

International Order of Aviation Characters, Fall Aviation and Aerospace Symposium, Jackson Hole, Wyo., September 3–7, and Las Vegas, Nev., September 7–10. **Contact:** Dr. James E. Crane, 965 Hope St., Stamford, Conn. 06907. Phone: (203) 322-2323.

Kentucky ANG

123d Tactical Reconnaissance Wing open house (celebrating 33 years), September 14, Standiford Field ANG Base, Louisville, Ky. **Contact:** Maj. Richard H. Jett, Dept. of Military Affairs, Office of The Adjutant General, Boone National Guard Center, Frankfort, Ky. 40601. Phone: (502) 564-8490.

Stearman Fly-In

September 3–7, activities at municipal airport, Galesburg, Ill. **Contact:** Ted McCullough, 821 S. Whitesboro St., Galesburg, Ill. 61401. Phone: (309) 342-2298.

2d Air Division Ass'n

33d annual convention, July 4–6, Regency Hyatt Hotel, Cambridge, Mass. **Contact:** James N. Kidder, 18 Brooks St., Winchester, Mass. 01890, or Evelyn Cohen, 610 Plaza Towers, 2350 Tremont St., Philadelphia, Pa. 19115.

17th Bomb Group

September 16–19, Dallas, Tex. **Contact:** W. D. Baird, 2301 Forest Lane, Garland, Tex. 75042. Phone: (214) 272-1591.

P-40 Warhawk Fighter Pilots

July 18–20, Imperial House-North, Dayton, Ohio. **Contact:** Lloyd "Scotty" Hathcock, 34 College Ave., Dayton, Ohio 45407. Phone: (513) 223-8432.

42d Rainbow Division

62d annual reunion, July 9–12, Cedar Rapids, Iowa, Roosevelt Royale Hotel. Make reservations direct at Roosevelt Royale Hotel, 200 First Ave., N. E., Cedar Rapids, Iowa 52401, Attn: Rainbow Division Reunion; or Stouffer's Five Seasons Center, Cedar Rapids, Iowa 52401, Attn: Rainbow Division Reunion. **Contact** for further information: Hank DeJarnette, 1207 31st St., N. E., Cedar Rapids, Iowa 52402.

68th Fighter Squadron Ass'n

August 22–24, Baton Rouge Hilton Hotel, Baton Rouge, La. **Contact:** John Terry, 607 Hickory Dr., Lafayette, La. 70503.

91st Bomb Group (H) Memorial Ass'n

"Wray's Ragged Irregulars," ex-members and supporting units at Station 121, Bassingbourn, England, September 2–6, San Diego, Calif. **Contact:** MSgt. George W. Parks, USAF (Ret.), Sec'y-Treas. Western Division, 91st Bomb Group (H) Memorial Association, 109 Wilshire Ave., Vallejo, Calif. 94590.

305th Bomb Group, 8th AF

364th, 365th, 366th, 422d Squadrons and attached units stationed at Chelveston, England, WW II; September 22–30. **Contact:** Abe Millar, Box 757, Sanger, Tex. 76266.

325th Fighter Group

35th "Checkertail Clan" reunion, July 24–27, San Antonio, Tex. **Contact:** Dan Penrod, 69 Keswick Ave., Pittsburgh, Pa. 15202.

379th Bomb Group (H), 8th AF

July 21–23, Dayton, Ohio. **Contact:** Frank L. Betz, 732 Emerald Dr., Lancaster, Pa. 17603.

388th Bomb Group (H) Ass'n

September 25–28, Fountain Bay Resort Club, New Orleans, La. **Contact:** Edward J. Huntzinger, P. O. Box 965, Cape Coral, Fla. 33904.

475th Fighter Group, 5th AF

"Satan's Angels," September 28–October 1, Frontier Hotel, Las Vegas, Nev. **Contact:** H. N. "Pete" Madison, 150 N. Myers, Los Angeles, Calif. 90033. Phone: (1-213) 261-7171 (office).

509th Bomb Wing

6th reunion, September 12–13, San Antonio, Tex. **Contact:** Jus Rose, 14703 Bold Venture, San Antonio, Tex. 78248. Phone: (1-512) 492-2770.

6147th Tactical Control Group

July 18–20, Ramada Inn, Erie, Pa. **Contact:** Ed J. Damico, 2408 Cabot Ave., Erie, Pa. 16511. Phone: (814) 456-9922.

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IN FOCUS...

By Edgar Ulsamer, SENIOR EDITOR

Washington, D. C., May 5

Changing Triad Vulnerabilities

Defense Department senior officials have concluded—on the basis of recent studies—that a submarine-launched ballistic missile (SLBM) with sufficient accuracy and yield to destroy superhard targets could be brought into the operational inventory toward the end of this decade. The proposed new SLBM is known as the D-5/Trident II. The current Five-Year Defense Plan (FYDP), however, does not provide for the acceleration of the D-5 development program needed to meet this ambitious schedule, a ranking Pentagon official told this column.

The notion that hard-target kill can be grafted onto a new SLBM presupposes that the Navy's Trident accuracy improvement program (AIP) will lead to CEPs (circular error probable, meaning a radius extending outward from the aimpoint within which half the warheads of a given missile type can be expected to impact) of between 500 and 600 feet. If the D-5 SLBM can indeed achieve such accuracies, there is the option to deploy as many as seven MK 12As on this SLBM. (The MK 12A is the RV with a yield of 335 kilotons that is being retrofitted on Minuteman III ICBMs and will be carried also on MX.) The D-5 then would have an assured capability of destroying such hard targets as Soviet ICBM silos and command centers.

At least in theory, there are options to boost the D-5's accuracy even further by using exotic terminal guidance systems. In its initial phase, the Trident AIP is confined to advances in stellar inertial guidance to improve midcourse trajectory corrections. But guidance experts believe that terminal guidance technologies such as map matching—a technique used by the Army's new Pershing II ballistic missile and USAF's ground-launched cruise missile (GLCM)—eventually might improve enough to be suitable for SLBMs and ICBMs.

Development of the D-5 SLBM with all deliberate speed and its deployment on a new fleet of Trident SSBNs was considered "very carefully" by the White House and the Defense Department in 1978 and 1979 as an alternative to MX. But the President decided instead to put MX in full-scale engineering development. Among the key reasons, according to a senior defense official intimately involved in those White House deliberations, was the diversity that the triad offers compared to an "enhanced dyad." Not only is a *synchronized*, preemptive attack on strategic offensive forces arrayed in a triad beyond present and foreseeable technical capabilities of either the US or the USSR, but the various "windows of vulnerability" encountered by individual components of the US triad tend to occur at different, staggered times. Concomitantly, from the Soviet point of view, it is more difficult to exploit such a vulnerability if two other types of strategic weapon systems remain invulnerable (as is the case under a triad) than if only one needs to be allowed for (as is true for dyad).

From the US point of view, shoring up a weak member of the triad is not quite as urgent an undertaking as would be true under a dyad. Pentagon leaders point out that historically these vulnerabilities are staggered in roughly five-year intervals. USAF's ICBMs are now becoming vulnerable to a Soviet ICBM strike, a condition that can be corrected by deploying MX in the second half of this decade. Starting probably in the mid-1980s, the air-breathing leg of the US triad—especially in terms of penetrating heavily defended airspace—can be expected to become vulnerable to Soviet look-down, shoot-down interceptors and missiles. While the question of how best to correct the anticipated vulnerability of the air-breathing leg is still being debated, several technical "fixes" are available for boarding up this window of vulnerability.

Lastly, beginning in the 1990s, serious vulnerabilities of the SLBM force are likely to occur. As a senior defense official recently put it, "My main reason for supporting MX is the belief that within ten or twelve years, submarines at sea will become vulnerable." He added that there is strong evidence that the US could develop an effective way of coping with Soviet SSBNs if the decision to do so were made: "If I were instructed to develop an anti-SSBN force, we could do it within [ten years]. We would not have to invent new technologies, but could attack Soviet SSBNs at sea with [systems using] existing technology." Although expensive, such an antisubmarine warfare (ASW) system can be made to work "worldwide" and wouldn't be affected by changes in Soviet operating doctrine.

The official acknowledged, however, that probably "my Soviet counterpart could not make the same statement" because Soviet SSBNs are noisier and thus easier to find than the US boats. Also, he claimed, "we have the world's best technology for [detecting submerged submarines] over very great distances by acoustic means." Using large numbers of long acoustic arrays, either embedded in the ocean floor or streamed behind surface ships, the US "can create a net that is capable of tracking Soviet subs worldwide." Each array, he said, can detect subs "many hundred miles" away. Initially such sensors might only be able to indicate the presence of a quarry within an accuracy range of about twenty miles. This approximation would be good enough for "barrage bombing" the area involved and to destroy the SSBNs.

The underwater detonation of an ICBM warhead with a yield in the one-megaton range, the Pentagon executive said, "has a crushing effect on submerged submarines many, many miles away from the burst." Anti-SSBN systems of this type, the Defense official stressed, could cope with any reasonable number of SSBNs at sea, using "fewer RVs" than would be needed to attack the US Minuteman ICBM force. Even if the number of SSBNs to be attacked is increased excessively over present levels and their deployment spread over wider ocean areas, "this would not cause major complications. It

would just take some more warheads" to cover a wider area. The incentive for the Soviets to develop such a system is great since destroying one target—a single US Trident SSBN—means the loss of 240 warheads. (Trident carries twenty-four SLBMs, each one of them carrying ten MIRVs.)

Command and control factors could affect the survivability of SSBNs and, conversely, the effectiveness of ASW in the future, the Pentagon official said. For the time being, SSBNs require a long trailing wire to receive communications in the VLF (very low frequency) range, the best if not the only band width for transmitting sizable amounts of information rapidly to submerged receivers over long distances. Even though submarines can travel at depths of up to 200 feet with the antenna wire deployed—and the wire need not, but might, surface—there is the acute danger that sophisticated detection systems in space or elsewhere would spot the wire and, hence, the submarine. (Direct communication with submarines at depth in the VLF range is possible but requires the presence in the immediate vicinity of a special communications aircraft, known as TACAMO. This aircraft deploys a trailing wire of its own that transmits VLF signals to nearby submarines.)

The Defense Department has tried for a number of years to overcome the communications problem of SSBNs by advocating several new communications systems, all meant to operate in the ELF (extremely low frequency) range. Signals of this type can be transmitted through water with no need for the trailing wire. To date, all ELF designs, which require extensive grids of underground wires at sites within the continental US, have been blocked by environmental considerations, often based on unproven or exaggerated claims about the system's side effects on the deployment areas. There is strong sentiment in Congress at this time to resurrect ELF.

With an operational ELF system, the SSBNs would not normally need to run out the trailing antenna. Because of its extremely low frequency rate, ELF can't transmit data quickly. But it can send out "all-is-well" messages continually. Only when a different code is sent—or no message at all is sent—via the ELF system, would the SSBNs deploy the VLF trailing wire to receive the "go code," the message telling them to launch their missiles and in which manner, the Pentagon official explained.

IN FOCUS...

Britain's Nuclear Weapons

British determination to develop and maintain independent nuclear deterrence forces entails major ramifications for NATO's theater nuclear forces (TNFs) and, at the same time, may act as a brake on future SALT III negotiations. Key issue is Britain's plan to build five ballistic missile-launching submarines (SSBNs) as replacements for the four aging US-built Resolution (Polaris) SSBNs. The US had hoped that Britain eventually would deploy sixteen Trident I (also called C-4) SLBMs on each new British-built SSBN. The British Navy plans to keep two boats on station at sea at all times, meaning that thirty-two SLBMs, each carrying fourteen warheads—or a total of 448 warheads—would be available to augment the 572 long-range theater nuclear weapons (Pershing IIs and ground-launched cruise missiles) that are to be deployed over the next few years. The British government, however, plans to retain an independent, albeit limited, assured destruction capability. Key feature of this plan is the ability to launch a massive SLBM strike against Moscow, which requires overcoming the "Galosh" ballistic missile defense system of sixty-four launchers plus assorted radars. The weapon system to do this job is the Chevaline, a modification of the existing A-3 SLBM.

Chevaline can carry three MaRVs (maneuvering reentry vehicles, *i.e.*, warheads) over enough distance to reach Moscow from the patrol areas of British SSBNs. These MaRVed warheads would descend on their target in a maneuvering, presumably corkscrew-like flight path, thus complicating the task of the Soviet Galosh missile defenses. The basic difference between a three-MaRV Chevaline and a fourteen-MIRV Trident is obviously one of numbers: Two SSBNs on station would carry only a total of ninety-six warheads when equipped with Chevalines as compared to a total of 448 warheads in the case of Trident I missiles.

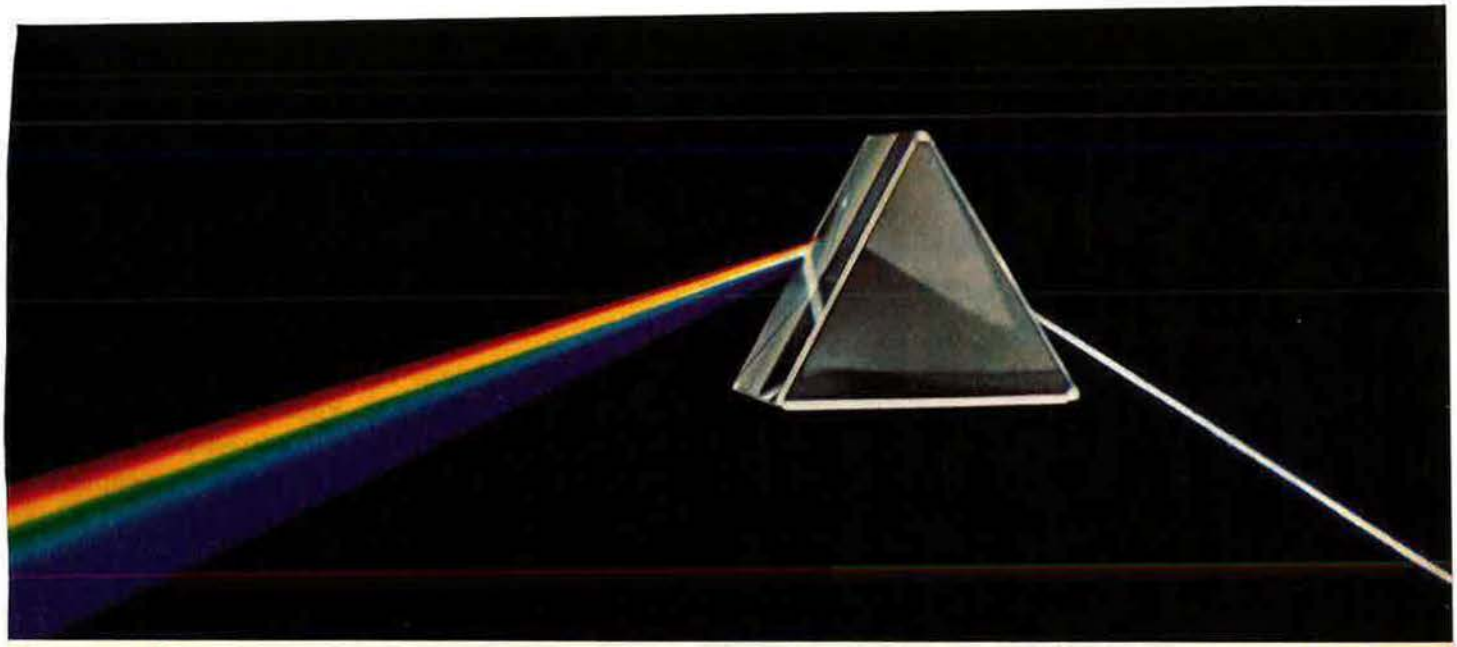
If the British were to decide to retain Chevaline on their new SSBNs—rather than use Trident I missiles—both NATO's long-range TNFs and US strategic deterrence (SIOP—for single integrated operational plan) forces could be affected significantly. In the first instance, the 572 ground-based long-range TNF systems—consisting of 108 terminally guided Pershing IIs and 464 GLCMs—that NATO agreed to deploy depend on augmentation by SLBMs carried by both British and US SSBNs. Any shortfall in warheads scheduled to be carried by British SSBNs probably will have to be made up for by assigning additional US SLBMs to the task. Thus, they would be removed from the SIOP force.

Complicating the situation further, congressional experts say, is the prospect that SALT III—which may become a substitute for the stalled SALT II accord and probably would include ceilings on TNFs—might limit the number of Pershing IIs and GLCMs below the currently planned total of 572 launchers. A reduction of this type would also impinge on the SIOP forces since a certain percentage of the TNFs is assigned to strategic targets in the western portion of the USSR. There is further concern in Congress about tentative White House plans to consider reducing the range of GLCM in order to minimize its potential effect on SALT III. The prospect of as yet undeployed US weapons being held hostage to SALT III and of having to reduce both their number and performance is producing a strong reaction in Congress.

Revived Mobilization Planning

In his State of the Union message, President Jimmy Carter announced a "major effort to establish a coherent and a practical basis for all government mobilization planning." Pointing out that this was the first program of its kind conducted at the Presidential level since World War II, he said virtually every federal agency was involved. Subsequently, the President signed a special order, or Presidential Decision (PD-57), that defines the key goals of US mobilization planning, including industrial mobilization patterned after the War Production Board of World War II. Another pivotal objective is "continuity of government," meaning the ability for government to function or to reconstitute itself along classic democratic lines after catastrophic events, including full-scale nuclear war. In case of the latter, emphasis is on aiding surviving regions or communities to reconstitute local government and to fuse such "pockets of survival" into governable entities.

PD-57, in the area of mobilization planning, stresses the importance of enlisting all available national re-



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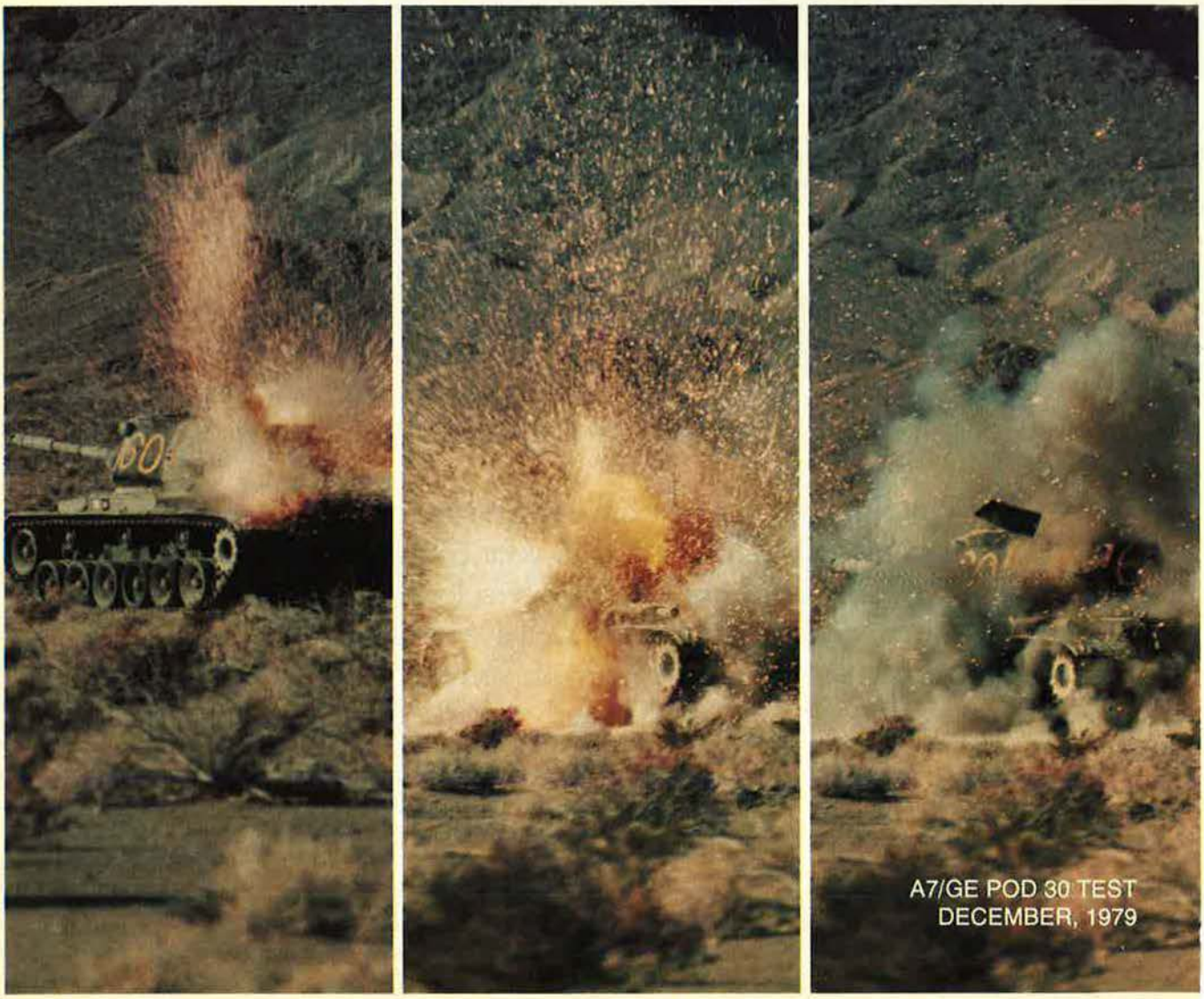
VOUGHT an LTV company



sources as quickly and as effectively as possible. In addition, the directive stresses to the twenty-one federal agencies involved the need to coordinate all military and civilian programs to enhance the nation's total war-fighting capability. A primary concern is with sustainability of the war effort, including civil defense and the buildup of war readiness materials (WRM). Implementation of PD-57 is the responsibility of the National Security Council. The Federal Emergency Management Agency is to prepare a master mobilization plan that will be reviewed on a continuing basis. Comprehensive mobilization exercises are to be carried out to seek out and correct weaknesses in mobilization planning.

Nuclear Test Observations Flawed

A senior Defense official who declined use of his name disclosed recently that an intensive US government study of a mysterious event in the Indian Ocean off South Africa in September 1979 failed to determine whether or not a nuclear detonation was involved. Spotted by two so-called bhangmeter sensors aboard a US Vela satellite, the event had the "unique signature" of a nuclear detonation. But, in contrast with all previously detected nuclear explosions in the atmosphere, there was no unambiguous corroborating evidence from other detection sources. The output from almost thirty other sensor systems that normally contribute information to nuclear test monitoring was analyzed carefully, according to the official, but only three or four of them showed abnormal but inconclusive data.

The government study, therefore, assumed that the event either wasn't a nuclear detonation but an anomaly or that whoever conducted the nuclear test "did it in such a clever and covert fashion" that all the normal information was suppressed. Congressional experts find irony in the fact that the Administration has classified secret almost all the information surrounding the event. Even details of estimates that the event might have been caused by a meteor that was not observed by other means—thought to be almost nonexistent—are being withheld. Reason for this unusual secrecy, congressional sources claim, is the Administration's unwillingness to discuss this country's current inability to monitor nuclear testing and the attendant deficiencies in enforcing arms-control accords.

Administration spokesmen instead stress that in the mid- and late 1980s

IN FOCUS...

the IONDS nuclear detection system will be deployed on all eighteen satellites of the GPS Navstar system. IONDS, thus, will observe any nuclear detonation in the atmosphere from four satellites simultaneously and provide precise optical and other information about its location and magnitude.

Washington Observations

★ The second, and latest, test of the Soviet Union's new SLBM, known as "Typhoon," took place on April 3 of this year, and also turned out to be a failure. Fired from a special device that simulates an underwater launch, the Typhoon's second stage blew up in a way similar to the first launch attempt. Telemetry data from this test was also encrypted. Several members of Congress have expressed concern that the Typhoon might be an ICBM in disguise or a hybrid usable as both SLBM and ICBM. The distinction between SLBMs and ICBMs is important because the SALT II accord, to which the US adheres even though the Administration withdrew the draft treaty from Senate consideration, treats the two types of weapons in different ways.

★ There is growing concern in Congress over the fact that the National Intelligence Estimate #1138 was held up for several months, supposedly by CIA Director Stansfield Turner. Congressional sources claim that the summary section was rewritten personally by Admiral Turner to include net assessment information that impinges on the MX system. The revision is said to assume excessively high growth in the number of Soviet warheads available for attacks on MX, thus putting in doubt the wisdom of building MX in the first place. There were other members of the intelligence community who refused to sign the estimate.

★ An April 22 letter from President Jimmy Carter to House Speaker Thomas P. O'Neill, Jr., has stirred up considerable doubt about the Administration's willingness to support even token increases in defense spending in FY '81. In his letter, the President expresses unqualified support for an amendment sponsored by Rep. David R. Obey (D-Wis.) that would cut defense spending (in budget authority) by $3.6 billion from the Administration's latest budget request while boosting spending in the domestic sector. Said President Carter in his letter: "I strongly favor the adoption of this amendment." Concerning an amendment by Rep. Marjorie Holt (R-Md.), which increases defense spending a modest $2.1 billion above the Administration request and cuts some social programs, the President made this comment: "It would reduce social and other non-defense functions to an unacceptably low level while providing for far more defense spending than is needed or advisable. I am strongly opposed to this amendment and urge the House to defeat it." The Holt Amendment, in the main, introduces what many members of Congress consider realistic assumptions about the increasing cost of fuel and restores cuts in the Defense budget made by the House Budget Committee. (The amendment failed by a wide margin, 164 to 246.)

★ The Pentagon suspects the Soviets are developing either a completely new or significantly improved ASAT space interceptor weapon system. The Soviet ASAT system tested to date, a senior Defense official reports, is an "unimpressive" weapon, marred by deficiencies in sensor capabilities and limited to low altitudes. "I imagine," the official said, "it doesn't impress [the Soviets either]." Seven out of ten tests of the Soviet ASAT have failed. The theory is that a new Soviet ASAT incorporating advanced sensor technologies and higher-altitude capabilities is under development. So far, no Soviet ASAT test has involved the use of directed energy (DE) weapons. Space weapons of this type, in particular laser, are "many years away" for both the US and the USSR, the Pentagon official believes. Probably the Soviets will first attempt to build ground-based DE weapons for use against satellites in low earth orbit since such systems "are easier to do." An ASAT test in April of this year, involving launch of the interceptor from the traditional ASAT launch site at Shari Shagan, was a failure; there are indications, however, that preparations for a new test are under way.

★ USAF's shortfall between the Defense Department's initial funding proposal for FY '82 and what the service needs to perform its mission is about $3.5 billion. Best early guess is that significant cuts in manpower are in the offing. The other services are similarly affected. ■

A billion man-hours "Lockheed" another

That figure is remarkable, and so are the accomplishments that have made Lockheed synonymous with airlift expertise for more than a quarter-century. No one else can match the record.

Who They Are

Of course, that capability starts with the people. And, put another way, the staff at Lockheed-Georgia has amassed more than half a million man-years of experience in designing and producing great airlifters.

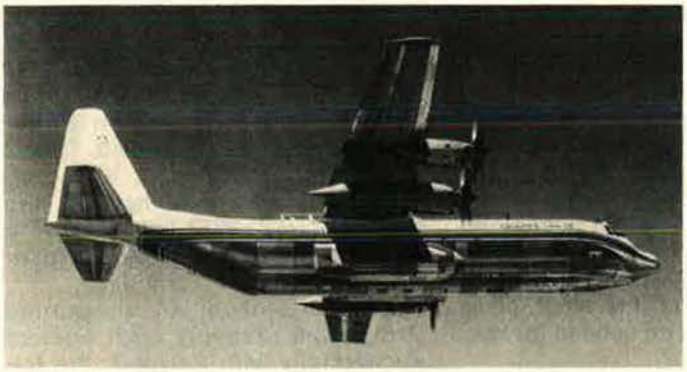
Who are they? They're researchers, designers, engineers, manufacturing experts, support personnel, and highly skilled workers. Thousands of them have been with the company for more than 25 years.

They've created and supported all the large aircraft that have formed the backbone of airlift capability for our nation and many countries around the globe.

# of experience make word for "airlift."

What They Produce

From that force of specialists has come the world's most versatile airlifter: the legendary C-130 Hercules. Famed for its country-building and mercy missions,



Hercules is flown by some 50 operators around the world and by the U.S. Air Force, Navy, Marines, and Coast Guard. It was the first big, turbine-powered airlifter with a rear cargo door, which lets large, fully assembled trucks and bulldozers be driven on and off. And Hercules can use short, remote airstrips of almost any surface—dirt, gravel, grass, sand, or snow.

Then there's the first jet airlifter, the C-141 StarLifter. Now, the 270 USAF C-141s are being given in-flight refueling capability for global range, and each is having its cargo hold "stretched" by one-third, affordably adding the equivalent capacity of 90 more StarLifters.

And finally there's the C-5 Galaxy, world's biggest airlifter. Depending on

load, it also can use short, unprepared airstrips. But it's further able to carry immense tonnages of outsize cargo, like two main battle tanks at once. No other airlifter approaches that capability.

Where They're Headed

The airlift experts at Lockheed-Georgia are just getting started, however.

They're shaping new airlift technology, and they plan to build ever more capable, dedicated airlifters. The techniques and the tools are in their hands. And their experience is just one of their strong credentials.

Put simply, the people of Lockheed-Georgia know more about airlifters, by far, than any other group in the world.

Lockheed

AEROSPACE WORLD
News, Views & Comments

By William P. Schlitz, ASSISTANT MANAGING EDITOR

Washington, D. C., May 6

★ McDonnell Douglas Corp. rolled out USAF's first KC-10 Extender tanker/cargo aircraft at its Long Beach, Calif., plant in mid-April. The Air Force plans purchase of twenty-six KC-10s.

The Extender, a modified version of the DC-10 convertible freighter, is equipped with an advanced aerial refueling boom, extra fuel bladders, an improved boom operator's station, and other features.

The plane is currently in an extensive operational qualification and flight-test program. Its air-refueling compatibility with various aircraft such as the F-15 and F-4 fighters, the A-10 and C-5, and Navy's A-4, F-14, and S-3 aircraft will be checked out both at high speed, high altitude and at low speed, low altitude, Air Force officials said.

The test-flight program will also entail the aircraft's operational effectiveness as a long-range refueler and cargo hauler with flights abroad, and maintenance under realistic conditions.

The aircraft is expected to be turned over to SAC for further testing in April 1981. It and additional KC-10s are to be based at Barksdale AFB, La.

The KC-10 will be able to reach practically any corner of the globe from both coasts of CONUS and America's Pacific possessions. Its range will vary from 5,500 nautical miles to an extreme of 7,500 nautical miles.

As for other operational capabilities, Air Force officials offer a comparison. During the long-range deployment of twelve F-15s to Saudi Arabia, which included 115 tons of equipment and 209 support personnel, sixteen KC-135s, three C-141s, and two C-5s were needed, requiring two days to complete the mission and using forward bases in Spain and the Azores.

Only six KC-10s would be needed to support the same deployment. A nonstop flight would have required one day and saved 600,000 gallons of fuel. However, to prevent excessive fighter pilot fatigue a rest stop in the Azores might be necessary, as in the F-15 deployment. In this event, only four KC-10s would be needed for the mission.

★ Two Soviet cosmonauts aboard Soyuz-35 docked with and boarded the orbiting space station Salyut-6 in early April.

According to news agency Tass, the two will conduct repairs to the station, launched in September 1977, perform medical and biological experiments of a space-related nature, and survey resources on earth. Planned duration of the mission, as is usually the case, was not reported.

One of the crew, Valery V. Ryumin, is a forty-year-old civilian flight engineer who was aboard the record-setting 175-day orbital mission of 1979. The current mission commander is Soviet Air Force Lt. Col. Leonid I. Popov, a thirty-four-year-old former fighter pilot who joined the Soviet space program in 1970 and has been a flight controller on earlier manned missions, Tass said. This is his first space mission.

It is Ryumin's third mission; the first, in October 1977, failed when the Soyuz-25 spacecraft developed guidance problems.

Late in March, an unmanned Progress-8 resupply craft docked successfully with Salyut-6; the following manned second mission is possible because of the space station's two entry ports.

The Air Force's first KC-10 Extender tanker/cargo aircraft following rollout ceremonies at the McDonnell Douglas facility at Long Beach, Calif. USAF is planning to buy twenty-six of these derivatives of the commercial DC-10 Series 30CF (see above).

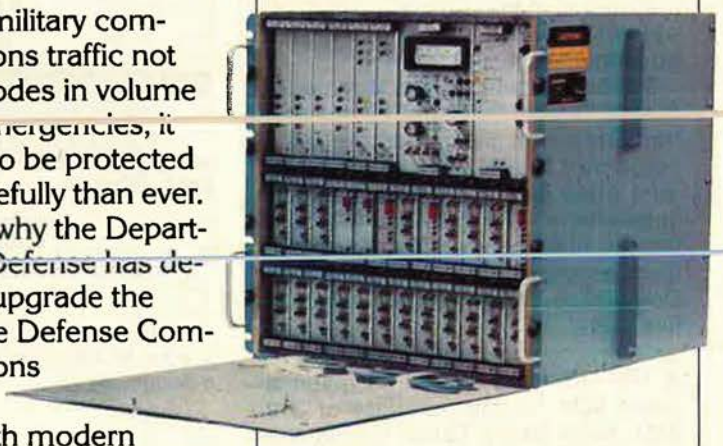
Cost Effective
DIGITAL
Transmission System for the DCS

Modern military communications traffic not only explodes in volume during emergencies, it also has to be protected more carefully than ever.

That's why the Department of Defense has decided to upgrade the worldwide Defense Communications System (DCS) with modern digital equipment.

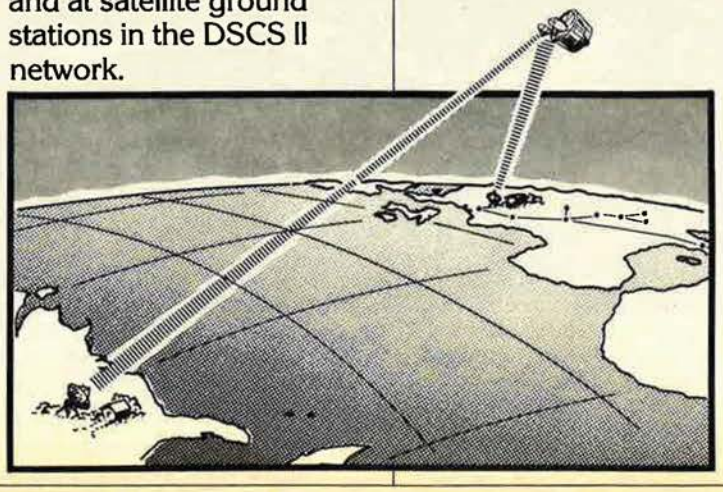
Digital technology will provide US forces worldwide with comprehensive communications security at reduced life-cycle costs.

As the first major contractor for the digital upgrade of terrestrial links in the DCS, TRW is demonstrating today's advanced digital transmission technology in the Washington Area Wideband System and at satellite ground stations in the DSCS II network.



More than 300 of our AN/FCC-98 communications terminals are now serving these critical communications areas with exceptional reliability.

We've also developed a complete line-of-sight transmission system for the Digital European Backbone communications network serving the command structure and forces of NATO throughout Europe.



Installation of our 1st and 2nd level digital multiplexers and the AN/FRC digital radio will begin in 1980.

We'll also be supplying digital radios and 3rd level multiplexers to the NATO Integrated Communications System which handles NATO's long-haul communications needs.

If you'd like additional information on TRW's digital communications capabilities, contact: Joe Wellington, TRW DSSG, (213) 535-2258.

DIGITAL COMMUNICATIONS from

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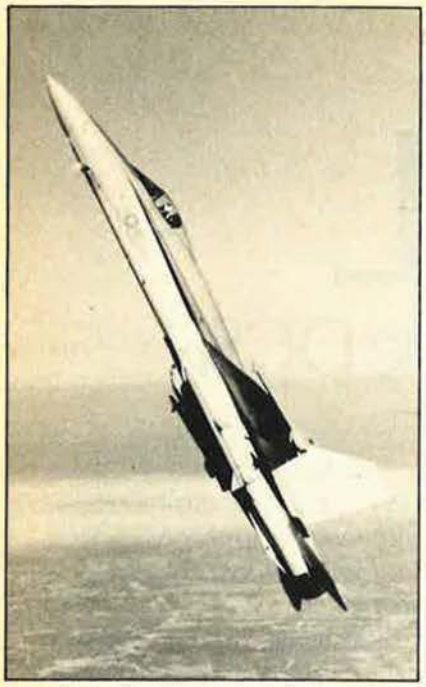
AEROSPACE WORLD



Canada will purchase 137 F-18A Hornets, the US Navy's hot new Strike fighter, powered by GE's F404 turbofan engine. First deliveries of the Canadian F-18s are expected late in 1982.

The latest manned mission coincides with the anniversary of the first manned mission, of Yuri Gagarin in April 1961.

★ The Canadian government has selected the F-18A Hornet, built by McDonnell Douglas, St. Louis, Mo., to modernize its Air Force in the current decade.

The F-18A edged out the F-16 produced by General Dynamics Corp., also of St. Louis, in the final selection process that ended a five-year debate over the choice and marked the new Liberal government's first major procurement decision.

Canada is to purchase a minimum of 137 Hornets, the acquisition of which will cost close to $2.5 billion. First deliveries are expected late in 1982 and are to continue on a schedule of two aircraft a month until 1989.

A key factor in the Canadian government's choice of the Hornet is Canada's potential participation in production and other work, valued at an estimated $2.9 billion over fifteen years.

★ The US Army and the Federal Republic of Germany's Deutsche Bundespost, its telecommunications authority, have agreed on replacing the antiquated (circa 1940) telephone network used by US forces stationed in Germany.

The new European Telephone System, to cost the US $125 million, will be delivered by a consortium of telecommunications firms under the supervision of Siemens AG, the German manufacturer of the telephone system. This will include delivery and installation of the complete switching network, as well as engineering, documentation, and training.

The system will use the facilities of the US Forces' Defense Communication System in Europe as well as a number of leased Deutsche Bundespost lines and will connect 80,000 subscribers. The network will also feature dial access to the Deutsche Bundespost public telephone net. Completion of the project will take five years.

★ The US Army has been given a green light for the purchase of 352 XM1 Main Battle Tanks during the current fiscal year.

The initial batch of "Abrams" tanks—named for the late Gen. Creighton W. Abrams, Jr., World War II tank commander and former Army Chief of Staff—demonstrated some reliability problems that induced the Army to put several modified XM1s through a rigorous test program at Fort Knox, Ky. The result: "Earlier problems with the tank's power train and related systems have been corrected, and the XM1 now meets or exceeds all major reliability and durability requirements. . . ."

The Army said that it plans to conduct additional testing and continue design refinement during 1980 pending a full-scale production decision on the Chrysler-built tank that could come as early as July 1981.

The self-contained, mobile air traffic control tower developed by Lockheed Aircraft Service Co. contains all equipment needed for VFR control over aircraft within a designated zone.

★ Test flights are under way of a C-130 Hercules modified with twin

An artist's concept of Northrop Corp.'s F-5G, the single-engine version of the highly successful tactical F-5 being specifically designed as a new intermediate export fighter. Because of the G's commonality with other F-5 versions, Northrop anticipates a significant international sales potential for the aircraft, to be powered by a GE F404 in the 16,000-lb.-thrust class.

"after-body strakes"—tail fins—that will increase the aircraft's speed and trim fuel consumption.

The strakes, measuring seven feet long by four inches thick by twenty inches high, are constructed of aluminum and fiberglass and are attached under the propjet's tail section to smooth airflow, thus reducing the aircraft's aerodynamic drag.

