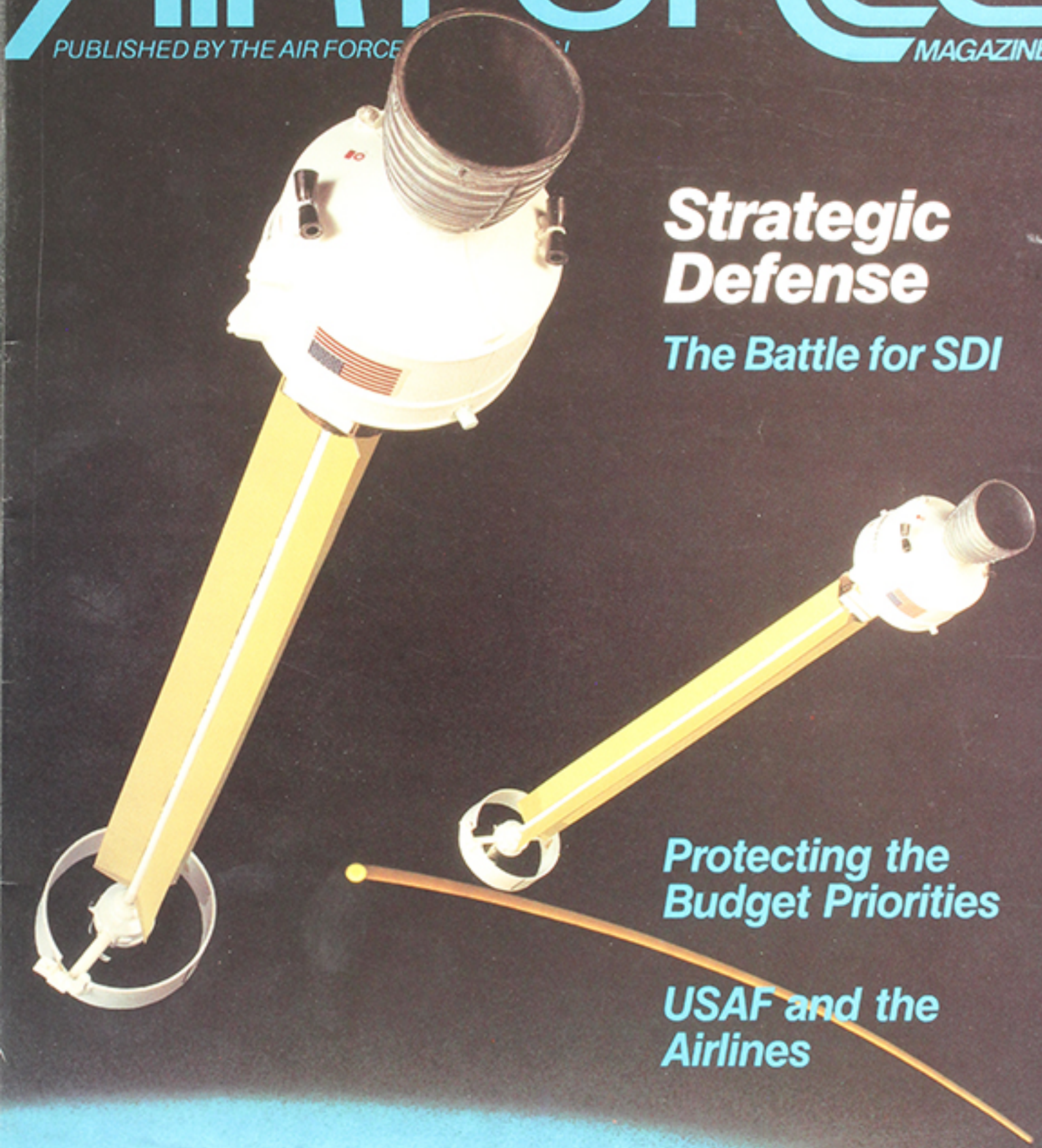
FEBRUARY 1985/$2

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE

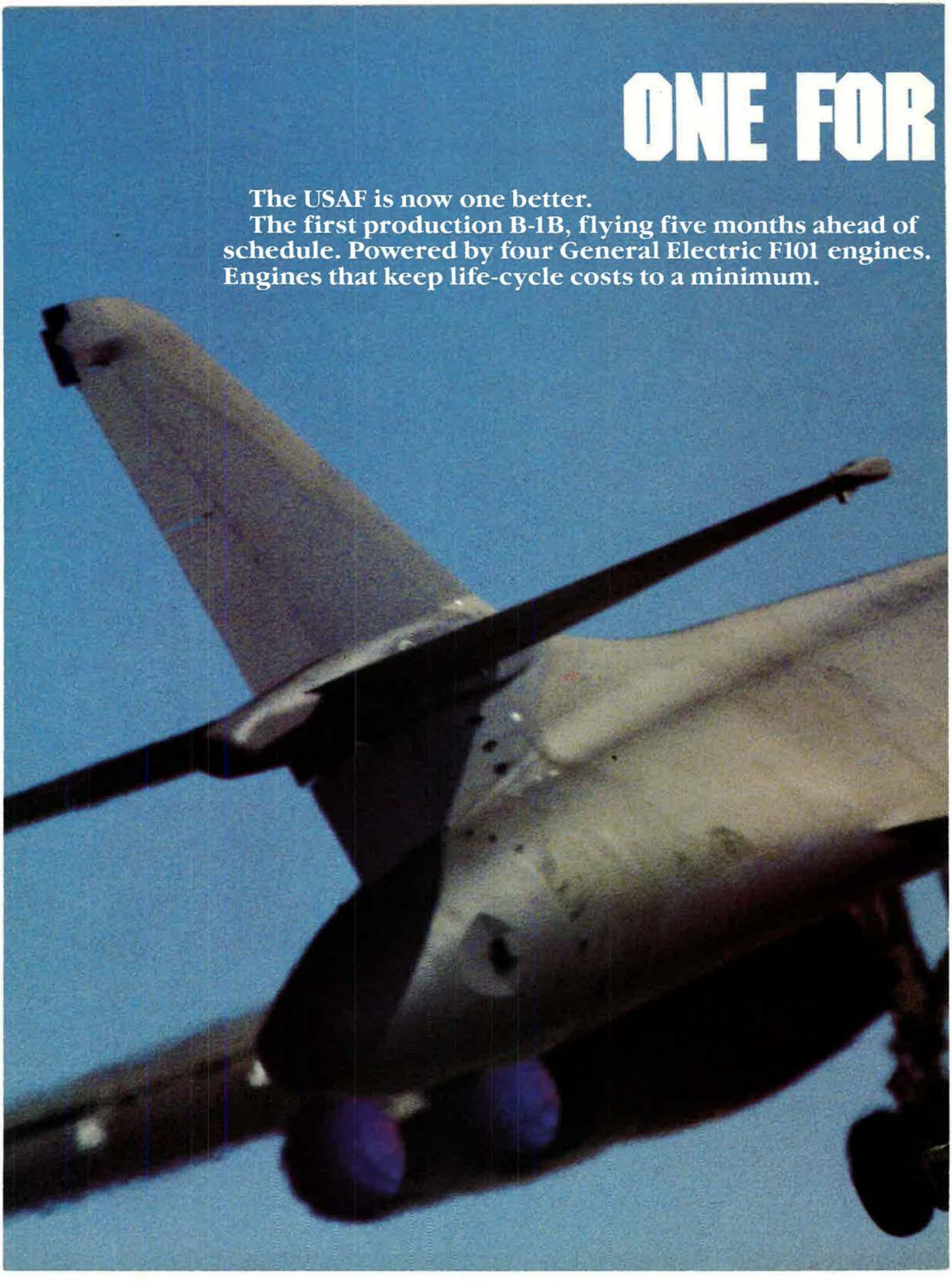


Strategic Defense

The Battle for SDI

Protecting the Budget Priorities

USAF and the Airlines

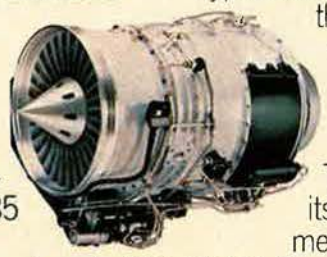

ONE FOR
The USAF is now one better.
The first production B-1B, flying five months ahead of schedule. Powered by four General Electric F101 engines. Engines that keep life-cycle costs to a minimum.


OUR SIDE.
Engines that give the B-1B exceptional range, payload and penetration capabilities. Engines that help the B-1B keep the peace.
A registered trademark of General Electric Company

The F109: Ahead of its time. And not just on paper.