The test flights are aimed at verifying earlier wind-tunnel test data and confirming the modified C-130's structural integrity. They are being conducted by Lockheed-Georgia Co., of Marietta, the aircraft's manufacturer, under USAF contract.

Engineers believe that C-130 fuel consumption can be shaved by three percent on long-range cruise and perhaps better than six percent on low-altitude missions. Aircraft speed would be increased from 345 mph to 365 mph, they declare.

Based on the current price of JP-4 aviation fuel, the saving on USAF's fleet of 550 C-130B, E, and H models could amount to about $9 million annually, it is estimated.

One reason for enthusiasm for such a modification program is that the strakes can be retrofitted easily to aircraft in the field.

A C-130 equipped with after-body strakes intended to smooth airflow and thus reduce aerodynamic drag, leading to fuel savings and somewhat increased speed. A test-flight program is being conducted by Lockheed-Georgia of Marietta.

★ AFSC's Electronic Systems Division, Hanscom AFB, Mass., is developing a portable, electronic device that will protect ground-based aircraft detection radars from attack by missiles homing in on a radar beam.

The Anti-Radiation Missile Alarm Sensor, or ARM Alarm Sensor, is actually a separate, smaller radar that operates on a different frequency than the aircraft detection radar it is connected to by cable.

When ARM Alarm detects an enemy radar-seeking missile, it automatically shuts down the parent unit, leaving the missile without a beam to home in on.

An ARM Alarm advanced development model, built by Syracuse Research Co., N. Y., has already proved the concept's feasibility in recent tests using actual missiles. Later this year, ESD plans to issue requests for proposals from industry to design and build eight engineering development units that will be fully militarized, weigh some 100 pounds (45.4 kg), and be capable of operation in all kinds of weather anywhere in the world.

Following extensive testing, USAF would then award a production contract for 118 ARM Alarm units for Tactical Air Command use.

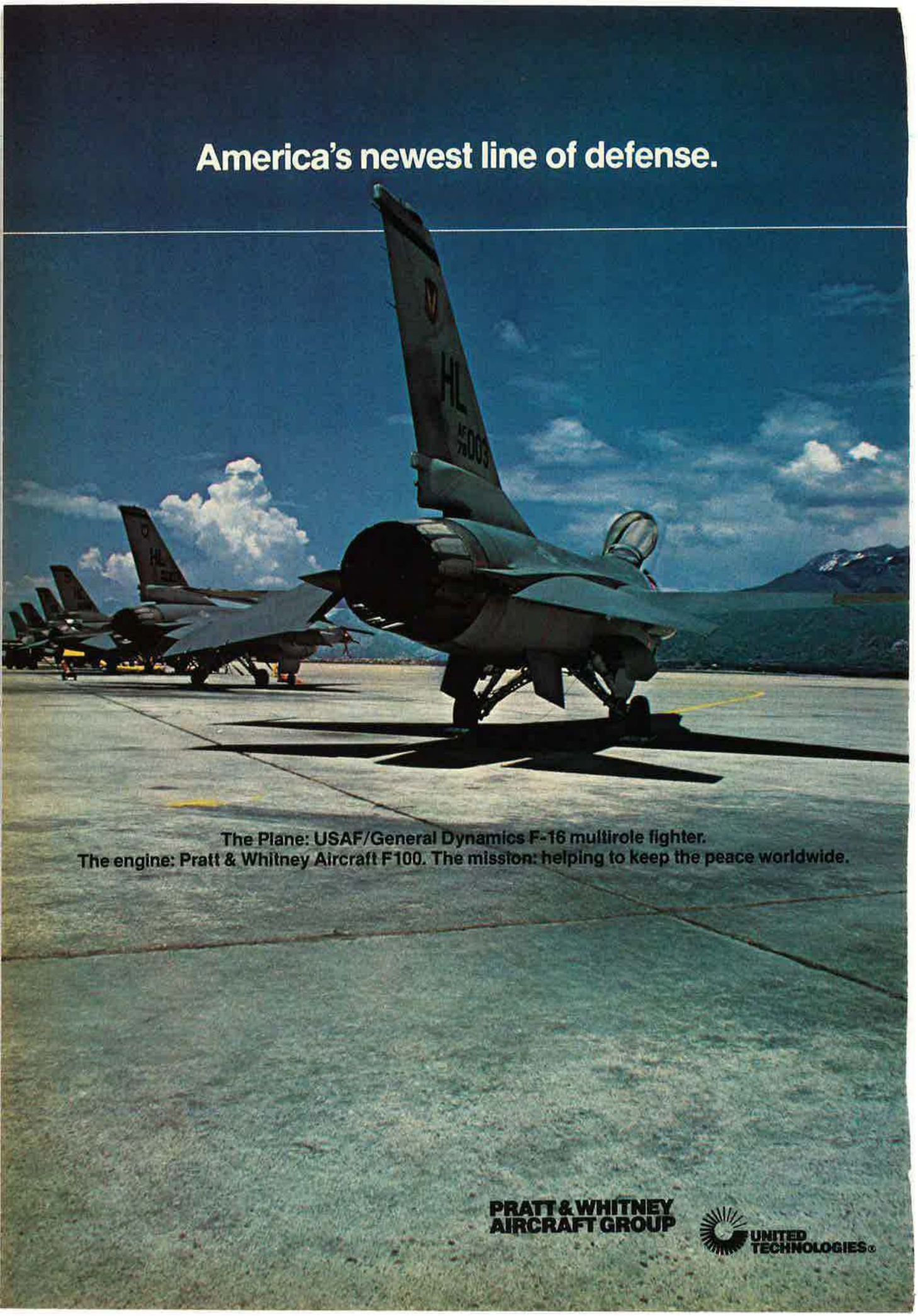
★ New solid-state air traffic control radar systems are scheduled to replace twenty-year-old equipment at fifty Air Force installations worldwide.

Developed by AFSC's Electronic Systems Division, Hanscom AFB, Mass., the hardware consists of airport surveillance radars to monitor aircraft within a sixty-nautical-mile (110 km) range, precision approach radars so that traffic controllers can assist pilots during landings, and operations center buildings to house personnel and equipment.

The new precision approach radars will allow controllers to track up to six planes simultaneously, up from two with the older equipment. These

AFCC air traffic controllers study aircraft activity on radar consoles in an operations center recently installed at Nellis AFB, Nev. Twenty-year-old equipment is being replaced with solid-state systems at fifty USAF installations worldwide.

America's newest line of defense.



The Plane: USAF/General Dynamics F-16 multirole fighter.
The engine: Pratt & Whitney Aircraft F100. The mission: helping to keep the peace worldwide.

PRATT & WHITNEY
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TECHNOLOGIES®

radars also have the ability to "see" through heavy rains or snow. The precision approach equipment is being provided by Raytheon Co., Waltham, Mass.

Texas Instruments, Sherman, Tex., is furnishing the airport surveillance radars and operations centers.

The first system, including both types of radar and an operations center, is already operational at Nellis AFB, Nev.

★ USAF has begun to offer cash bonuses to qualified six-year enlistees in three of its highly specialized career fields.

The bonuses, according to recruiting officials, are to be paid to recruits who complete technical training in Radio Communications Analysis/Security, Voice Processing, or Explosive Ordnance Disposal.

Payments will vary, with Radio Communications Specialists receiving $1,000; Explosive Ordnance Specialists $1,500; and Voice Processing Specialists $2,000. These will receive a lump-sum payment at the first duty assignment following training.

Applicants for these specialties must be high school graduates or hold a state-certified GED. They must have no prior military service and have full qualifications for the specialty training sought.

Air Force recruiters have further details.

★ Two TAC crew members—Capts. Joseph Mastascusa and Wendell Johnson, both of the 474th Tactical Fighter Wing, Nellis AFB, Nev.—have been named recipients of the Aviators' Valor Award, presented annually since 1953 by New York's American Legion Post 743.

The award is presented to any rated Air Force member for conspicuous acts of valor performed during an aerial flight in or out of combat.

On June 28, 1978, the two were returning from a training mission in an F-4D Phantom. On landing, a wing dropped, skewing the aircraft to the right. Captain Mastascusa pulled the plane out of the drift by applying full left rudder and aileron while simultaneously jamming on full afterburner. Off the runway, the plane traversed about 1,000 feet of hard-packed sand surface before becoming airborne.

Aerial inspection by a wingman determined that the right landing gear was missing, as was the aft section of the right external fuel tank. In the face of these and other complications, the decision was made to land gear up, which was accomplished successfully with damage only to the two external fuel tanks. The crew's reaction in a critical emergency saved the aircraft and perhaps their lives.

AEROSPACE WORLD

★ Under a recent DoD action, thousands of women members of the World War II Women's Army Auxiliary Corps are to become eligible for certain veterans benefits. These could include medical treatment, home loan guarantees, pensions, and payment of some burial expenses.

The change in status was granted former WAACs who chose not to enter the newly created Women's Army Corps established as part of the Army in 1943, about twenty-five percent of the WAAC force. Those that did have had veterans' status since leaving military service.

VA Administrator Max Cleland said that former WAACs desiring eligibility

The F-16 in Simulated Wartime Deployment

A new nonstop flight record of ten hours was recently set for F-16 multirole fighters of the 34th Tactical Fighter Squadron, 388th TFW, Hill AFB, Utah.

During an exercise dubbed "Red Max Alpha," the fighters flew north to the Great Lakes, east to the Atlantic Coast, south to Florida, and, finally, over Texas and southern Utah back to Hill. The 4,350-mile flight simulated the distance from Hill to a base in central Europe, and required three aerial refuelings by SAC KC-135 tankers along the route.

Back at Hill, the aircraft continued participation in Red Max Alpha, a three-day event designed to evaluate aircrews, aircraft, support personnel, and flying and maintenance operations in a wartime environment. During the exercise, twelve F-16s flew a total 101 missions to gunnery ranges in Utah, Nevada, and Idaho, with sixty-one missions accomplished the third day. For all that, nine of the twelve aircraft continued maintenance-ready if further missions had been required, officials said.

According to F-16 manufacturer General Dynamics, the F-16 has more than twice the combat radius of the F-4 Phantom on an air-superiority mission, with each aircraft carrying its design air-to-air armament and flying the same combat maneuvers. And the F-16 uses half the fuel needed by the F-4 when performing the same missions.

Data derived from Red Max Alpha is to be used in planning future F-16 exercises, USAF officials said.

An F-16 fighter refuels during its recent 4,350-mile endurance flight. A number of F-16s from the 388th Tac Fighter Wing, Hill AFB, Utah, participated in the simulated deployment, which required three aerial refuelings and culminated in a high-sortie exercise dubbed "Red Max Alpha."

The "Incredible Hulk," a restored tail section of a C-141 used as a loading simulator, the only one in existence, in training by the Aerial Port Squadrons at Dobbins AFB, Ga. Lockheed-Georgia donated the former stress test article.

must first obtain an honorable discharge by applying to the Department of the Army, US Army Reserve Component and Administrative Center, Attention: AGUZ-PSA-P, 4700 Page Blvd., St. Louis, Mo. 63132. On receipt of a discharge, the former WAAC should then contact a benefits counselor at the nearest VA regional office via the toll-free numbers listed in telephone directories.

The DoD action is the result of legislation that made possible last year's extension of benefits to World War II's Women's Airforce Service Pilots and World War I's civilian telephone operators who served in France.

★ The ninth annual Bishop Milton Wright Air Industry Awards were presented during ceremonies in New York in mid-April. The awards, named in honor of the father of the Wright brothers, are presented to outstanding persons who have distinguished themselves in the air industry "by their humanitarian goodwill, courage, love, and concern for their fellow man."

Individuals honored this year were William T. Seawell, Chairman of Pan American World Airways; Mrs. Blanche Noyes, pioneer aviatrix; and Gregory and Paul Poulos of Sky-del, Inc., John F. Kennedy International Airport, N. Y.

Also honored was Tuskegee Airmen, Inc., an organization of black Air Force veterans and active-duty people of all ranks, as well as other black veterans who served in World War II, Korea, and Vietnam. The Tuskegee Airmen, formally constituted in 1972 and named for the black airmen who were trained at the famous Alabama Institute during World War II, has fifteen chartered chapters throughout the US. Its aims are to promote historical, scientific, and social research, to publish and produce literary and educational programs and projects, and to grant scholarships to deserving American youths seeking aviation and aerospace careers.

Accepting the award on behalf of the Tuskegee Airmen was the organization's National President, Dr. Hannibal M. Cox, Jr., a fighter pilot veteran of the three wars who is currently an Eastern Air Lines executive. The award was presented by Herbert O. Fisher, a former Iron Gate Chapter President and AFA National Director.

AEROSPACE WORLD

★ **NEWS NOTES**—In order "to improve the Air Force's **tactical electronic warfare and theater defense suppression capabilities,**" twenty-four F-111As at Mountain Home AFB, Idaho, **will be modified to EF-111A configuration by mid-1981** and equip two tac electronic warfare squadrons to be activated there, officials said. The move will increase military personnel at the base by about 100.

FAA's National Aviation Facilities Experimental Center, Atlantic City, N. J., was to change its name to the **Federal Aviation Administration Technical Center** with the dedication in late May of its **new $50 million headquarters complex.** Also inaugurated at the Center was a new operational and research heliport.

The **first operational aerial refueling** of a stretched MAC C-141B took place in early April during a nonstop flight of the aircraft from Beale AFB, Calif., to RAF Mildenhall, UK. It was the **longest mission thus far** for the B, of the 443d MAW, Altus AFB, Okla., and the **first mission to Europe.** In a related matter, Lockheed-Georgia Co., Marietta, announced that **all phases of the C-141B's flight-test program had been successfully concluded.** In use was a new ad-

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vanced airborne test data system of some dozen microcomputers on the aircraft to provide very fast and efficient data acquisition; for example, a preflight of up to 1,000 channels took two hours under the older system. The new system provides preflights in only five minutes.

Parks Aeronautical College of St. Louis University, Cahokia, Ill., the first federally approved school of aeronautics, will host its **annual Open House June 14–15** to include military and civil aircraft, static and student displays, parachuting, and an air show. Call Capt. Terry Lowe (800-851-3048, ext. 230) for details and free exhibit space.

In April, NASA tested a group of men **aged fifty-five to sixty-five** on their ability to withstand the stress of weightlessness in spaceflight and will test women in that age group later in the year. Younger age groups have already been observed. The program is designed to set baseline medical criteria for Shuttle flights.

This May marked the **fiftieth anniversary of airline flight attendants.** On May 15, 1930, **eight young nurses** took to the air for Boeing Air Transport. Today, there are more than 125,000 flight attendants worldwide.

TSgt. Robert Wickley, a photojournalist with the Aerospace Audiovisual Service, Norton AFB. Calif., has been named **1979 Military Photographer of the Year.** The photo competition is sponsored by the National Press Photographers Association and the University of Missouri. In addition to placing first, Sergeant Wickley won three second place awards, two third place awards, and three honorable mentions.

A new monument, **in honor of the orbital Mercury flights** of John Glenn, Scott Carpenter, Walter Schirra, and Gordon Cooper, was recently dedicated at Complex 14 at Cape Canaveral AFS, Fla.

Died: Thomas K. Finletter, second Secretary of the Air Force and longtime public servant who was permanent representative to NATO during the Kennedy Administration, of a heart attack in New York in April. Mr. Finletter advocated both universal disarmament and US military preparedness. He headed a commission on military aviation policy whose 1948 report, *Survival in the Air Age,* was instrumental in greatly expanding the fledgling and independent Air Force. He was eighty-six. ■

Randolph AFB, Tex., headquarters of Air Training Command, this year marks its fiftieth anniversary. It celebrated almost fifty years of teaching flying with an open house and air show in May. Here, in this 1932 photograph, a flight instructor uses familiar gestures to demonstrate maneuvers to young cadets, proving that while equipment and uniforms may change, pilots and their fascination with flight haven't.

READY RADIOS

carry on emergency communications

A single portable emergency transceiver now combines broad frequency selection with modulation methods so you can tie together communications networks including air, mobile, and ground units. Use Motorola's PT-25 as a rugged portable radio or mount it in surface and airborne vehicles. Or air traffic control towers. For primary or emergency communications. Lightweight. AM/FM and VHF/UHF multimode operation. Scanning included. The PT-25 puts 8360 frequency synthesized channels to work for you over government and commercial aviation bands. Battery or AC/DC operation. From 116-150 MHz. And 225-400 MHz. Removable control unit makes for easy remote installation anywhere.

Vehicle Mount. Makes short-range, on-the-go communications easy for emergency or airport vehicles. Ideal for remote field air controller operations.

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CAPITOL HILL

By Kathleen G. McAuliffe, AFA DIRECTOR OF LEGISLATIVE RESEARCH

Washington, D. C., April 28

FY '81 Budget

The House and Senate Budget Committees have reported out balanced budgets with overall spending close to the $611.5 billion target set by the President for FY '81. Only the Senate resolution provides real defense increases, with $173.4 billion in budget authority and $155.7 billion in outlays. The $13.5 billion Senate increase, including an 11.7% salary hike for all military personnel, collides with proposals to up domestic programs but probably will be sustained. The House Budget Committee pegged budget authority at $160.8 billion and outlays at $147.9 billion.

Neither house is expected to stray far from committee proposals and in conference a compromise on defense spending is likely. The Administration had estimated $4.5 billion in increased costs for FY '81, but added only $2.9 billion for fuel in its amended budget. DoD would have to absorb $1.6 billion in program cuts and deferrals.

In tandem with a vote on the 1981 resolution is a revised second budget resolution for FY '80. The Senate added $4.1 billion for defense to cover understated costs, Nunn-Warner military manpower benefits, and a twenty percent pay hike absorption. The House added only $2.8 billion for similar costs, but kept pay absorption at the forty percent proposed by the Administration.

Holt Amendment

Rep. Marjorie Holt (R-Md.), in the only defense spending amendment to the House Budget Resolution, proposed to increase defense outlays for FY '81 by $5.1 billion and reduce domestic programs by a similar amount. The measure was rejected by a vote of 246 to 164. The added funding was targeted to pay for increased fuel costs, restore funds cut by the Budget Committee, and provide that DoD absorb only the traditional twenty percent of pay hikes.

Nunn-Warner

An amendment sponsored by Sens. Sam Nunn (D-Ga.) and John Warner (R-Va.), which increases military compensation benefits and will cost $3 billion over the next five years, has passed the Senate and is pending in the House. The Military Compensation Subcommittee is to establish a position on the proposal. Further action is being held in abeyance, however, until after the Budget Resolution is adopted. The subcommittee, aware of Administration objections to the variable housing and subsistence allowances, expects to make some changes. At this writing, Administration officials predict the legislation will be vetoed if sent to the President in its present form.

Doctor Pay Incentives

Congress will again send a military physician bonus package to the President for his signature. Elements of House and Senate Armed Services Committees have passed proposals to help retain doctors in the military by providing permanent bonus pay for the MDs. Only the House bill provides guaranteed special pay for dentists, a provision that is objectionable to the Administration. Both measures are expected to pass floor consideration after the adoption of the Budget Resolution and differences will then be worked out in conference. With the urgent need to retain the doctors and President Carter's promise to again veto any legislation providing bonus entitlements to any group other than military physicians, the dental provision will probably be dropped by the conferees.

CX Loss

The Air Force's proposed outsize cargo transport, CX, will not be included in the House Armed Services' "shopping list" when Appropriations marks up DoD spending in July. Some $80.7 million for the R&D program was struck by a vote of twenty-two to seventeen after C-5 capabilities, added sealift, and efforts to balance the budget were considered. Further, the proposed 1986 IOC (Initial Operating Capability) drew sharp criticism as not alleviating current problems. CX does not appear to have a chance of being resurrected in the House, and its future in the Senate Authorization Bill is unclear at this time.

MX Survey

With MX facing a rough road in Congress, Rep. Dan Marriott (R-Utah), in whose district the proposed ICBM would be deployed, released results of a survey showing Utahns, by a margin of forty-seven percent to forty-four percent, favor basing MX in Utah if they can be convinced of its necessity for national security. Further, fifty percent said they would favor MX in their area if environmental and socio-economic effects could be overcome. Those favoring MX gave its deterrent value and survivability as reasons for support, while those against said the environmental impact and desire to split deployment among several states were deciding factors.

FY '81 Authorization Bill

The House Armed Services Committee increased R&D and procurement programs by $5.9 billion, with $1.1 billion targeted for additional USAF aircraft. Although the committee voted down the $80.7 million for CX, it added twelve A-7Ks, eight C-130s, two KC-10s, $400 million for a Strategic Weapons Launcher (SWL—a B-1 derivative), and $253 million for initial spares for the F-15 and F-16. The Navy was voted an extra $2.2 billion for two SSN-688 nuclear attack submarines, two *Perry*-class frigates, and to recommission the carrier *Oriskany* and the battleship *New Jersey*. A total of $243 million was added to the Marine Corps AV-8B V/STOL program for FY '81. The committee included language supporting the Administration's registration proposal, but rejected a move to save operations and maintenance from cuts by refusing to set a "priority guideline" for Appropriations to follow. The Appropriations Committee traditionally makes cuts despite recommendations in the authorization bill. ■

Where the interests of several great powers intersect, tension and conflict can be expected. That has been the case in Northeast Asia for centuries. The tension continues today. Whether conflict will break out depends to a large degree on perceptions of . . .

NORTHEAST ASIA: The Shifting Balance

BY F. CLIFTON BERRY, JR., EXECUTIVE EDITOR

JAPAN

A VISITOR to Northeast Asia after an absence of six years should expect to see changes. But that expectation is scant preparation for absorbing the really profound shifts that have occurred in the region since 1974, and most especially in the past year and a half. The catalog is long, but a few highlights will suffice: US recognition of China and dropping Taiwan, buildup of Soviet forces in Asia and the Pacific, possibility of "talks about talks" between the two Koreas, the assassination of President Park Chung Hee, and the heightened consciousness in Japan toward enhanced national defense.

The changes are not only political and psychological; they also include procedural and hardware advances in both Korea and Japan, all of which contribute to US interests, goals, and national security. Five years ago, AIR FORCE Editor John Frisbee termed Korea the "linchpin of US Asian policy." In the spring of 1980, US officials interviewed for this article used the identical term, applying it both to Korea and Japan in the current context. "Linchpin" is an apt word in this situation. In the dictionary meaning, it holds together the elements of a complex. Thus, either Korea or Japan or both together can be called a linchpin. If either one is threatened or lost, so is the other and the complex can fly apart. This relationship is understood clearly by Japanese, Korean, and American officials on the scene. It should not be overlooked in Washington because of preoccupations with the Middle East and Persian Gulf regions.

Japan's Evolving Consensus

Even open discussion of defense matters was virtually taboo in Japan for years, and espousal of improved defense posture was done only in private. Not so anymore. The topic is open for discussion now by politicians, the media, and the public. Consequently, progress is being made. But an American expert enters a cautionary note. Before attempting assessment of the shifting military balance in Northeast Asia, he says that one must remember that the Japanese frame of reference is different from ours. He puts it this way: "Their frame of reference is Northeast Asia, and then the global picture." With that caveat entered, he and other Americans are quick to point out that Japanese views on defense matters have indeed changed profoundly within the past year. This follows a period of about three years of consciousness-raising on defense topics within the body politic.

The Japanese government considers strong public support to be essential to vigorous defense. Ganri Yamashita, then Director General of the Defense Agency, said in his 1979 Defense White Paper, "National consensus on defense issues is the foundation of national defense. Without such consensus, there can simply be no effective defense."

The evolving consensus is unmistakable and quantifiable. The Prime Minister's office samples Japanese public opinion on defense issues every three years, most recently in December 1978. The 1978 interviews with a nationwide sample of 3,000 men and women older than twenty years revealed that eighty-six percent agreed with the need to have a Self-Defense Force (SDF). That compared with seventy-nine percent in 1975 and seventy-three percent in 1972. (The figure favoring existence of an SDF was less than thirty percent in the mid-1960s.)

A few Japanese still favor discontinuing the SDF; it was five percent in 1978. That was twelve percent in 1972 and eight percent in 1975, so the decline is steady and significant. The five percent of people who opposed the existence of the SDF gave the following rationales: "constitutional renunciation of war" (forty-five percent), "heavy economic burden on the people" (twenty-eight percent), and "possibility of becoming involved in a war" (twenty-six percent).

Reasons for the burgeoning consensus on defense issues are numerous. Those most often cited include the ominous buildup of Soviet naval and airpower in the region; the provocative Soviet fortification of islands north of Hokkaido still claimed by Japan; uncertainty over US intentions as exemplified by the precipitate recognition of China and the Carter withdrawal of US forces from Korea (now suspended); and a realization that it is time they assumed a larger share of the defense of Japan and its surrounding air and waters.

The 1978 government survey shed light on the last point—increasing defense power. The percentage dou-

bled from eleven percent in 1972 to twenty-two percent in 1978. As for maintaining present levels, the proportion of adult Japanese held steady at fifty-one percent (1972) and fifty-three percent (1978). In fact, the amount of money devoted to the defense budget doubled from 1974 to 1979, from 1,093 to 2,094.5 billion yen.

Results of the Consensus

Perhaps the most dramatic result is the formation of a special standing committee on national security affairs in the House of Representatives of the Diet, Japan's parliament. The committee has twenty-five members drawn from across the spectrum of parties represented in the House. Until now, national security matters have been secondary issues for discussion in such standing committees as those on the Cabinet, foreign affairs, and the budget, according to columnist Masaru Ogawa. Ogawa notes that even the Socialist Party joined the opposition Democratic Socialist Party and the ruling Liberal Democratic Party in approving the new committee. Only the Communist Party voted against the committee's establishment, but decided to participate once its existence was certain.

It appears that the new Diet committee will provide a closer and more regular oversight of national security matters than the Diet has exercised in the past. Thus, they will be discussed in a more normal way than in a crisis-like or major-issue atmosphere. Certainly it will continue the strong tradition of civilian control over the uniformed military. However, uniformed military officials are expected to respond to requests to testify before the committee, and give expert testimony on topics within their responsibilities.

Another step forward in the legislative sphere is endorsement by the major opposition party, the Democratic Socialist Party, of the government's proposals to amend existing legislation on the SDF in two respects. One would authorize a 2,331-person increase in the SDF strength, now 180,000. The other would permit revision of existing law in order to organize a new submarine fleet headquarters for unified command of the two sub flotillas of the Maritime Self-Defense Force. The new fleet headquarters will be responsible for training submariners, as well as command and operation of submarine units.

The Japan Defense Agency's five-year plan for improving the quality of its forces is called the Mid-Term Operations Estimate (MTOE). It is a sliding plan, updated each year and projected one year further ahead. The current document is for the 1980–84 period, and calls for about $11 billion worth of improvements. In late spring, there were indications that the Defense Agency and the Ohira government were planning to accelerate the plan by a year; that is, to accomplish by 1983 what was planned for completion by 1984. That would be an ambitious undertaking, which would require competition against other programs in the government's budgets for the years ahead. If executed, it will demonstrate even more concretely Japan's resolve and commitment to sharing a larger portion of the burden of its defense.

Japanese Defense Expenditures

(In billions of yen)

Fiscal Year	Defense Budget (billions of yen)	Percentage Growth from Previous Year
1974	1,093.0	16.8%
1975	1,327.3	21.4%
1976	1,512.4	13.9%
1977	1,690.6	11.8%
1978	1,901.0	12.4%
1979	2,094.5	10.2%

Source: Japan Defense Agency White Paper, "Defense of Japan 1979"

The US team in Japan is led by Ambassador Mike Mansfield (left). The top US military man in the country is Lt. Gen. William H. Ginn, Jr., USAF (right). General Ginn is Commander, US Forces Japan, and also of Fifth Air Force, with units in Japan and Korea.

For a time, the Carter Administration was pressing Japan strongly and publicly to increase its defense budget to break through the "One Percent Barrier," and spend more than one percent of its Gross National Product (GNP) on defense. The figure has hovered at or near nine-tenths of one percent of GNP in recent years. It is slightly higher if pensions for the Imperial Forces are included, and even higher (about 1.1 percent) if offsetting support of US forces is included. In the opinion of most experts on Japan, such public prodding is counterproductive. The Administration apparently agrees, and has settled for quiet encouragement of a steady increase in Japanese defense spending. In Japanese opinion, a steady increase in defense spending is also a significant demonstration of resolve. This suggests that the internal logic of the Japanese system will adjust its actions much better than overanxious pressures by a US administration. To that end, the US outcries have been muted in recent months, with more productive discussion of requirements and responsibilities taking place. (As an aside, one US expert pointed out that Japanese defense outlays have increased by larger percentages each year since the mid-1970s than the increases by NATO nations.)

Equipment improvement steps are already in progress. The acquisition of about 120 McDonnell Douglas F-15CJs has been set in motion. They will supplant F-104s as deliveries begin late in 1980. The domestically manufactured supersonic support fighter, the F-1, con-

Paratroopers of the 1st Airborne Brigade, Ground Self-Defense Force, make a training jump near their base east of Tokyo.

tinues to replace F-86s at a rate of five per year. For airborne early warning, Japan has chosen the Grumman E-2C Hawkeye. Deliveries of the first two will be in 1982, the second two in 1983, and four more later, unless accelerated by the MTOE speedup.

In air defense, Japan's surface-to-air HAWK missile systems are expected to be replaced within the the next few years by a newer system, perhaps the Patriot. The overall BADGE system is also due for rapid upgrading. (BADGE is a computerized system installed in 1967 to spot and identify flying objects, process data on them, and assign targets to aircraft and SAMs.) For antisubmarine work, Japan has already begun deployment of an eventual forty-five Lockheed P-3C Orion aircraft as successors to the P-2 Neptune. For the Ground Self-Defense Force, the government ordered a twenty-five percent expansion of production of the modern Type 74 tank. It increased from forty-eight to sixty per year, and that may be revised upward to achieve deliveries of 300 by 1983. The GSDF is also moving ahead with production and deployment of the advanced Type 73 armored personnel carrier and the Type 75, 155-mm self-propelled howitzer of indigenous design.

Japanese-US Military Cooperation

As the Self-Defense Force capabilities have increased over recent years, there has been a steady increase in the number and types of cooperative activities with US forces. These range from exchange of students at military colleges to participation in dissimilar air combat training and involvement in large-scale combined fleet maneuvers. The most visible recent example was Maritime Self-Defense Force (MSDF) ships maneuvering with warships of the US, Australia, Canada, and New Zealand in the RIMPAC exercise held in late February in the Central Pacific. Although the RIMPAC participation generated ritual protests, the media and political consensus in Japan favored it.

US units of all services welcome Japanese cooperation and joint activities, according to officers on the scene. USAF Lt. Gen. William H. Ginn, Jr., Commander of US Forces Japan and Fifth Air Force, notes that more than 200 Japanese Air Self-Defense aircraft have already participated in dissimilar air combat training (DACT) against USAF, Navy, and Marine fighters, with DACT a continuing and regular program. Most recently, F-15s from 18th Tactical Fighter Wing at Kadena Air Base engaged Japanese F-4EJ, F-104J, and F-1 fighters in the Pacific maneuvering area east of Misawa AB on northern Honshu.

General Ginn has more than 44,000 US military persons in Japan, including those on Okinawa. He oversees 120 US facilities in the country, including forty-nine on Okinawa. Of the 120, there is joint Japanese-US use at twenty-nine. This is down from 2,824 US facilities in Japan in 1952 at the height of the occupation and Korean War. Japan's contribution to support of US forces in the country is about $1 billion annually, and expected to increase gradually.

Major changes in USAF deployment in Japan are afoot. They include the conversion of Kadena's 18th TFW's fighter squadrons from F-4C and D to the F-15 Eagle fighter. That is scheduled for completion in September, when the four fighter squadrons will have seventy-two new Eagles. Beginning in July, two E-3A Sentry AWACS aircraft will be based at Kadena on permanent rotation from the parent 552d Airborne Warning

Two ships of the Haruna *class helicopter destroyer have been commissioned, and construction continues on two more. Maximum speed is thirty-two knots. Armament consists of three antisubmarine helicopters, two five-inch rapid-fire guns, one ASROC unit, and two triple-mounted, short-range torpedo tubes.*

The PS-1 antisubmarine flying boat, of Japanese design and manufacture, is capable of takeoffs and landings in rough seas with wave heights up to three meters. External armament includes launchers beneath each wingtip for air-to-surface rockets, and underwing pods for torpedoes. It carries a crew of twelve and has an operational range of about 2,400 nautical miles.

and Control Wing at Tinker AFB, Okla. E-3As have made frequent short-term deployments to Japan and Korea over the past two years. Tactical reconnaissance continues to be provided by the mainstay RF-4C, with a squadron based at Kadena and a detachment continuously deployed at Osan AB, Korea.

General Ginn and Japanese officials highlight recently expanded bilateral planning as one of the most significant cooperative steps in recent years. This came about under the aegis of the November 1978 "Guidelines for Japan-US Defense Cooperation." General Ginn says the Guidelines provide the basis for bilateral military-to-military planning, as well as associated defense activities. The end result will be, he notes, detailed plans for the defense of Japan and for mutual cooperation in the case of other Far East contingencies. The increased number and scope of bilateral exercises will be expanded further under the Guidelines framework.

Other results expected are increased interoperability of Japanese and US systems, establishment of joint and combined command and control mechanisms, and an improved joint posture to deter aggression. Associated activities include joint exercises and training, definition of mutual communications/electronics requirements, exchange of intelligence, and closer coordination of logistics activities.

Future Trends

In the immediate future, more Japan-US exercises involving all services can be expected. Also, increased Japanese Self-Defense Force participation in multinational maneuvers at sea and air will be seen. The tentative and exploratory visits between Japanese and Korean experts concerned with security matters may become more frequent. Real outlays by Japan for defense will increase steadily, and equipment modernization will be accelerated, although the overall size of the SDF will grow only gradually. As the consensus on defense permeates the Japanese institutions, it seems likely that the self-imposed ban on exports of military equipment will begin to relax. However, while it is unlikely that Japanese SDF units will project themselves outside the spaces immediately surrounding Japan, they can be expected to improve their capability to deter and repel intrusions by any aggressor into those spaces.

Perhaps the most pointed summary of the shift in Japanese opinion on defense resulted from the deployment of USS *Midway* to the Indian Ocean as part of US reaction to the terrorists' seizing of the American Embassy in Teheran. *Midway* is homeported at Yokosuka, Japan, and normally operates in the Western Pacific. After she had been gone to the Indian Ocean for a few weeks, American officers said their Japanese friends began asking, "When is our carrier coming back?" When *Midway* did return to Yokosuka in early April there were no demonstrations against her presence, and the group of dignitaries on the pier included the Mayor of Yokosuka.

KOREA

THIRTY years after North Korean forces invaded the South by crossing the thirty-eighth parallel on a quiet Sunday morning in June, the Korean peninsula remains a focal point of the security interests of the major powers. The interests of China, Japan, the Soviet Union, and the United States all intersect in Korea in varying degrees and intensities at different times.

Regionally, Defense Secretary Brown has noted the increase of Soviet ground forces on the Chinese border. He also has cited their expansion and modernization of the Pacific Fleet, plus reinforcement of the Soviet garrisons on the Northern Territories of Japan, which the Russians have occupied since the end of World War II. Turning then to Korea, he said, "We now know with considerable confidence that, starting early in the 1970s, the North Koreans have engaged in a major military buildup, primarily of their ground forces." He said the North Korean navy and air force have also been expanded and modernized, then notes: "The intentions of North Korea are unclear, but its military forces clearly are not geared for defensive operations."

Other analysts of the Korean situation are more direct in their assessment, saying that the North Korean buildup is for offensive purposes. They cite the record: seizure of the *Pueblo*, 1968; the shooting down of EC-121 aircraft, 1969; assassination of President Park's wife, 1974, and repeated attempts on his life; murder of two US officers in the Demilitarized Zone (DMZ), 1976; tunneling under the DMZ into South Korea, continuing; and air, ground, and seaborne commando raids, continuing.

During his 1976 campaign, President Carter expressed his conviction that US units should be withdrawn from the Republic of Korea. In office, he began the process virtually without consultation, either with Korea and Japan, or within the US government itself. The action shocked the Japanese and Koreans. Meanwhile, a US Army intelligence reassessment of North Korean ground forces had begun to turn up irrefutable evidence that they were larger and more powerful than had been previously thought. Ultimately, after withdrawing an infantry battalion and turning over some equipment to ROK forces, Mr. Carter suspended the withdrawal. Secretary Brown says any further withdrawal of US ground combat elements "will be held in abeyance until 1981." He says, "At that time, we will consider whether a satisfactory North-South balance has been restored, and whether there has been tangible progress toward a reduction of tensions on the Korean peninsula."

The reduction of tensions doesn't seem likely this year. There were scraps between North Korean raiders and South Korean security forces throughout the winter and early spring, for example. At the same time, Kim Il Sung's regime continues its preparations for offensive actions against the South. They include:

- Creation of an unusually large (100,000-man) commando raiding force aimed at large-scale disruptions in the rear areas of the ROK;
- Construction of naval bases and hardened airfields in the forward areas of North Korea, which facilitate operations against the flanks of ROK, and a demonstrated intention to put them to use;
- Moving armored formations forward to be deployed near the DMZ, ready for commitment into the traditional invasion corridors;
- Construction over the past five to seven years of heavily reinforced and hardened artillery positions adjacent to the DMZ. Many of these positions permit close artillery support of invading forces during the breakthrough and, with a single displacement, support of forces entering the northern outskirts of Seoul;
- Continued large-scale tunneling operations under the DMZ, which date back to 1971. So far, three tunnels have been uncovered and neutralized, as a result of concentrated counter-tunnel actions since 1974;
- Continued high spending for military forces, ranging

Republic of Korea Defense Expenditures

(In millions of 1977 constant dollars)

Year	Amount	Percentage Growth from Previous Year
1976	$1,833	
1977	$2,076	13.3%
1978	$2,522	21.5%

Source: Preliminary data for World Military Expenditures and Arms Transfers, 1969–78, US Arms Control and Disarmament Agency.

North Korean Force Estimates Before and After the Intelligence Reevaluation

(As of Oct. 1979)

	Before	After
Ground Forces:		
Active-Duty Personnel	440,000	600–700,000
Combat Divisions/ Brigades	25	35–40
Commando Personnel	Not Listed	50–100,000
Medium Tanks	1,850	2,500
Light/Amphib Tanks	100	100
Assault Guns	105	100
Armored Personnel Carriers	750	1,000
Field Artillery Guns	3,035	3,500–4,000
Multiple Rocket Launchers	1,300	1,500–2,000
Antiaircraft Weapons	5,500	8,000–9,000
Naval Forces:		
Personnel	30,300	31,000
Combat Ships	482	450
Air Forces:		
Personnel	45,000	45–50,000
Jet Fighters	581	650
MiG-15/17	328	320
MiG-19	110	160–200
MiG-21	121	120
Fighter-Bomber (Su-7)	22	20
Transports	320	250
Helicopters	65	65
Jet-Capable Airfields	20	20

Source: US Department of Defense

from a low estimate of fifteen percent of GNP to the 19.6 percent attributed by the US Arms Control and Disarmament Agency in its annual survey.

The result, for the Korean armed forces and the US military people on the scene, is a hardening of resolve to be more effective and resolute against the North Korean threat. Gen John A. Wickham, USA, the senior US military man on the peninsula, told AIR FORCE that he considers the Republic of Korea the US's strongest and staunchest ally, and the US presence in Korea a clear indication of the US government's commitment to peace and stability in Northeast Asia. Both he and his deputy, USAF Lt. Gen. Evan Rosencrans, told AIR FORCE that an enemy decision to attack the Republic of Korea entails a realization that it is a concurrent attack on the United States, and a declaration of war. General Wickham followed that up by saying, "We are determined to carry out our treaty obligations," which means, under the 1954 US-ROK treaty, committing forces to the aid of Korea if attacked.

General Rosencrans points to the differences between the situation in Korea in June 1950, in Vietnam in the 1960s, and the present situation in Korea. Foremost among the differences is that the entire military effort in the south is now combined and integrated under the Combined Forces Command, which will fight the war—if it comes—under the United Nations flag. Added to that is the fact that the Republic of Korea armed forces are now among the most modern conventional forces in the world, with combat experience alongside US units in Vietnam. Furthermore, both US and ROK troops of all services are aware of the invasion threat from North Korea only twenty-five miles north of Seoul, about the distance from the White House to Dulles Airport. Leaders and troops alike told AIR FORCE Magazine that motivation is not an issue in Korea; the motivation is there. The concentration, then, at all levels, is on figuring out more simple, effective ways to fight the battle when it comes. To that end, some rather commonsense steps have been taken, which ought to pay dividends if the war starts.

First, realistic training is possible at all times. An infantry battalion of the 2d Infantry Division, for instance, has an allocation for training ammunition of more than $500,000 per year for its basic individual and unit training programs. If more is needed, it can be had. That does not include expenditures of air-delivered munitions, or naval gunfire support also available to the battalion commander. Thus, there is no excuse for troops being unfamiliar with the sound and smell of gunfire in training. (As small unit leaders point out quite proudly, the 2d Infantry Division is the only unit in the US armed forces that dispatches combat and ambush patrols every night into the DMZ with the sole mission of killing people. It should also be noted that the same units have reenlistment rates that are among the highest in the US Army worldwide.)

The same sort of common sense applies to USAF and ROK air force and air defense units of both countries. They fire live ammunition daily, take off for missions that may turn into live combat if the North Koreans attack, and always prepare for combat. Organizationally, this is exemplified by the situation at Osan Air Base.

At Osan, Maj. Gen. George Edwards, USAF, commands the 314th Air Division. He is the man who will fight the air battle for USAF should war come, with General Rosencrans providing the strategic direction from the Combined Command. General Edwards's headquarters is on one slope of Hill 180. Across the hill is the headquarters of Lt. Gen. Kim Sang-Tae's ROK Combat Air Command (CAC), which controls all ROKAF combat air assets. On the same hill is US Army Brig. Gen. Victor J. Hugo's 38th Air Defense Artillery Brigade, controlling surface-to-air missiles, and linked into ROK counterpart systems. The result is a totally integrated system, both organizationally and personally, for fighting the air battle.

As the system is improved, the persons responsible for it are intent on making sure it is integrated with developments for the E-3A AWACS data generation, with the Navy's E-2C capabilities, and, in the long run, with the Japanese upgrade of their BADGE system. The ultimate result could be an integrated air defense web over Northeast Asia better than any elsewhere in the world. To be sure, such an accomplishment is in the future, but, for the moment, all the players on the friendly side are deter-

Top: USAF and ROK Air Force forecasters from the Weather Support Unit at Osan AB, Korea, examine weather satellite photos during Exercise Team Spirit '80, last April. Lower photo: three weapons technicians at Osan AB carry a Sidewinder missile to an F-4 fighter of the 36th Tactical Fighter Squadron during operational readiness testing, winter 1979–80.

Fire fighters of the 51st Composite Wing, Osan AB, Korea, rehearse rescue procedures on an F-4E of the 36th Tactical Fighter Squadron.

mined to aim for such a result and, in the interim, to achieve the most integration possible within technology that can be fielded today.

USAF Air Assets in Korea

Major USAF unit in Korea is the 314th Air Division, with headquarters at Osan AB. Its main units are the 51st Composite Wing at Osan (with F-4E and OV-10 aircraft, plus a control group), and the 8th Tactical Fighter Wing (F-4D) headquartered at Kunsan on the southwest coastline, plus various housekeeping and support units nationwide. One F-4D squadron of the 8th Wing (the 497th) is based at the ROKAF base at Taegu, with its aircraft maintained entirely by ROKAF technicians. (At a very high in-commission rate, incidentally.)

Because the commands are so closely integrated, Generals Edwards and Kim point out that the fragmentary orders ("frags") for air strikes are issued without regard to the air force flying the mission, the ground and air controllers, or the forces supported. Any and all combinations of ROK and US air and ground units are employed routinely. So, too, is cross-servicing of aircraft routine, since both air forces to a large degree have the same types of planes and munitions.

The issue of motivation is as strong with Air Force units as with the 2d Division troops. Their basic week is forty-eight hours long, with overtime and surge periods a matter of course. Yet man after man agrees with the assertion that "We're aware of the threat, we know our jobs, and we're ready to fight." This ranges from senior people at the Tactical Air Control Center to maintenance men in the hangars, to individuals at remote mountaintop radar control sites. The threat is clear to them every day, and they exert their efforts to deter it.

View From the Top

General Wickham put the Korea situation into a nutshell summary for AIR FORCE, at least as he perceives it. His first point is this: "This is a dangerous area of the world with a potential flashpoint for war. Kim Il Sung [of North Korea] is intractable and seems determined to build an offensive war machine. For our part, we are doing everything in our power to deter war. The single

USAF and ROK Air Force pararescue team members rush toward an approaching rescue helicopter during Exercise Team Spirit '80, during April of this year.

most important element to deterrence is the presence of US air and ground forces on the peninsula."

General Wickham then cites three reasons why peace and stability in the Korean peninsula are integral to US national security:

- Geostrategic, at the confluence of US, Chinese, Russian, and Japanese interests in Northeast Asia;
- Economic; the Republic of Korea is now our twelfth biggest trading partner, headed for sixth or seventh in a few years (and, as Secretary Brown notes, US trade with the East Asia region now is at a higher level than with Europe);
- Moral, based on the 1954 mutual security treaty, and the US physical presence demonstrates the national commitment to that treaty.

General Wickham stresses that the Republic of Korea has been—and is—a staunch ally, probably the staunchest we have. They have continuously been open and forthcoming on US base requirements in the ROK, for instance. In addition, they participated in the Vietnam campaigns alongside US units, committing a 50,000-man force to the effort for several years. And, significantly, the Republic of Korea is now committing something like $2 billion of its resources to a combined defense improvement program, which directly and specifically benefits US units or support elements. *(See box for partial list.)*

Finally, General Wickham notes that the ROK constantly commits substantial amounts of its resources to its own defense. In military expenditures, that has meant about five to six percent of GNP recently, with more than six percent envisioned for the immediate future. It also means a draft of manpower, which calls for thirty-three months of national service from young men, and a succession of five-year plans for improving the quality of ROK units. The industrial sector is involved in this effort, as well. Secretary Brown notes that the Korean industry now produces equipment ranging from M-16 rifles and M-60 machine guns, through various mortars, 105-mm and 155-mm howitzers, ammunition of all kinds, antiaircraft guns, jeeps and trucks, radios both portable and vehicular, rebuilt M-48 tanks, naval vessels, and coproduction of F-5 fighter aircraft.

Regarding naval vessels, the ROK government in mid-April revealed that it has just launched the prototype of a new class of home-designed and -built fast frigate, the *Ulsan* class. This is the next logical step following their demonstration of capabilities for merchant ships, trawlers, mine warfare and patrol craft, and amphibious ships. The first ship of the *Ulsan* class, now fitting out at a southern Korean port, is expected to be the proving ground for various combinations and permutations of propulsion, electronics, and weaponry. For the moment, the 1,700-ton ship apparently will be propelled by a German diesel engine (with possible gas turbine augmentation), guided by British radars, armed with Italian guns and a variety of missiles, directed by a Dutch fire-control system. The expectation in naval quarters is that ultimately all of the foreign systems will be succeeded by indigenous ROK components.

The same progression is expected in aerial weapons, from missiles to aircraft. We have already cited the ROKAF maintenance of USAF F-4s at Taegu. In addition, programmed depot maintenance of USAF F-4s from Pacific-wide is now under way by Korean Air Lines technicians at Kimhae, supplanting the depot work formerly performed in Taiwan. At the same time, the ROK aviation industry has geared up for F-5 coproduction and is already coproducing Hughes 500 MD helicopters under license. So the expectation is that within a few years, indigenous ROK aircraft can be expected as a logical product of the capabilities already existing in the Republic.

Examples of Republic of Korea Support for US Forces

- Assignment of KATUSA personnel to US units (about 6,600 men).
- Construction and maintenance of ammunition storage sites.
- Local currency support for Joint US Military Advisory Group.
- Extending petroleum pipeline north of Seoul to forward units.
- Construction of 1,100 units of housing for US military families.
- Beddown facilities for A-10 aircraft.
- Building POL and munition storage for USAF and USMC contingency stocks.
- Allocation of port facilities, stevedores, and long-haul road and rail transport for wartime logistics movement.
- Providing real estate for US military use at no cost.
- Dredging Pusan harbor to accept US aircraft carrier.
- Construction of Combined Field Army command and control center, and construction of combined Tactical Air Control Center.
- In negotiation: Memorandum of Agreement for ROK government furnishing Korean flag shipping and Korean Airlines aircraft in a contingency.

Source: AFM interviews

Future Trends

As with Japan, expect closer integration of defense planning with the United States than is already under way. Also, look for indications of ROK-Japanese cooperation if it should prove politically feasible. Expect more combined training with US units, particularly dissimilar air combat training, air-to-ground support, and air defense integration. Watch for more intense efforts to detect and repel North Korean raiding parties entering the ROK by all means. Expect democratization to occur gradually, but in the Korean mode and consistent with the Korean heritage and character, not in imitation of the US example. Watch for evidence of North Korean and Soviet efforts to drive a wedge between the US and ROK.

Finally, do not expect a repetition of the unprepared, unwarned situation of June 25, 1950. Instead, as General Wickham says, "Expect us to fight instead of falling back; it is more prudent to deter war with this commitment than have to fight our way back in at a large cost in blood and treasure." ■

Even though the Air Force's research and development budget has been increased slightly over the past few years, steadily rising costs and the tendency to make only safe investments in weapons development combine to lower USAF's technological horizon. USAF's ranking R&D executive, the Commander of the Air Force Systems Command, believes that what we need is . . .

A MORE LIBERAL, AVANT GARDE R&D PROGRAM

BY EDGAR ULSAMER, SENIOR EDITOR

IN AN ERA of skyrocketing costs and exploding technological diversity and complexity, US defense research and development gravitates toward low-risk, limited payoff programs. R&D investments that provide safe returns become more attractive than high-risk, high-payoff ventures. But there is one program, in the view of Gen. Alton D. Slay, Commander of the Air Force Systems Command, that "I point to with pride because it advances the frontiers of technology—the High-Energy Laser Program."

Taking pains to stress that the Air Force and other elements of the Defense Department are not now building laser weapons, but rather are conducting a "technology program," he told AIR FORCE Magazine that the principal challenge is to translate a scientific invention into an engineering reality that is viable on the battlefield. "We know," he said, "what the high-energy laser will and won't do," just as there is little doubt about the fact that the lasers the Air Force is working with now don't represent optimal engineering solutions. Also, there are various ancillary technologies that over the next ten years or so must be refined. The Air Force, therefore, will continue to examine new lasers, beam control techniques, and pointing and tracking systems.

Integrating high-energy laser and beam control components into USAF's Airborne Laser Laboratory (ALL, a specially modified KC-135), will be completed this year. The two major goals of the High-Energy Laser (HEL) program, according to Dr. William J. Perry, Under Secretary of Defense for Research and Engineering, are to advance rapidly the state of the art, and to "collect the lethality data" needed to determine if such systems can be cost-effective when compared with more conventional weapons. He added that ALL will lead to decisive lethality demonstrations and "will engage and kill air-to-air and surface-to-air missiles. Last year, its laser was ground-tested with good beam quality." ALL's first flight tests are scheduled for this fall.

Dr. Perry believes that directed energy technologies, comprised of HEL and Particle Beam systems, may lead to a new class of weapons that could revolutionize tactical and strategic warfare: "In the nearer term, perhaps before the end of this decade, we may see high-energy lasers in use on the battlefield. In the 1990s, we can expect to see them play a role in the air and in space. Particle beams also show a similar promise, although the certainty with which we can predict their utility is lower because the basic feasibility of propagation has yet to be demonstrated."

HEL's main attraction, from an operational point of view, General Slay points out, lies in the fact that it can deliver lethal amounts of energy over operational distances with the speed of light. Used by aircraft, perhaps as a bomber defense weapon or as a supplement to fighter air-to-air missiles, HEL, "once we lock on the target, reduces the intercept problem to zero because we don't have to lead the target. Also, we can jump from one target to another far more rapidly than with conventional weapons," according to the AFSC Commander. Before the end of the century, he predicted, it will be possible to build laser weapons that can defend strategic aircraft against large numbers of simultaneously launched intercept missiles. The ability to acquire, track, and shoot down air-to-air missiles with airborne laser weapons

Gen. Alton D. Slay heads up the Air Force Systems Command.

won't turn out to be a "big challenge" over the long term, he predicted.

For the time being, reducing the size of both the laser device and the pointing and tracking system, along with improving the weapon's power densities, are the principal engineering challenges that must be solved before HEL can become an operational system, General Slay said.

Closely linked to USAF's HEL program is work by the Defense Advanced Research Projects Agency (DARPA) on high-energy laser technologies suitable for various space defense missions. During the past year, DARPA reported significant gains in the development of chemical lasers, large beam expanders, and in pointing accuracies. This work is scheduled to lead to a series of prototype demonstrations in the near future.

Beyond the HEL program, USAF and DARPA are exploring the feasibility of particle beams for weapons applications. Emphasis is on the physics of beam generation, particle acceleration, pointing, tracking, and propagation of both charged and neutral particles. According to Dr. Perry, a key step is the development of accelerators that can provide the particle energy and beam current necessary to conduct realistic experiments involving charged particle beam propagation through the atmosphere. DARPA recently completed development of such an experimental test accelerator. This, in turn, is expected to point the way toward more advanced devices whose much higher energy is expected to demonstrate the feasibility of propagating charged particle beams stably over significant distances in the atmosphere. As in the case of HEL, General Slay points out, particle beam weapons have both "big promises as well as drawbacks." Whether or not they can be developed into tactically useful systems will depend on "our ability to solve all the engineering problems." He believes that directed energy weapons of one kind or another can be developed for use on the ground, in the air, and in space.

USAF's Dependence on the Space Shuttle

USAF's "big hurdle" in terms of intensified space operations is "the Shuttle; anything that affects the Shuttle affects our space program," according to General Slay. Program slippage due to cost growth and technical difficulties is threatening to impinge on USAF's space program since "we are committed to transition from expendable launch systems to the Shuttle."

USAF's Shuttle-related expenditures, including construction of a launch and landing facility at Vandenberg AFB, Calif., will approach $500 million this year, according to General Slay. He is confident that the Shuttle's main engine will "work all right at one hundred percent" of the thrust output the original design called for, but predicts that it will take some time to reach an output of 109 percent that is required to compensate for the increase in the Shuttle's weight. Weight growth also requires additional thrust augmentation to meet long-term performance requirements. This involves adding strap-on solid motors or liquid-propulsion modules to the basic Shuttle configuration.

Probably the most serious technical challenge confronting the Shuttle is the so-called tile problem that plagues its reusable Orbiter stage. Large surface areas of the Orbiter, a vehicle roughly the size of a DC-9/737 jetliner, are covered with special, individually tailored tiles that protect the craft from the searing heat encountered on reentering the atmosphere. General Slay states that solving the tile problem has proved to be very "time-consuming."

The Defense Department and the Air Force see the Shuttle as the means for conducting manned military space operations and for realizing a host of other benefits—compared to expendable launch systems—including greater payload weight and volume capacity and increased launch reliability. These traits, in turn, will make it possible to use more backup systems and to increase nuclear hardening to improve satellite survivability. Also, with spacecraft weight less of a factor than at present, more sensors can be built into each satellite and more attitude control propellant can be carried on board, thus increasing the useful life of military space systems.

Finally, an ambitious, comprehensive series of experiments known as the Space Test Program (STP) depends on the Shuttle.

While NASA is in charge of developing the Shuttle, USAF is responsible for the design and acquisition of the Inertial Upper Stage (IUS). Because the Shuttle can only deliver payloads into low altitude earth orbits, IUS is needed to deliver DoD spacecraft to higher orbital altitudes and inclinations than can the Shuttle alone. IUS also will be used by NASA for synchronous orbit and planetary missions. It is being designed to be compatible with the Titan III expendable launch vehicle and provides a backup if the Shuttle program encounters problems. IUS, General Slay told this writer, is the only major Air Force program that during the past two years has encountered significant cost growth and schedule slippage. The IUS development schedule had to be stretched from twenty-seven to forty-two months, and the original cost estimate went up by about fifty percent. The Air Force has restructured the IUS contract with Boeing, the prime contractor, to include a not-to-exceed "cap" on the agreement, General Slay said. Full-scale development of IUS includes building nine preproduction vehicles to meet the initial operational requirements of both the Defense Department and NASA.

Key Space Programs

SAC's Commander in Chief, Gen. Richard H. Ellis, has stressed consistently the need for a survivable space-based command control and communications (C^3) system to assure reliable dissemination of Emergency Action Messages (EAMs), and two-way communications among the National Command Authorities (NCA), the Joint Chiefs of Staff, the Commander in Chief, and their nuclear-capable forces throughout the world. General Slay concurs and considers such a system—known as the Strategic Satellite System (SSS)—an overriding requirement in the field of strategic C^3. SSS is crucial to the command and control of the Single Integrated Operational Plan (SIOP) Forces after the start of hostilities. In effect, in the trans-attack and post-attack phases of nuclear war, or in the termination of hostilities, the control of the SIOP would be severely inhibited because of inadequate C^3 capabilities. General Slay stressed the importance of SSS, which is meant to be a follow-on to the highly vulnerable AFSATCOM (Air Force Satellite Communications) System, stating that as the Soviets'

technological threat continues to increase, the current AFSATCOM system will lose its ability to meet these essential mission requirements.

Last year, Congress deleted funds for the dedicated satellite segment of SSS, called STRATSAT, partly because of recommendations by the Defense Science Board that the first priority should be to increase the number of certain key components—the Single Channel Transponders or SCTs—on host satellites. This is being done, with SCTs scheduled to "piggyback" on such host spacecraft as DSCS III, the Satellite Data System, and the Global Positioning System. Even though this arrangement amounts to a full constellation of SCT packages, it does not provide for the categoric requirement of two-way communications recognized by the Defense Science Board.

Existing space-based surveillance sensors are vulnerable to high-energy laser and nuclear weapons effects. Additionally, these systems rely on data transmission networks that involve fragile data links and foreign bases, subject to political vicissitudes. USAF's Missile Surveillance Technology (MST) program is meant to cure these problems by linking mosaic "staring" sensor technology with a survivable missile surveillance system. But this program fared poorly last year in Congress. All funds for the mosaic sensor program (MSP), the center piece of MST, were eliminated.

The reason for MSP's difficulties is that some members of Congress perceived it to be in competition with DARPA's mini-HALO (High Altitude Large Optics) program. The latter uses high-risk, revolutionary technologies that are years if not decades away from operational status. But, as General Slay points out, since the two programs are meant to perform similar missions, there is a tendency to take the big step toward a revolutionary system and leapfrog the evolutionary MSP. The drawback, of course, is that the operational availability of an advanced warning system thus is pushed back in time. Current plans, therefore, aim at a compromise where elements of both MSP and mini-HALO are merged into a joint program, according to General Slay.

The ASAT Program

The Soviet Union has in being the capability to intercept and destroy spacecraft operating at low to medium-high orbits. The US has no antisatellite weapons, known as ASATs. But the Air Force is now developing ASAT systems that can be either ground- or air-launched and are thought to have greater flexibility and growth potential than the existing Soviet ASATs. General Slay warned, however, that, although the US approaches appear to be "tactically more useful, we can't ignore the fact that the Soviets have been doing [space interception] for a long time, and have proved beyond the shadow of a doubt that they can do this *today*. We can't." The Air Force, he added, has not been authorized to go beyond development of ASAT prototypes: "We have not been told to deploy such systems." While the absence of Presidential authorization to conduct ASAT flight testing is not yet affecting the program's schedule, it would seem pointless to carry out such a program without eventually conducting tests in space. In FY '80, $80.5 million was appropriated for ASAT prototype work and the new Defense Budget seeks an additional $125 million.

Crux of the US ASAT is development of high-velocity weapons that would collide with the target at high speed. According to Dr. Perry, the "primary US ASAT effort is the development of a high technology interceptor using a miniature vehicle. The design has the advantage of being of low weight and will be launched from an F-15 aircraft. A low-risk hedge to this approach, a conventional interceptor design, has been developed."

The first ground test warheads, dispensers, and attitude control subsystems are nearing completion. Other ASAT work in progress involves computers for upper stage guidance, modification of an F-15 mission simulator, and development of displays and other equipment for ASAT's prototype mission operations center. The latter is to be integrated with USAF's Space Defense Operations Center.

Advanced Aeronautical Technologies

The lack of sustained R&D investments in military aeronautics—technology programs in this field seem to fall prey to the congressional budget cutters' ax with maddening regularity—has slowed but not foreclosed major advances in the design of US tactical and strategic aircraft. The only specific R&D program for a new tactical aircraft included in the FY '81 Defense Budget is CAT (Combat Aircraft Technology), funded at a paltry $5.6 million. Key goals of CAT are analyses of basic mission concepts weighed in terms of readiness, complexity, cost, runway dependency, and basing vulnerabilities. CAT was germinated by the assumption that in the 1990s a new tactical aircraft will be needed to alleviate current, and growing, deficiencies in the air-to-air and air-to-ground mission. For the time being, uncertainties about which mission areas will be emphasized by the Soviets—and thus would demand specific US responses—require that CAT provide the flexibility to stress one or the other option. The assumption is, however, that by the mid-1980s the Soviets will have made their choices and that subsequently USAF will be in a position to make a suitable acquisition decision with the help of the technology base built up through the CAT program.

AFSC, General Slay told AIR FORCE Magazine, is also taking a second look at VTOL and V/STOL technologies. The maturing of some of the associated technologies and changes in operational requirements appear to strengthen the case for VTOL or V/STOL aircraft. Achilles heel of this technology has been the limited payload of VTOL or V/STOL aircraft and the difficulty of controlling and supporting them in the field. But the advent of small, highly lethal smart armament and munitions cuts back support and payload requirements tremendously, General Slay suggested, and thus makes VTOL and V/STOL more attractive. Also, there is evidence that greatly improved engine performance, especially in the pivotal area of thrust-to-weight ratio, is becoming possible and thus might enhance the performance of future VTOL and V/STOL designs.

Two specific technologies show potential for comprehensively contributing to dramatic increases in the performance of future tactical and strategic aircraft. They are, General Slay said, the mission adaptive (vari-

able camber) wing and the variable cycle engine. Both techniques help tailor aircraft to various flight regimes, such as supersonic, transonic, or subsonic and high or low altitudes. They could overcome the age-old handicap of "point-design," or having to optimize a design for a specific, narrow performance range and thus penalizing the aircraft in all other flight regimes. The mission adaptive wing makes it possible, in concert with digital flight control and other innovative techniques, for the aircraft to adapt with great precision to various flight conditions. So does the variable cycle engine, which mates bypass ratios and other key propulsion factors to changing flight conditions.

By linking variable cycle propulsion with mission adaptive aerodynamics, broad performance gains can be scored because of the synergistic effect of these technologies, General Slay predicted. More generally, AFSC is pursuing new propulsion techniques to improve specific fuel consumption and to reduce significantly the number of engine parts required. The payoff is better reliability and maintainability and lower engine weight, General Slay said.

"CAT was germinated by the assumption that in the 1990s a new tactical aircraft will be needed to alleviate current, and growing, deficiencies in the air-to-air and air-to-ground mission."

Perhaps the most crucial decision in military aeronautics confronting the Air Force revolves around what kind, or kinds, of aircraft should be built for the strategic and force projection/conventional warfare missions.

The driving question, General Slay stressed, is how to balance SIOP strategic mission requirements against design and performance features related to nonnuclear war and force-projection missions. Air Force Secretary Dr. Hans Mark recently convened a meeting of senior Air Force officials on this subject with the result that AFSC's Aeronautical Systems Division is drafting a detailed assessment or "matrix" of the available technical options to "support a national decision" on this issue, General Slay said. ASD will complete the assessment by this summer or early fall. The Scientific Advisory Board is also doing related work.

A possible complication of this issue has arisen in the interim, however, because the House Armed Services Committee recently voted $400 million—not requested by the Administration—to begin developing a Strategic ALCM Launcher (SAL) derived from the B-1 strategic bomber. Such an aircraft presumably would lack the ability to penetrate heavily defended airspace and be essentially a standoff platform. In practical terms, a commitment to such a weapon system would foreclose the option to develop a penetrator, usually referred to as LRCA (long-range combat aircraft), in the foreseeable future, General Slay fears.

The notion of some program analysts that the increasing capabilities of modern air defenses have made the penetrating bomber obsolete is not shared by General Slay: "This folklore has been around for thirty years and ignores the fact that the offense invariably has the jump on the defense. Some people have been trying for years to reverse the situation but in fact nothing has changed since this theorem was first propounded. The initiative is still with the offense."

One of the key questions that congressional experts raise about the future of manned strategic systems is whether the B-1 strategic bomber should be resurrected or a new-from-the-ground-up weapon system might be more effective. General Slay points out that in part the decision is between "a bird in hand as compared to two in the bush." Another vital consideration depends on how soon such an aircraft is expected to reach the inventory: "Obviously, if we started today to design an aircraft for the strategic mission we could do better than we did when we set out building the B-1 about fifteen years ago. Technology has not stood still in the meantime. It follows that *when* the aircraft is needed determines how much or how little new technology can be accommodated. If we need it very soon we would have to use older, existing technology. Our current study deals with the question of whether for this mission we are better off with mainly new or older technology, or something in between. We also look at the pluses and minuses of penetration vs.

standoff. If all we want is a standoff aircraft with long-range cruise missiles, the design task would not be too severe, and we probably could confine ourselves to existing technology. On the other hand, if the goal is to cope with year 2000-type air defenses combined with force projection capability and the ability to penetrate with conventional weapons, the use of new technology becomes mandatory."

The Air Force is modifying the B-52G/H fleet to improve its capabilities as an ALCM-launching standoff as well as a penetrating force. In addition, USAF is carrying out several R&D programs in the field of manned strategic systems. The Bomber Penetration Evaluation project involves penetrativity testing of the B-1 against simulated future Soviet air defenses. These tests are expected to produce important information about the performance and effectiveness of a modern, high-speed, low-altitude, penetrating bomber aided by automatic electronic countermeasures. The information from these tests will help in either modifying existing aircraft or in designing new ones.

The Strategic Bomber Enhancement Program focuses on technology demonstration and advanced development in such areas as advanced bomber/aircraft concepts, new avionics technologies, new weapon concepts, and cruise missile technologies. Initial work under this program will include the application of new radar absorbing materials, the evaluation of high-density weapon launchers, demonstration of advanced aerodynamic and flight-control systems, and the use of variable camber airfoils for bombers. In addition, this program will examine advanced propulsion and fuel concepts that could be applied to the B-52/FB-111 force and to a future penetrating bomber.

The Cruise Missile Carrier Aircraft (CMCA) program provides a hedge against unforeseen failure of the B-52 force or the need for a larger force of ALCMs than can be carried on the B-52G/Hs. The CMCA studies—initiated in 1978—involve three categories of aircraft; derivatives of existing military and commercial transports, Advanced Medium STOL Transport (AMST) variants, and technology derivatives of the B-1 aircraft. The study results suggest that derivatives of existing transports are the least-suitable choice. Designs of this type score high under low threat levels but lose ground rapidly in a severe threat environment, especially against SLBMs. Initial assumptions about the low cost of such aircraft turned out to be illusory because modifications, especially nuclear hardening for the CMCA mission, drive up the overall cost substantially. The study's findings on AMST variants for the CMCA role also were not encouraging. Although transport aircraft are not particularly attractive for CMCA use, the CX aircraft, when in production in the late 1980s or early 1990s, might well prove to be the most capable and cost-effective option at *that* time.

Initially, the primary focus of the CMCA program is on a B-1 derivative, or Strategic ALCM Launcher (SAL). The reason is a range of B-1 characteristics, such as its excellent base escape capability, hardening, and the ability to carry as many as thirty ALCMs. The Air Force has sought some $60 million in FY '80 and FY '81 to modify the third B-1 aircraft for both internal and external ALCM carriage. Flight evaluation of SAL is scheduled for FY '82 and is to be coupled to some advanced engineering work. This will provide the option to enter into full-scale engineering if that becomes necessary. In accordance with a congressional directive, the Air Force will evaluate both SAL and CX but not necessarily on a concurrent basis. Since the B-52 force is expected to serve well in the cruise missile carrier role for some years to come, the Air Force does not plan to rush the SAL evaluation.

Cruise Missile Technology

On March 25 of this year, Secretary Mark announced the award to the Boeing Co. to build USAF's Air-Launched Cruise Missile. Overall, about 3,000 ALCMs are to be bought over the next five years. ALCM, Gen-

"By linking variable cycle propulsion with mission adaptive aerodynamics, broad performance gains can be scored because of the synergistic effect of these technologies..."

eral Slay points out, represents a "tremendous" capability that is now wholly adequate to perform its mission, Nevertheless, the Air Force—in concert with DARPA—is pursuing the Advanced Cruise Missile Technology (ACMT) program that exploits emerging technologies to respond to the evolving Soviet defensive threat. Key concerns of ACMT include advanced cruise missile engines and fuels; airframe improvements centered on the use of new materials and designs stressing low radar and infrared signatures; avionics improvements in boost guidance, maneuverability, and threat avoidance; and new capabilities for retargeting, ECM, and automated route planning.

At the high end of ALCM technology is USAF's Advanced Strategic Air-Launched Missile (ASALM), a supersonic weapon with long-range, air-to-air and air-to-ground capabilities. Using integral rocket and ramjet propulsion, ASALM is meant to improve bomber and cruise missile survivability and effectiveness by suppressing enemy defenses—such as the Soviet Union Airborne Warning and Control Systems (SUAWACS), interceptors, and SAM sites—as well as by attacking terminally defended targets that are beyond the capabilities of SRAM. The basic technological challenge attending ASALM, General Slay points out, is the hybrid propulsion system that transitions in flight from a rocket motor to an air-breathing supersonic ramjet. ASALM's Propulsion Technology Validation test flights in the past few months "have been highly successful and exceeded our most optimistic expectations. We have demonstrated that the propulsion problem is solved and that we know how to build ASALM from the propulsion standpoint." Remaining questions concerning guidance, he said, aren't a comparable challenge.

Next phase of the ASALM program—subject to the outcome of the pending DSARC I (Defense System Acquisition Review Council meeting granting program go-ahead)—is subsystem demonstration and validation with emphasis on air-to-air guidance and radar cross section reduction. USAF is working toward an initial operational capability in the late 1980s. Both within the executive and the legislative branches of government, General Slay suggests, there is the tendency to overlook or downplay ASALM's vast potential as an offensive weapon that significantly enhances the effectiveness of the bomber force and to treat it narrowly as a bomber defense missile and SUAWACS killer.

The Ground-Launched Cruise Missile (GLCM), which is expected to achieve IOC in December 1983, is a mobile, 2,500-km-range theater nuclear capable system that integrates the Tomahawk cruise missile with a transporter-erector-launcher (TEL) and associated launch control centers. In peacetime, the GLCM will be housed on main operating bases proposed in five European countries and maintained in a quick-reaction alert posture. In times of crisis, the GLCM units would be dispersed to increase their survivability. Its mobile, quick-reaction, all-weather capability will improve the prelaunch survivability of the theater nuclear strike force and boost firepower as well as flexibility. The basic combat flight of the GLCM system consists of sixteen Tomahawk missiles, four transporter-erector-launchers, and two launch control centers.

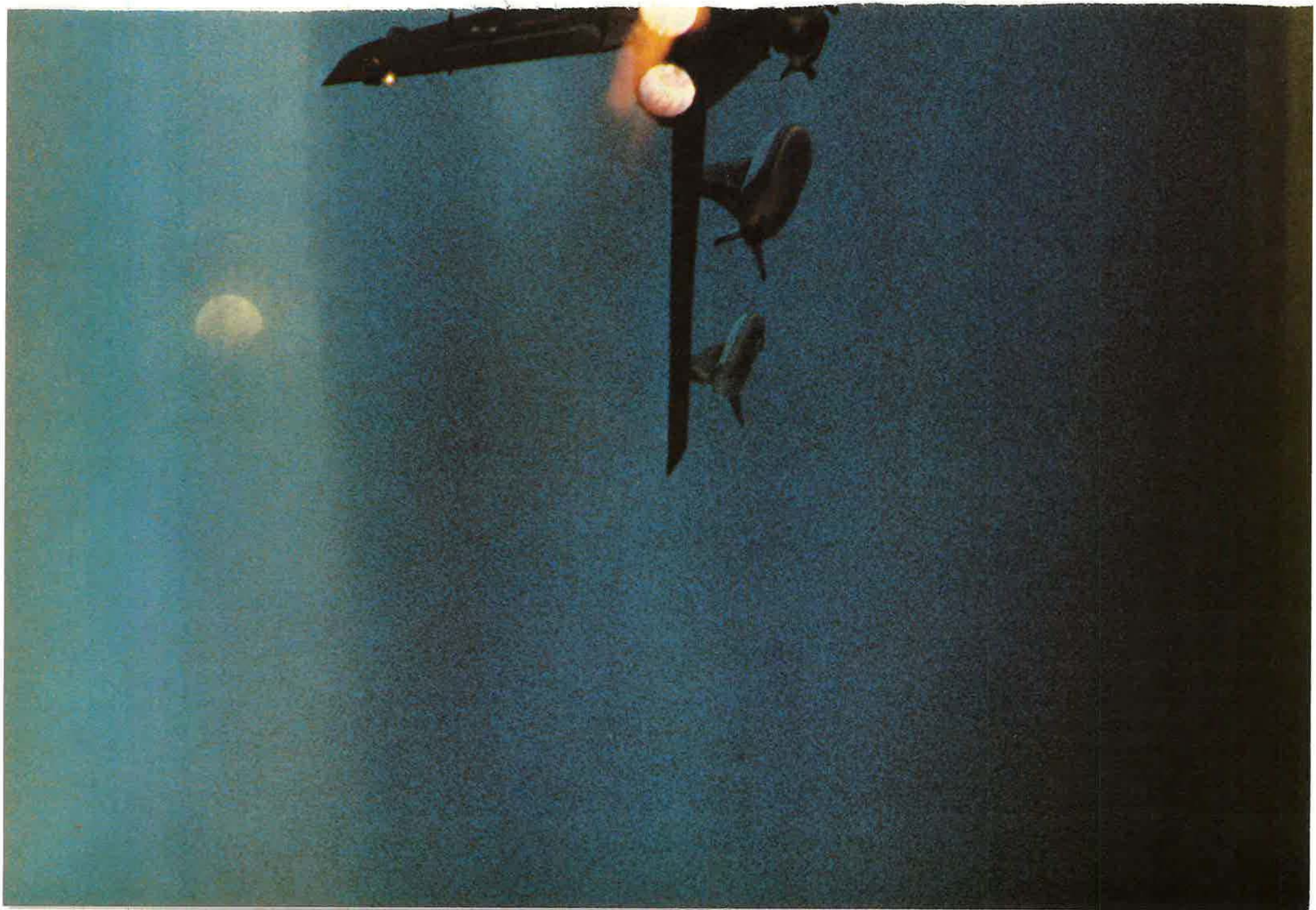
Three of the five proposed host countries in NATO have approved GLCM basing and approval by the remaining two is expected within two years. Some defense analysts in the Pentagon and in Congress have expressed reservations about GLCM's basing mode, claiming that it makes the weapon vulnerable to barrage bombing by Soviet ballistic missiles, such as the SS-20. The suggestion, therefore, is to provide GLCM with concealed, hardened multiple-aim-point shelters in the manner of MX. General Slay countered this contention, saying that targeting GLCM in its mobile configuration is "extremely difficult," short of barrage bombing most of Western Europe. He added that under such an extreme "worst-case" supposition, it is possible to argue against the deployment of Pershing missiles, tactical air forces, or even US ground forces in Europe, for none "would be likely to survive."

A derivative of the AGM-109 Tomahawk is the conventionally armed Joint Tactical Medium Range Air-to-Surface Missile (MRASM), whose purpose, according to Dr. Perry, is to provide the Air Force and the Navy with a "reasonable cost, survivable weapon with which to attack high-value land and sea targets." In a recent memorandum to the Secretaries of the Air Force and of the Navy and to the Joint Cruise Missiles Project Office, Dr. Perry termed it a matter of national importance that MRASM "be added to our strike warfare systems as soon as possible."

General Slay pointed out that MRASM appears highly suitable as a carrier of Wide Area Anti-Armor Munitions (WAAM) and other multiple warhead munitions, such as the JP-233 Low-Altitude Airfield Attack System (LAAAS). Yet, under certain circumstances, MRASM could deliver single nonnuclear warheads against such targets as bridges and command and control facilities. Basic purpose of MRASM is to cut aircraft attrition by attacking heavily defended key targets with this unmanned standoff weapon. A production decision concerning MRASM could come as early as December 1984 and might involve a modular guidance system permitting the interchange of either radar or imaging infrared guidance.

Overall, USAF's research and development effort, in General Slay's view, is faced with a serious dilemma. While R&D funding is increasing on paper, the cost of doing business is accelerating even more: "Thus, we tend to be very conservative in R&D programs. The bulk of our funds goes to full-scale engineering. I would like to see more liberal, avant garde work to advance the state of the art. For instance, we have no projects in the highly promising area of hypersonic flight. Also, we have no funds to build and test a variable cycle engine. Somehow it seems difficult under our system to accept the challenge of pushing the frontiers of technology."