When the Air Force selected Garrett's F109 to power the new Fairchild T-46 trainer, they got more than just another advanced technology engine.

They got the new standard in engine durability, safety, and efficiency. An engine that is rolling on schedule toward an early 1985 takeoff.



F109-GA-100

As the first engine developed under the strict criteria of ENSIP (Engine Structural Integrity Program), the F109 is designed for the 18,000-hour life of the airframe.

Moreover, its advanced core technology, full-authority digital electronic fuel control, and 5:1 bypass ratio all contribute to SFC's that are miles ahead of any other engine in its class.

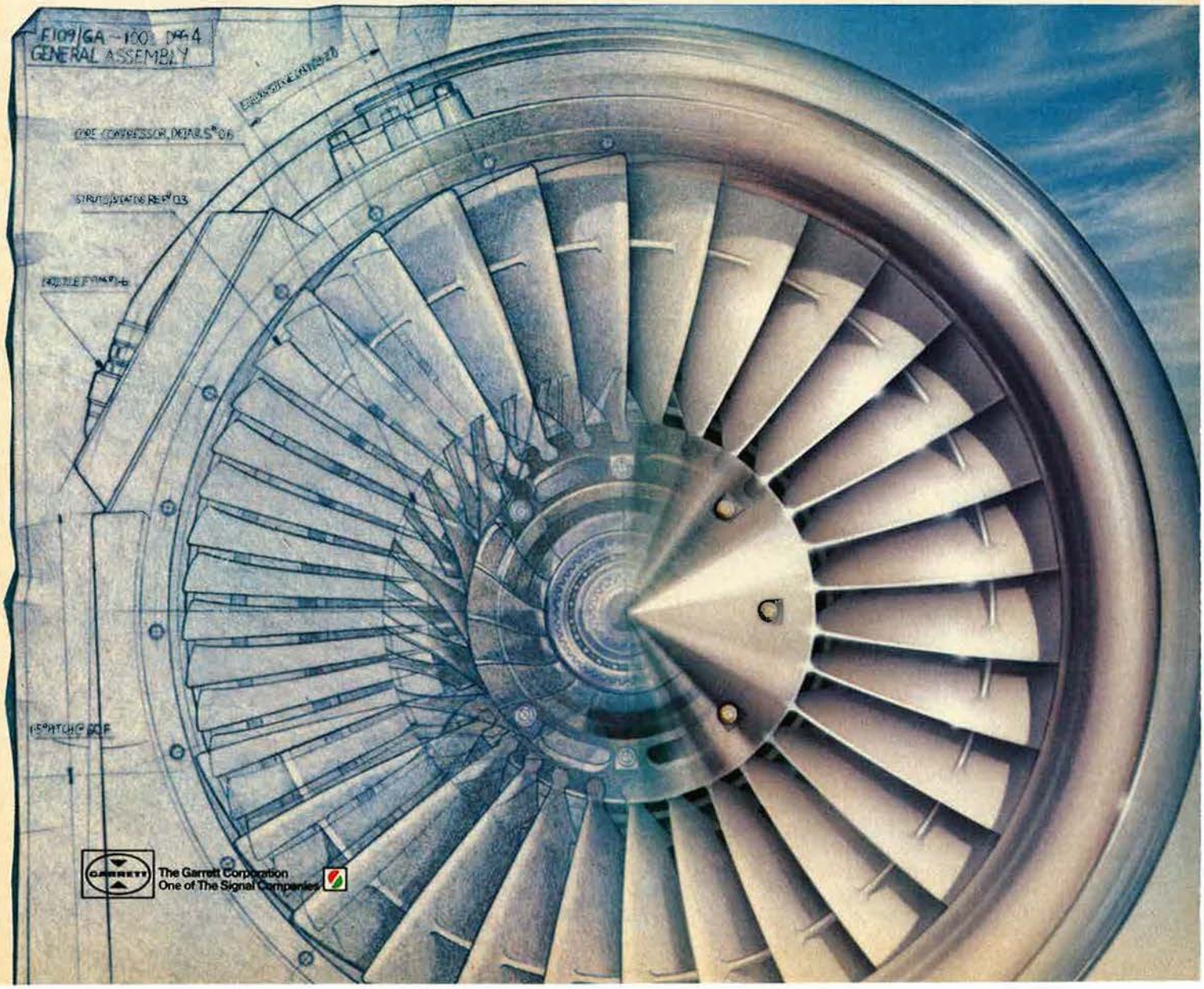
And that's just the beginning.

The first F109 exceeded its 1,300 lb. thrust requirement on its initial run Dec. 4, 1983, 4 weeks ahead of schedule. With its capability for growth and configuration flexibility, the F109 is also the basis for a very affordable and durable new family of engines for turboprop, turboshaft, and turbofan applications.

Garrett's F109. On test, on cost, on schedule for delivery in 1984. An engine that's on target for the times.

For more information, contact: Manager F109 Sales, Garrett Turbine Engine Company, P.O. Box 5217, Phoenix, AZ 85010. Or call: (602) 231-1037.

GARRETT



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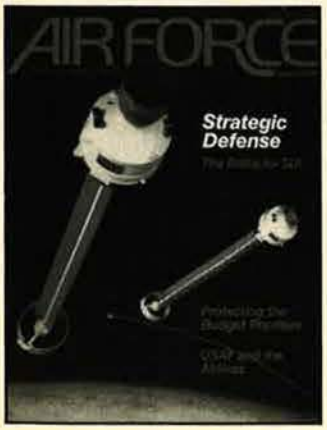
Page 85



About the cover: Kinetic-kill weapons, such as the hypervelocity launchers in this artist's concept, are a promising avenue for exploration under the Strategic Defense Initiative. A special section on "Strategic Defense" begins on p. 44. (Photograph by Paul Kennedy)

Special Section: Strategic Defense

Features

Departments

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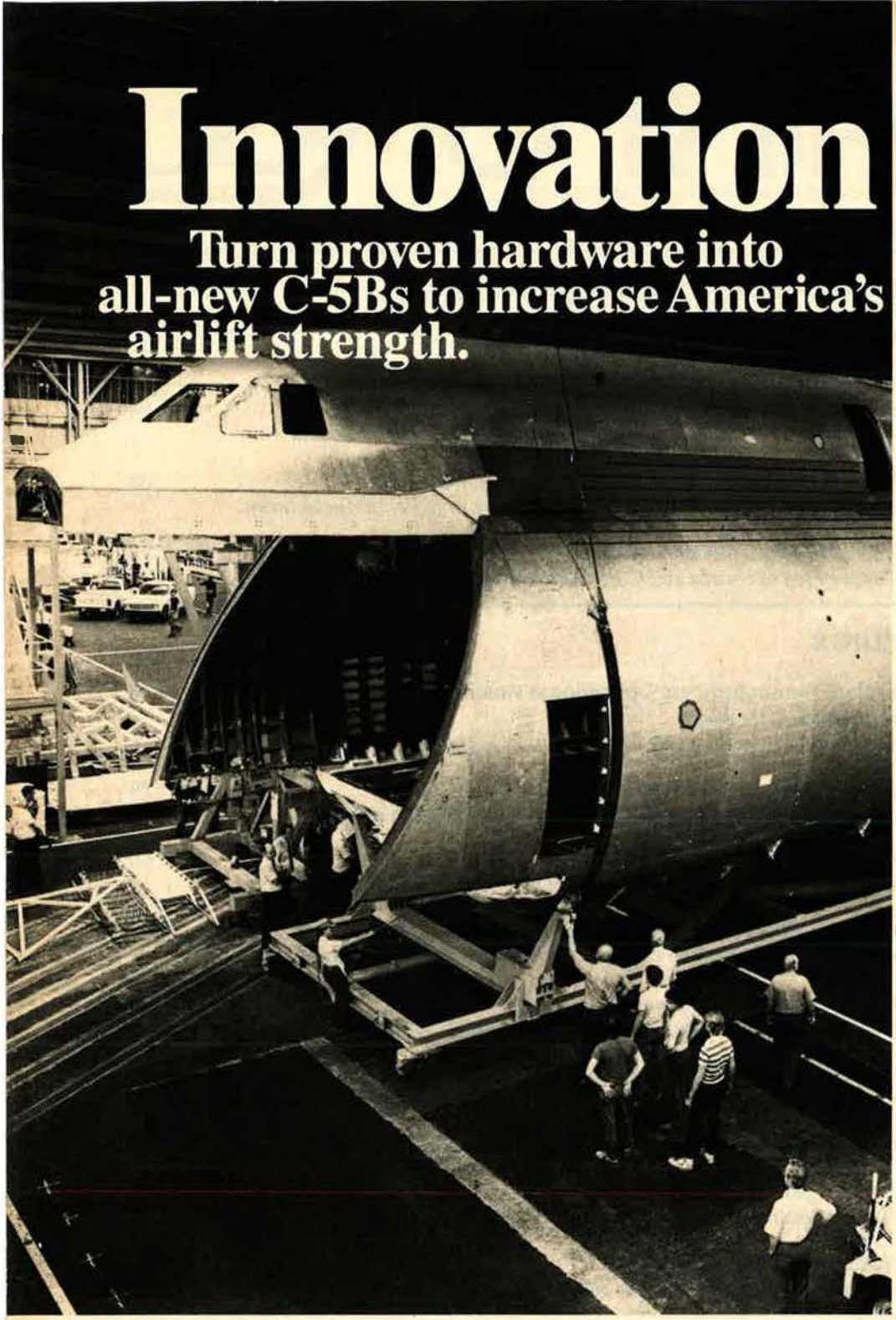
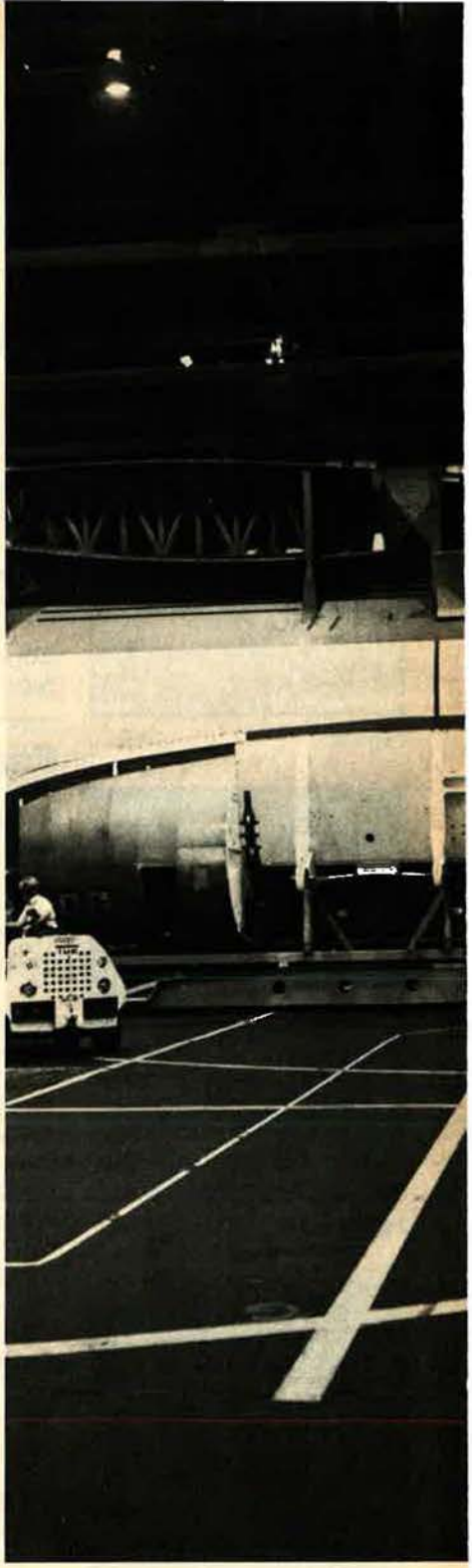
Innovation