Yet another dilemma that confronts AFSC, its Commander points out, is a critical and worsening shortage of engineers and scientists. The shortfall at this time is about 1,200 science and engineering officers. General Slay suggests that the solution to the problem is to close the widening pay gap between the military and civilian sectors. General Slay says he has pulled all the stops on recruiting efforts, nonmonetary incentives, and job enrichment, but a basic concern over financial survival is, in simple fact, *the* overriding issue. He thinks Congress is becoming aware of the seriousness of the problem and is hopeful that a significant pay boost is imminent. ■

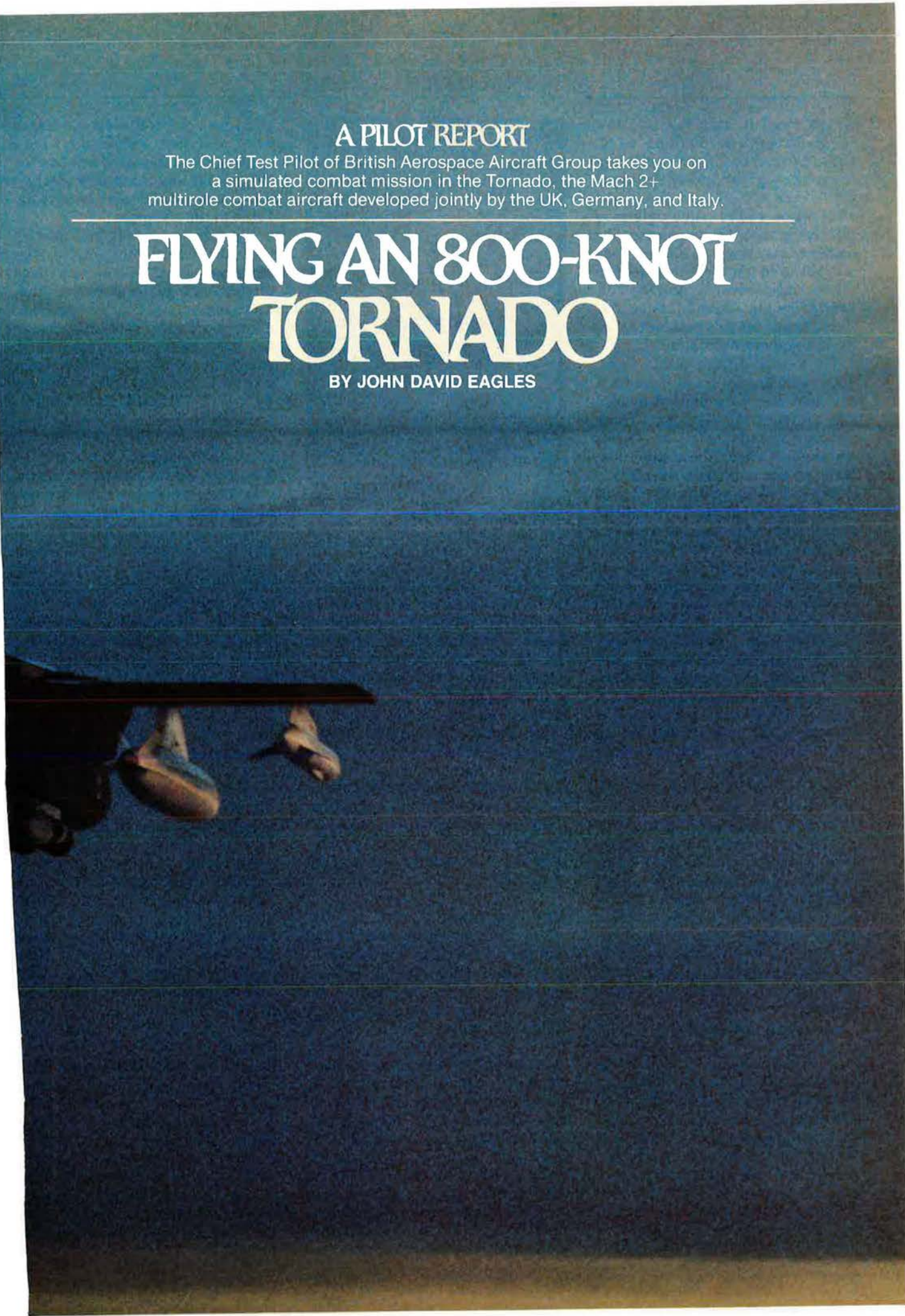


A PILOT REPORT

The Chief Test Pilot of British Aerospace Aircraft Group takes you on a simulated combat mission in the Tornado, the Mach 2+ multirole combat aircraft developed jointly by the UK, Germany, and Italy.

FLYING AN 800-KNOT TORNADO

BY JOHN DAVID EAGLES

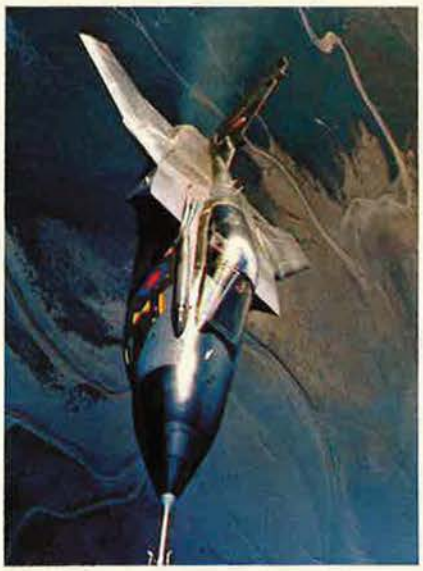


THE need to stay fast and low these days is obvious to all strike pilots. The higher you fly, the more likely ground-to-air weapons are to pick you off, and this is true even when you're using defensive electronic countermeasures. The ability to stay down at 200 feet even at night or in our famous European "murk" is invaluable. And the Tornado is the first aircraft produced in Europe that has this capability. Let me tell you more about it.

While you do the walkaround, your navigator settles into the back seat and starts his inertial navigation system (IN) alignment. There are no ground power or starter trucks on the line. The aircraft auxiliary power unit (APU) is already running and powering the right-hand generator and hydraulic pump. The APU uses aircraft fuel and is designed to power up the aircraft on standby for four hours. As you walk around the aircraft, you'll be surprised at its small size, and that's another aid to survival in the low-level attack game. Its empty weight is around 30,000 pounds, but it is densely packed and has about the same surface area as the F-18. For today's mission the aircraft is carrying eight 1,000-pound bombs under the fuselage, and the wing stations are empty.

Into the cockpit and strap in. The Martin Baker Mk. 10 seat is comfortable and quick to strap into even though it has the addition of arm restraint cords to attach. With a normal operating regime of very high indicated airspeeds, the air forces that will be using the Tornado specified some tight survival requirements. Arm flailing would be inevitable at ejection speeds, about 500 knots indicated airspeed (IAS), without restraint.

One thing that large and slightly ungainly nose has provided is a wide, roomy cockpit, and after the cockpits of the BAC Lightning and British/French Jaguar fighters, this one looks like a ballroom. The size of the nose radome itself was dictated by the dimensions and layout of the two antennas for the Ground-Mapper and the Terrain-Following (TF) radars, the first of which the navigator is checking now with its Built-In Test Equipment (BITE). Cockpit layout in the front is pretty conventional, dominated by the big five-inch lens Head-Up Display (HUD) and the Head-Down Repeater Projected Map Display in the center. Other features that might be new to you, depending on your background, are the "E" Scope high up on the left front panel, which will give you raw returns from the Texas Instruments TF radar, and the hand controller—a small handle just behind the throttles with various switches, enabling the pilot to control some of the HUD attack symbology and thus input to the aircraft's main computer.



There is no trim change and little change in handling with the wings in the fully swept position. (Crown Copyright)

Why Two Seats?

I'm going to pause here to add that the cockpit layout is a remarkable achievement of agreement among four air forces (German Air Force, German Navy, Italian Air Force, and Royal Air Force). You can almost guarantee as many opinions as there are pilots involved when you discuss cockpit matters, and in this case we had graduates from all four of the Western test pilot schools; *i.e.*, USAF TPS, USN TPS, the French TPS, and the Empire Test Pilots' School. The result of their efforts works really well. The only difference between layouts in aircraft for the different air forces is that some government-furnished equipment boxes were specified individually; *e.g.*, radio and information friend or foe (IFF) controllers have different layouts, but are in the same relative position in the cockpits.

If you had paused to look into the back cockpit on your way to your seat, you would have seen a much greater change from convention. The same roomy cockpit space has allowed a logical panel layout, but the front panel at eye level is all electronic with a Combined Radar and Projected Map Display flanked by two TV Tabular Displays and associated keyboards. The radar hand controller sits on a pedestal between the operator's knees and the TV. Tabs allow dialogue with the computer, which stores 65,000 bits of information in its memory.

Why two seats? That debate is endless. I believe that with high-speed, low-level bombing, the probability of mission success is much improved by splitting the workload. Of course, the single-seat solution *can* be mechanized—the early Tornado investigations did it—but the result is very much less flexible than the two-seat version. It is easy, for example, to successfully fly a single-seat Auto TF laydown bombing attack through weather to take out a planned target. But if another type of target is spotted on the way, if a change of target is ordered while en route, if an evading diversion from planned track is made necessary preventing planned navigation updating, if a single failure occurs necessitating manual instead of Auto Terrain Following—in any of these not unusual cases you would be glad to have someone to share the extra workload while you keep the aircraft ou of the weeds.

As you close the canopy fo start-up, you will notice with satis faction the thickness of the wind screen and canopy transparencie and their supporting ironmongery Weight saving is all right in its place but on an aircraft that has alread demonstrated 800 knots indicate airspeed, and which normally ope ates well below the maximum cei ing of your average house-sparrow let's give the crew the necessar protection.

Firing Up

Start-up is simple. The APU is already running the right gearbox, so pressing the starter switch to "Right" simply clutches in that engine to its own gearbox. The two engine gearboxes can be connected via a cross-drive shaft, and in the case of loss of either engine in the air, the cross-drive clutch closes automatically and thus no services are lost from the failed engine. By use of the cross-drive clutch, either engine can be started first from the APU.

The cockpit, with climate conditioning on or off, is quiet. Crew communication problems in the Hawker Siddeley Buccaneer, flying at high speeds, focused attention on this aspect of Tornado. Researchers at the Royal Aircraft Establishment, Farnborough, attached microphone/recorder packs to the development crews during the early high IAS sorties to determine the depth of the "problem." They came back several times because they were having trouble with their kit; noise levels were hardly high enough to register. But that's the way it is. Cockpit noise levels in Tornado at 800 knots are remarkably low and certainly do not affect crew chat levels.

> "Preflight checks take up very little time. Most systems . . . have their own BITE, and the only 'extra' check on Tornado is to sweep the wing . . . before starting to taxi."

Preflight checks take up very little time. Most systems, including the fly-by-wire Command Stability Augmentation System (CSAS) and the associated autopilot have their own BITE, and the only "extra" check on Tornado is to sweep the wing once each way before starting to taxi. Nosewheel steering is permanently engaged, but can be cut out on the stick paddle switch in case of malfunction. In its normal mode, nosewheel steering has a two-slope gearing suitable for takeoff, landing, and normal taxiing. For tight turning in a restricted space, a "High" gear can be selected by pressing the "Steering Engaged" light. Rudder pedal forces are a little higher than optimum for ground handling, but nothing to get worked up about.

While taxiing, we can check on Bob Newhart's "other way of stopping"—*i.e.*, throwing it into reverse! Rocking both throttle levers left through an over-center action spring selects both sets of spoilers to the Lift Dump mode and deploys the engine thrust reverser buckets on whatever engine power is selected at the time. The throttles can continue to be used in the normal way with the reversers deployed; in other words, moving throttles forward increases reverse thrust. So even a failure of both wheel-braking systems won't prevent us from stopping, and we can slow or stop on ice without directional problem—another bonus in Europe.

One of Tornado's virtues is its short-field capability. With lift dumpers extended, reverser buckets out, both engines at max power, and brakes stamped on, it will stop in less than 1,500 feet in no-wind conditions.

A Luftwaffe Tornado with the MW-1 cluster dispenser that ejects a large number of small munitions to either side of the aircraft.

Running up the Turbo-Union RB.199 engines against the brakes prior to takeoff shows the rapid wind-up times that the electronic control system provides. The link from throttle to engine is all electronic and gives the nicest control that this pilot, anyway, has ever found. You can slam from idle to combat power anywhere in the flight envelope, and it is also possible to very quickly set up a particular engine speed absolutely accurately—a function of rapid response, gauges that can be read to 0.1 percent, and a total lack of creep or sponginess. But the real beauty of these small three-spool fan engines is about to be revealed to us when we get the machine into the air. The RB.199 has the highest thrust-to-volume ratio of any turbine engine in the world today, giving the Tornado a Mach 2+ level flight capability with engines small enough to look at home on a business jet.

"The [small] RB.199 has the highest thrust-to-volume ratio of any turbine engine in the world today, giving the Tornado a Mach 2+ level flight capability. . . ."

A Joy to Fly

Max dry power is held against the toe brakes, then minimum reheat, and finally the throttles are slammed to full combat power as the brakes are released. Acceleration with eight 1,000-pound bombs is good, and the aircraft is lifted off in about half our 6,000-foot runway.

When the flaps are raised from their mid, 35° position, they retract only to the "Maneuver" setting of 7° flap, 11° slat. Thereafter, the wing will clean up automatically as incidence is reduced for cruising. With maneuver extended, we can maintain very high turn rates at sea level, and we are not going to be much above that level during the first part of this sortie.

With the flap/slat retracted, we settle down at the best range speed to fly to the target range and deliver our payload. Normally we would simply put the autopilot on "Track-hold" and let the automatic flight plan take us there. We can choose a pitch channel controlled by either the Terrain-Following Radar of Barometric Height Hold or Radar Height Hold, depending on the desired altitude, and monitor the route on the Projected Map (front seat) and radar in the rear. Fuel flow is back to a very low figure, even with our eight 1,000-pound bombs, and the navigator will plan to update the nav system twice or three times during the first half hour to guarantee the kind of system accuracy that is going to be required if the weather is poor and we have to lay down the bombs blind. Updating is done by radar and laser ranging, and in visual conditions the pilot can switch into the loop using the fixing marker in the HUD.

The Federal Republic of Germany is buying Tornadoes for both the Luftwaffe and Navy. The aircraft can carry a wide variety of ordnance on fuselage and wing hardpoints.

But today let us look at aircraft handling on the way to the range.

Pulling the aircraft into a turn at our 350 knots transit speed automatically extends maneuver devices (flap and slat), giving no trim change, but reverting the aircraft from a high wing loading maximum range machine into a lower wing loading, highly maneuverable ship. Stick forces are light to moderate—perhaps slightly lighter than American fashion—and harmony between pitch and roll is excellent. The triplex fly-by-wire system provides superb stability and response, making the aircraft a joy to fly clean or with a heavy payload, at sea level or at 30,000 feet, at 140 knots or at 800 knots. As an example of control-system performance, full stick roll rate is identical between zero and four "G" in 25°, 45°, or 67° wingsweep positions and between Mach 0.5 and 1.0 at all altitudes and with all loads. Stick force per G does vary slightly with Mach number, stiffening up a little at supersonic speed, but remaining always in the "pleasant" category.

Opening up to max dry power, we quickly reach the Mach 0.8/500 knots IAS limit for forward-swept wing. With maneuver devices retracted, we are back to a high wing loading, low gust response ride even with the wing forward. The wing is swept manually on the Strike variant using the wing lever inboard of the throttle box. (The Air Defense variant has auto-sweep, which we would also like to see on the Strike version.) There is no trim change during sweeping and very little change of handling qualities—only a slight change in the background hum as you put the wing all the way back to 67°.

The wing-mounted spoilers, which provide additional roll control with the wing forward, are switched out of circuit at sweeps greater than 50°. Their effectiveness is becoming negligible at higher wing angles. The differential tail now provides both pitch and roll. But the main gain to the Strike pilot from sweeping fully back is that the wing not only attains a lower lift curve slope, but also reduces its area by about five percent as the inboard trailing edge gets tucked away into the fuselage. And now you have ride comfort in low-level turbulence that is unequaled by any other aircraft flying.

The Strike version of Tornado normally will operate "below the ceiling of your average house-sparrow." (Crown Copyright)

The smoothness of the ride here at 200 feet, Mach 0.92 isn't just an added tourist attraction. It makes it possible to monitor the Terrain-Following track-keeping and the HUD attack symbology without distraction or fatigue in all-weather attack conditions.

Delivering the Ordnance

Approaching the range, let's set up for a single pass laydown attack, dropping our eight 1,000-pound bombs in a stick. With Terrain-Following selected, and Hard Ride, we can be sure that we are following the ground contours as closely as any aircraft at 600 knots can do. Wind down the "Clearance Height" setting knob to the minimum level and you are down in the weeds giving the hardest possible task to any defending weapon system. It's comforting to know that there is triplex attitude-monitoring going on in the Automatic Terrain-Following System and that you'll get an automatic pull-up before the airplane is handed back to you in the event of a failure. The only trips to date with the system have been caused by discrepancies between the different attitude sensor sensitivities, finally ironed out after many hours of TF over the Black Forest in southern Germany.

The air-to-ground weapons are selected by the navigator. Prior to flight, he can divide the stores he has to deliver into "packages" and allocate one package to each planned target. Today he has inserted one package of eight bombs in a stick at a ground spacing set in meters. As we fly toward the target, the navigator will have been monitoring the navigation system accuracy through the Combined Map and Radar Display and the TV Displays. Extensive use of Kalman Filtering ensures that navigation accuracy does not significantly degrade with time. If necessary, however, he will have updated the system through radar or laser fixing.

At about twenty miles to the target, the navigator selects the weapon package, the "Attack" mode on the TV Display, and the "Stabilized" mode on the Combined Map and Radar Display. The stabilized mode brings the computed target or radar offset to screen center overlaid with an aiming marker. An automatic radar identification tilt facility along with the stabilized mode makes the task of target identification and possible marker position refinement a low workload task.

In the front seat, you will be checking the attack progress through the HUD with hand on stick ready to take over from the autopilot if you should be able to identify the target visually and see an aiming error.

As the navigator refines the target position using his own hand controller, you will notice the HUD aiming marker move to superimpose on the new target ground position and also feel the aircraft react to the autopilot adjusting the aircraft track to achieve the correct release solution. The throttles can be left alone since IAS is being controlled by the auto throttle. A circle around the aircraft symbol in the HUD unwinds to show the number of seconds to automatic bomb release. Some time before the pilot would see the target in visual conditions, the navigator will have finished

aiming and the laser rangefinder will be ranging on the target position to give the weapon system very accurate plan range and aircraft height information. You will squeeze the stick-mounted pickle button, which is the pilot's "commit" signal. You can prevent release at any time up to the last second by releasing the button.

If the European weather maintains its usual form, your only contribution to the bomb drop as pilot will be to monitor the whole exercise to ensure safety. If the weather is clear, you will probably have the satisfaction of recognizing the target lying under the HUD target marker, and there is absolutely nothing to be gained by switching to a "Phase 2" attack—bringing the pilot into the loop. But if the target is seen anywhere but under the marker, or if a more attractive alternative target is seen, you can either use the "eyeball" on the hand controller to move the marker accurately over the new target and let the autopilot take care of the track change required, or you can take over control of the aircraft to hand-fly it to a release point, aiming with the CCIP marker (Continuously Computed Impact Point). If it's the latter case, you'll be glad that Tornado's handling qualities are so consistently excellent, because dragging an airplane out of autopilot to pull a hard turn at 200 feet and 600 knots with only two or three seconds to go to release demands nothing less.

The stick of eight 1,000-pound bombs rippling off the belly comes through as a slight shuddering and results in a noticeable acceleration, having ditched the drag. The navigator confirms all bombs gone with his Release Deficiency Indicator, and the plan would now be to stay fast and low back to where it's friendly. But today let's have a look at Tornado's handling characteristics at high Mach numbers.

Full stick roll rate is identical between zero and four G, in varying degrees of sweep, and with all loads.

High and Hot

The fuel system is entirely automatic, and all except the fuel in the fin is gauged. The flight refueling probe, retracted into a blister on the right side of the nose, can be used with the buddy system carried by a sister ship or with a standard tanker. But we have enough fuel remaining to briefly investigate Tornado's clean performance, giving a taste of the capabilities of the air defense variant (ADV) ordered by the RAF.

The ADV will use the Tornado's varied characteristics to achieve a different kind of sortie profile. With four semisubmerged Skyflash air-to-air missiles and two Sidewinders, it will cruise out at medium altitude and remain on combat air patrol (CAP) with wing forward. The ADV's FMICW (Frequency Modulated Interrupted Continuous Wave) radar incorporates a multitarget track-while-scan facility and gives excellent look-down performance. After high-level target contact, ADV will accelerate to a high supersonic speed, giving a capability to take out targets to altitudes well in excess of 55,000 feet, by using a combination of aircraft zoom and missile performance. Interception can be carried out "hands off" and in all weather, right down to the trees.

When approaching Mach 0.8 here at 25,000 feet, the wing is brought back to the mid 45° position, which compared with 67° gives reduced drag in hard maneuvering. Leading edge slat is still available at 45°, but the maneuver flap is inhibited. Carefree maneuvering up to high incidence is provided courtesy of the SPILS—Spin Prevention and Incidence Limiting System. SPILS reduces roll and yaw authority at high alpha (angle of attack) and eventually limits alpha itself. The roll authority reduction is hard to detect, and very respectable roll rates are still available up to very high incidence. The alpha limiting is felt as a "heavying up" when the limitation is approached. The system allows the pilot to get the maximum performance out of the aircraft with total confidence—a requirement that is here to stay in the modern combat aircraft.

Slamming to combat power here at 25,000 feet starts a healthy airspeed increase, and the wing is swept right back at about Mach 0.92. The 45° wing is, of course, good for high supersonic speeds, but we are after the optimum acceleration. There is slight Mach "noise" at Mach 0.98, but all is smooth and quiet again at the jump-up to supersonic speed and the optimum acceleration is achieved by building up to around 550 knots IAS, and then maintaining that in a climb to the tropopause. Full stick rolling here in the climb at Mach 1.5 produces only slightly lower roll rates than at the same IAS at sea level, and pitch stick forces are still very comfortable though slightly increased from their subsonic level.

The flying control system can be switched into "Mechanical" anywhere around the flight envelope, clutching in a rod linkage between stick and taileron actuators, providing a get-you-home capability in case of failure or damage. The resulting degradation in handling qualities was described (fortunately by a USAF pilot!) as making the aircraft feel "like an F-4. . . ." At the

John David Eagles joined the Royal Navy in 1953 and received his flying training with the US Navy. During his fifteen years of service with the Royal Navy, he was assigned to a number of carriers and squadrons before graduating from the Empire Test Pilots' School in 1963. In 1968, he led the Buccaneer aerobatic team at the Farnborough Air Show. He left the Navy in 1968 as a lieutenant commander to join British Aerospace Corp. as a test pilot. In 1970, he was named MRCA (Tornado) Project Pilot and in 1977 became Chief Test Pilot at BAC's Aircraft Group.

Wings fully swept, "you have ride comfort in low-level turbulence that is unequaled in any other aircraft."

tropopause, our rate of Mach progress depends, of course, on the outside air temperature and the aircraft's handling qualities remain good. You can put in full rudder pedal at Mach 2—or indeed anywhere else around the flight envelope. Sideslip is automatically kept within limits, and dutch roll damping is good.

Let's cut the afterburner now and drop the nose to pick up 800 knots IAS on the way home. This is the only aircraft that the writer has flown cleared to such speeds, and surely it says all there is to say about the suitability of the airframe designed to spend most of its life hammering along at very low level. Noise levels are surprisingly low, and even at this speed the turbulence encountered on plunging through cumulus cloud comes through as very soft-edged aircraft reaction. Crew intercom is via a voice-operated switch with a dynamic switching threshold. Background noise is never sufficient in itself to switch the microphones on, and yet voice level for switching remains normal.

> "You can put in full rudder pedal at Mach 2—or . . . anywhere else around the flight envelope."

Airbrakes can be selected at any time, but they are scheduled to restrict their angle in relation to Mach number, and they never give an eye-pulling deceleration. They sit on the shoulders at each side of the fin and they are trim-change free. But we don't need airbrakes to decelerate from 800 knots. Idle power has the desired effect initially, and below about 600 knots the wing can be swept forward to 45°, which also helps.

Landing Is Half the Fun

An experience equally impressive as smoldering along at 800 knots IAS is cruising home low level at best-range speed. Very low fuel flows can be achieved from these fan engines, developed solely for this airframe.

The final benefit of the Tornado design to be demonstrated is also very much built-in with a war in Europe in mind. There's no doubt that a dependence on long concrete runways is going to be an embarrassment when the tanks start to roll. What's the advantage of being able to demonstrate 1,000-feet takeoff performance if it takes you 3,000 feet to stop when you get back? Let's set the aircraft up for a short landing.

Back at the home base the weather is 200 feet and a mile in

Tornado Facts and Figures

Manufacturer: Panavia Aircraft GmbH—a consortium of three companies: British Aerospace, Messerschmitt-Bölkow-Blohm, and Aeritalia.
Planned Production: The RAF plans to buy 385 Tornadoes of which 220 will be Strike versions and 165 for air defense. The Federal Republic of Germany will buy 212 for strike, counterair, close support, and reconnaissance; and the Italian Air Force 100 for strike, air superiority, and reconnaissance.
Powerplant: Two Turbo-Union RB.199-34R-04 turbofan engines, each rated at 9,000 lb. static thrust dry, and 16,000 lb. static thrust with afterburning.
Length: 54 feet 9.5 inches.
Height: 18 feet 8.5 inches.
Wingspan: Fully spread—45 feet 7.25 inches; fully swept—28 feet 2.5 inches.
Maximum takeoff weight with external stores: 58,400 pounds.
Armament: Two 27-mm cannon.
Ordnance capacity: Maximum 16,000 pounds, varied according to mission.
Takeoff and landing run: Approximately 1,200 feet.
Performance: Mach 2.0-plus at altitude.
Ferry range: 2,420 miles.
Radius of action with weapons load: (hi-lo-lo-hi) 863 miles.
Crew: Two.

(Source: Jane's All the World's Aircraft 1979–80.)

rain, and we position for an Instrument Landing System (ILS) approach. The autopilot can be set to Height and Heading Hold for the final maneuvering and mid flaps and gear are dropped at 300 knots and 250 knots respectively. The pattern is flown at 200 knots with "Auto Approach" selected and speed is finally bled off to 140 knots for final approach after full flap has been lowered. Full flap brings with it noticeable buffet for the first time since the bombs were dropped, but this reduces to a low level at final approach speed. The auto throttle is optimized for the approach, and IAS is kept throughout to within three knots of that selected.

The landing checklist includes a requirement to check a "Weight-on-Wheels" switch indicator before preselecting reverse thrust. Although it would need a double failure to permit airborne activation of Reverse and Lift Dump, the effects could be sobering, so the check is thought wise. With the system checked okay the throttles are rocked outboard where they continue to be moved to and fro by the auto throttle. Autopilot performance during the approach is monitored through the Head-Up Display and can be cross-checked against the raw ILS information head down. Although aircraft handling is considered ideal throughout the flight envelope, it is particularly so in the landing configuration, and visual approaches or manual ILS are equally pleasant.

At 200 feet, the runway lights appear out of the murk and the autopilot is disconnected by the thumb switch on the stick. Roundout, and as the main wheels touch down, the lift dumpers extend and kill any tendency to float. At the same time, the reverser buckets snap out on about eighty-five percent rpm and as the aircraft derotates, both engines are slammed to max power and the brakes are stamped on. The resulting deceleration is the nearest thing to a carrier deck landing that an air force pilot is likely to experience. In no wind, you can come to a full stop with ease in less than 1,500 feet.

As you slow through fifty knots, the reingestion audio warning will sound, warning you to throttle back to idle reverse to avoid reingestion. Hot gas reingestion will cause the odd pop-surge, but the real object is to avoid blowing loose stones forward and causing foreign object damage. A clean runway policy is even more important with this aircraft than usual.

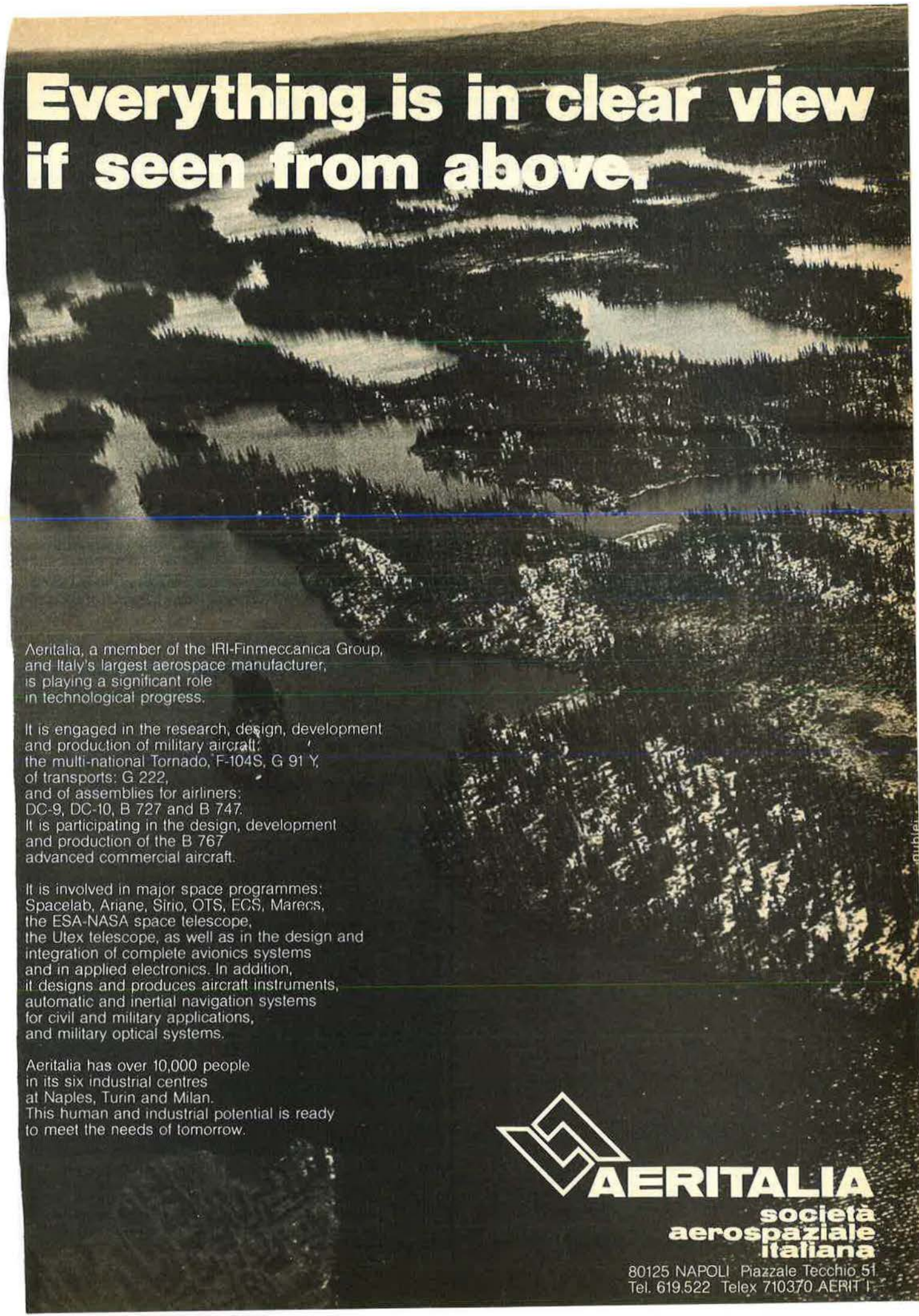
> "Of all the air-to-ground weapon systems in Europe today, Tornado has the best chance of getting through with the goods."

Early reverse development showed up a directional stability problem at high reverse powers. Some fancy footwork was needed on the nosewheel steering to keep the aircraft on the center-line. The problem, caused by the forward jet flow attaching to the fuselage at random, was fixed in two ways. First, the reverser bucket geometry was changed to ensure engine flow attachment to the upper fuselage at all times. The random yawing moments previously generated were thus eliminated. But in addition, the yaw rate signal from the CSAS was fed to the nosewheel steering system. This removed the need for pilot steering after touchdown. Now the airplane runs straight down the center-line "feet off" at max reverse.

When you shut down one engine to taxi in, the cross-drive clutch closes automatically, keeping both generators and both hydraulic pumps on line. And having canceled reverse by rocking the throttles back inboard, there is no chute to be repacked—another factor contributing to quick turnaround.

The Service Chiefs are going to be glad to see Tornado achieve mission readiness in Europe. The need for a low-level strike airplane that can operate in any weather or light conditions is clear. Of all the air-to-ground weapon systems in Europe today, Tornado has the best chance of getting through with the goods. And it's nice to know that besides being effective, the Tornado crews are going to enjoy flying it too. ■

In addition to the strike version of the Tornado, shown here, there will be an air defense variant for the RAF. Its radar will have a multitarget track-while-scan capability with excellent look-down performance.


Everything is in clear view
if seen from above.
Aeritalia, a member of the IRI-Finmeccanica Group,
and Italy's largest aerospace manufacturer,
is playing a significant role
in technological progress.
It is engaged in the research, design, development
and production of military aircraft:
the multi-national Tornado, F-104S, G 91 Y,
of transports: G 222,
and of assemblies for airliners:
DC-9, DC-10, B 727 and B 747.
It is participating in the design, development
and production of the B 767
advanced commercial aircraft.
It is involved in major space programmes:
Spacelab, Ariane, Sirio, OTS, ECS, Marecs,
the ESA-NASA space telescope,
the Utex telescope, as well as in the design and
integration of complete avionics systems
and in applied electronics. In addition,
it designs and produces aircraft instruments,
automatic and inertial navigation systems
for civil and military applications,
and military optical systems.
Aeritalia has over 10,000 people
in its six industrial centres
at Naples, Turin and Milan.
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Soviet command control and communications systems are flexible, survivable, and technologically advanced. Whether their "top-down" rigid structure will permit continuous operations in a hostile environment is another matter. In any case, the Soviets appear to be significantly ahead of US forces in deployed command control and communications capabilities.

SOVIET C3

BY NORMAN POLMAR

A SOVIET military analyst has observed that, in the Soviet view, there have been three revolutions in military technology since World War II: nuclear weapons, long-range missiles, and command and control. The last is in some ways the most significant because Soviet approaches to command control and communications appear to differ considerably from Western C^3 concepts and activities. Further, C^3 is one of the more difficult aspects of military power to observe. For example, unlike nuclear weapon and missile tests (and those of other hardware), C^3 activities are more easily simulated, are not always identifiable, and are sometimes simply impossible to observe or intercept.

The situation is further complicated for the West because the Soviet Union is territorially adjacent to its principal allies of the Warsaw Pact, while even its most likely objectives—the NATO nations of Western Europe and Iran (and, of course, Afghanistan)—have land borders with the Warsaw Pact or USSR. This geographic situation reduces the Soviet reliance on radio communications, permitting more use of land lines, which are more secure from both Western jamming and the possibility of interception.

At the same time, the Soviet Armed Forces appear to plan for extensive use of jamming and intercept against Western communications. Further, Soviet tactical doctrine gives actual attacks against Western command posts and communications centers a high priority (along with strikes against Western nuclear weapon storage and delivery systems).

The Soviet Style

Soviet C^3 systems and activities are based on a "top-down" concept, with command and control highly centralized and largely directed from Moscow. The Soviet National Command Authority or NCA—to use an American term—can be considered in the context of a single individual—President of the USSR and First Secretary of the Communist Party Leonid Brezhnev.

The so-called "hot line" between Moscow and Washington was established in 1963 in the aftermath of the Cuban missile crisis. The Washington terminal is in the National Military Command Center in the Pentagon. At both ends, Soviet and US rapid teletype devices are installed side by side. The two nations alternate transmitting test messages every hour, every day of the year.

The Zhdanov, part of the Soviet Black Sea Fleet, is one of two Sverdlov-class cruisers converted during the 1970s to a flagship configuration, including extensive C³ facilities and accommodations for an admiral and his staff. Note the extensive antenna arrays on the three tripod masts, the new block-like structure aft (forward of turret), to add more C³ space and mounting for surface-to-air missiles. The other cruiser converted for this purpose is the Admiral Senyavin.

As First Secretary, Brezhnev is first among equals on the thirteen-man ruling Politburo. Today there are no professional soldiers on the Politburo, although Minister of Defense Dimitri Ustinov, longtime head of the armaments industries, like most members—including Brezhnev and Ustinov—held military ranks and served in World War II. (Two professional soldiers have been Politburo members: Marshal Georgi Zhukov for four months in 1957, and Marshal Andrei Grechko from 1973 until his death in 1976. Each served as Minister of Defense during his period of Politburo membership.)

The Politburo, the most powerful organ in the USSR, is a *political* body. Brezhnev, as President of the USSR, is the Supreme Commander in Chief of the Armed Forces. Reporting to him, through the Council of Ministers, is Minister of Defense Ustinov. However, the operative military organ—and hence the Soviet "equivalent" to the American NCA—may be the Defense Council. Little is known about the Defense Council, which is a state, rather than Party, organ. It is chaired by Brezhnev with only a few other members, possibly only two, Ustinov and a political representative, also from the Politburo. The Defense Council has major responsibilities for the armed forces. While there are no professional military officers in the group, the senior officers of the Soviet Armed Forces obviously are readily available to the Council and probably provide certain staff functions, including—through the General Staff—the C³ links to major commands.

The senior defense organization is the Ministry of Defense, under Ustinov, with the General Staff providing centralized command of all Soviet military services. In addition, the Soviet General Staff appears to have operational control over operational forces except for the Warsaw Pact. That means that Soviet operations in other areas, presumably at sea and those military units in Afghanistan and Vietnam, for example, are under command of the General Staff. This is a somewhat similar concept to that of the United States, with unified commands and special forces reporting to the US Secretary of Defense and Joint Chiefs of Staff. However, unlike the JCS, which consists of almost equal representation from the various services, the Soviet General Staff is dominated by the Ground Forces (*i.e.*, Army). Within the General Staff there is a Communications Directorate (one of about a dozen major staff agencies).

Assessments of Soviet C³ at the unclassified level are difficult to achieve. A recent article in *Aerospace Daily* discussed US and Soviet capabilities based on an interview with a senior US defense official who noted that "the Soviets have a much more hierarchical" command and control structure that can be interpreted as more "orderly" than US and NATO systems. "In terms of the capability of the Soviet communications, they have perhaps gone a little further than we have," he continued, making reference also to critical shortfalls in US communications security. Asked when the United States could parallel the command and control in the Soviet OKEAN naval exercises of 1970 and 1975, the official said, "I would hesitate to put a date on it."

The Il-62 Classic and Il-76 Candid similar to those shown here have been converted by the Soviets to "flying command posts." Their markings may be as shown, or in the livery of Aeroflot, the Soviet flag carrier.

Conceptual Approaches to C³

Soviet C³ concepts are probably based on several aspects of Soviet military policy, doctrine, and tactics. These include—among others—combined arms, mass, mobility, surprise, and emphasis on the offensive. All of these impose demands on C³ systems and doctrine.

Combined arms means the operational integration of armor, artillery, and infantry of the Soviet Ground Forces, closely supported by Frontal Aviation, which is roughly the equivalent of US tactical air forces, but is operationally under the control of Ground Forces when deployed forward. This requires C³ operating doctrines and equipment to ensure that all units, regardless of type, can communicate readily on and monitor the same frequencies.

The massing of forces is a basic Soviet tenet of military operations. This could require the rapid concentration of spread-out units as well as communications with large numbers of units. Again, there are certain C³ requirements that evolve from this situation.

The high degree of mobility demanded of Soviet forces means doctrine and equipment are needed to maintain continuous C³, including communication by radio and by wire when practical while troop units are in a fluid situation.

Surprise includes several of the above constraints plus a very high degree of C³ security. That is, not only communications security, but denying an enemy knowledge about the location of one's own command and control activities.

The offensive—the key to Soviet military operations—demands C³ mobility, but also such considerations as "leap-frogging" C³ facilities to ensure that the commander who is moving forward has all needed facilities available while not disrupting on-going command control and communications activities. A recent Soviet article on communications during the 1941–45 war gives some indications of the demands placed on C³ activities during an offensive:

"During the Belorussian Operation, the headquarters of the fronts [army groups] moved to a new control facility deployment area every five days on the average, while army headquarters moved every two to three days. During the first sixteen days of the operation, the majority of army headquarters of the First Belorussian Front changed their location seven times, and the headquarters of the Third and Twenty-eighth Armies—eight times. During the same time the headquarters of the First Baltic and Third Belorussian fronts displaced three times."

Soviet records show that during the final thrusts into Germany in April 1945 the headquarters of the assaulting armies were being moved two or three times per week! Special preparations were made for these frequent

moves, such as organizing command post (CP) personnel into shifts with one shift prepared to move at all times, predesignation of equipment to be moved first, and arrangements for adequate transport. Plans called for no more than thirty to forty minutes for an army headquarters to organize and move out the signal units for setting up communications at a forward CP, and sixty to ninety minutes of warning for front (army group) communications teams to move out. The front communications centers were handling more than 5,000 messages per day during this period.

There is every reason to believe that today's Group of Soviet Forces in Germany and the forward-deployed units in the Far East would be at least as adroit in the mobility of their CPs and communications as their 1945 counterparts. Indeed, with Soviet forces committed to the same offensive strategy in the same region for three decades, there is ample evidence to support the belief that all conceptual approaches to C^3 have been executed in a highly capable manner.

The rigid top-down approach to C^3 is evident throughout the Soviet military establishment. According to a US Defense Intelligence Agency evaluation, "the Soviets regard command as the exercise of constant and effective control." Control is maintained at the highest possible level. While this limits individual unit commanders' initiative and flexibility in preplanned operations, it assures maximum possible exploitation of breakthroughs and rapid shifting of uncommitted forces.

Details about USSR top-echelon communications are sketchy. There are seventy-five hardened sites within the Moscow beltway alone for the Soviet NCA and supporting staffs, and the Armed Forces' leadership. Some of these are several hundred feet underground and are hardened to withstand 1,000 pounds per square inch of blast overpressure. (In comparison, the United States is believed to have only three or four major hardened, underground command posts with only one, Fort Ritchie, Md., near Washington, D. C.)

There are duplicate reserve command centers, also protected, for each major military service and command as well as for those subordinate units that handle nuclear weapons down to the regimental level. Of course, the latter include the launch control centers for ICBMs and IRBMs of the Strategic Rocket Forces.

Specially configured aircraft are available to the Soviet leadership in addition to fixed command centers. The Soviets fly Ilyushin Il-62 Classic and Il-76 Candid transports in what Americans call the National Emergency Airborne Command Post (NEACP) configuration. Both are modern, four-engine aircraft. Reportedly, during the late 1970s, these airborne command posts were active during crisis situations.

An unusual aspect of Soviet top-echelon communications is the so-called "hot line" between Moscow and Washington. Established in 1963 in the aftermath of the Cuban missile crisis, the hot line is intended to facilitate communications between the Kremlin leadership and the US President. (The Washington terminal is in the National Military Command Center in the Pentagon.) The Kremlin terminal uses earth satellite stations near Lvov and Vladivostok with the system using both satellite and cable routes to ensure rapid and reliable transmissions. In both the Kremlin and Pentagon, Soviet and US rapid teletype equipment are installed side by side. The two nations alternate transmitting test messages every hour, twenty-four hours a day, 365 days a year.

At lower echelons, for example in rifle units, the battalion commander quite often controls the subordinate company radio nets. The lower-level platoon and squadron leaders use their radios primarily to receive instructions. They transmit infrequently, usually only to provide information to seniors. In tank units, radios in other than commanders' tanks are normally operated only in the receiving mode. Platoon leaders and tank commanders are allowed to transmit only in emergencies.

C^3 Technology

Soviet C^3 activities make use of high technology systems. Adm. James L. Holloway III, the former US Chief of Naval Operations, has stated: "When you compare our navies, I do think the Soviets have an advantage over the US Navy in that they have more and better communications systems than we do. I tend to think we may be at a standoff as far as electronic warfare itself is concerned. But I give them a clear advantage in secure communications." At the same time, then-Secretary of the Navy J. William Middendorf declared, "The Soviets have the best command and control one can imagine."

"Conventional" communications equipment (*i.e.*, radio, video, data link, telegraph, and telephone equipment) in the Soviet Armed Forces incorporates many advanced technologies. However, this equipment—like much Soviet hardware in the military and civil sectors—is primitive or unsophisticated by US standards. But the Soviet equipment tends to get the job done. It is generally specialized rather than multipurpose and hence cheaper and easier to maintain; it is more rugged and less affected by weather than Western equipment; and it requires less sophisticated checkout and support equipment. These characteristics are even true of some advanced C^3 systems, such as computers and satellites.

Also, Soviet civilian communication systems, for example, are designed from the outset to be compatible and integrated with military systems, providing rapid wartime conversion, similarity in personnel training, cost benefits in providing maintenance and parts, etc. The contrast to US commercial communications systems is obvious, with neither design nor existing usage policies facilitating their use by the military. In the same way, almost all Warsaw Pact communications equipment is of Soviet design, and hence inter-army compatible. Some NATO nations have *similar* equipment, but nothing close to the degree of Warsaw Pact compatibility.

Norman Polmar is an analyst specializing in aviation and maritime affairs. From 1966–77, he was editor of the US section of Jane's Fighting Ships. *He is the author of* World Combat Aircraft Directory *(Doubleday & Co.),* Strategic Weapons: An Introduction *(Crane, Russak & Co.),* Guide to the Soviet Navy *(US Naval Institute Press), and several other books on defense subjects. Mr. Polmar's articles have appeared in many newspapers and magazines in the US and abroad. He has visited the USSR as a guest of the Soviet Institute of the USA and Canada and the Soviet Navy.*

The Soviet Armed Forces have widely adopted "mathematical" support and "cybernetics" in C^3 activities. Mathematical support consists of operations research and electronic computer technology being introduced "into the working practice of control entities at all command echelons."

According to Soviet papers on the subject, *prior* to forces performing a mission, mathematical support can substantiate variants of a decision with any amount of detail, thus giving a commander a better understanding of possible courses of action and their effect. During the execution of a mission, mathematical support of command and control can perform calculations for correction or for making new decisions.

Cybernetics, the study of control and communications as they relate to the interface between man and machines, has led to many reductions in time-consuming computations and decision-making processes. The Soviets took the initiative in this field with respect to military use, with the late Engineer-Admiral Askel' Berg being internationally recognized as a leader in this field.

The principal area of computer support to C^3 is in the Air Defense Forces (PVO-Strany) for early warning and control. But computers for C^3 have more recently been identified at lower and more diverse commands, including at sea aboard cruisers, primarily for the coordinated direction of antisubmarine and, possibly, antiair warfare.

The computer field is one in which Soviet technology has evidenced shortcomings. The superiority of US computer technology is generally acknowledged, with the Soviets purchasing Western computers for civil and military application. But superior computers do not automatically confer superior C^3; the US World-Wide Military Command and Control System (known by the acronym WWMCCS—pronounced "wimex") makes extensive use of computers but still does not function properly.

A senior US defense official notes that the United States still leads in the automated control of combat forces, but adds, "The Soviets are placing emphasis on this area."

Satellite Systems

Satellites are one of the more important components of modern Soviet C^3 activities. The USSR, which launched the first, and the first large-payload, earth satellites in 1957, uses satellites in eight mission areas related to military operations: general research, including weather reporting; navigation; mapping; communications; sensors, including ocean tactical surveillance and strategic warning; weapons guidance; weapons delivery, such as the Fractional Orbital Bombardment System (FOBS); and antisatellite systems.

The predominant communications satellites for military C^3 are the Molniya series. The Molniya I system became operational in the mid-1960s, followed by Molniya II and III. These satellites have highly elliptical twelve-hour orbits. The improved Molniya I-S has a twenty-four-hour synchronous orbit. (The Molniya III is used in the Moscow–Washington hot-line link, as is the US Intelsat IV.)

Of course, "civilian" communication satellites in the USSR do not exist in the sense they do in the United States because of military control or at least influence in the development of all civilian systems using advanced technology. As with the Soviet radio-television-telegraph operations, it seems probable that the civilian satellites are fully compatible with military systems and are included in military contingency planning. Conversion from civilian to military use is further facilitated by the large number of reserve and active military officers in the civilian communications organizations.

The quality of Soviet satellite systems is difficult to ascertain on an unclassified basis. In 1978, the US Under Secretary of Defense (Research and Engineering), Dr. William J. Perry, stated that: "US space-based systems are generally superior in performance to their Soviet counterparts across the board, although the Soviets lead in deployed radar surveillance from space, and may be closing the gap in operational missile-detection capabilities. The Soviets have in fact attempted to compensate for limitations in the performance of their satellites by launching a greater number of vehicles."

The Soviet space program—including those satellites that support military C^3—has shown continued qualitative improvement as well as quantitative leadership over the United States. For example, during 1979 the Soviet Union had eighty-seven successful space launches, of which most were primarily military in nature; the United States had only sixteen successful launches, with relatively few military payloads. Qualitative improvements have resulted in a Soviet failure rate for space boosters of under ten percent since 1970. However, one of the most troublesome Soviet boosters has been the Proton, used to launch man-related flights and synchronous orbit communications satellites.

Like other aspects of military C^3 and anti-C^3 activities, space offers many opportunities, and the current Soviet thrusts in this direction indicate a thorough understanding of the opportunities and the vulnerabilities of space-related command control and communications.

C^3 Survivability

All Soviet military C^3 systems are developed and deployed with considerable emphasis on survivability—much more than comparative Western systems. Dr. Perry has observed that, compared to US C^3, the "Soviets have an advantage in the survivability of C^3 systems and installations against physical and jamming attack." The Soviets seek to achieve survivability through concealment, dispersal, hardness, mobility, and redundancy.

Concealment is practiced at all levels of C^3 activities. Drawing on World War II experience for lessons for the future, Marshal of Signal Troops I. Peresyfkin, the senior Red Army communications officer, writes that during the 1941–45 war "the commanding generals of large strategic formations constantly devoted attention to communications center field fortifications, camouflage, security and defense, as well as restricting the number of persons with knowledge of their location."

These measures appear to be in use today. Marshal Peresyfkin also notes that "communications center equipment at the front CP was . . . carefully camouflaged; special trucks and vehicle-mounted radio sets were positioned in open pits and carefully camouflaged, internal telephone communications cables were laid in special trenches and covered with turf. . . . The com-

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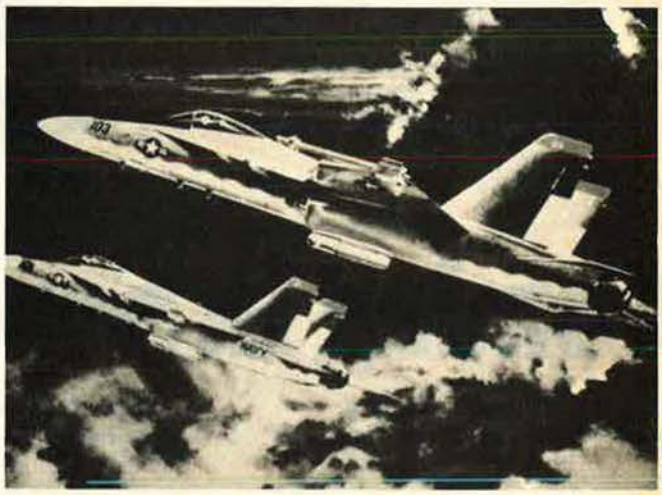

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manding general of the front was constantly assigning special aircraft to inspect the control facility sites and their camouflage, with the pilots reporting back to the commander. . . . Deficiencies noted from the air were immediately corrected."

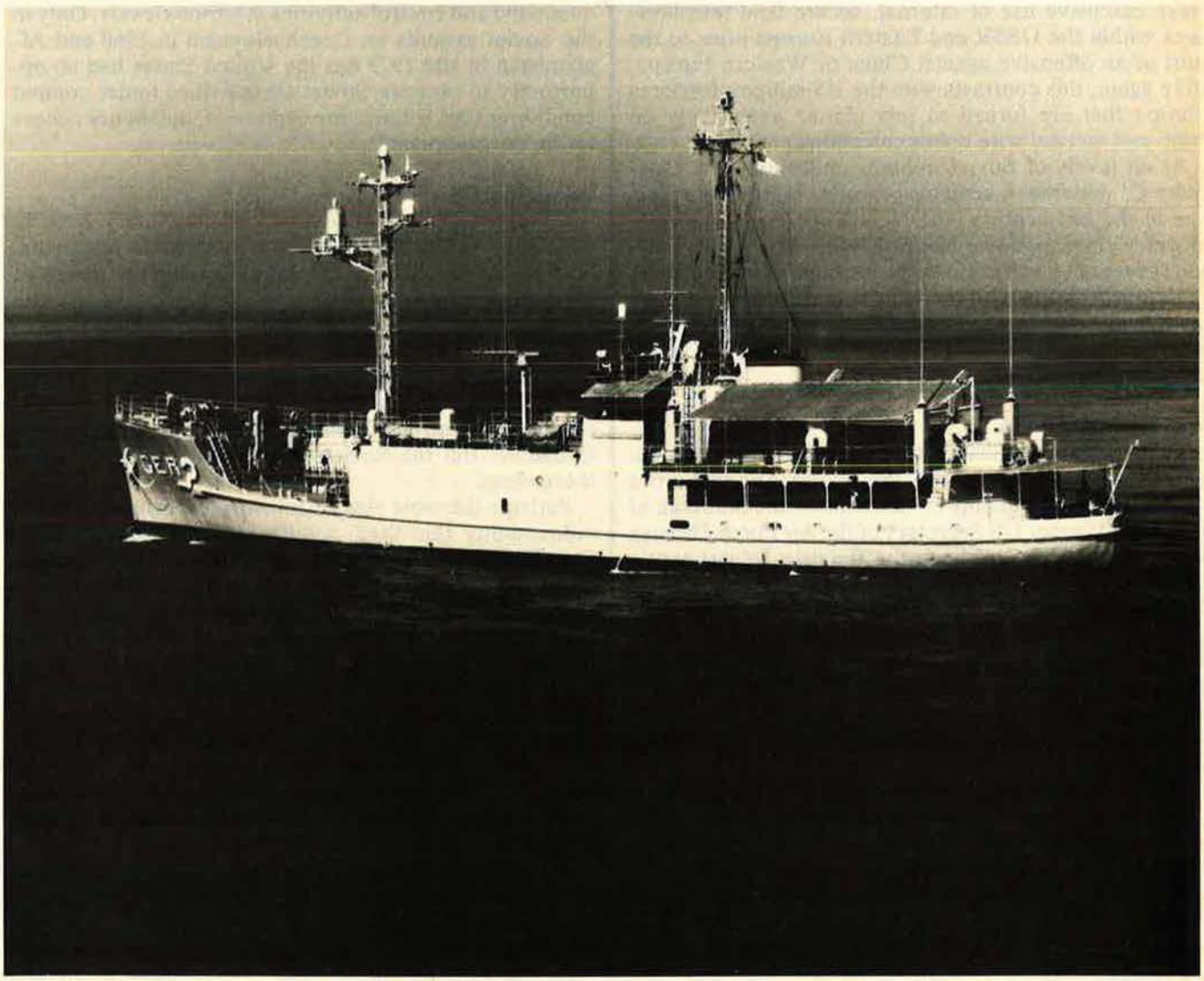
Dispersal is provided in Soviet military C^3 by several means, including redundancy (*see below*). The dispersal requirement means an increase in communications equipment and personnel requirements, as well as forces for physical security of C^3 facilities. The Soviets are willing to pay the price.

Hardness—for survivability against nuclear and chemical weapons as well as conventional ones—is found at many levels on Soviet C^3, especially for commanders of large troop formations, and for virtually all units that have or control nuclear weapons.

Mobility is similarly provided at all echelons of Soviet C^3, to some extent as an alternative to hardness, as the Soviets tend to provide for all aspects of survivability. At the highest levels of command are aircraft configured for the NEACP role. In the Navy, mobility is provided, in part, by two large (19,200-ton) cruisers, the *Zhdanov* and *Admiral Senyavin,* that have been specifically converted to provide working spaces, communications, and accommodations for a senior admiral and his staff. These ships can provide C^3 facilities for the direction of complex, large-scale military operations in areas distant from the Soviet Union.

Within Soviet Ground Forces, there are extensive mobile C^3 facilities, designed to provide troop commanders with full capabilities as their units move forward on the offensive. In this regard, Soviet signal units are equipped to rapidly lay wire to provide advancing commanders with hard-wire telephone and telegraph services as well as the use of radio. Mobile communications are provided in some instances up to the level of the front (army group) commander. These include their own power generators as well as radio and wire communications equipment.

Redundancy is provided at all echelons of command. All major commands and units operate a main command post and a rear CP, with both having similar capabilities and both maintaining a full "plot" of the situation. In addition, some commands have alternate communications centers a few miles from the main communications facility at the CP, "capable of fully replacing the principal facility if necessary," according to Soviet literature.



Soviet anti-C^3 activities have been aided by the North Korean capture of the intelligence ship USS Pueblo *(GER-2) in 1968 and large amounts of communications and cryptologic equipment when South Vietnam fell in 1975.*

Again, the cost in equipment and personnel is considerable.

To the extent possible, duplicate communications nets—radio and wire—are established to provide physical, jamming, and intercept survivability.

Communications Security

A related aspect of Soviet C^3 survivability is communications security (COMSEC)—caution in what is transmitted, when, and where. Lack of COMSEC was a major factor in the heavy Russian losses to the Germans in World War I. In the key Tannenberg campaign of August–September 1914, the Russians were completely routed by smaller German forces that were kept fully informed of Russian radio messages transmitted in the clear. The Tsarist officers, with limited knowledge and interest in radio communications, had a total disregard for communications security, while the German leadership was keenly aware of the value of both radio security and intercept.

Radio (and radar) silence is rigidly enforced in the Soviet Armed Forces. Transmissions are used astutely with the maximum use being made of prior coordination and visual signals. Most significant, the Soviets can make extensive use of internal, secure land telephone lines within the USSR and Eastern Europe prior to the start of an offensive against China or Western Europe. Here again, this contrasts with the US military forces in Europe that are forced to rely almost exclusively on radio and tactical wire communications.

At all levels of Soviet military endeavor—but especially C^3 activities—secrecy prevails. Marquis de Custine in the last century, the New York *Times's* former Moscow correspondent Hedrick Smith in our own time, and scores of observers in between, have marveled at the Russian obsession with secrecy. This attitude toward secrecy and deception is deeper rooted than most Westerners comprehend—and is directly applicable to military communications.

Anti-C^3 Operations

These efforts to enhance C^3 survivability in part are a reflection of the importance the Soviet Armed Forces place on attacking enemy C^3 activities at the outbreak of a conflict. Former US Secretary of the Air Force Thomas Reed, who earlier had been the Defense Department's Director of Telecommunications and Command and Control Systems, has stated that, "in view of our extreme dependence upon communications and radars, I believe we must take the Soviet EW [electronic warfare] threat very seriously. They carefully worked out a plan designed to 'divide and conquer' by denying our eyes and ears, and then overrunning a disorganized and uncoordinated NATO defense."

More recently, William Schneider, the astute aide to Congressman Jack Kemp, has pointed out the "double irony" of the situation: "The United States has not only failed to fully exploit electronics as an instrument of warfare, but has allowed its entire concept of operations to revolve about a highly sophisticated and centralized scheme of command that depends heavily on radio-communications (*i.e.*, voice, teleprinter, and data) with deployed forces.

"The Soviets," continues Schneider, "apparently recognizing this high degree of centralization, have developed a scheme of electronic warfare that threatens the ability of the US [commanders] to successfully communicate with their forces deployed in the field due to Soviet electronic warfare tactics."

Writing in late 1979, Mr. Schneider pointed out that the United States continues to lack a doctrine adequate to the magnitude of the problem and risks "catastrophic failure because of the [US] inability to communicate successfully during combat operations."

The Soviet anti-C^3 planning is considerable, with many units and weapons targeted against communications centers. Beyond that, there are major jamming systems plus the development and deployment of antisatellite systems, aimed at US communications as well as reconnaissance satellites.

Soviet anti-C^3 activities have been aided by the capture of the intelligence ship *Pueblo* by North Korean forces and the availability of probably a large amount of US communications and cryptologic equipment when South Vietnam fell. Of course, the long and intensive US participation in the Vietnam War provided the Soviets with an excellent laboratory in which to observe US command and control activities at various levels. Only in the Soviet assaults on Czechoslovakia in 1968 and Afghanistan in late 1979 has the United States had an opportunity to observe Soviet C^3 activities under combat conditions (but without the capture of, and hence access to, Soviet equipment).

Summing Up

C^3 represents one of several critical military areas in which the USSR has devoted considerable resources, both to develop its own C^3 and to develop the means of disrupting allied C^3 activities. In both respects the Soviets appear to be significantly ahead of US forces in most deployed capabilities.

The Soviets do lag behind the United States in several technologies, among them data communication links, automated control of combat forces, and satellite performance. But the Soviets are making strides in all of these areas.

Perhaps the most significant Soviet C^3 shortfall is the vulnerability that their culture has given them. Adm. Stansfield Turner, the Director of Central Intelligence, has observed: "The Soviets have a command structure that goes all the way up the line and is very tightly controlled because of the different kind of society that they live in. If we can break their command structure in an early stage of a war, they probably are less flexible in responding, though they do, in contrast to that, have more redundancy in their system than we do. They probably have more alternate command structures. But I suspect the individual—to put it in my own terms—ship captain out at sea is on a much tighter tether than would be ours."

But the systems operational concepts and tactics must be developed to interrupt this Soviet command structure, while at the same time US C^3 activities must be made more secure against Soviet interception, deception, jamming, and destruction. US progress in this direction has been slow, frighteningly slow. ■

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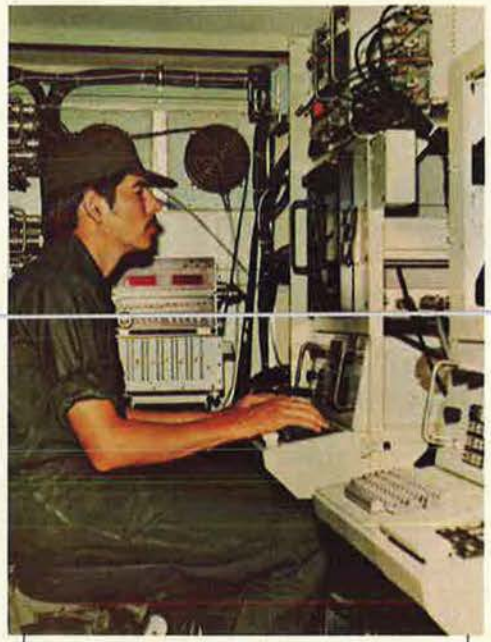

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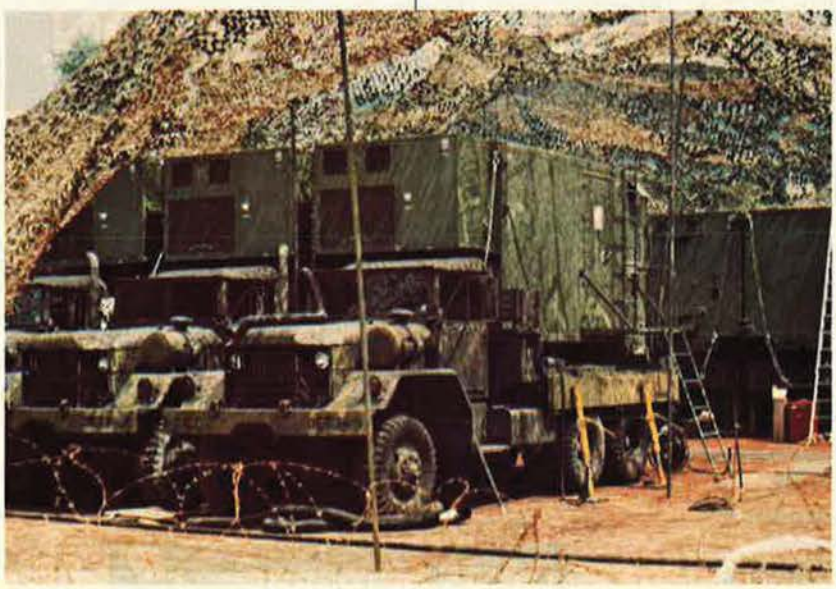

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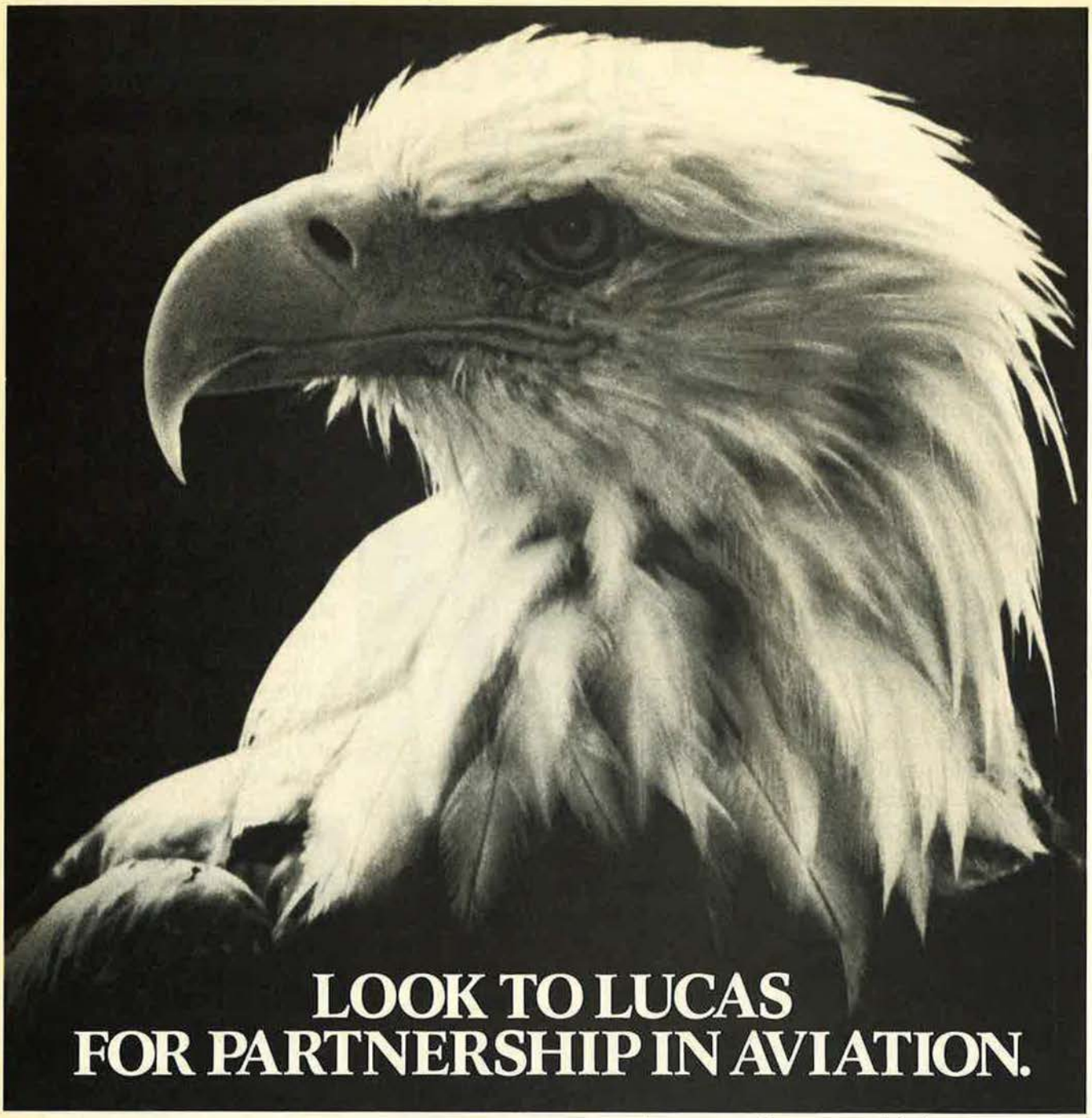

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The Grupo Fabricación (Fabrication Group) of the FMA is currently producing the nationally-designed IA 58A Pucará counter-insurgency aircraft, 60 of which have been ordered by the Argentinian Air Force. Forty of these had been delivered by 1 March 1980. Also on order are 40 examples of a developed version, the IA 58B Pucará Bravo.

IA 58B PUCARÁ BRAVO

Design of this improved version of the Pucará started in September 1977, and construction of a prototype began 12 months later. This aircraft (AX-05) flew for the first time on 15 May 1979, and made its public debut at the Paris Air Show in May/June of that year. A total of 40 has been ordered by the Argentinian Air Force, and production of these is scheduled to begin in early 1981.

The airframe and power plant remain essentially the same as for the IA 58A, except for deepening of the forward fuselage to accommodate a heavier nose armament. Other improvements include a new avionics installation.

TYPE: Twin-turboprop counter-insurgency aircraft.

WINGS: Cantilever low-wing monoplane. Wing section NACA 64_2A215 at root, NACA 64_1A212 at tip. Dihedral 7° on outer panels. Incidence 2°. No sweepback. Conventional semi-monocoque fail-safe structure of duralumin. Frise-type fabric-covered duralumin ailerons, and all-dural slotted trailing-edge flaps, actuated by pushrods. No slats. Balance tab in starboard aileron, electrically-operated trim tab in port aileron.

FUSELAGE: Conventional semi-monocoque fail-safe structure consisting of duralumin frames and stringers.

TAIL UNIT: Cantilever semi-monocoque structure of duralumin. Fixed-incidence tailplane and elevators mounted near top of fin. Rudder and elevators actuated by pushrods, and each fitted with inset trim tab.

LANDING GEAR: Retractable tricycle type. All units retract forward hydraulically, steerable nose unit into fuselage, main units into engine nacelles. Shock-absorbers of Kronprinz Ring-Feder type on all units. Single wheel on nose unit, twin wheels on main units, all with Dunlop Type III tubeless tyres, size 7.50-10, pressure 3.10 bars

This view of the Pucara Bravo shows clearly the deepened front fuselage, housing larger guns

(45 lb/sq in). Dunlop hydraulic disc brakes on main units. No anti-skid units.

POWER PLANT: Two 761 kW (1,022 ehp) Turbomeca Astazou XVI G turboprop engines, each driving a Hamilton Standard 23LF/1015-0 three-blade metal propeller with spinner. Fuel in two fuselage tanks (total 782 litres; 172 Imp gallons) and one 238.75 litre (52.5 Imp gallon) self-sealing tank in each wing, giving overall internal capacity of 1,259.5 litres (277 Imp gallons). Refuelling point on top of fuselage aft of cockpit. Fuel system includes provision for up to 30 s of inverted flight. A long-range auxiliary tank, capacity 1,200 litres (264 Imp gallons), can be attached to the fuselage centreline pylon, and a 330 litre (72.5 Imp gallon) auxiliary tank on each underwing pylon. Max internal and external fuel capacity 3,119.5 litres (686 Imp gallons). Oil capacity 11.75 litres (2.6 Imp gallons).

ACCOMMODATION: Pilot and co-pilot in tandem on Martin-Baker Mk AP06A zero-zero ejection seats beneath transparent moulded canopy which is hinged at rear and opens upward. Rear seat elevated 25 cm (9.8 in) above front seat. Bullet-proof windscreen, with wiper. Dual controls standard.

SYSTEMS: Hydraulic system, pressure 207 bars (3,000 lb/sq in), supplied by two engine-driven pumps, actuates landing gear, flaps, and wheel brakes. Electrical system includes two 28V 175A starter/generators for DC power; two 250VA static inverters for 115/26V AC power, and one giving 1,000/200V AC for windscreen demisting/de-icing. One 24V 36Ah SAFT Voltabloc battery. Liquid oxygen bottle. No APU, pneumatic, or wing/tail de-icing systems.

AVIONICS AND EQUIPMENT: Standard avionics include Collins 718US HF/AM SSB and Bendix VHF/AM radio; Bendix VOR/ILS, ADF, DME, and ATC/IFF. Optional avionics include Bendix VHF/FM with homing, Omega, and radar. Blind-flying instrumentation standard.

ARMAMENT: Two 30 mm DEFA 553 cannon, each with 140 rds, in underside of forward fuselage; and four 7.62 mm FN-Browning machine-guns, each with 900 rds, in fuselage sides abreast of cockpit. One underfuselage and two underwing hardpoints for up to twelve 125 kg bombs; one 30 mm Dassault gun pod, plus four Alkan 530 rocket launchers or two drop-tanks; or six Alkan 530 launchers; or three drop-tanks.

DIMENSIONS, EXTERNAL:

Wing span	14.50 m (47 ft 6¾ in)
Wing chord at root	2.24 m (7 ft 4¼ in)
Wing chord at tip	1.60 m (5 ft 3 in)
Wing aspect ratio	6.95
Length overall	14.25 m (46 ft 9 in)
Length of fuselage	13.68 m (44 ft 10½ in)
Fuselage: Max width	1.24 m (4 ft 0¾ in)
Max depth	2.10 m (6 ft 10¾ in)
Height overall	5.36 m (17 ft 7 in)
Tailplane span	4.70 m (15 ft 5 in)
Wheel track (c/l of shock-absorbers)	4.20 m (13 ft 9¼ in)
Wheelbase	3.48 m (11 ft 5 in)
Propeller diameter	2.59 m (8 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.85 m (9 ft 4¼ in)
Max width	0.81 m (2 ft 8 in)
Max height	1.25 m (4 ft 1¼ in)
Floor area	2.90 m² (31.2 sq ft)
Volume	2.74 m³ (96.8 cu ft)

AREAS:

Wings, gross	30.30 m² (326.1 sq ft)
Ailerons (total)	3.29 m² (35.41 sq ft)
Trailing-edge flaps (total)	3.58 m² (38.53 sq ft)
Fin	3.465 m² (37.30 sq ft)
Rudder, incl tab	1.565 m² (16.84 sq ft)
Tailplane	4.60 m² (49.51 sq ft)
Elevators, incl tabs	2.612 m² (28.11 sq ft)

WEIGHTS AND LOADINGS:

Max weapons load	1,686 kg (3,717 lb)
Max fuel load: internal	1,005 kg (2,215 lb)
external	1,250 kg (2,755 lb)
Max T-O weight	6,800 kg (14,991 lb)
Max zero-fuel weight	4,546 kg (10,022 lb)
Max landing weight	5,600 kg (12,345 lb)
Max wing loading	224.4 kg/m² (46 lb/sq ft)
Max power loading	4.46 kg/kW (7.3 lb/ehp)

PERFORMANCE (at max T-O weight except where indicated):

Never-exceed speed	404 knots (750 km/h; 466 mph)
Max level speed at 1,000 m (3,280 ft)	252 knots (467 km/h; 290 mph)
Max cruising speed at 1,000 m (3,280 ft)	237 knots (440 km/h; 273 mph)
Stalling speed, flaps up	107 knots (198 km/h; 123 mph)
Stalling speed, flaps down, power reduced	86 knots (159 km/h; 99 mph)
Max rate of climb at S/L	660 m (2,165 ft)/min
Climbing speed at S/L, one engine out	182 knots (338 km/h; 210 mph)
Service ceiling	7,400 m (24,275 ft)
Service ceiling, one engine out	2,300 m (7,550 ft)
T-O run	710 m (2,330 ft)
T-O to 15 m (50 ft)	1,040 m (3,412 ft)
T-O to 15 m (50 ft) at 5,800 kg (12,787 lb) gross weight	750 m (2,460 ft)
Landing from 15 m (50 ft) at max landing weight	605 m (1,985 ft)
Landing run at max landing weight	470 m (1,542 ft)
Range with max internal and external fuel	1,620 nm (3,000 km; 1,865 miles)

CESSNA

CESSNA AIRCRAFT COMPANY, Head Office and Works: Wichita, Kansas 67201, USA

CESSNA MODEL 425 CORSAIR

Cessna has introduced for 1980 a new twin-turboprop business aircraft which is based on the airframe of the Model 421 Golden Eagle. Design of this new light transport began on 1 November 1977, and construction of a prototype was initiated three months later, on 30 January 1978. This flew for the first time on 12 September 1978, and construction of a pre-production example was started during 1979. Initial deliveries of production aircraft were scheduled to be made almost immediately after FAA certification had been gained, the certification programme being scheduled for completion by mid-1980. All available details follow:

The new Cessna Model 425 Corsair, a turboprop development of the piston-engined Model 421 Golden Eagle

TYPE: Six/eight-seat pressurised light aircraft.

WINGS: Cantilever low-wing monoplane. Wing section NACA 23018-63 (modified) at root, NACA 23009-63 (modified) at tip. Dihedral 5° on outer panels. Incidence 2° 30' at root, −0° 30' at tip. All-metal two-spar structure of light alloy, with stamped ribs and surface skins reinforced with spanwise stringers. Outer wing panels of bonded construction. All-metal ailerons and electrically-operated trailing-edge split flaps. Trim tab in port aileron. Optional pneumatic de-icing of wing leading-edges.

FUSELAGE: Conventional all-metal semi-monocoque structure, with fail-safe construction in the pressurised section.

TAIL UNIT: Conventional all-metal cantilever structure, with sweptback vertical surfaces. Tailplane has dihedral of 12°. Trim tab in starboard elevator, with dual heavy-duty actuator. Trim tab in rudder. Optional pneumatic de-icing of fin and tailplane leading-edges.

LANDING GEAR: Hydraulically-retractable tricycle type, main units retracting inward, nosewheel aft. Oleo-pneumatic shock-absorbers, with main units of articulated (trailing link) type. Steerable nosewheel. Single wheel on each unit. Main wheel tyres size 6.50-10, 8 ply rating, pressure 4.83 bars (70 lb/sq in). Nosewheel tyre size 6.00-6, 6 ply rating, pressure 2.42 bars (35 lb/sq in).

POWER PLANT: Two Pratt & Whitney Aircraft of Canada PT6A-112 turboprop engines, flat rated to 335.6 kW (450 shp), each driving a wide-chord three blade constant speed fully feathering and reversible-pitch metal propeller. Fuel contained in integral tanks in outer wing panels, nacelle cells, and inboard collector tanks, with a combined capacity of 1,389 litres (367 US gallons). Refuelling point above each engine nacelle. Oil capacity 10.4 litres (2.75 US gallons). Engine inlet ducts have a separator mechanism to prevent ingestion of water. Propeller de-icing and synchroniser standard. Engine fire detection system standard.

ACCOMMODATION: Two seats side by side in pilot's compartment, with dual controls. Optional curtain, or solid divider with curtain, to separate pilot's compartment from main cabin. Standard seating provides for four passengers, but optional arrangements have the front passenger seats facing aft and forward-facing seventh and eighth seats. Optional equipment includes storage drawers, refreshment centre, tables, toilet, radio telephone, stereo system, and aft cabin divider. Door, of two-piece type with built-in airstairs in bottom section, on port side of cabin at rear. Plug-type emergency escape hatch overwing on starboard side of cabin. Foul weather windows on each side of fuselage for pilot and co-pilot. Baggage accommodated in nose with external access doors, capacity 272 kg (600 lb), and in rear of cabin area, capacity 227 kg (500 lb). Total baggage capacity 499 kg (1,100 lb). Accommodation is pressurised, heated, and air-conditioned.

SYSTEMS: Freon air-conditioning system of 17,500 BTU capacity, plus engine bleed air and electric boost heating. Pressurisation system with max differential of 0.35 bars (5.0 lb/sq in) provides a 3,050 m (10,000 ft) cabin altitude to 8,075 m (26,500 ft). Electrical system includes a 28V 250A starter/generator on the starboard engine and a 40Ah nickel-cadmium battery. Hydraulic system for operation of landing gear and brakes. Vacuum system for blind-flying instrumentation and optional wing and tail unit de-icing. Oxygen system standard.

AVIONICS AND EQUIPMENT: Standard avionics include Cessna Series 400 dual nav/coms, dual glideslope, ADF, DME, marker beacon, transponder, and encoding altimeter; Series 1000 autopilot with 3 in HSI, and yaw damper, audio panel, basic avionics kit, avionics cooling kit, and all associated antennae. Optional avionics include Cessna Series 1000 equipment or Collins Pro Line. Standard equipment includes flight hour recorder; co-pilot's blind-flying instrumentation; cabin pressure control system; emergency locator transmitter; cabin fire extinguisher; starboard landing light; navigation, taxi, and strobe lights; external power socket, nosewheel fender, and static wicks.