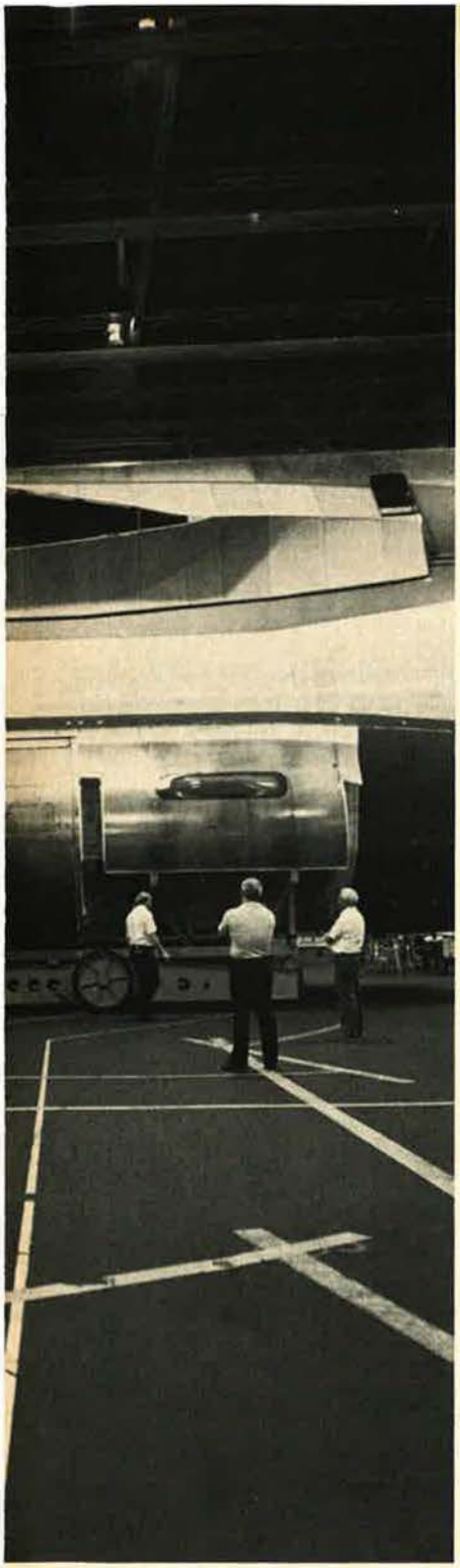
Turn proven hardware into all-new C-5Bs to increase America's airlift strength.