DIMENSIONS, EXTERNAL:

Wing span	13.45 m (44 ft 1½ in)
Wing chord at root	1.77 m (5 ft 9¾ in)
Wing chord at tip	1.21 m (3 ft 11¾ in)
Wing mean aerodynamic chord	1.59 m (5 ft 2¾ in)
Wing aspect ratio	8.65
Length overall	11.09 m (36 ft 4½ in)
Height overall	3.84 m (12 ft 7¼ in)
Tailplane span	6.03 m (19 ft 9½ in)
Wheel track	5.28 m (17 ft 3¾ in)
Wheelbase	3.20 m (10 ft 6 in)
Propeller diameter	2.37 m (7 ft 9½ in)
Propeller ground clearance	0.23 m (9¼ in)
Passenger door: Height	1.30 m (4 ft 3¼ in)
Width	0.63 m (2 ft 8 in)
Height to sill	1.21 m (3 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.42 m (14 ft 6 in)
Max width	1.40 m (4 ft 7 in)
Max height	1.29 m (4 ft 3 in)
Volume	6.11 m³ (215.6 cu ft)

AREAS:

Wings, gross	20.90 m² (224.98 sq ft)
Fin	2.37 m² (25.53 sq ft)
Rudder (incl tab)	1.46 m² (15.72 sq ft)
Horizontal tail surfaces	5.76 m² (61.99 sq ft)

WEIGHTS AND LOADINGS (preliminary data):

Weight empty, equipped	2,198 kg (4,846 lb)
Max fuel weight	1,115 kg (2,459 lb)
Max T-O weight	3,719 kg (8,200 lb)
Max ramp weight	3,753 kg (8,275 lb)
Max zero-fuel weight	3,057 kg (6,740 lb)
Max landing weight	3,629 kg (8,000 lb)
Max wing loading	177.94 kg/m² (36.45 lb/sq ft)
Max power loading	5.54 kg/kW (8.70 lb/shp)

PERFORMANCE (at max T-O weight, preliminary data):

Never-exceed speed
Mach 0.52 (240 knots; 445 km/h; 277 mph) CAS
Max cruising speed at 5,700 m (18,700 ft)
264 knots (489 km/h; 304 mph)
Stalling speed, flaps up, power off
87 knots (161 km/h; 100 mph) CAS
Stalling speed, flaps down, power off
77 knots (143 km/h; 89 mph) CAS

Max rate of climb at S/L	575 m (1,888 ft)/min
Rate of climb at S/L, one engine out	130 m (425 ft)/min
Service ceiling	10,365 m (34,000 ft)
Service ceiling, one engine out	5,790 m (19,000 ft)
T-O run	561 m (1,840 ft)
T-O to 15 m (50 ft)	701 m (2,300 ft)
Landing from 15 m (50 ft)	771 m (2,530 ft)
Landing run	427 m (1,400 ft)

Range with max fuel at max cruising power, allowances for start, taxi, T-O, climb to cruise altitude, descent, and 45 min reserves at max cruising power:
at 8,075 m (26,500 ft)
1,263 nm (2,341 km; 1,455 miles)
at 9,145 m (30,000 ft)
1,409 nm (2,611 km; 1,622 miles)

Range with max fuel at max range power, allowances as above, and 45 min reserves at max range power:
at 8,075 m (26,500 ft)
1,585 nm (2,937 km; 1,825 miles)

SUKHOI

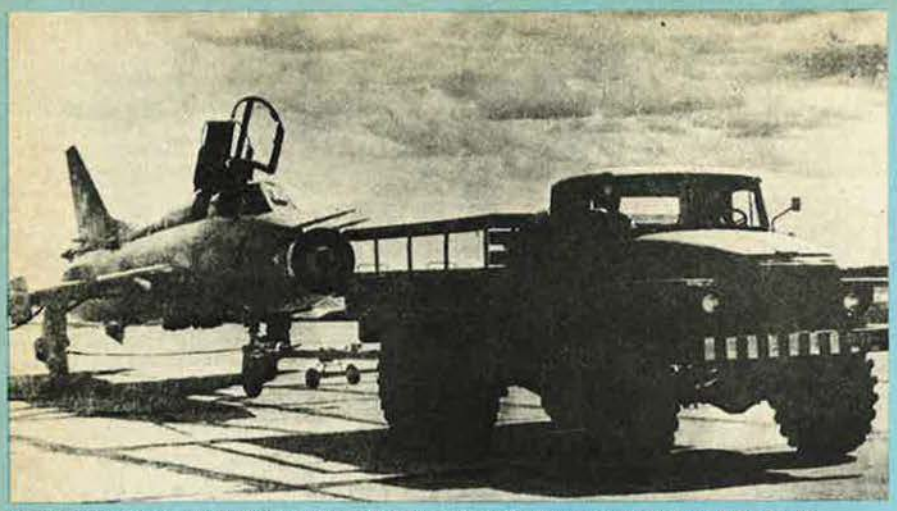
SUKHOI DESIGN BUREAU; USSR

SUKHOI Su-17, Su-20, and Su-22
NATO reporting names: Fitter-C and -D

The variable-geometry Su-17, with more powerful engine and improved avionics, is in a completely different class from the veteran Su-7 ('Fitter-A'). The prototype was an R&D aircraft shown at the Soviet Aviation Day display at Domodedovo Airport, Moscow, in July 1967, and was allocated the NATO reporting name 'Fitter-B'. Only some 4.0 m (13 ft) of each wing was pivoted, outboard of a very large fence, the remainder of the airframe being virtually identical with that of the Su-7. An attachment for an external store was built into each wing fence, but the power plant appeared to be unchanged and there was no reason to expect 'Fitter-B' to form the basis of a production aircraft, in view of the modest improvement in overall performance offered by such minimal modification.

Discovery of at least one or two squadrons of "improved 'Fitter-Bs' " in service with the Soviet tactical air forces in 1972 came as a surprise, suggesting that even a small improvement in range and endurance by comparison with the fuel-thirsty Su-7 was considered worthwhile. Only after several years did the true measure of improvement become apparent. The combination of a more powerful engine and the variable-geometry wings permitted a doubled external load to be lifted from strips little more than half as long as those needed by the Su-7, and to be carried about 30% further. Added to new avionics, this made the Su-17 so attractive that about 650 are deployed currently by Soviet tactical air forces, and by Soviet Naval Aviation units as-

Close-up of the nose of a 'Fitter-D' model of the Sukhoi Su-17, showing clearly for the first time the undernose radome and the laser marked target seeker in the undersurface of the intake centrebody



Poor-quality photograph of the new, and so far unidentified, two-seat version of the Su-17

signed to anti-shipping strike and amphibious support roles in the Baltic Sea area. Differences between the various versions identified to date are as follows:

Su-17 ('Fitter-C'). Basic single-seat attack aircraft for Soviet Air Force, with Lyulka AL-21F-3 turbojet, offering better specific fuel consumption than AL-7F-1 of Su-7. Detailed description applies to this version.

Su-17 ('Fitter-D'). Generally similar to 'Fitter-C', but forward fuselage lengthened by about 0.38 m (1 ft 3 in). Added undernose radome. Laser marked target seeker in intake centrebody.

Su-20 ('Fitter-C'). Export counterpart of Soviet basic 'Fitter-C', with reduced equipment standard. Variations in rear fuselage contours by comparison with Su-17 suggest a different engine, possibly the Su-7's AL-7F-1 afterburning turbojet (98.1 kN; 22,046 lb st). Supplied to Algeria, Czechoslovakia, Egypt, Iraq, Libya, and Poland.

Su-22 ('Fitter-C'). Variant of Su-20 first delivered to Peru in 1977 and subsequently to Syria. Further reduced equipment standard, with Sirena 2 limited-coverage radar warning receiver, virtually no navigation aids, and IFF incompatible with Peru's SA-3 (NATO 'Goa') surface-to-air missiles. Weapons include 'Atoll' air-to-air missiles.

In early 1980, a photograph of a tandem two-seat version of the Su-17 was published in the Soviet press. The rear cockpit appears to be slightly raised, as it is in two-seat versions of the Su-7 and Su-15 (NATO 'Flagon-C'). However, the rearward-hinged canopy is 'solid' except for a window at the front on each side, which would not be compatible with a normal training role. The width and depth of the dorsal spine are increased aft of the rear canopy. To compensate for added side area forward, a ventral fin has been added and the size of the dorsal fin increased.

TYPE: Single-seat ground attack fighter.

WINGS: Cantilever mid-wing monoplane, with wide-span fixed centre-section and manually-actuated variable-geometry outer panels, with min sweep angle of 28° and max sweep angle of 62° approx. Centre-section appears to be generally similar to inner wings of Su-7, except for slight sweepback on trailing-edge of area-increasing centre-section flaps. Outboard of these flaps, centre-section trailing-edge is swept to align with trailing-edge of outer panels when they are fully swept. Full-span leading-edge slats on movable panels. Entire trailing-edge of each movable panel made up of a slotted flap, operable only when the wings are spread, and a slotted aileron operable at all times. Large main fence on each side, at junction of fixed and movable panels, is square-cut at front and incorporates attachments for external stores. Shorter fence above centre-section on each side, inboard of main fence.

FUSELAGE: Conventional all-metal semi-monocoque structure of circular section. Large dorsal spine fairing along top of fuselage, from canopy to fin. Ram-air intake in nose, with variable shockcone centrebody. Four door-type airbrakes, at top and bottom on each side of rear fuselage, forward of tailplane. Pitot on port side of nose; transducer to provide data for fire control computer on starboard side.

TAIL UNIT: Cantilever all-metal structure, with sweepback on all surfaces. All-moving horizontal surfaces, with anti-flutter body projecting forward on each side near tip. Conventional rudder. No tabs.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Nosewheel retracts forward, requiring blistered door to enclose it. Main units retract inward into centre-section. Container for twin brake-chutes between the base of the rudder and the tailpipe.

POWER PLANT: One Lyulka AL-21F-3 turbojet engine, rated at 80.1 kN (18,000 lb st) dry and 109 kN (24,500 lb st) with afterburning. Fuel capacity increased to 4,550 litres (1,000 Imp gallons) by added tankage in dorsal spine fairing. Provision for carrying up to four 800 litre (176 Imp gallon) drop-tanks on outboard wing pylons and under fuselage. When underfuselage tanks are carried, only the two inboard wing pylons may be used for ordnance, to a total weight of 1,000 kg (2,204 lb).

ACCOMMODATION: Pilot only, on ejection seat, under rearward-hinged transparent canopy. Rearview mirror above canopy.

ARMAMENT: Two 30 mm NR-30 guns, each with 70 rds, in wing-root leading-edges. Total of eight weapon pylons (two tandem pairs under fuselage, one under each centre-section leading-edge, one under each main wing fence) for up to 5,000 kg (11,023 lb) of bombs, rocket pods, and guided missiles such as the air-to-surface AS-7 (NATO 'Kerry').

AVIONICS AND EQUIPMENT: SRD-5M (NATO 'High Fix') radar in intake centrebody; ASP-5ND fire control system; Sirena 3 radar homing and warning system providing 360° coverage, with antennae in slim cylindrical housing above brake-chute container and in each centre-section leading-edge, between fences; SRO-2M IFF; SOD-57M ATC/SIF, with transponder housing beneath brake-chute container; RSIU-5/R-831 VHF/UHF and R5B-70 HF.

DIMENSIONS, EXTERNAL (estimated):

Wing span: fully-spread	14.00 m (45 ft 11¼ in)
fully-swept	10.60 m (34 ft 9½ in)
Wing aspect ratio: fully-spread	4.9
fully-swept	3.0
Length overall, incl probes	18.75 m (61 ft 6¼ in)
Fuselage length	15.40 m (50 ft 6¼ in)
Height overall	4.75 m (15 ft 7 in)

AREAS (estimated):

Wings, gross: fully-spread	40.1 m² (431.6 sq ft)
fully-swept	37.2 m² (400.4 sq ft)

WEIGHTS (estimated):

Weight empty	10,000 kg (22,046 lb)
Max internal fuel	3,700 kg (8,157 lb)
T-O weight, 'clean'	14,000 kg (30,865 lb)
Max T-O weight	17,700 kg (39,020 lb)

PERFORMANCE (estimated for 'clean' aircraft, 60% internal fuel, except where indicated):

Max level speed at height	Mach 2.17
Max level speed at S/L	Mach 1.05
Touchdown speed	143 knots (265 km/h; 165 mph)
Max rate of climb at S/L	13,800 m (45,275 ft)/min
Service ceiling	18,000 m (59,050 ft)
T-O run at AUW of 17,000 kg (37,478 lb)	620 m (2,035 ft)
T-O to 15 m (50 ft) at AUW of 17,000 kg (37,478 lb)	835 m (2,740 ft)
Landing run	600 m (1,970 ft)
Combat radius with 2,000 kg (4,409 lb) external stores:	
hi-lo-hi	340 nm (630 km; 391 miles)
lo-lo-lo	195 nm (360 km; 224 miles)

ALR

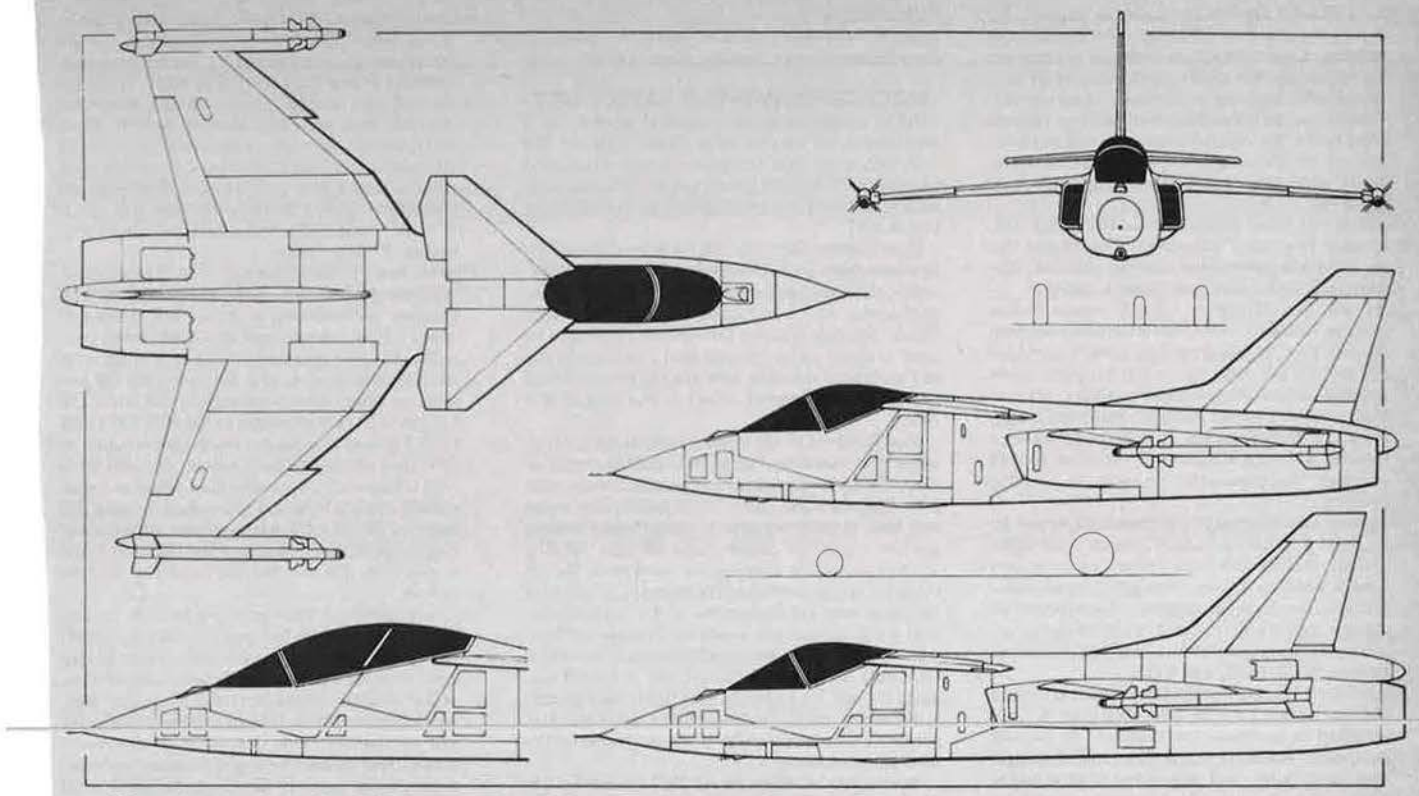
ARBEITSGRUPPE FÜR LUFT- UND RAUMFAHRT (Aerospace Task Force); Address: Postfach 63, CH-8050, Zürich, Switzerland

ALR PIRANHA

This group of Swiss scientists started work on the design of the Piranha in September 1977, in an attempt to develop a new-generation, lightweight supersonic combat aircraft at a cost that could be afforded by the world's less affluent air forces, so enabling them to embody both quality and quantity of new aircraft in their re-equipment programmes.

Primary missions of the Piranha are seen as: clear-weather, low/medium-altitude air defence; low-level FEBA strike, mainly under VFR condi-

Radio-controlled and powered 15% scale model of the Piranha in flight



Three-view drawing of the ALR Piranha 4, with additional side elevations of the Piranha 2D (bottom) and the two-seater cockpit (scrap view)
(Michael A. Badrocke)

tions; reconnaissance; electronic warfare; and operational training. A limited amount of active ECM and reconnaissance equipment is carried as standard, but all-weather interception and strike systems are not. This avoids the weight and performance penalties that such systems would inevitably attract, and keeps the pilot's workload to a minimum. STOL capability was considered essential, to permit operation from dispersed airfields with runways no more than 1,000 m (3,280 ft) long.

Principal design features include a short-coupled canard configuration, with all-moving foreplanes; shoulder-mounted wings, to provide an optimum stores attachment layout; fly-by-wire flight control; and a centrally-located high-performance gun. Other inherent advantages claimed for the Piranha are low procurement and operating costs, small radar and infra-red signatures, and transonic speed capability.

Details have been released of four basic proposed single-seat versions:

Piranha 2C. Transonic ground attack version, with single Rolls-Royce Turboméca Adour Mk 811 turbofan engine, rated at 24.6 kN (5,520 lb st) dry and 37.4 kN (8,400 lb st) with afterburning. No radar.

Piranha 2D. Combined ground attack/air superiority version of 2C, with more powerful RT.172-63 Adour turbofan rated at 29.2 kN (6,570 lb st) dry and 44.9 kN (10,100 lb st) with afterburning. General appearance shown in accompanying side-view drawing.

Piranha 4. Twin-engined ground attack/air superiority version, with two 15.5 kN (3,485 lb st) Turboméca-SNECMA Larzac 05 turbofan engines (each 25.0 kN; 5,620 lb st with afterburning) in shorter and wider fuselage. General appearance shown in accompanying three-view drawing.

Piranha 5. Similar to Piranha 4, but powered by two Garrett/Volvo Flygmotor TFE1042-7 turbofans (each 18.4 kN; 4,135 lb st dry, 30.2 kN; 6,800 lb st with afterburning).

Each of the above models could be produced in tandem two-seat form for ECM and training purposes. Preliminary design, and selection of the major systems, has been completed for the Piranha 2D and Piranha 4, and negotiations with several possible customers were under way in early 1980. At that time, the Piranha 4 was considered to be the principal version.

The following description applies to all currently-projected versions, except where specifically indicated otherwise:

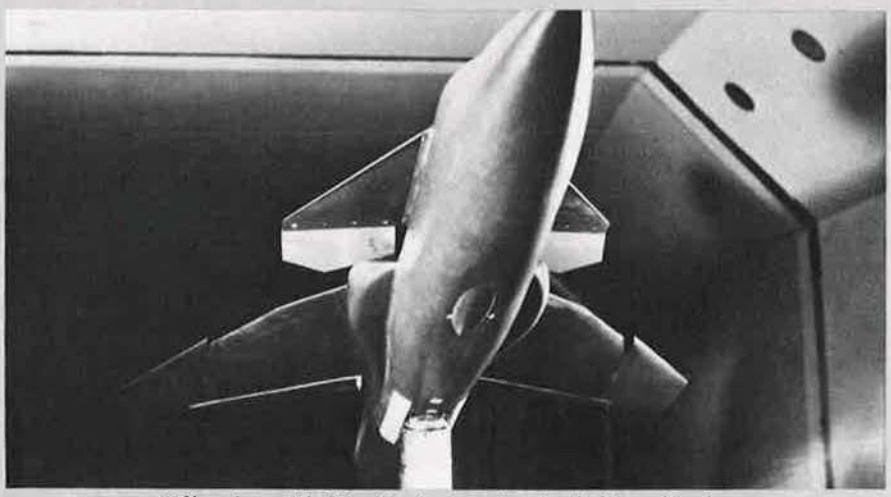
TYPE: Proposed multi-purpose lightweight combat aircraft.

WINGS: Tandem arrangement of shoulder-mounted, all-moving canard foreplanes, each with powered elevator on trailing-edge for pitch control. Immediately aft of foreplanes, and mounted slightly lower on fuselage, are low aspect ratio sweptback main wings, each with single flap/aileron ('flaperon') on trailing-edge. Main wings have compound sweep on leading-edges, which have extended chord outboard on outer panels. Thickness/chord ratio of main wings decreases from 5.5% at root to 4% at tip. Main wings have 4° of anhedral from roots, and are set at incidence of 1° 24'. Sweepback at quarter-chord 45° on outer panels, 31° on inner panels. Multi-spar main wings, which form torsion box passing through fuselage, are of light alloy construction with machined skins. Flaperons are of honeycomb sandwich construction. Fly-by-wire control of foreplanes, elevators, and flaperons. No tabs or slats.

FUSELAGE: Conventional metal semi-monocoque structure. Door-type airbrake in upper surface of rear fuselage on each side of fin.

TAIL UNIT: Vertical surfaces only, comprising sweptback fin (with small dorsal fin) and fly-by-wire powered rudder.

LANDING GEAR: Retractable type, of Dowty (Piranha 2) or Messier-Hispano-Bugatti design (Piranha 4 and 5), with single wheel on each unit; all units retract forward into fuselage. Nose unit offset from centreline to provide clear field of fire for centrally-mounted gun. Oleo-pneumatic shock-absorbers. Dowty gear for Piranha 2 has size 350 × 157 mm nosewheel tyre and 560 × 215 mm main-wheel tyres, all at nominal pressure of 8.6 bars (125 lb/sq in). Anti-skid units for all versions. Irvin braking parachute (9.5 m²; 102.3 sq ft or 13.0 m²; 140.0 sq ft) in bullet fairing on top of rear fuselage.



15% scale model of the Piranha for subsonic wind tunnel testing

POWER PLANT: One or two turbofan engines (for details see under model listings), installed in rear fuselage. Lateral intake on each side of fuselage, with auxiliary inlet doors, spring-loaded for low-speed and high-angle-of-attack manoeuvres. Fuel in one main fuselage tank and two integral wing tanks. Provision for one external auxiliary tank on underfuselage station and one on each inboard underwing station. No in-flight refuelling capability.

ACCOMMODATION: Single Martin-Baker Mk 10L ejection seat under rearward-sliding canopy; or, on ECM and operational training versions, tandem seats under sideways-opening canopy.

SYSTEMS: BAe Dynamics cockpit pressurisation system, with pre-cooler and two-wheel bootstrap cold-air unit. Triplex hydraulic system (pressure 207 bars; 3,000 lb/sq in), comprising two main systems and a pump-driven auxiliary system. Two generators, each of 12kVA minimum rating, for AC electrical power. Electrical fly-by-wire system, with four actuators powering all control surfaces. No pneumatic, oxygen, or de-icing systems.

AVIONICS AND EQUIPMENT (Piranha 2D, 4, and 5): Ferranti LINAS nav/attack system with lightweight inertial platform; laser rangefinder; Smiths head-up display; Ferranti Comed multi-purpose head-down display; Thomson-CSF Agave lightweight search/track/designation/telemetry/navigation radar; internally-mounted passive ECM, chaff, and flares.

ARMAMENT: One high-performance cannon (27 mm Mauser BK 27 or 30 mm Oerlikon KCA), mounted in underside of fuselage, on aircraft centreline, beneath cockpit. One underfuselage, four underwing, and two wingtip attachment points for air-to-surface weapons such as Maverick, Beluga, and Durandal; or air-to-air missiles such as AIM-9L Sidewinder and Matra Magic. Provision for active ECM and reconnaissance equipment to be carried in underfuselage pod.

DIMENSIONS, EXTERNAL (Piranha 4):

Wing span (excl missile rails)	6.49 m (21 ft 3½ in)
Wing aspect ratio	2.63
Foreplane span	3.14 m (10 ft 3½ in)
Length overall	10.50 m (34 ft 5½ in)
Height overall	4.12 m (13 ft 6¼ in)

AREAS:

Wings, gross (reference area)	16.00 m² (172.22 sq ft)
Flaperons (total)	1.28 m² (13.78 sq ft)
Foreplanes, gross (reference area)	4.57 m² (49.19 sq ft)
Elevators (total)	0.73 m² (7.86 sq ft)
Fin	3.33 m² (35.84 sq ft)
Rudder	0.56 m² (6.03 sq ft)

WEIGHTS AND LOADINGS (Piranha 4*):

Max external weapons/fuel load	approx 2,000 kg (4,410 lb)
Max T-O weight (air superiority configuration, with gun, ammunition, and two air-to-air missiles)	6,200 kg (13,668 lb)
Wing loading at T-O (air superiority configuration)	388 kg/m² (79.5 lb/sq ft)
Thrust/weight ratio (50% internal fuel)	greater than 1.0

PERFORMANCE (Piranha 4, estimated, at max T-O weight; other versions not significantly different):

Never-exceed speed	Mach 1.9
Max level speed at 11,000 m (36,100 ft)	Mach 1.8 (1,033 knots; 1,915 km/h; 1,190 mph)
Max rate of climb at S/L	more than 13,800 m (45,275 ft)/min
Service ceiling	16,000 m (52,500 ft)
T-O run at S/L, ISA (air superiority configuration)	less than 500 m (1,640 ft)
Landing run at S/L, ISA (minimum fuel, using brake 'chute)	less than 500 m (1,640 ft)
Range with typical combat load, incl 5 min combat (lo-lo-lo)	more than 189 nm (350 km; 217 miles)

* *2D slightly lighter, 5 heavier*

BEECHCRAFT

BEECH AIRCRAFT CORPORATION; Head Office and Main Works: Wichita, Kansas 67201, USA

BEECHCRAFT MARITIME PATROL 200T

After investigating the potential market for a maritime patrol version of its Super King Air 200 twin-turboprop light transport, Beech announced on 9 April 1979 that it had begun to flight test such an aircraft for FAA certification as the Maritime Patrol 200T.

In production form, the 200T will be equipped for missions such as monitoring exclusive economic zones, detecting pollution, inspecting offshore installations, and conducting search and rescue flights. Special missions for which it could also be used include aerial photography, environmental and ecological research, airways and ground-based navigation equipment checks, and ambulance duties.

Modifications to the standard Super King Air to adapt it to Maritime Patrol 200T configuration include fitting new outboard wing assemblies, with mountings for a 200.5 litre (53 US gallon) removable fuel tank at each wingtip; a strengthened landing gear to cater for higher take-off and landing weights; a bubble observation window in the aft cabin for visual search and photography; a hatch for dropping survival equipment; and a search radar with a full 360° scan in a radome beneath the fuselage. Advanced navigation equipment is available, especially for maritime patrol use; standard avionics include VLF/Omega which provides ground stabilisation and is coupled with the autopilot. This permits a search pattern to be programmed before take-off or en route.

Seven of 13 Maritime Patrol 200T aircraft bought by Japan's Maritime Safety Agency had been delivered by 1 March 1980. All available details follow:

TYPE: Twin-turboprop maritime patrol or multi-mission aircraft.

WINGS: Cantilever low-wing monoplane. Wing section NACA 23018.5 (modified) at root, NACA 23011.3 at tip. Dihedral 6°. Incidence 3° 48′ at root, −1° 7′ at tip. No sweepback at quarter-chord. Two-spar light alloy structure; outer wing panels redesigned to permit mounting of removable wingtip tanks. Conventional ailerons of light alloy construction, with trim tab in port aileron. Single-slotted trailing-edge flaps of light alloy construction. Pneumatic de-icing boots for wing leading-edges standard.

FUSELAGE: Light alloy semi-monocoque structure of safe-life design.

TAIL UNIT: Conventional cantilever T-tail structure of light alloy with swept vertical and horizontal surfaces. Fixed-incidence tailplane. Trim tab in each elevator. Anti-servo tab in rudder. Pneumatic de-icing boots standard, on leading-edge of tailplane only.

LANDING GEAR: Electrically-retractable tricycle type, with twin wheels on each main unit. Strengthened construction by comparison with standard Super King Air 200 to cater for higher take-off and landing weights. Single wheel on steerable nose unit, with shimmy damper. Main units retract forward, nosewheel aft. Beech oleo-pneumatic shock-absorbers. Goodrich main wheels and tyres size 18 × 5.5. Goodrich nosewheel size 6.50-10, with tyre size 22 × 6.75-10. Goodrich hydraulic multiple-disc brakes. Parking brake.

POWER PLANT: Two 634 kW (850 shp) Pratt & Whitney Aircraft of Canada PT6A-41 turboprop engines, each driving a three-blade constant-speed fully-feathering and reversible metal propeller. Bladder type fuel cells in each wing, with main system capacity of 1,461 litres (386 US gallons); auxiliary system capacity of 598 litres (158 US gallons); plus provision to mount a 200.5 litre (53 US gallon) removable tank at each wingtip, to provide a maximum fuel capacity of 2,460 litres (650 US gallons). Two refuelling points in upper surface of each wing and above each tip-tank. Oil capacity 29.5 litres (7.8 US gallons). Anti-icing of engine air intakes by hot air from engine exhaust is standard. Electro-thermal anti-icing for propellers.

ACCOMMODATION: Pilot and co-pilot side by side on flight deck, with full dual controls and blind-flying instrumentation. Partition with sliding door between flight deck and cabin, and partition at rear of cabin. Door at rear of cabin on port side, with integral airstair. Inward-opening emergency exit on starboard side over wing. Maintenance access door in rear fuselage; avionics compartment access doors in nose. Electrically-heated windscreens, hot air windscreen defroster, dual storm windows, sun visors, map pockets, and windscreen wipers. Cabin is air-conditioned and pressurised.

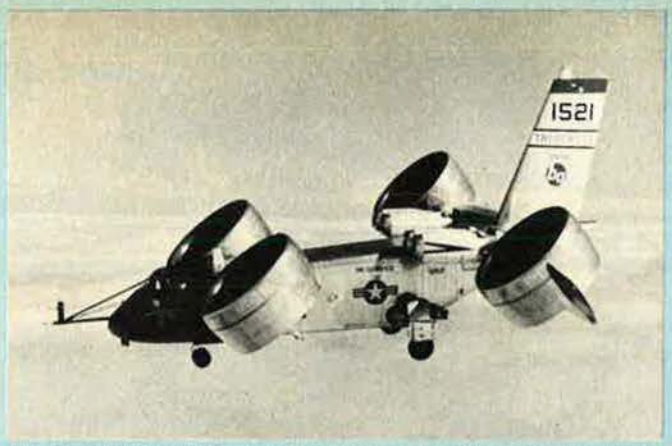
SYSTEMS: Cabin pressurisation by engine bleed air, with a maximum differential of 0.41 bars (6.0 lb/sq in). Cabin air-conditioner of 34,000 BTU capacity. Oxygen system. Dual vacuum system for instruments. Hydraulic system for brakes only. Pneumatic system for wing and tailplane de-icing. Electrical system includes two 250A 28V starter/generators and 24V 45Ah aircooled nickel-cadmium battery with failure detector. AC power provided by dual 250VA inverters.

AVIONICS: Standard avionics include VLF/Omega which is coupled to the autopilot. Optional avionics include INS, VHF/FM com, HF and VHF com, FLIR, LLLTV, multispectral scanner, tactical navigation computer, and two alternative search radar systems, both with 360° scan and weather avoidance capability.

DIMENSIONS, EXTERNAL:

Wing span with tip-tanks	17.25 m (56 ft 7 in)
Wing chord at root	2.18 m (7 ft 1¾ in)

Beechcraft Maritime Patrol 200T of the Japan Maritime Safety Agency



Bell/Navy X-22A V/STOL research aircraft, used by Calspan to investigate advanced control systems for deck-landing helicopters

Lockheed NT-33A engaged on Display Evaluation Flight Test programme

Wing chord at tip	0.90 m (2 ft 11⅝ in)
Wing aspect ratio	10.5
Length overall	13.34 m (43 ft 9 in)
Height overall	4.57 m (15 ft 0 in)
Tailplane span	5.61 m (18 ft 5 in)
Wheel track	5.23 m (17 ft 2 in)
Wheelbase	4.56 m (14 ft 11½ in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.37 m (1 ft 2½ in)
Distance between propeller centres	5.23 m (17 ft 2 in)
Cabin door: Height	1.31 m (4 ft 3½ in)
Width	0.68 m (2 ft 2¾ in)
Height to sill	1.17 m (3 ft 10 in)
Nose avionics service doors (port and stbd):	
Max height	0.57 m (1 ft 10½ in)
Width	0.63 m (2 ft 1 in)
Height to sill	1.37 m (4 ft 6 in)
Emergency exit door (stbd):	
Height	0.66 m (2 ft 2 in)
Width	0.50 m (1 ft 7¾ in)
DIMENSIONS, INTERNAL:	
Cabin: Length (excl flight deck)	5.08 m (16 ft 8 in)
Max width	1.37 m (4 ft 6 in)
Max height	1.45 m (4 ft 9 in)
Floor area	7.80 m² (84 sq ft)
Volume	11.10 m³ (392 cu ft)
AREAS:	
Wings, gross	28.15 m² (303 sq ft)
Ailerons (total)	1.67 m² (18.0 sq ft)
Trailing-edge flaps (total)	4.17 m² (44.9 sq ft)
Fin	3.46 m² (37.2 sq ft)
Rudder (incl tab)	1.40 m² (15.1 sq ft)
Tailplane	4.52 m² (48.7 sq ft)
Elevators (incl tabs)	1.79 m² (19.3 sq ft)
WEIGHTS (A : Normal category; B : Restricted category):	
Weight empty:	
A, B	3,744 kg (8,255 lb)
Max T-O weight:	
A	5,670 kg (12,500 lb)
B	6,350 kg (14,000 lb)
Max landing weight:	
A	5,670 kg (12,500 lb)
B	6,123 kg (13,500 lb)
PERFORMANCE (at max T-O weight):	
Max cruising speed, AUW of 4,990 kg (11,000 lb) at 4,265 m (14,000 ft)	265 knots (491 km/h; 305 mph)
Typical patrol speed	140 knots (259 km/h; 161 mph)
Range with max fuel, patrolling at 227 knots (420 km/h; 261 mph) at 825 m (2,700 ft), 45 min reserves	1,790 nm (3,317 km; 2,061 miles)
Typical endurance at 140 knots (259 km/h; 161 mph), at 610 m (2,000 ft), 45 min reserves	6 h 36 min

CALSPAN

CALSPAN ADVANCED TECHNOLOGY CENTER; Head Office: PO Box 400, Buffalo, New York 14225, USA

Calspan Advanced Technology Center has recently advised *Jane's* of the current status of its aviation flight research programmes. The aircraft being operated by Calspan in 1980 include:

X-22A. Since 1970, under contract to the US Naval Air Systems Command, Calspan has been operating the Bell/Navy X-22A V/STOL research aircraft, last described in the 1970–71 *Jane's*. In this continuing programme, research is focused on the evaluation of desirable V/STOL flight qualities and display formats. The X-22A is being used currently in a programme to investigate advanced control systems suitable for helicopters which are required to make deck landings on ships in heavy seas.

NT-33A. From 1958, under contract to the US Air Force Flight Dynamics Laboratory, Calspan has been operating the Lockheed/USAF NT-33A for varied studies into flying qualities and training simulations. More recently these programmes have investigated the effects of digital flight control systems on handling qualities, and the development of side stick controllers. The NT-33A has been used also to familiarise pilots with the characteristics of new aircraft, prior to the first flights of these machines: these have included the F-15, YF-16, YF-17, and F-18. In addition, under a joint US Navy/Air Force programme, the NT-33A has been used since 1977 in a project known as Display Evaluation Flight Test (DEFT). The DEFT system, operational since September 1979, provides the necessary link between any new class of aircraft display/information hardware and software, and the pilot's needs. In this configuration the NT-33A, which is equipped with a programmable head-up display and associated sensors, provides the capability of examining the interaction of display characteristics and handling qualities. Growth potential has been included for head-down vertical situation and energy manoeuvrability displays. The DEFT systems can be used also to investigate terminal area problems, manoeuvring performance, energy management, ground attack, and air-to-air combat.

TIFS. Under contract to the US Air Force Flight Dynamics Laboratory, Calspan has been operating since 1969 this extensively modified Convair/USAF NC-131H. It is called the Total In-Flight Simulator (TIFS) as it has an independent control for each degree of freedom, with computer-controlled side force surfaces, direct lift flaps, and throttle, in addition to control of its conventional ailerons, elevators, and rudder. It is used primarily to investigate the flying qualities of larger aircraft, and is involved currently in programmes to study for NASA the Space Shuttle Orbiter's landing control system, and advanced supersonic cruise transport handling qualities.

Learjet. For the past 20 years, Calspan has been operating two variable-stability Douglas B-26s for training and demonstration of aircraft stability and control at the US Air Force and Navy Test Pilot Schools. In 1979, Calspan was awarded a contract to modify a Learjet 24F to replace these B-26s. The

Calspan's Total In-Flight Simulator, an extensively modified Convair/USAF NC-131H

aircraft, purchased by Calspan, was delivered to the company in December 1979. In early 1980, installation of the Calspan-designed variable-stability system, including three-axis moment control, variable feel system, and digital computer configuration control system, was in progress. First flight of the modified Learjet 24F is planned for the latter half of 1980, with operational use in 1981.

AEROSPACE

NEW ZEALAND AEROSPACE INDUSTRIES LIMITED; Head Office and Works: Hamilton Airport, R.D.2, Hamilton, New Zealand

This company produces the piston-engined Fletcher FU-24-954 agricultural and utility aircraft, of which more than 270 have been delivered to customers in Australia, Bangladesh, Dubai, Iraq, New Zealand, Pakistan, Thailand, Uruguay, and the United States.

Nearing certification at the beginning of 1980 was a turboprop development of the FU-24, known as the Cresco 600.

Close-up of the nose of a New Zealand-built Fletcher FU-24-954

AEROSPACE CRESCO 600

Design of this turboprop development of the FU-24 began in 1977. Construction of a prototype started in the following year, and this aircraft (ZK-LTP) first flew on 28 February 1979. Powered by an Avco Lycoming LTP 101-600 turboprop engine, it has many components interchangeable with the FU-24-954. Use of this engine, together with some structural refinement, permits a reduction in empty weight and a substantial increase in agricultural max T-O weight. The name Cresco is Latin for 'I grow'.

Certification of the Cresco 600 was pending in January 1980, at which time five had been ordered. The first production aircraft was due to be completed in February 1980, with deliveries beginning shortly afterwards.

TYPE: Turboprop-powered agricultural and general-purpose aircraft.

WINGS: Cantilever low-wing monoplane. Constant-chord, non-swept wings of NACA 4415 section. Dihedral (outer panels) 8°. Incidence 2°. Two-spar structure, built mainly of 2014, 2024, and 6061 light alloys. Plain mass-balanced ailerons and single-slotted flaps, all of light alloy. Ground-adjustable tab in each aileron. Single row of vortex generators forward of each aileron.

FUSELAGE: All-metal semi-monocoque structure. Cockpit area stressed for 25*g* impact.

TAIL UNIT: Cantilever structure of 2024, 6061, and L65 light alloys. All-movable horizontal tail with full-span anti-servo and trim tab. Ground-adjustable tab on rudder.

LANDING GEAR: Non-retractable tricycle type, with steerable nosewheel. NZ Aerospace Industries air-oil shock-absorber struts. Cleveland wheels and hydraulic disc brakes on main units. Goodyear tyres, size 8.50-6 on nosewheel, 8.50-10 on main wheels.

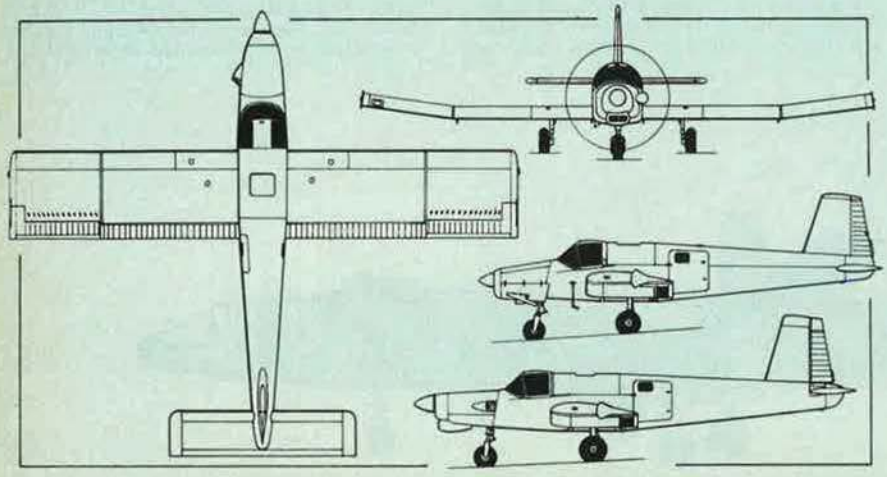
POWER PLANT: One 447 kW (600 shp) Avco Lycoming LTP 101-600A-1A turboprop engine, driving a Hartzell HC-B3TN-3D/T10282H three-blade constant-speed metal propeller with spinner. Four fuel tanks in wing centre-section, total capacity 545.5 litres (120 Imp gallons). Two refuelling points in upper surface of each wing. Oil capacity 5.5 litres (1.2 Imp gallons). Variable-geometry inertia separating intake under nose.

ACCOMMODATION: Pilot only, or crew of two side by side, under rearward-sliding bulged cockpit hood. Tinted windscreen and canopy side panels standard. Dual controls available optionally. Large forward-hinged door, with window, aft of wing on port side. Generous cargo space immediately aft of hopper. Cockpit ventilated; heating system optional.

SYSTEMS: No air-conditioning, pressurisation, hydraulic, pneumatic, or oxygen systems. Electrical system powered by 24V 150A Auxilec starter/generator and two 24V 25Ah lead-acid batteries.

AVIONICS: Range of Narco or Becker avionics available, including VHF, VOR, ADF, and transponder. Stall warning system standard.

AGRICULTURAL EQUIPMENT: Glassfibre hopper aft of cockpit, capacity 1,777 litres (391 Imp gallons) of liquid or 1,860 kg (4,100 lb) of dry chemical. Range of dispersal systems available to customer's requirements, from ultra-high-volume solids to ultra-low-volume spray.



Aerospace Cresco 600 turboprop-powered agricultural aircraft, with additional side elevation of the Fletcher FU-24-954 (centre) (*Michael A. Badrocke*)

DIMENSIONS, EXTERNAL:

Wing span	12.81 m (42 ft 0 in)
Wing chord (constant)	2.13 m (7 ft 0 in)
Wing aspect ratio	6
Length overall	11.06 m (36 ft 3¼ in)
Length of fuselage	10.74 m (35 ft 2¾ in)
Fuselage: Max width	1.22 m (4 ft 0 in)
Max depth	1.52 m (5 ft 0 in)
Height overall	3.42 m (11 ft 2½ in)
Tailplane span	4.61 m (15 ft 1½ in)
Wheel track	3.71 m (12 ft 2 in)
Wheelbase	2.77 m (9 ft 1¼ in)
Propeller diameter	2.59 m (8 ft 6 in)
Propeller ground clearance (static)	0.38 m (1 ft 3 in)
Cargo door (port): Height	0.94 m (3 ft 1 in)
Width	0.94 m (3 ft 1 in)
Height to sill	0.91 m (3 ft 0 in)

DIMENSIONS, INTERNAL:

Cargo compartment volume (aft of hopper)	3.40 m³ (120.0 cu ft)
Hopper volume	1.77 m³ (62.5 cu ft)

AREAS:

Wings, gross	27.31 m² (294.0 sq ft)
Ailerons (total)	2.08 m² (22.4 sq ft)
Trailing-edge flaps (total)	3.06 m² (32.9 sq ft)
Fin	1.53 m² (16.5 sq ft)
Rudder, incl tab	0.63 m² (6.8 sq ft)
Tailplane, incl tab	5.08 m² (54.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,161 kg (2,560 lb)
Max disposable load (Agricultural, incl fuel)	1,929 kg (4,254 lb)
Max fuel load	435 kg (960 lb)
Max T-O weight: Normal	2,925 kg (6,450 lb)
Agricultural	3,175 kg (7,000 lb)
Max landing weight	2,925 kg (6,450 lb)
Max wing loading:	
Normal	107.07 kg/m² (21.94 lb/sq ft)
Agricultural	116.19 kg/m² (23.81 lb/sq ft)
Max power loading:	
Normal	6.54 kg/kW (10.75 lb/shp)

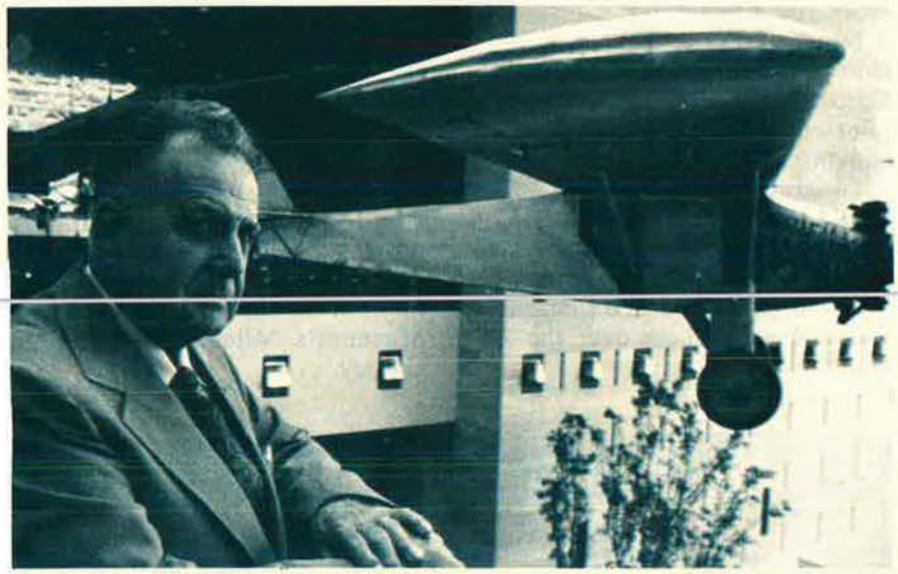
PERFORMANCE (at max Normal T-O weight, ISA, except where indicated):

Never-exceed speed	177 knots (328 km/h; 204 mph)
Max level speed at S/L	148 knots (274 km/h; 170 mph)
Max cruising speed (75% power)	127 knots (235 km/h; 146 mph)
Stalling speed at 2,767 kg (6,100 lb) AUW, flaps down, power off	52 knots (96.5 km/h; 60 mph)
Max rate of climb at S/L	290 m (950 ft)/min
Service ceiling	6,400 m (21,000 ft)
T-O to 15 m (50 ft)	436 m (1,430 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Range with max fuel, no reserves	460 nm (852 km; 529 miles)

A remarkable man whose life and career have paralleled the development of flight in the United States is . . .

AVIATION HISTORIAN PAUL GARBER: Sixty Years With the Smithsonian

BY WILLIAM P. SCHLITZ, ASSISTANT MANAGING EDITOR



Dr. Garber and one of the Smithsonian's earliest aeronautical acquisitions—Lindbergh's Spirit of St. Louis.

IT'S A brisk, crisp March Sunday in the nation's capital. On the Mall by the Washington Monument the fourteenth annual Kite Festival, sponsored by the Smithsonian Institution, is in progress.

Kites of all shapes, sizes, and colors dot the pale, spring-chilled sky, their handlers tending lines earnestly in the ten-knot breeze. In the competition area, a queue of people, clutching homemade entries, snakes past the judges' tables. There, the kites are scrutinized for design, craftsmanship, beauty, and ingenuity before being put to a flight test. Contestants are vying for a score of trophies at stake.

Bundled up against the cold and directing proceedings from a nearby podium is the festival's master of ceremonies, Dr. Paul Garber, Historian Emeritus of the Smithsonian's National Air and Space Museum. His cheerful commentary and suggestions to those struggling to get kites airborne indicate that the eighty-year-old Dr. Garber is enjoying the day's events as much as anyone at the popular festival.

In the mid-1960s, when Smithsonian Secretary S. Dillon Ripley was searching for outdoor activities on the Mall in which people could participate, Dr. Garber suggested an annual kite festival. It was a natural for him, being one of the nation's foremost kite enthusiasts. "Good idea, Garber," he was told. "You run it!" And Dr. Garber, with considerable volunteer help, has done so every year since.

As with most programs at the Smithsonian, the Kite Festival has its instructive, as well as its entertainment, side. In conjunction with it is Dr. Garber's workshop on how to build kites, and his annual lecture and display, sponsored by the Smithsonian Associates program, on the history and uses of kites around the world. After all, kites have their serious side. They date back more than 2,000 years and are mankind's first aircraft. Benjamin Franklin flew a kite in his famous experiments with electricity; the Wright brothers studied the aerodynamic properties of kites before moving on to more advanced notions.

But Dr. Garber's interest in aviation matters through the years has extended far beyond kites. As Historian Emeritus of the Air and Space Museum, Dr. Garber in June of this year celebrates his sixtieth year of association with the Smithsonian Institution. His life and career with the Institution have run parallel to the development of aviation in the United States.

Aviation—The New Science

Dr. Garber's interest in the new science of aviation was kindled early in the 1900s, when as a boy he built and flew model airplanes based on designs of such pioneers as the Wrights.

During a visit to Washington in 1909, young Garber boarded a streetcar for a trip to nearby Fort Myer, lured by the knowledge that Orville Wright was flight-demonstrating the Military Flyer there. Later, when his family had relocated to the District of Columbia from Philadelphia, Garber would ride his bicycle out to the Army's flying field at nearby College Park in Maryland to watch H. H. "Hap" Arnold and other aviators put the Army's wire, wood, and fabric crates through their aerial paces. By then, Arnold and the others, perched in seats on the lower wing of their aircraft, had begun to wear protective goggles and padded helmets, initial gestures toward what was to become a growing effort—flying safety.

In 1915, Dr. Garber built and piloted a hang glider based on a scale

Dr. Paul Garber officiates at the Smithsonian's annual Kite Festival, an event much anticipated by the Washington area's young and young-at-heart.

model of an early Chanute glider he had seen on exhibition at the Smithsonian. This made him eligible for membership in an exclusive club, the Early Birds of Aviation, an organization of pilots who soloed prior to December 17, 1916. The Early Birds still have on their roll fifty-eight members, and Dr. Garber is a past president.

In 1918, young Paul signed on as a jack-of-all-trades with the newly organized Postal Air Mail Service, following a stint of pilot training in the Army that was brought to a halt by the Armistice. The pilots of the Air Mail Service flew under hazardous conditions imposed by the primitive state of aviation technology and with the barest essentials in navigation aids and instrumentation. Their courage and determination made a lasting impression on the young man.

The World War had greatly accelerated advances in aviation. (The US's singular technical contribution to the aerial fighting was the Liberty engine, which was in use for years thereafter in military aircraft because of tight defense budgets. But inevitably the military, too, would get the more advanced engines being developed to power the metal-skinned monoplanes coming into being.)

Start of a Career

Dr. Garber began his career with the Smithsonian in 1920. Initially, he was set to work refurbishing and repairing exhibits, but his attention was never far from aviation, and he followed progress in flying activities with keen interest.

During the decade of the 1920s, aviation in the US really began to flower. In the spring of 1927, the press carried details of preparations by a young man named Lindbergh to solo the Atlantic in a single-engine plane from Long Island to Paris, a plan many believed to be foolhardy at best.

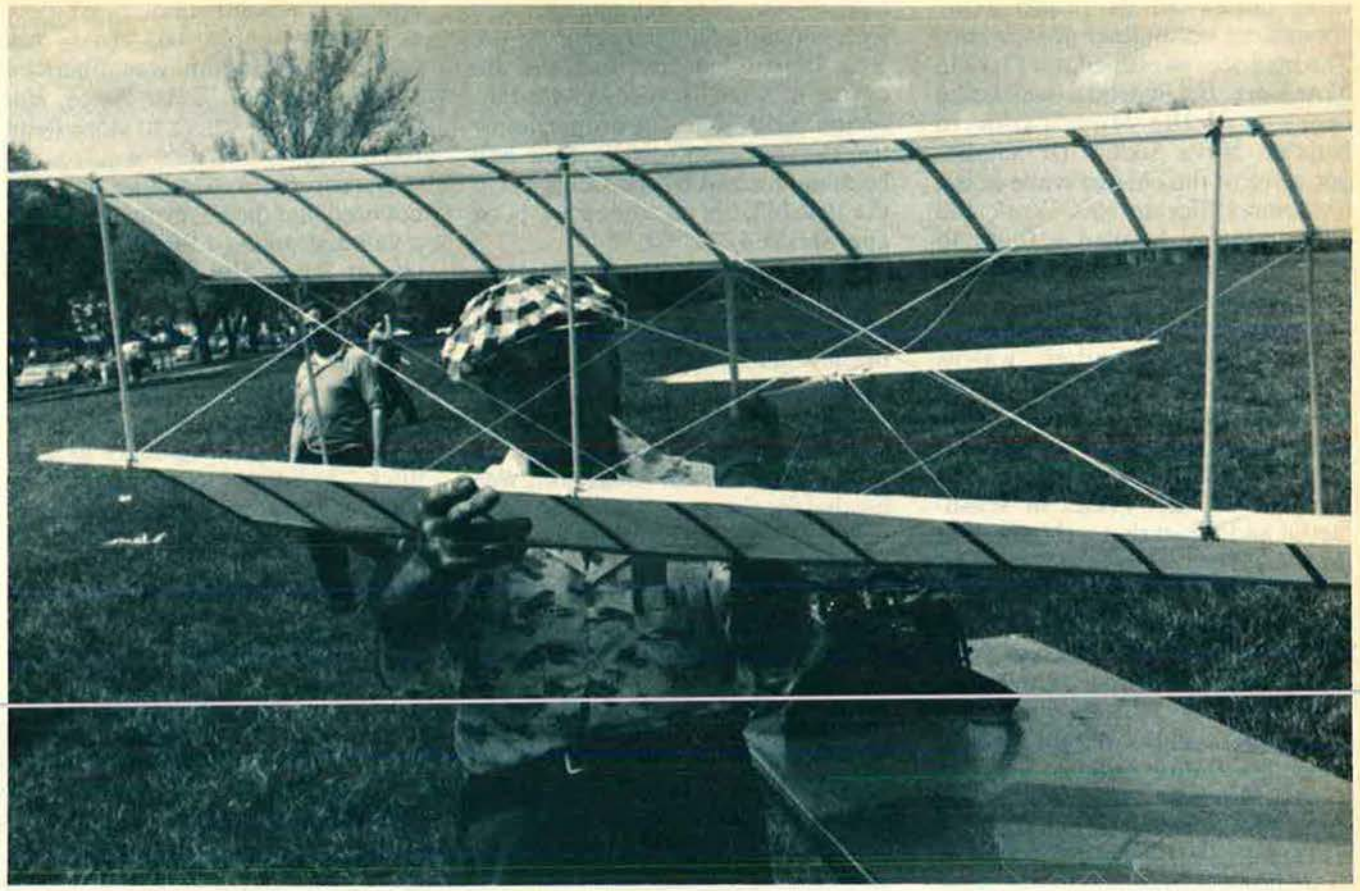
Not Garber. When word came that Lindbergh was airborne, Garber was so convinced that the pilot would make it that he urged his superiors at the Smithsonian to send a congratulatory cablegram that would also request the donation of the plane—the *Spirit of St. Louis*—to the Institution as an aviation exhibit. This while Lindbergh was still somewhere over the Atlantic.

"He hasn't got there yet," Garber was told. His answer: "He will. He's got a good airplane and good instruments. . . ." What's more, he had trained as an airmail pilot!

The cablegram, relayed through the American ambassador to France, was one of the first read by Charles A. Lindbergh following the historic thirty-three-hour flight.

In 1928, following his triumphant aerial tour of cities in the US and Latin America, Lindbergh flew the *Spirit* to Washington, where Dr. Garber awaited him. Climbing out, the pilot said simply of the most famous airplane in the world at the time: "Well, Paul, here it is." The plane was put on display in the Smithsonian's Arts and Industries Building, where it immediately drew unprecedented crowds. Today, it is one of the prominent exhibits in the National Air and Space Museum's Milestones of Flight Gallery.

Kites at war: providing antiaircraft target practice for ships' gunners.



Applying basic principles: a Garber-designed and -built "Wright Flyer" kite.

In 1953, Lindbergh came to visit the *Spirit*. Ostensibly, he was writing a book, and wanted to refresh his memory with some pencil markings he had made in the cockpit during the transatlantic flight. So, after visiting hours, Garber placed a ladder beside the aircraft, hung suspended from the ceiling in the darkened museum building, and Lindbergh climbed up into it.

Sensing that the great pilot wanted to be alone with the aircraft, Garber moved off a bit and waited. Whether the visit was partly inspired for reasons of nostalgia or not, after about a half hour Lindbergh summoned Garber to examine the markings made to keep track of gasoline consumption during the famous flight.

The acquisition of the *Spirit* followed that of such other historically significant aircraft as the Fokker T-2, the Douglas World Cruiser *Chicago*, and the 1924 Berliner Helicopter. In 1932, Dr. Garber's dedication to acquiring aircraft for the Smithsonian began to bear fruit. The Institution created a Section of Aeronautics within the Mechanical Engineering Department, and Garber was named Assistant Curator and chief of the new Section.

War Years Contribution

During the years of World War II, Dr. Garber put aside his museum work and served five years in the US Navy, with promotion to the rank of commander. Among his contributions—stemming from his service aboard the jeep carrier USS *Block Island*—was a program to develop such training devices as controllable target kites for ship-to-air gunnery practice, which were patented by the Navy in his name. Dr. Garber also developed the aircraft recognition models that were used throughout the military services and by volunteer civilian spotters; interestingly enough, the models were derived from a collection depicting Japanese combat aircraft assembled by Dr. Garber even before the war began.

Following the war, Dr. Garber was kept in uniform a further year to help write a history of naval aviation. Also following the war, the Smithsonian's collection of aircraft grew in magnitude due in large part to the foresight of General of the Air Forces Hap Arnold, who made representative types of warplanes available to the museum.

In 1946, under legislation drawn up by aviation enthusiast Rep. (now West Virginia Sen.) Jennings Randolph, and through the efforts of Hap Arnold, the Congress established the National Air Museum (later renamed the National Air and Space Museum) within the Smithsonian. Paul Garber was named first Curator of the new museum. His habit of collecting famous aircraft "not only made a national air museum possible, but necessary," says Museum Director of Aeronautics Donald Lopez.

All this time, the original 1903 Wright Flyer remained far from home on loan to a British museum. Dr. Garber helped to convince Smithsonian officials that the Flyer should take its rightful place in the National Air Museum as the world's first powered and controllable aircraft.

In 1948, the plane was packed in

three crates for its return home aboard the ocean liner *Mauritania*. The plan was to offload the Flyer in New York, but instead a dock strike there sent the *Mauritania* to Halifax, Nova Scotia. Dr. Garber got word of the change while at the Customs Office in New York and without delay booked a flight to Halifax, where he located the three precious crates at dockside.

It was November in Halifax and to the lightly clad Garber "was as cold as a polar bear's foot" as he stood guard over his charge. He managed to telephone one of his former commanding officers, US Navy Adm. Mel Pride, in Washington and asked that a ship be sent for the Flyer. "Good God, Garber, you think of the damnedest things," was the Admiral's initial reaction. Nevertheless, the Navy not only sent a ship, but fittingly enough an aircraft carrier, USS *Palau*, to collect Garber and the Wright Flyer.

As the *Palau* entered Halifax harbor, the port came to life with ships' horns, whistles, and the like, all sounding off in what seemed to be a salute. Garber thanked a Canadian official for the welcome the ship was receiving and was told: "Sorry, but we're celebrating the announcement of the birth of Charles, Prince of Wales."

The Wright 1903 Flyer now occupies "a place of highest honor" in the Milestones of Flight Gallery. Two other Wright-built aircraft are also in the national collection: the first 1909 Military Flyer and a reconstructed *Vin Fiz*, in which Calbraith Rodgers in 1911 became first to fly coast to coast. (He made about seventy-five landings during the eighty-four-day journey and survived fifteen crackups; en route, he was accompanied by a rail car containing spare parts, three mechanics, and his wife. All was in vain as far as the $50,000 prize offered by newspaper publisher William Randolph Hearst was concerned—he never delivered.)

The Need for Elbow Room

By 1950, the National Air Museum was rich in historical aircraft but poor in display and storage space. The exhibit areas were confined to the Arts and Industries Building on the Mall and the adjacent "Tin Shed," a World War I hangar—the first building devoted to aeronautical engineering by the War Department and thus the ancestor of what is now Wright-Patterson AFB, Ohio. A proper home for the museum's collection had been authorized by the Congress in the 1946 bill, but no money had been appropriated.

The Korean War delayed matters still further, although in the 1950s a place on the Mall was set aside for the new museum. With the war, too, came another threat to the airplane collection. The building area in which the World War II airplanes were stored in Park Ridge, Ill., was needed for the war effort. One solution that was offered: bulldoze the aircraft.

Dr. Garber, working with Smithsonian staff and a crew at Park Ridge, dismantled the aircraft in the open in mid-winter and crated them as best they could. The planes' rail trip to Washington was financed courtesy of the US Air Force. But the problem of where to store them remained.

Garber checked around and discovered that the government owned a wooded, unused twenty-one-acre site at Silver Hill, Md., about six miles from downtown Washington. Not ideal for his purposes but good enough. Dr. Garber received permission to occupy the Silver Hill acreage and then persuaded the Army Corps of Engineers to conduct "bulldozer training" there. Soon the area was clear of trees.

Later at Silver Hill, a number of hangar-like buildings were obtained at minimum cost with the help of a Navy contractor, and a nearby cement company obliged with some

THE THIRTEEN MOST IMPORTANT PLANES

The original idea—suggested by Kevin Brown of Hearst Enterprises—"was to pick the 'ten most famous' aircraft, based on technological significance and historical impact," said Dr. Paul Garber.

But when he and aviation figures Jerome Hunsaker, Grover Loening, John Victory, James Doolittle, and Charles Lindbergh got together in 1962, the list, following "strenuous debate," was expanded to thirteen. They are:

- The 1903 Kitty Hawk Flyer. The world's first powered and controllable aircraft is on display in the National Air and Space Museum's Milestones of Flight Gallery.
- The Blériot XI. It crossed the English Channel, the first airplane to do so, in 1909. A version of this aircraft is on display in NASM's new Early Flight Gallery.
- The Curtiss hydro-aeroplane, designed by aviation pioneer Glenn Curtiss. Near San Diego, Calif., in 1911 it became the first American plane to fly from and land again on water.
- The Verville-Sperry Racer, designed by Army Air Service engineer Alfred Verville in 1922–24. It incorporated advanced features that were to become standard for racing and military planes.
- The Junkers F-13. Introduced in 1920, the German-built craft is considered a "fundamental example of a transport airplane."
- The *Spirit of St. Louis*, on display in NASM's Milestones of Flight Gallery.
- The Piper Cub. The small lightplane that also served as a reconnaissance aircraft in World War II was built by the thousands by W. T. "Papa" Piper and "inspired extensive interest" in aviation through the years. One is on exhibit in NASM'S General Aviation Gallery.
- The DC-3. First flown in 1934, the beloved Douglas C-47 "Gooney Bird" of World War II fame was utilized by many of the world's airlines and is still being flown. One is on exhibit at NASM.
- The Sikorsky XR-4, built in 1942, was the first helicopter to fly across the country. One is on display at NASM.
- The Bell X-1. Piloted by Charles "Chuck" Yeager, it broke the sound barrier in 1947. It is on display in NASM's Milestones of Flight Gallery.
- The DeHavilland Comet. Introduced in 1949, the first jetliner, built in Britain, could cruise at 500 mph.
- The Boeing 707. First flown in 1954 and adopted by airlines worldwide, the jetliner cruises at 600 mph and is still in service.
- The North American X-15 was "an outstanding research aircraft" first flown in 1959. It reached an altitude of sixty-seven miles and speed of 4,534 mph. Chuck Yeager, among others, flew it. One of three built is on display in NASM's Milestones of Flight Gallery.

Resplendent on the Washington Mall—with the Capitol as backdrop—is the National Air and Space Museum, storehouse of the nation's aviation heritage. Paul Garber made NASM "not only possible, but necessary."

road paving. Beneficial, too, was the congressional appropriation that allowed aircraft restoration and preservation work to go forward at the facility.

With the Silver Hill complex available, Dr. Garber was able to continue to acquire and squirrel away aircraft—"never to be seen again," carped some critics.

"However," says Melvin Zisfein, National Air and Space Museum Assistant Director, "when it came time for us to plan the exhibits that were to go into the new NASM building, the hardware was right there, due to Paul's avocation of saving old airplanes." With additional transfers by the Navy, the collection now numbered well over 200 aircraft.

Realizing the Dream

Congress had come through with the appropriation, and ground was broken for the new NASM building downtown on the Mall in Washington in November 1972. It opened its doors to the public below cost and ahead of schedule in a Bicentennial celebration on July 1, 1976. The new museum was an instant success, and visitors to it by this spring have numbered some 40,000,000 people. This public popularity had its effect on Silver Hill, too. Such was the interest in the preservation, storage, and restoration facility that it was opened to the public for guided tours in January 1977.

"Right from Day One" in planning and creating the exhibits that were to go into the new museum, Dr. Garber's phenomenal memory for aviation history served the staff well, according to former Astronaut Michael Collins, the first NASM Director and currently a Vought Corp. executive. "We could and did check out facts with Paul; it saved staff members hours of searching through the files."

Reaching the mandatory retirement age of seventy in 1969, Dr. Garber, whose official title was Head Curator and Senior Historian, was named Historian Emeritus. In the new NASM building he was given an office "that not simply by coincidence is closest to the museum library. We consider him an adjunct to it," says Melvin Zisfein.

"Even to this day he gets hundreds of phone calls a year from outside researchers and 700 to 800 letters addressed specifically to him asking for information. These he answers personally with the help of volunteer secretarial help," says Michael Collins.

Approaching eighty-one years of age, Dr. Garber's energy is still awesome. It was thought that on retirement he would come to his office perhaps once or twice a week to clear up routine business. But he puts in a long day's work there each day that he is not traveling. "Paul is frequently out of town and probably gives more lectures than the rest of the museum staff put together," says Donald Lopez. So far this year he's either given or is scheduled to deliver forty-five lectures. One of his favorites: How he and aviation figures Jerome Hunsaker, Grover Loening, John Victory, James Doolittle, and Charles Lindbergh gathered to choose "The Thirteen Most Important Aircraft" (*see box*), the airplanes that contributed most to the growth of aviation. Most often, his lectures are given without notes.

Despite his extraordinary schedule, Dr. Garber has managed to complete the on-camera narration of ten 28½-minute films in conjunction with the US Navy Photographic Center, in which he discusses the history of flight. The films receive general distribution and are used in education courses by the Civil Air Patrol and by the Air Force and Naval Academies. Dr. Garber writes and rehearses the scripts himself and, with the Navy, plans twenty more in the series, to run comprehensively from flight in nature to the space age.

At the NASM, Dr. Garber is Ramsey Fellow, and as such oversees the Adm. DeWitt Clinton Ramsey Fund, named for and established by a close friend who died in 1961. The fund, among other things, rewards excellence in aviation studies.

In ceremonies this month recognizing Dr. Garber's sixtieth year with the Smithsonian, the Silver Hill facility will be renamed in his honor. ■

Convincing the antiwar zealots that military types are also against war is a tough proposition, especially when they don't want to listen. After spending time listening to their line, one must ask them . . .

Is Nothing Worth Fighting For?

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

As someone once said, a good part of life is spent just showing up. Accordingly, I showed up a few weeks ago at an antiwar conference, having lent my name to the publicity fliers for the event. The earnest people putting on the affair said they wanted someone from the other side. It was, on reflection, a curious reason. As I tried to explain to the sizable, and polite but clearly unsympathetic audience, military types are against war with at least as much fervor as peace activists. We just have a different view on how war is best prevented. Well, no matter what I told them. It was what I learned from them that was fascinating.

First of all, I discovered, we are the ones who are pushing the Soviets into their current behavior. The prospect of Pershing missiles with nuclear warheads in NATO Europe was doubtless the reason behind the Soviet move into Afghanistan. The Soviets are, above all, human beings willing to relax tensions and live in peace if we will only encourage them, as witness the withdrawal of 20,000 Russian troops from Western Europe. We, however, frighten them instead with our military preparation. It is our own defense spending that has accelerated theirs.

One of my fellow panelists, a man who has made a comfortable living for a good many years recasting the same old line, proposed unilateral disarmament as the simple and immediate way to end the threat of war. Once we have disarmed, the Soviets will no longer feel threatened, and they, too, will disarm. And if they do not? It is still no real problem. A few commissars here and there are infinitely better than the prospect of war. Old Bertrand Russell at least had the excuse of senility when he advanced the same argument. It is evidently not possible to convince the antiwar movement there is a middle ground: neither Red nor dead.

The strength and influence of the antimilitary movement—for it is really antimilitarism that peace activism is all about—is difficult to assess. Certainly, it is making itself felt in a variety of ways during the current political campaign. Now that the draft no longer involves the citizenry at large in national defense, the antipathy toward the military has taken on a more subtle tone. There is the cost, first of all, of defense and its consequent effect on social programs. And then there is the emotional business of going to war for the oil companies, or for dictators, or for whatever. Finally, and underlying it all, is the articulate opposition to any sort of national military service.

My brother and sister celebrants at the peace conference organized workshops on such useful matters as "Draft Counseling and Values Clarification," a seminar that might have been more honestly called "How to Dodge the Draft," and a folksy one, "Ain't Goin' to Study War No More." There was also a workshop, of course, on "Federal Spending: Shall We Buy Guns or Care for People?" There were other instructional sessions on how to organize campus movements, protesting in general, and the important business of lobbying or, to use the polite term, political action.

And yet, there was an air of defensiveness—zealots pursuing a lost cause. It was reminiscent of Henry Wallace and the Progressive Party in the Presidential election of 1948, when Soviet behavior in Berlin and Czechoslovakia alerted the country to the Soviet menace for the first time after the brief and euphoric affair with good old Uncle Joe Stalin.

Now we face an uncertain future, something even my companions in the antiwar festival recognize. They see that future in stark black and white: either the apocalypse or peace on any terms. There is no room in their view for any of the considerations that have traditionally inspired this country of ours to mobilize. Nothing, in the peace activist's view, is worth fighting for, although they stop short of putting it that clearly. And if nothing is worth fighting for, then it follows that there is no logic in maintaining military forces whose job it is to fight.

One way or another, we have worked ourselves back to 1948, with the Soviets once more challenging our national resolve. This time, instead of Berlin, it is a global challenge, one that ranges all the way from Southeast Asia and Afghanistan to our own backyard. For while we remain absorbed in our Tehran humiliation, there is an ominous Soviet-influence creep taking place in the Caribbean.

As we have discovered lately, our allies are no longer as easily led as they were in the days when they had confidence not only in our leadership but in our military power. They are still allies, but our trumpet is giving off an uncertain sound. The antiwar activists make little sense, true enough, but neither does a doctrine that calls for military defense of our vital interests without providing for an adequate military. ■

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GRUMMAN
50 years

This is one of the F9F Cougars from the author's squadron (VF-21).

In 1953, exchange duty with the Navy was fairly rare, our sister service was just beginning to transition to sweptwing jet operations from carriers, and the author, newly qualified in the F9F Cougar, was among early blue-suiters to hear the words . . .

Welcome Aboard, Air Force

BY MAJ. DOUGLAS K. EVANS, USAF (RET.)

THE roster of Air Force pilots who have served on exchange duty with our sister services is now a long one. But at the time of this "sea story," as the Navy would call it, the list was short, and being fully operational far from one's Air Force environment was rather unusual.

It was early 1953—a time when the F-86 Sabre was the bright star in our fighter ranks, causing a veritable aluminum shower of Russian MiG-15s to fall from Korean skies. The US Navy, keen to get up into the high scoring ranks, was introducing into the Fleet its first sweptwing fighter, the Grumman F9F Cougar. All the interesting features of that neat little bird were to become familiar to me, but while that unexpected chance was approaching, I was happily flying the flashy Sabre at George AFB in California. The tremendous vault of clear sky in that desert environment was like a superbowl for aerial sport, in contrast to the often cloudy and deadly serious skies of Korea, which I had left a few months earlier.

The top team in that southwest arena of the US was the great 94th "Hat-in-the-Ring" Fighter Squadron, just about the hottest outfit I ever belonged to. For that squadron, formation aerobatics and expert gunnery were routine exercises. Just imagine a squadron that, except for a few recent graduates, was packed with veterans of two wars who had reveled in smoking up the skies in the classics: the P-40 and P-47, the P-38 and P-51, and the F-80 and F-84. As good as all that was, we topped it off with a combined total of 15,000 hours F-86 time!

We often remarked that dogfighting in combat, you only had to fight for your life, while in dueling with such "friendly" talent you had your honor to defend—a very gripping affair. When the 94th leaped off with all that tiger blood, whatever the mission called for, we regularly cleaned the clocks of every other fighter and bomber outfit in Southern California. Shades of Red Flag!

It seemed a shame and yet it was inevitable that the ranks of such a combat-wise squadron had to be thinned out to spread the wealth among other outfits. What chilled us day-fighter pilots was the conversion (we were in the Air Defense Command) to all-weather/night radar interceptors. But just as those transfers began, the chance for what I thought would be unusual adventure came through; the Air Force had a quota of four pilots for Navy exchange duty. I volunteered, and the Navy allowed me to pick my squadron, one of the first to begin equipping with the Cougar in preparation for MiG hunting in Korea.

My plans for a second tour of MiG Alley were dashed when the war ended within a month of my arrival at NAS Oceana, Va., in the summer of 1953. But all the rest of my expectations for the unusual were more than fulfilled.

A Different Breed of Bird

At first look the Cougar appeared to be merely a very streamlined version of the Grumman Panther, the Navy straight-wing fighter-bomber that did such good work in Korea. Actually, the Cougar was a much hotter airplane. Within its pleasing lines were some innovations that, in comparison with the Sabre, are worth passing on.

The first surprise was that the Cougar had no ailerons, only spoilers called flaperons, which produced a snappy rate of roll and instant reversals without adverse yaw, and held the nose to a point in fast rolls like a rifled bullet. (At that time the only other airplane I knew of without ailerons was the Martin B-51 bomber, in which I got some cockpit time. That was a very intriguing craft, I might add.) The second surprise was a healthy safety feature: the Cougar had a selective option, a manual elevator (like the F-86A), or hydraulic flying tail (like the F-86E and F).

The most obvious difference between the Sabre and Cougar was the arrangement for air intake to the engine. While the size and weights of the two planes were very close, the divided intakes of the Cougar permitted double the internal fuel capacity of the Sabre. The pros and cons of split vs. direct, or single intake for single engine fighters have never really been resolved to my satisfaction

(not being an aeronautical engineer). However, I lean toward the advantages of more internal fuel and less dependence on auxiliary drop tanks. Korean War experience influenced my considerations on that matter. The Cougar carried no external tanks, but the wing fuel could be dumped to get quickly to fighting weight without resorting to punching off a set of drops, which added to maintenance and supply problems.

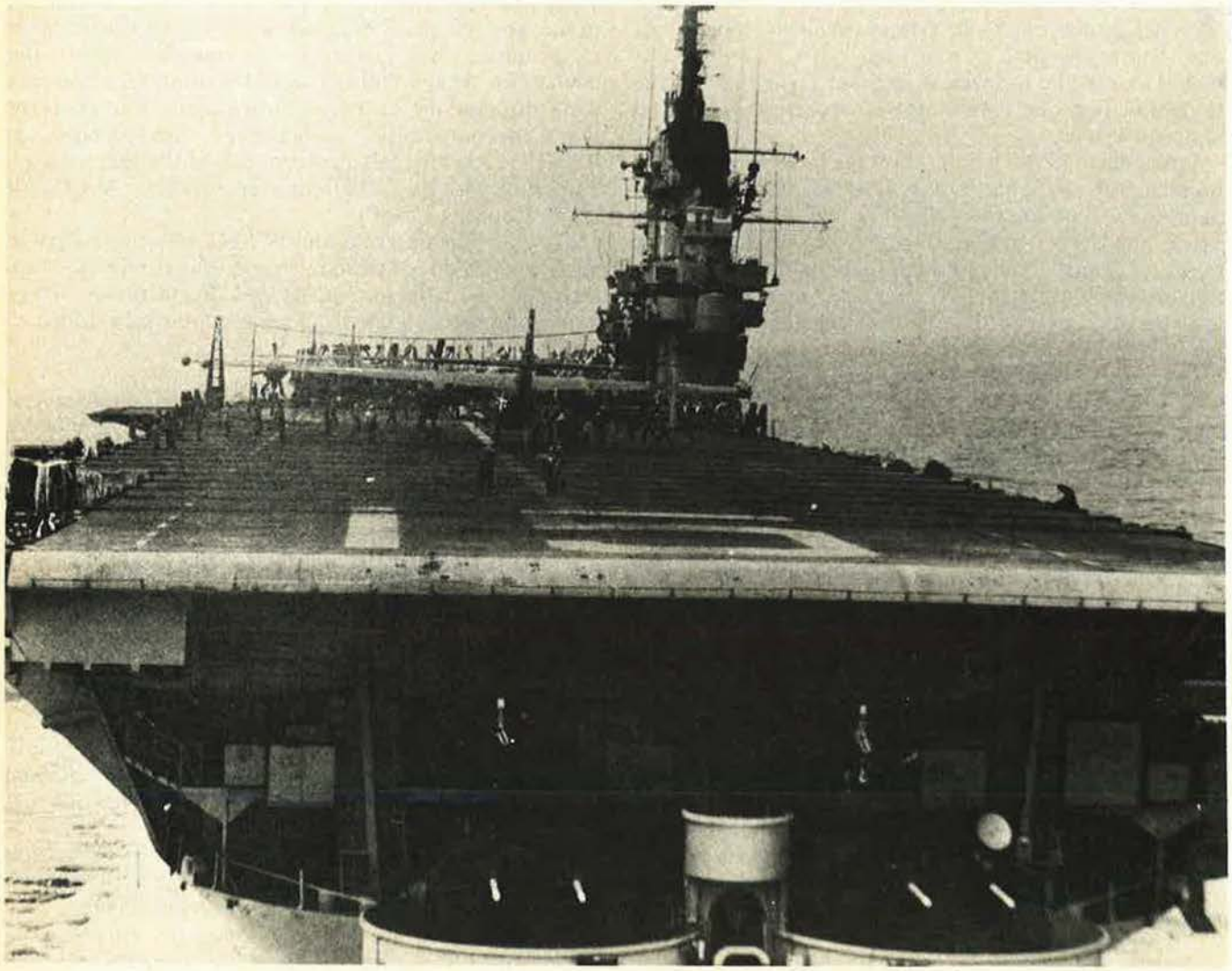
From the shooter's viewpoint, the key difference in the two aircraft was the guns. While Air Force fighters were still carrying six fifties, the Navy/Marine fighters had switched to four cannons. In the Cougar the four 20-mms were stowed snugly in parallel on a deck in the nose. It was like sighting over a four-barreled shotgun. I did extensive gunnery all during my Navy tour and became as familiar with the twenties as I had been with fifties.