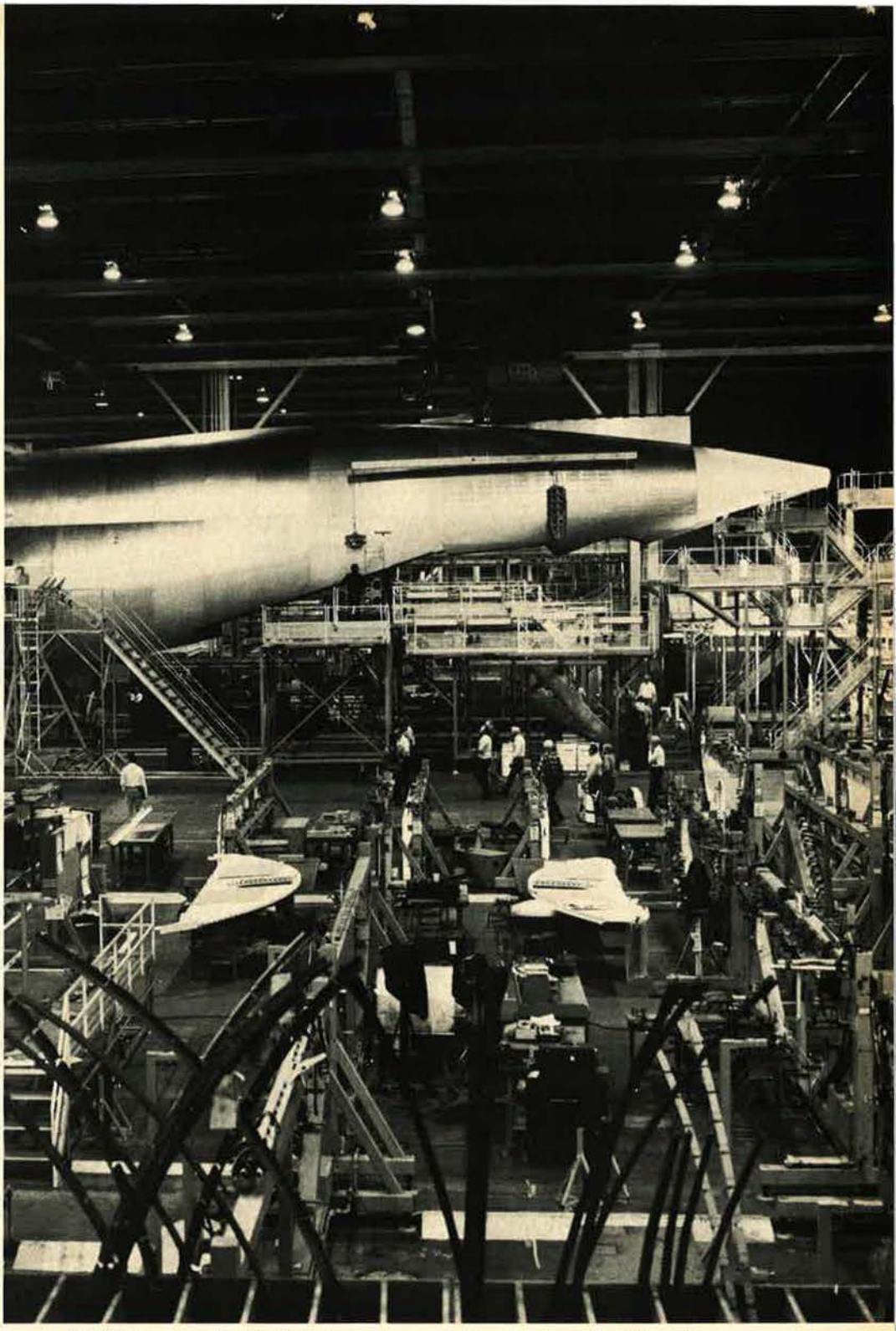




Lockheed-Georgia

Giving shape to imagination.





Marietta, Georgia—January 1985

Major assembly is continuing rapidly on the first of the new USAF C-5Bs. After its first flight this fall, it will join the 77 C-5As already in service with the Military Airlift Command.

The fixed-price program calls for Lockheed-Georgia to produce 50 C-5Bs, making America's outsize cargo capacity 65% greater and dramatically expanding airlift—the backbone of deterrence.

This will increase the nation's ability to airlift fully assembled helicopters, infantry fighting vehicles, self-propelled artillery, M-1 tanks, and all other needed equipment to any part of the world with the speed necessary for effective deployment.

Moreover, the new C-5Bs will significantly enhance operations through such improvements as a simplified automatic flight control system; color weather radar that is lighter and more reliable; a digital air data computer; and a highly advanced navigation/communications system.

The C-5B also will have improved engines with increased reliability. And much of the aircraft will employ new alloys that are stronger and more corrosion-resistant. Other advances enhance its maintainability.

As assembly continues at Marietta, Georgia, the C-5B is meeting or exceeding all program quality requirements—one result of our new, modern machines and production methods.

It is also a testimonial to the skill and energy of the people at Lockheed-Georgia, as well as workers at Lockheed's suppliers in 47 states.

With the C-5B, they are not only building the free world's biggest airlifter, they are building it better.

AN EDITORIAL

Research and Technology vs. Operational Reality

By Russell E. Dougherty, PUBLISHER

WHEN he was Secretary of the Air Force, Dr. Hans Mark frequently contrasted the perceptions of things held in the *programmatic world of Washington* with the way things really are in the *operational world* of the combatant commands—the real world, where the weapon systems are and where the blue-suiters live and work. Nothing illustrates just how vast this gap is between Washington-level thinking and the *real world* of operational weapons like the debate now raging over President Reagan's Strategic Defense Initiative (SDI).

Starting from his dramatic March 1983 "Star Wars" speech concerning the need for ballistic missile defenses (and his challenge to our scientific and technological communities to perfect them), the "fog count" in Washington began to increase. A drift toward mischief was evident when the strategic gurus of the Potomac began converting the President's general objectives and broad technology initiatives into specific capabilities with measurable performance parameters and near-term options.

Fortunately, British Prime Minister Margaret Thatcher got it right; she called SDI what it is—a major (and demanding) research and technology program. Would that some of the zealots and space warriors on our side of the Atlantic exercise that same discipline and judgment.

We are now being inundated by the intellectual Mafia of the political/military think tanks. Books, op-ed pieces, articles for the prestigious national magazines, arms-control seminars, and background sessions with industrial leaders are bursting out all over. Now that the Administration and Congress are preparing to come to grips with the tip of the SDI budgetary iceberg and our negotiators are reopening substantive discussions with the Soviets on arms-control measures, the conceptual battle lines are forming—but with some surprising areas of agreement between strange bedfellows.

That earlier "fog count" has thickened to the point of obscuration, and some real-world operational facts are in danger of being overlooked or ignored. As important as the President's SDI programs are (and SDI *is* an important, exciting, top-down initiative), we cannot afford to let the long-range research and technology programs take on *unwarranted operational dimensions*. We must separate conceptual dreams, desires, and hopes from the immediate task of satisfying critical operational requirements, strategic and general purpose, in today's operational world.