Not long after I reported for duty with VF-21 (Fighter Squadron 21), the full quota of Cougars was received to replace Panthers and we went all-out in transition. After a month of daily flying in our new birds, we leaped off for another month of intensive aerial gunnery at Guantanamo Bay, Cuba . . . and the blue Caribbean and its emerald isles. What a nasty break! Every weekend there were trips to nearby islands, and in twenty-six flying days I got sixty-five hours in short gunnery sorties—a very hot schedule.

The real significance of sea duty caught up with me eventually, and when December rolled around so did our date with our aircraft carrier, the USS *Hornet*. Of course, we had been preparing ourselves by working in the "bounce" pattern at NAS Oceana and our auxiliary field. About ten bounce periods were the general rule at that time for our outfit, and as our LSO (Landing Signal Officer) was satisfied, we girded ourselves for the real thing, Carrier Qualification or CarQual. Everybody except myself had already been aboard carriers. We had several ensigns or "nuggets" from Pensacola and the rest were seasoned fleet pilots. For them it was just a matter of qualifying in their new sweptwing Cougars.

Welcome Aboard, Air Force

What I wanted to do was go out to the ship with the first flight to see what it was like as soon as possible and then come back *with* the "hairy" stories rather than wait for them. Everybody in a Navy squadron is somewhat tense just before CarQual, and I was more than "somewhat," considering my zero level of experience in the trade. In



This is what an incoming pilot saw just before landing on one of the old straight-deck carriers. The heavy attack AJ Savage that had just landed would, of course, have been cleared from the landing area. Note the arresting cables on the deck.

The author (second from left) with members of his gunnery flight, Guantanamo Bay, Cuba, in September 1953, proudly shows off the aerial banner recording 222 hits out of 444 rounds of 20-mm ammunition fired.

fact, when we had been briefed by the ship's crew on flight-deck procedures, the point was made that the great majority of the ship's crew had never seen a plane land on board, as the *Hornet* was newly recommissioned.

On December 9, 1953, I went out with the first six planes from the squadron, led by the skipper. He reminded me to be on my toes as they had knocked off some Air Force pilots in carrier operations. That was food for thought, but the butterflies in my stomach were certainly not hungry.

I guess my first view of a carrier from altitude was typical, "You mean I've got to land on *that*!" At that time, the only angled, or canted, deck in operation in the US Navy was on the carrier *Antietam*, but touch-and-go landings were shot on straight decks for familiarization before dropping the tail hook. We shot two touch-and-go's, and these gave me a rough idea as to patterns and LSO paddle signals at sea compared to land practice.

When I came into the groove for my first arrested landing, the previously clear deck looked as if it had suddenly sprouted a forest. The two crash barriers were up, and beyond them the high jet barricade with its stanchions, and the webbings of nylon flapping in the breeze. As I followed the LSO's signals up to the "cut," I'll bet my facial expressions would have made a fascinating study. The "forest" impression in the mid-deck of the straight deckers was a definite psychological factor to pilots, especially at the speed of jet operations. The landing speed of the Cougar, for example, was about 125 knots—the highest in the Navy at the time—and the stopping distance on the straight deck carriers only eighty to 100 feet.

At the cut, I dive-bombed the deck as all that arresting paraphernalia loomed in my face. I had absolutely no conception of an arrested landing and when I hit the deck and caught a cable simultaneously, I thought I'd bought the farm for sure. Still sort of dazed from the shock, I realized my head was full forward (I felt stretched like a giraffe), the joystick was crammed full forward, and throttle against the fire wall. I hurriedly reengaged my brain and recovered everything (except myself) to normal. The voice of the friendly LSO came over my radio, "Welcome aboard, Air Force. Congratulations." I was a bit incoherent at that stage but managed to mumble something resembling thanks.

Later, down below decks in the squadron ready room, I was meditating seriously on such thoughts as, "You meathead! What have you got yourself in for now?" After comments by the six of us on the flight and future operations, the skipper and two others left the ready room to inspect squadron spaces (offices to landlubbers) to be used when the Air Group was aboard for operations.

We were expecting further flying during the day so the skipper and his wingman had their aircraft on the catapults ready for launch whenever the word came. When the squawk box blared out, "Pilots of Fighter Squadron 21, man your planes!" I had a tightening of the stomach as I realized that with the skipper gone, I was the senior officer present of VF-21. The only thing to do was to run out in what was to become the familiar mad dash for the flight deck.

That First, Unforgettable Cat Shot

I scrambled up into the skipper's plane and the other guys took the next two. While I strapped in, I noticed the sky condition looked bad—to my digestive system it looked sickening. The clouds were very low and dark, we were pelted by light rain, and a bitter wind was whipping up whitecaps and whistling traces of light salt spray over the flight deck and on my windshield. When I say bitter, remember, in December, 120 miles off the coast of Virginia, it is anything but balmy. To keep my flying suit and cockpit dry, I closed the canopy and awaited orders to start up.

There came a rapping on the fuselage. It was the squadron commander. I opened the canopy and he called loudly over the whistle of the wind, "Don't let them launch you in the rain." I nodded, as I fervently hoped everybody on the ship felt the same way.

The ship was essing to find a steady wind and clear area and then we received the order to start engines. My mind was going like a computer without all the circuits plugged in, trying to remember everything I'd been told about catapult takeoffs. A few of the blank circuits were to show up in the next few seconds. The next orders from the Air Boss in Pri-Fly (Primary Flight Control) were, to me, what have ever since been stirring words, "Prepare to launch."

I got the two finger turn-up signal from the catapult officer, got my Cougar wound up to full bore, saluted that I was ready, and braced myself. Nothing happened. Out of the corner of my eye I saw the cat officer vigorously nodding his head back. "Oh, my gosh! I'm supposed to have my head braced back against the head rest. Here I am hunched forward like a jockey at the starting gate." Don't think I didn't get ribbed for that gap in my circuitry.

As soon as I got properly squared away, there was a tremendous explosion against my back. It blew me hurtling down the flight deck to the void beyond the bow. My impression of that first cat shot is still that of a violent, helpless squashing against the seat and a suicidal plunge over a cliff. Those who have experienced jet launches off the old hydraulic catapults will tell you about the same thing.

After the initial gasp, I'm sure I didn't breathe again

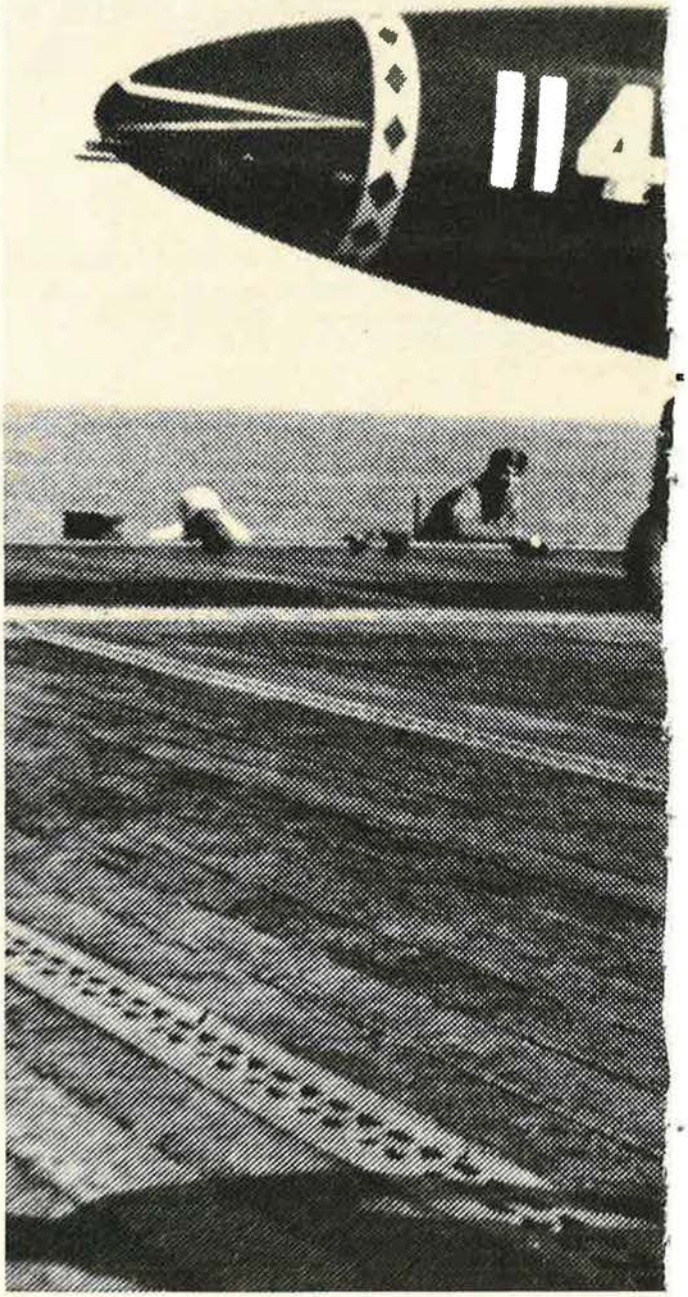
Maj. Doug Evans, a frequent contributor to this magazine, flew F-86 Sabres in Korea, where he scored two kills and a probable. He later had separate tours of exchange duty with the Navy and the Marine Corps. Early in the Vietnam War, he helped establish the Forward Air Control program, described in the February issue of AIR FORCE. *Since he retired in 1968, Major Evans has lived in Fort Myers, Fla.*

until my forgiving F9 changed from a projectile back into an airplane. After what I figured was enough time and distance, I banked left into the downwind to start the carrier traffic pattern. After my turn was well established, I realized I had forgotten another item, "Remember the compass heading of the ship at time of launch." Now what was I going to use as a downwind heading? In the middle of the ocean there are no convenient roads, prominent trees, or red barns for landmarks. Also, I couldn't follow somebody else's flight path as I was the first one off. Well, you learn as you go, so I tried to judge heading by the angle of the distant ship, which was difficult at first. I found out later the difficulty wasn't all my judgment. The ship was again essing to find the wind—a big help.

We were launched with a light fuel load, so we needed only one practice pass and go-around before we were ready to land aboard. On that first pass I was too tense. I overcontrolled on the paddle signals. That got me a bit, and so did the quick view of the men on the bridge, known quaintly in naval aviation as "Vulture's Roost." I figured there might be some smart remarks coming my way later. I guess at that point the realization hits you that, way out there, out of sight of land, you are the sole representative of the Air Force. The pressure is on and so are all eyes. Not only do you have to prove yourself, but also the reputation of your service. All very conducive to a sweaty flying suit.

The weather was still anything but cheery and, with the canopy rolled back, the chill slipstream made my eyes water. I had that "all alone" feeling that comes over you occasionally in the fighter business. The next pass I thought was fairly good, and just as I anticipated a cut, I got a waveoff. I racked my brain, analyzing my pass, and had to resolve just to go to it as I thought I should. The third pass was a waveoff, too, and I knew it was OK. I was both rattled and enraged by that time—mostly enraged—and that was good in a way. I forgot how shook up I'd been about the operation and took that as a challenge to get my fighter properly on that flight deck. I must have had the right combination because—"CUT"—and I was aboard and stopped.

I got the thumbs up query from the flight deck crew which meant, in this case, "Is your plane OK and are you ready to be catted off?" I gave the thumbs down on that. My fuel was low, and I had a keen desire for a friendly little chat with the LSO. He patiently explained to me that on my last two passes he could have gotten me aboard, but he wanted them as close to perfect as possible since he and all the pilots were brand new to sweptwing jet operations on carriers. That made me feel a whale of a lot better, and the next day when we all got blasted into the air again, I got a cut and smooth landing on every pass. In fact, I was having such a ball at the end I was giving thumbs up when the ship was giving me thumbs down. Pri-Fly had to tell me, "Flight ops are secured for the day."



Converting the Naval Aviators

It was a great feeling to be getting the hang of it—the tremendous acceleration as the catapult shoots you into the air, the careful maneuvering as you approach the ramp, the wrenching arrested landing, and the exultation over a good pass. Then the quick taxi up the deck to the cats to do it all over again. I was accepted by the pros in the carrier business, and had passed the qualifications to be a Naval Aviator. My father, Naval Aviator #26 and Marine Corps Aviator #4, was pleased when he heard about it.

That evening in the wardroom I was looking forward to

Though this is not the author's outfit, it's typical of a Cougar just at the moment before the "thrill" of a catapult launch.

the next day's operations and returning to the beach, as they call a land base in the Navy. The few pilots on board and some of the ship's officers wanted to know my impressions of carrier duty, and I remarked, "One thing for sure, I'll never have to go to Coney Island."

"Why is that?" someone asked.

"This is the craziest amusement park ever built," I answered.

After Christmas, the entire Air Group went to sea on the *Hornet* for more than two months of operations in the Caribbean, during which I averaged thirty hours a month off the flight deck. As a lot of other Air Force pilots have found out since then, I learned what it means to be combat-ready at sea.

Before returning to the Air Force fold, I cleared up a couple of matters of importance with my Navy friends. One was that when asked what their job was, the answer should not be Naval Aviator (sometimes referred to by the surface Navy as Nasal Radiator), but *fighter pilot*. The other point was to leave unbuttoned the top button of their blouses, at least in the "O" Club, to indicate their exalted status as fighter jocks. Before the source of that heresy could be discovered, I left the scene and went back to flying the Sabre in the Tactical Air Command. ■

PERSPECTIVE
Comment & Opinion

By Frederick C. Thayer, PITTSBURGH, PA.

Airlift and "Rapid Deployment": The Old Questions Return

To reread President Kennedy's 1961 State of the Union message is to realize how much 1980 resembles an earlier time:

> Obtaining additional air transport mobility—and obtaining it now—will better assure the ability of our conventional forces to respond, with determination and speed, to any problem at any spot on the globe, at a moment's notice.

Judging from news accounts, airlift confusion is as rife as in 1961, inside and outside the Pentagon. Few seem to have asked why the 1961 decision may not have worked all that well. To understand the airlift expansion of the 1960s, it helps to distinguish between the doctrinal and operational aspects of that expansion. Sadly, experience seldom affects doctrine.

On the doctrinal side, Air Staff planners may not have completely understood the controversy with the Army in those years. Airlift expansion, in C-130s, C-141s, and C-5s, was tied to the idea that all transports should have a full range of "combat" assault capabilities for the sake of the airborne divisions. Yet the "strategic" airlift mission is incompatible with the combat assault mission in terms of organization, maintenance, and training. The Military Airlift Command (MAC) found itself involved in numerous airdrop exercises, hindering attempts to fly C-141s up to 240 hours per month. In order to cover all requirements, MAC had to keep three to four crews on hand for each plane, then train them all in airdrop. Yet, the airdrop mission itself requires only a single crew, even as it limits normal supply operations.

As the Army expanded in the 1960s, conversely, it turned some attention away from the airborne divisions, conceptualizing "air-assault" divisions having their own "retail" logistics airlift. Doctrinally, the Air Force was somewhat tied to airborne divisions, the Army dreaming of its own huge "feeder airline" for the remainder of its forces.

On the operational side, the Vietnam War produced quite different outcomes. Strategic airlift was somewhat "airline" in character and, indeed, airlines under contract (with stewardesses) routinely landed in combat zones. (Ironically, MAC had been condemned in the 1950s for having women flight attendants, that being a pre-feminist age.) While Southeast Asia was full of C-130s, these performed mainly logistics missions. All airlift operations clearly depended on fixed, sophisticated, and generally invulnerable airfields, relatively close to forward areas.

The most far-reaching problems of the C-5, I suggest, were traceable to doctrine. C-5 "combat" capabilities may well have led to airframe tradeoffs that made it impossible to operate the aircraft at a sustained high utilization rate (six to ten hours per day). Aircraft able to perform every conceivable airlift mission must be prohibitively expensive in attempting to do the impossible.

News reports indicate that "improved" C-5s are on the way. For the CX, much money is to be spent on "unimproved airfield" capabilities, and presumably airdrop as well. A C-5 (or CX) is an expensive item to expose to small-arms fire; moreover, when a number of them land in one place, a supply depot is automatically created. A runway would not be that huge an added expense. As always, C-5s (like all strategic airlift) operating into "unimproved airfields" without facilities are unlikely to achieve high utilization unless sophisticated facilities are close by. Yet, the high rates are needed if large forces are to be moved in short time periods.

All of this suggests the following:

- There are obvious needs for "outsize" capability, but these do not require building combat capability into C-5s or the CX. Further, much of the outsize equipment can itself be kept operational only with sophisticated facilities close by. Logically, the cargo must land where the personnel land.
- Except for outsize needs, strategic airlift is easily available. Quickly escalating fuel costs are beginning to have disastrous effects on airlines, the greatest travel reductions in years now widely forecast. CRAF-type aircraft (beefed-up floors, etc.) can be assembled in many ways. Even "off-the-shelf" procurement from civilian assembly lines is a better solution than designing new strategic airlifters.
- The Army should be compelled to live with its own mythical history. Airborne divisions never have been militarily significant, useful only for recruiting and VIP demonstrations. As pilots should know, men in parachutes are too vulnerable. Only tactical surprise is possible (1,500 or so troops), strategic surprise out of the question. The Army could not sell itself on the need for the combat capabilities it long has demanded of the Air Force. If it wants airdrop capability, let it buy its own.
- Unglamorous it may be, but the primary airlift mission always is logistical. Combining it with other missions is just about impossible, the reason why the 1980 decision may be no more effective than the 1961 deci-

HOW TO SHARE YOUR PERSPECTIVE

The purpose of this department is to encourage the presentation of novel ideas and constructive criticism pertinent to any phase of Air Force activity or to national security in general. Submissions should not exceed 1,000 words. We reserve the right to do minor editing for clarity, and will pay an honorarium to the author of each accepted contribution. The Air Force Association does not necessarily agree with opinions expressed in this department.

sion. This is the airlift version of the TFX problem.

Even larger strategic questions remain, and I briefly mention two. If, as news stories suggest, we seek "rapid-deployment forces" we can move anywhere without *any* sophisticated bases along the way, I am dubious. Even with in-flight refueling, some bases are needed, but the larger problems are the Army's. Ground forces cannot operate far afield from backup support. Nor can they immediately be sent into battle after a 10,000-mile flight; jet lag alone requires staging areas. The second question may be more serious. The global oil situation makes it doubtful that conventional war on a large scale ever again can be sustained.

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By Donald M. Bishop, SPRINGFIELD, VA.

The Tragic Triumph of Material Thinking

A particular strain of military thought has become a dangerous form of orthodoxy within the Air Force, and it is time for a dissenting view. The Air Force can only remain strong if it sustains within itself the legacy of the Mitchell era and recognizes that all forms of "conventional wisdom" need to be challenged.

At least since the end of World War II, the institutional development of the Air Force has rested on a fundamental assumption—that developing advanced weapons and exploiting science and technology are the most important elements of strength for future conflicts. That assumption is flawed—a half-truth with dangerous consequences, which we now see all around us.

In the air combat arena, we pit a man and an aircraft against an enemy. In the strategic forces realm, the missile is only the instrument of the men who resolve to fire it. The aircraft and the missile are not by themselves the critical factors in the calculus of aerospace power, for only men can give them life and purpose. The fusion of men *and* machines gives us power.

Weapons, materiel, science, and technology are important. The lessons of World War II, Korea, and Vietnam testify to that. In World War II, for instance, the defeat of Japan and Germany depended on the superior weight of Allied resources and the fact that American science and technology outdistanced Axis efforts. But to draw the conclusion that materiel, science, and technology were the dominant factors in Allied victory and that the same elements must absorb most of our current energy is to distort the record of the war.

Did the Flying Tigers, to take but one of many examples, win their victories because of superior aircraft or superior tactical *thinking*?

Surely, then, a few other considerations should concern Air Force thinkers. Who will fly the planes of the future into Soviet air defense missile nets? Who will maintain them in a fallout environment? What spirit will animate the Air Force?

Any line officer or NCO in a wing could explain that leading, motivating, and retaining people are far greater challenges than operating and maintaining weapons. Said again, the Air Force's top priorities cannot be only *material*. They must be equally *human*.

Is this a true assessment of where Air Force priorities lie? It is worthwhile examining the testimony of AIR FORCE Magazine. Generals, Secretaries, and the editors write of weapons and budgets. Every new weapon is trumpeted as the latest essential for maintaining national power.

On the other hand, the letters written by readers of the magazine reflect the prominence of human problems, the most important being a slow and painful demise of the Air Force's spirit. Pilots are separating not because their aircraft are obsolescing. They are leaving because they have lost confidence in the willingness of our political leadership and the chain of command to sustain the members of the armed forces.

Col. Donald Baucom's letter (May 1979 "Airmail"), and the several that appeared in response, were particularly important reflections of the readers' perceptions. They have given voice to a view that the Air Force's pain stems from a whole series of wrong assumptions that have remained unchallenged for too long. Colonel Baucom challenged the assumption that "Peace Is Our Profession." Let me challenge another.

We hear over and over that "People are our most important resource." This slogan seems to belie my view that the Air Force has ignored its people, but the slogan actually explains why the Air Force does so. Equating people with resources puts them on the same plane as jet fuel, computer time, and money. The slogan subordinates people by grouping them with things. It witnesses the triumph of material thinking because it forces us to think of people in material terms. People, however, cannot be managed as resources are managed. Their concerns cannot be quantified. And they cannot be governed by policies that stem from an assumption that people are a resource—labor—that can be bought like other resources.

The notion that "People are our most important resource" drives a corollary form of conventional wisdom, also flawed. That is the concept that leadership is merely a branch of a larger science of management. It is taught that way in our service schools, but it is wrong. In the military environment, people are led. Leadership—the ability to develop in others a willingness to perform the mission—is a distinct art. It requires such nonquantifiable and intangible human efforts as creativity, integrity, concern, dedication, and will.

AIR FORCE Magazine does print articles on personnel matters. They are as regular as the changes in policy, as the Air Force responds to each successive crisis. Where the articles, and the personnel staffers who created the policies, go wrong is in the assumptions. If people take a second place to weapons in planning for war, then policies for people will always be second rate. And if people are merely another resource, then they can be treated as inanimate "factors." People, however, will take only so much "management" before they look for other work.

AIR FORCE Magazine would do well to forego one or two of its repetitive articles on our strategic capabilities or the latest rub in the NATO threat, and print instead a few articles on the primacy of the human element in military endeavor. A few junior officers and a few airmen might be willing to invest their futures, and perhaps give their lives, for an Air Force that considers them—not its weapons—to be its heart.

Donald M. Bishop is a Foreign Service Information Officer with the International Communication Agency. As an active-duty officer, he served in Vietnam, Korea, and on the history faculty of the Air Force Academy.

AIRMAN'S BOOKSHELF

Airborne: History at Secondhand

AIRBORNE: The History of American Parachute Forces, by Edwin P. Hoyt. Stein & Day, New York, N. Y., 1979. 228 pages including notes, index, maps, and photos. $12.95.

Book publishers have discovered the airborne recently. The result has been a flow of books of which Hoyt's is one of the most recent. To airborne troops and others interested in vertical envelopment, the new attention is gratifying.

Airborne books are best as comprehensive first-person narratives such as retired US Army Lt. Gen. James M. Gavin's *On To Berlin* or Ross Carter's *Devils in Baggy Pants,* or when a significant action is researched and written about by one who took part, as in British Lt. Gen. Napier Crookenden's *Drop Zone Normandy.* With them, the reader gets more than an account of the actions. He gets a feel for the events because the writer-participant's choice of words and methods of description verify that he was there. Through these books, the extent of airborne knowledge (and lore) is increased. Most important, the reader gains insights into airborne leaders and followers, and the paratrooper's frame of mind. That was—and is—as potent a weapon as his ultralight weaponry in the airhead.

But the same virtues rarely accrue in airborne books assembled from secondary sources by nonparatroopers. In them, airborne knowledge is not increased; it is stirred up and reissued in different form. Hoyt's book falls in this category. It is a compilation of extracts from other writings, including Gavin's. But, as such, it must necessarily compress and omit. The result is disappointing.

The book's title initiates the problem. This is not "The History" of American parachute forces. It is at best "A History," and a flawed one at that. For example, eight of the fifteen maps are reprinted with permission directly from *Rendezvous With Destiny,* a history of the 101st Airborne Division. The section on "New Airborne-Airmobile" overemphasizes the 1st Air Cavalry Division and the 82d Airborne, apparently more because information was available than for an evaluation of their contributions to contemporary airborne warfare.

The book ends with an apparently uncritical use of a 1978 speech by Maj. Gen. Roscoe Robinson, then-Commander of the 82d. This leads to "Gee Whiz" statements that (present-day) "equipment of airborne troops rivals a Buck Rogers armory," which stretches credulity, considering the light armament of the 82d Airborne. Similar overdrawn statements are made about the 82d's 155-mm howitzers, claiming they had "rocket-assisted projectiles and cannon-launched guided missiles" in 1978, when those rounds were still in development.

A more accurate summary of present-day airborne was given by William P. Schlitz in the February issue of AIR FORCE. For history, the reader is encouraged to seek out Gavin, Crookenden, Carter, and other participants.

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

A Senator Remembers

With No Apologies, the Personal and Political Memoirs of United States Senator Barry M. Goldwater. William Morrow & Co., Inc., New York, N. Y., 1979. 320 pages. $12.95.

One of the most important influences in Sen. Barry Goldwater's life has been family, the heritage of which has been a strong sense of individualism. His grandfather, "Big Mike" Goldwasser, was a Polish-Jewish refugee who, in his teens, fled the rule of the czars in Poland and made his way through Germany to Paris and London and finally to San Francisco.

Barry Goldwater's father was sixteen when, in 1882, the family moved to Prescott in the Arizona Territory. While Barry's father was a private, if not solitary, man, his mother took the children on camping trips, explaining history and geography. From her Barry acquired his love of the land and history.

Barry, who had learned to fly before World War II, was barred from combat by age and faulty eyesight. He did become a chief ferry pilot, and in the CBI theater helped train Chinese pilots. After the war, he played a leading role in forming the Arizona Air National Guard, in which he served as a jet fighter pilot.

He learned the family retail-merchandising business from the bottom up. Subsequently, he became involved in the "war" for water in the west, and his dissatisfaction with New Deal policies, foreign and domestic, eventually propelled him into politics.

In 1952, Barry Goldwater won election to the US Senate by 7,000 votes. He is still in the Senate, espousing strong foreign and defense policies.

Originally, Goldwater appreciated the soundness of the Marshall Plan but over the years has generally opposed foreign aid. He has fought to curtail the sale of sophisticated technical and oil-drilling equipment to the Soviets, and advocates the philosophy that the United States cannot buy friends around the world. Foreign aid, according to Goldwater, has seriously hurt the US economy.

Senator Goldwater also fought against the policies of Secretary of Defense Robert S. McNamara in "quantifying" US defense activities. However, Goldwater's view that McNamara and his "whiz kids" received an unrestrained, uncritical press misses the mark since McNamara's policies and programs received their share of media criticism.

In descriptions of key political figures of his time, the Senator is frank and outspoken. Goldwater expresses admiration for Harry S. Truman, but not for his policies, especially in Korea. Eisenhower, he writes, was a better President than is generally conceded. In Goldwater's view, Kennedy and Johnson espoused disas-

trous foreign and defense policies. On Vietnam: "More than 40,000 Americans had died in a war the civilian policymakers had forbidden the military to win."

In retrospect, Goldwater thinks Nelson Rockefeller would have made a good president. On Hubert Humphrey, whose politics he disagreed with: " . . . he was warm and wonderful and, for the most part, a very direct man . . . never vindictive." On Oregon's controversial Sen. Wayne Morse: "He massaged his ego twenty-four hours a day."

In Goldwater's view, Nixon did not trust the people and in 1972 was obsessed with winning by a huge majority. In the Watergate scandal, Nixon deceived Goldwater and the Republican leadership as well as the American people.

According to Goldwater, President Carter's foreign and domestic policies have been even less successful than either President Kennedy's or Lyndon Johnson's.

Barry M. Goldwater was raised to respect people, to earn one's way, to keep one's word. He remembers his frontier heritage and the spirit of community that seems now to exist in few places. A man of the West, he has remained direct and forceful, as reflected in this memoir.

—Reviewed by Herman S. Wolk, Office of Air Force History.

New Books in Brief

The Army Gets an Air Force, by Frederic A. Bergerson. In the early 1970s, the US Army had the world's third largest air force, surpassed only by USAF and the Soviet Air Force. This book explains how a land army came to acquire its own air force through "insurgent bureaucratic politics." Of special interest is Mr. Bergerson's analysis of the role of Army aviation in the Vietnam conflict. Appendices, notes, bibliography, index, tables, and figures. The Johns Hopkins University Press, Baltimore, Md., 1980. 216 pages. $14.

Astrodynamics 1979, edited by Paul Penzo, *et al.* This book, in two volumes, presents the proceedings of the annual American Astronautical Society/American Institute of Aeronautics and Astronautics conference on astrodynamics held in Massachusetts last July. Volume I contains papers concerning navigation (including a paper on the Navstar Global Positioning System) and planetary missions; the second volume deals with an assortment of subjects from celestial mechanics to applied computational methods. Many technical charts, tables, and appendices. Order from Univelt, Inc., P. O. Box 28130, San Diego, Calif. 92128, 1980. 959 pages. Part I: hard cover $40; soft cover $30. Part II: hard cover $45; soft cover $35. Microfiche supplement $20.

Deception in World War II, by Charles Cruickshank. The use of deception in World War II has been until now mainly a subject for fictional spy thrillers. Drawing on recently declassified war documents, Dr. Cruickshank details the actual deceptions used by British and Americans in the European theater. Includes photos never before published. With sources, selected bibliography, notes, and index. Oxford University Press, New York, N. Y., 1980. 248 pages. $13.95.

Dying, We Live, by Julian Eugeniusz Kulski. Here is the poignant memoir of a remarkable young man who came of age in war-torn, occupied Warsaw. The son of the city mayor, he was only ten when the war began. He joined the Polish resistance, was jailed by the Gestapo, and after his release fought with the Polish Home Army in its two-month battle with the German Army in 1944. Captured again, the author was a POW before he was sixteen. He wrote a journal after the war to work out the nightmarish events he had lived through and now, thirty-three years later, has transcribed his notes into English for publication. The book, complete with personal photos, is a tribute to the courage of the Poles—Christian and Jew—who suffered during the Nazi occupation. Holt, Rinehart and Winston, New York, N. Y., 1979. 304 pages. $18.95.

Ed Heinemann: Combat Aircraft Designer, by Edward H. Heinemann and Rosario Rausa. Ed Heinemann, "Mr. Attack Aviation," was responsible for the design and development of more than twenty aircraft, ranging from the Dauntless dive bomber and A-26 Invader to the A-4 Skyhawk. Although his formal education ended with high school, his designs provided the US and allies with some of the most reliable aircraft ever built. His story is told with the help of former Navy pilot "Zip" Rausa. Photos, drawings, appendix, bibliography, and index. Naval Institute Press, Annapolis, Md., 1980. 277 pages. $18.95.

Forty Years of the Incredible Spirit of Class 40-A, compiled and edited by Col. Robert F. Schirmer, USAF (Ret.). Colonel Schirmer, Historian of the Class 40-A Association, spent fifteen years assembling this 636-page collection of records, more than 1,000 photos, personal combat records, and memorabilia on the military and civilian careers of the 221 men graduated from Advanced Flying School at Kelly Field, Tex., on March 23, 1940. This collection, compiled primarily for the surviving members of the class, should be of interest to historians and World War II buffs. A few copies are still available and may be ordered from: Col. Robert F. Schirmer, 8978 East Anna Place, Tucson, Ariz. 85710. The price is $100.

The Great War, by Correlli Barnett. This large-format book covers World War I with perceptive analysis and evocative illustrations. Written by military historian Correlli Barnett, *The Great War* conveys the extent of the tragedy and the changes that the conflict brought about in warfare and society. With appendix, bibliography, and index. G. P. Putnam's Sons, New York, N. Y., 1980. 192 pages. $19.95.

Handbook of Soviet Lunar and Planetary Exploration, by Nicholas L. Johnson. This is a detailed scientific study of the Soviet Union's manned space exploration program, written with an eye toward objective analysis of hardware and technology. Much of the book's research is based on original Soviet academic materials. Part of the Science and Technology Series published by the American Astronautical Society. Photos, appendices, bibliography, and index. Order from Univelt, Inc., P. O. Box 28130, San Diego, Calif. 92128, 1979. 262 pages. Hard cover $35; soft cover $25.

The Hitler Movement: A Modern Millenarian Revolution, by James M. Rhodes. Could a movement such as Nazism once again threaten the world? James Rhodes, in this analysis of the Hitler movement, suggests that such an idea is not completely implausible. Nazism was a secular, apocalyptic, millenarian uprising with approximate historical antecedents, and under certain conditions a similar movement could occur. With notes, bibliography, and index. Hoover Institution Press, Stanford, Calif., 1980. 253 pages. $14.95.

Ice Crash: Disaster in the Arctic, 1928, by Alexander McKee. In the late 1920s, the dirigible was believed to be

the long-distance air transport of the future. It attracted such pioneers as Italy's airship designer Umberto Nobile, who in 1928 launched his *Italia* in an attempt to traverse the Arctic that proved a disaster. It crashed and claimed many lives (both crew and rescuers), including that of famous Norwegian explorer Roald Amundsen. Photos, maps, selected bibliography, and index. St. Martin's Press, New York, N. Y., 1979. 326 pages. $12.95.

Japanese Aircraft of the Pacific War, by René J. Francillon. Japan was able to mask her development of airpower before Pearl Harbor and stunned the Allies during the early days of the war with both the quantity and quality of her air forces. This updated second edition is an analysis of Japan's aviation industry and aircraft produced between 1927 and 1945. Includes photos, drawings, appendices, and index. Putnam & Co., London, 1980. 570 pages. $31.95.

The Kremlin's Dilemma, by Tufton Beamish and Guy Hadley. Concern for human rights within the Soviet Union is still treated as a "disease," the authors note. Still, the Kremlin has failed to halt the rising infiltration of Western ideas into the satellite countries of Eastern Europe, while the Helsinki Accords have provided a focus for increased protests. Human-rights campaigners have gained strength and confidence, presenting the Kremlin with formidable problems. The authors believe the satellite countries are now becoming more of a liability than an asset. They point out the weaknesses, especially economic, of the Soviet position and call for a firmer and more united Western policy. The book covers thirty years of broken Soviet promises—from Yalta to Helsinki. Appendices, index. Presidio Press, San Rafael, Calif., 1979. 285 pages. $12.95.

A Short Research Guide on Arms and Armed Forces, by Ulrich Albrecht, *et al.* The small size and relatively high price of this guide belies the great value of such a bibliography for research of arms control and arms transfer. Part I of the book lists various reference sources and how to obtain them; Part II evaluates three of the best-known sources (IISS's *Military Balance, Jane's Fighting Ships,* and SIPRI's *Yearbook on World Armaments and Disarmament*). Appendices, index. Facts on File, 119 W. 57th St., New York, N. Y., 1980. 112 pages. $17.50.

AIRMAN'S BOOKSHELF

Soviet Policy in the Post-Tito Balkans, edited by Philip A. Petersen. With Yugoslavia's President Tito gravely ill at present, this scholarly work receives added urgency as it grapples with the problem of Balkan instability and Soviet policy. The result of discussions growing out of the annual Central Slavic Conferences, the authors analyze the interests, tools, and processes that have a potential for playing significant roles in what might occur in the Balkans after Tito passes from the scene. Published under the auspices of USAF as part of the Studies in Communist Affairs series. Available from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402, 1979. 157 pages. $4.75.

The Soviet Threat to NATO's Northern Flank, by Marian K. Leighton. The author raises the alarm that NATO has neglected the vitally strategic Scandinavian front. She analyzes the growing Soviet military and diplomatic pressures on NATO's northern partners and focuses on the urgent need for appropriate responses. National Strategy Information Center, 111 E. 58th St., New York, N. Y. 10022, 1979. 100 pages. $3.95.

Space Shuttle: Dawn of an Era, edited by William F. Rector III and Paul A. Penzo. A compilation of papers presented at the American Astronautical Society's 1979 annual meeting, these two volumes emphasize the potential benefits of the Shuttle. With technical charts, tables, photos, and appendices. Vol. 41 of the Advances in the Astronautical Sciences Series. Order from Univelt, Inc., P. O. Box 28130, San Diego, Calif. 92128, 1980. 948 pages. Part I: hard cover $40; soft cover $30. Part II: hard cover $45; soft cover $35. Microfiche supplement $5.

The 1,000 Day Battle, by Jim Hoseason. Painstaking research has produced this fascinating narrative of B-24 operations against Germany, with details on the bombing systems, the airplane, and the crews. The author also discusses the operations of the 448th Bombardment Group and other B-24 units based in East Anglia's Waveney Valley. In twenty-eight chapters, he tells the complete story, from the launching of the Eighth Air Force through V-E Day and the return to America. There is a wealth of information not previously assembled in other books of this type, including little-known experiments with remote bombing techniques, jamming of German gun-laying radar, and electronic countermeasures. The book is large format, lavishly illustrated with photos, maps, charts, and diagrams. 1980. 256 pages. Orders for this book, @ $17 postpaid, may be placed through Col. Ron Kramer, 131 North Shore Dr., Syracuse, Ind. 46567.

Toward the Endless Frontier, by Ken Hechler. A history of Congress's Committee on Science and Technology, this book documents the political judgments that helped guide twenty years of American scientific and technological advancement. Painstakingly researched and rich in human detail, the book provides a rare insight into the functioning of an increasingly important congressional committee as it attempts to come to grips with the difficult questions and choices presented by technology. Of special interest to readers will be the committee's work on the US space program in the early 1960s. Photos, bibliography, and index. Available from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402, 1980. 1,073 pages. $11.

To War in a Stringbag, by Cmdr. Charles Lamb. The Fairey Swordfish (nicknamed "Stringbag"), a torpedo-reconnaissance biplane of the British Fleet Air Arm, was an unlikely hero of World War II. In this memoir, Charles Lamb recalls his adventures flying the scrappy "Stringbags" and the exploits of the courageous men who piloted them. Bantam Books, New York, N. Y., 1980. 369 pages. $2.50.

The United States Air Forces in Europe. A publication of *Armed Forces* magazine, this booklet covers USAFE missions and forces, training, maintenance, readiness, and reinforcement plans, and assesses USAFE's difficult future as a deterrent against a numerically superior adversary. Includes organizational charts and a foreword by Gen. John W. Pauly, Commander in Chief, USAFE. Photos. Available from Ian Allen Ltd., Mail Order, Terminal House, Shepperton, TW17 8AS England, 1980. 35 pages. Price if by surface mail $1.50; airmail $3.

—Reviewed by Hugh Winkler.