Norman Augustine, former Chairman of the Defense Science Board, recalled recently that, during the intense ballistic missile defense debates of the mid-1960s, two-thirds of those citizens polled believed that *the system then deployed afforded good protection*. Of course, there was *no* system then deployed—there was *no* protection! That is the great danger for us in the current situation—the inability of our people (and our allies) to separate the SDI technology programs seeking what *might be* from the modernization programs for operational forces that are *in being*.

The programmatic world now being shaped for SDI cannot substitute for the deterrent strength that rests in our ICBMs, bombers, and sub-launched missiles, but we must be alert to those who will try, deliberately or inadvertently, to do exactly this. The ongoing modernization of our current operational forces must not be relegated to the budgetary scrap heap. For there is *no* ballistic missile defense system, there is *no* near-term possibility of such a system, there is *no* operational alternative to our current deterrent force, there is *no* substantial agreement that we can (or should) place primary reliance for our security on defensive systems, even if such defensive systems should evolve beyond our current hopes and expectations. In a much longer term, we may be able to make substantial modification in the nature of our strategic offensive forces, but failure to modernize them in this decade, as planned, would be a grievous error.

The President's admirable hope that we can find a technological alternative to deterrence, which is based on what he termed as "the immoral threat of nuclear retaliation," must be viewed in exactly that vein: a futuristic hope backed by a widespread, vigorous technology program. For now, we should encourage Lt. Gen. Jim Abrahamson and his people to press technology for progress toward an encompassing strategic missile defense, and we can hope for achievements that surpass our understanding. Meanwhile, we must take with a lot of salt those who describe, with precision, "operational" defensive systems or who place seemingly precise time frames around the viability of deterrent forces, the utility of nuclear retaliation, or the demise of nuclear ballistic missiles.

National decisions must not be made or swayed by the assertions of those who describe, in absurd detail, how our operational space defenses will work, how effective they will be, what they will replace, how much they will cost, and when we can have them "on line." We should not even repeat such irresponsible conjecture, for it is sure to mislead our people into thinking that we have, or soon can have, a comprehensive ballistic missile defense.

The recent and remarkable exoatmospheric intercept of an incoming reentry vehicle near Kwajalein atoll can easily be misinterpreted as such a ballistic missile defense. If our national leadership is misled into this erroneous mind-set, they will fail to see the pressing operational requirement for our strategic offensive and retaliatory modernization. There will be no MX, no B-1B, no D-5 missiles for our submarines, no small, mobile ICBMs. And if we fail to do what we *must* while we search for our hopes and dreams, all too quickly we could find ourselves without arms-control leverage, without relevant deterrent strength, without defenses, without a guarantor of our freedom. Then, nothing else we do will count for much. ■

COLLINS GPS:

The Collins GPS tested by 

is the same as the GPS tested in  . The GPS tested on 

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Now that's commonality!

Collins Navstar Global Positioning System receivers are currently being tested on land, at sea, and in the air.

Our precise, 3-dimensional position / velocity / time GPS systems have been environmentally tested as well as EMI and CERT tested. Equipment producibility has even been proven on our production line.

Designed-in commonality reduces the need for repeated performance testing in new applications. It also helps reduce initial cost and lowers life-cycle costs through greatly reduced maintenance and spares requirements.

Collins GPS user equipment sets share 75% of all Line Replaceable Units, and field-proven GPS software is common to more than 80% of all applications.

For a status report on our Navstar Global Positioning System, contact Collins Government Avionics Division, Rockwell International, Cedar Rapids, Iowa 52498. (319) 395-2208.

COLLINS AVIONICS

Rockwell International

...where science gets down to business

Who took 3,000 lbs. out of the B-1B?

Harris did. With EMUX, the most advanced airborne electrical multiplexing system yet developed.

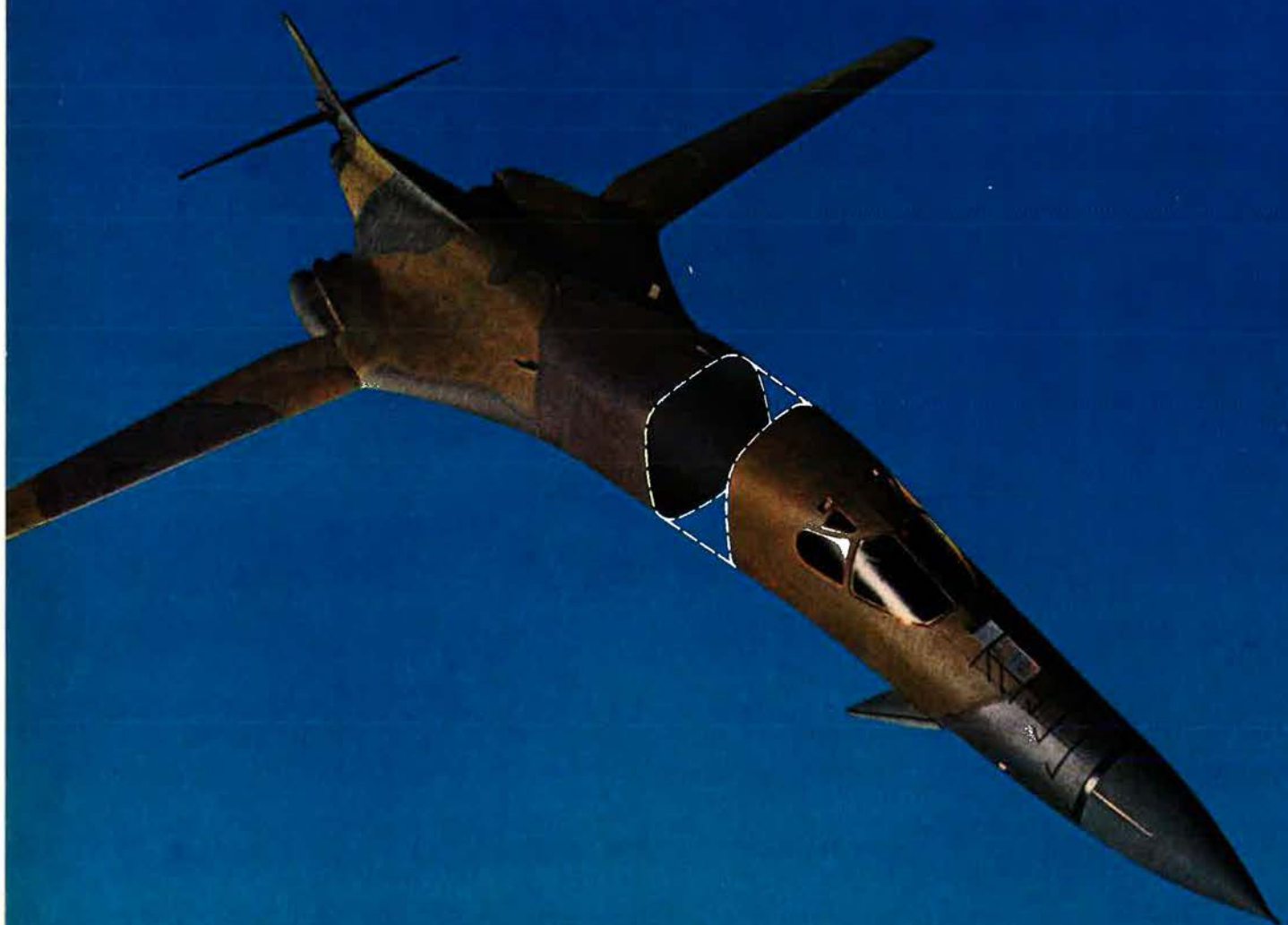
What's missing is a lot of wire and conventional control hardware—not needed because our EMUX does the job without it. This advanced system controls some 13,000 different signals for such major systems as electrical power, engines and weapons, via redundant data buses. The key? Programmable hardware that not only computes but also transfers the subsystem data.

Besides slashing weight (allowing more payload and fuel capacity), EMUX reduces cost, fuselage area and crew workload. It also improves reliability and survivability, while ensuring flexibility for the future.

Harris invented Vehicle Interior Multiplexing in the late '60s, and our EMUX has been flight proven since 1974. Ahead of schedule and in full production on B-1B, EMUX is another example of Harris's long and continuing leadership in advanced avionics.

It shows how *Harris Aerospace* meets unique challenges in the information field—by advancing systems technology. Harris Corporation, Government Aerospace Systems Division, Melbourne FL 32902. Phone (305) 727-5115.

For your information, our name is Harris.



HARRIS

AIRMAIL

The Wrong End?

I read your editorial twice to make sure I got your thoughts correct. *(See "The Little Big Deal," p. 4, December '84 issue.)* As you expressed your thoughts in the December 1984 editorial, I figure you grabbed the wrong end of the stick.

I would have thought that you would have been appalled and embarrassed by any indication of wrongdoing as it pertains to the pricing of material for our defense services. Instead, you react by namecalling (*i.e.*, "horror story groupies") and miss the point entirely.

God bless those in and out of the services who blow the whistle on the cheats, the incompetents, and the slovenly. The bigger the organization, the more trash to conceal. Think how the overpricing of that $300 screwdriver, the $700 toilet seat, and the $7,622 coffee maker has deprived the services of money to purchase needed equipment. Think of how the disclosure of such "theft" has weakened the argument for an adequate defense budget. "Low-value parts"? I didn't think such a thing existed among our government's present purchases. How come a stock aircraft, stripped of all civilian appointments, costs the government more than it would than if it had been delivered to a civilian purchaser in all its prettiness? Mil-specs? Who are you kidding?

Military spending must be conducted by capable people. The incompetent must be eliminated whenever their presence is detected, five stars or PFC.

If we want our defense budget, or any part of the government's budget, to do its prescribed job, we must all be alert to negligent waste. Demanding the "best" is the only way you're going to attain it. Treating the military organization and its overall decisions as a "sacred cow" is just plain stupid.

James J. Goebel, Jr.
Conroe, Tex.

• *The editorial does not endorse spare parts overpricing. The point was that this problem is not, by a long shot, the most important one on the defense agenda. The media circus on "horror stories" has run nonstop for two years, and it is diverting attention and resources from matters of far greater consequence. The relative effort on spares overpricing should be in proportion to the significance of the problem, not to the noise level of the circus.*—THE EDITORS

Navigation Nostalgia

As I read through your December 1984 edition of AIR FORCE Magazine, and specifically through Lt. Col. Ralph R. Williams's article, "Navigation: From Dead Reckoning to Navstar GPS," a nostalgic chord sounded when I got to page 66. There the author recorded: "At Morrison Field, Fla., . . . eighteen student navigators and an instructor boarded a C-54 Skymaster." Although he did not mention any names, I feel that it is quite possible that the instructor to whom he referred might well have been myself or one of my colleagues, since at that time I was the director of electronic navigation training at Morrison Field.

I had been discharged from the Army Air Forces in January 1946, having served with the Caribbean Division of the Air Transport Command at Miami AAF throughout most of the war years as a Loran instructor. I accepted a Civil Service appointment to establish a postwar electronic navigation school at Morrison Field that same month. There I directed the formation of an AN/APS-10 radar program that included use of a modified APQ-13 T1-A supersonic trainer for ground instruction, a Loran (AN/APN-4 and AN/APN-9) course, and a pressure pattern program employing the SCR-718 radar altimeter.

Two line C-54 aircraft were made available for modification to enable their use as flying radar/Loran classrooms. One of our early "discoveries" was the cause for numerous operational reports that complained of the unacceptably short radar range (twenty to twenty-five nautical miles) of the APS-10. We found that all of the C-54 radomes had been finished with a lead-based paint, and, once it had been removed, the search range at 8,000 feet altitude increased to an average of eighty nm.

I would appreciate making contact with any other "old-timers" who may have been associated with this initial effort in equipping transport aircraft with relatively lightweight navigational search radar and who instructed in its operation and maintenance at Boca Raton or who used it during the Berlin Airlift. The last time I used the APS-10 was on an AFCS "Gooney Bird" out of Westover AFB, Mass., in 1960.

Lt. Col. George E. Ballweg, Jr., USAF (Ret.)
11 Jessie Rd.
Chelmsford, Mass. 01824

Submissions to "Airmail" should be sent to the attention of the "Airmail" Editor, AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should not exceed 500 words and should preferably be typewritten. We reserve the right to condense letters as may be needed. Unsigned letters are not acceptable. Because of the volume of letters received, it is not possible to print all submissions, and none can be returned. Photographs cannot be used or returned. Please allow lead time of *at least* two months for time-sensitive announcements.

Strike Off the Band?

Re: Your article "From Valley Forge to Gabriel," December '84 issue, p. 74.

While there can be no doubt that the professional men and women of the Air Force Band have improved the morale of some of their fellow members, one can certainly wonder if having a band is worth the taxpayers' money.

I noted in one of your issues this year that more than 1,000 personnel are in the band career field. Since I have been on active duty (more than five years), I have never had the privilege of taking in one of their performances. The point is that life would

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continue without a band. And I doubt highly that the brass in the Washington, D. C., area would bail out for lack of a band.

Lt. Gen. Duane Cassidy, the Deputy Chief of Staff for Manpower and Personnel, remarked recently in the *Air Force Times* that "when you don't have 100 percent manning, our people take it in the ear." As I see it, the solution is simple—cut band authorizations to about 100 maximum (one large band, period) and redistribute the others to those critical areas that need them.

You must agree that such a move would increase our warfighting capability if these authorizations went to the weapon systems field instead of for military bands. You may argue that morale would plummet, but I say that morale will improve greatly for those who no longer have to do the job of one and a half people.

We owe it to ourselves and to the American people to distribute our limited manpower in the wisest fashion. Maintaining more than 1,000 people in the band career field when serious shortages exist in primary weapon systems is not only a waste of taxpayers' dollars, but also pure folly.

Capt. Paul G. Hough, USAF
Tampa, Fla.

The Military Balance

I returned home from a recruiting conference last night to find the December '84 issue of AIR FORCE Magazine waiting for me. The special IISS section on "The Military Balance 1984/85" follows their usual standard of excellence; however, there are some discrepancies that I feel confident they would be interested in correcting.

The first is on page 86 under the heading "Strategic Nuclear Forces." They include thirteen Air National Guard tanker units (of which we are one) in the KC-135A/Q category. As of this date, more than ninety-five percent of the Air Guard's -135s have been converted to the E version by replacement of the old J57 engines with newer TF33s. These give greater thrust, quieter operation, longer range, greater payload capability, enhanced fuel efficiency, cleaner emissions, and thrust reversers—features that the Air Force's KC-135As don't have.

The second correction concerns the map on the top of page 160. The OTH-B is not located merely at "Bangor (Maine)"—it is a tenant operation at Bangor ANGB, Me. We are very proud of the fact that, having been in the same location since February 1947, we received our official "base designation" effective October 16, 1982. It is that same pride that causes our desire to be referred to officially and correctly.

While we're on the subject, "Otis AFB" (also referred to on the map) was closed by the Air Force several years ago. It is now known as Otis ANGB.

I hope that these corrections will be accepted in the manner intended.

MSgt. Michael P. Gleason, MeANG
Bangor ANGB, Me.

Re: The map of US strategic systems deployment on page 160 of the December 1984 issue.

Please note that two Strategic Air Command bases were not shown on the map—Wurtsmith AFB, Mich., and K. I. Sawyer AFB, Mich. Also, Mather AFB, Calif., is not a SAC base. It is an Air Training Command base, with a SAC bomb wing as a tenant unit.

Thank you for allowing me to clear this up.

Capt. Randall A. Nordhagen, USAF
Oscoda, Mich.

Wrong First

This letter is regarding the November '84 article "Tribute to Excellence" about honoring the Air Force's outstanding airmen.

The portion on TSgt. Katherine R. Todd states that she was "the first woman WC-130 crew member." I served with the 53d Weather Reconnaissance Squadron from December 1977 until August 1981, and I can state that Sergeant Todd is definitely *not* the first woman WC-130 crew member. I was privileged to fly with Sgt. Martha Kelly, dropsonde systems operator, Capt. Florence Fowler (now Parker), navigator, Capt. Sharon Bush, airborne weather reconnaissance officer, and several other women crew members before 1979.

Although I do not know who was the first WC-130 woman crew member, it definitely was not Sergeant Todd. Hopefully, one of your readers can provide the name of the first woman WC-130 crew member.

Capt. Harry C. DeBruhl, Jr., USAF
Eglin AFB, Fla.

• *Captain DeBruhl is correct. The article should have read that Sergeant Todd was the first woman* WC-135 *crew member.*—THE EDITORS

Memories of Java

Re: "Valor: Journey to Java" on p. 166 of the November '84 issue.

John L. Frisbee's account of the

"fun" in 1942 brought to mind a discussion I had in May 1982 during the Washington State AFA convention in Seattle, during which John F. E. Claringbould—who is currently living at 19220 68th Ave. W., Lynnwood, Wash. 98036—told me about his own experiences.

John was flying seaplanes for Batavian Petroleum when he was "drafted" by the Netherlands East Indies Navy to fly Sikorsky flying boats. He told me and a host of others who had flown on the side of the Americans that the Sikorskys were a "bag of spare parts flying in formation." Many times during takeoffs and landings, the craft would fall apart.

I gave John's address as he would like to hear from more of his buddies.

Keep up the good work. I enjoy reading your highly interesting articles, which help me keep abreast of the future for USAF.

Ferdinand L. Joosten
Lynden, Wash.

The Missing Wing

Re: Your November 1984 article, "The Case of the Missing Wing," p. 37.

I was wondering what happened to the wing on that F-15. The article was very interesting, but didn't mention the cause of the accident. Could you please let us know?

SrA. Lester E. Wheeler, USAF
Rhein-Main AB, Germany

• *The foreign-owned aircraft was damaged during a midair collision.*—THE EDITORS

A Better Value

Re: "Assuring Access to Space," p. 80, November '84 issue.

On page 84, there appears a comment about "satellites hovering in geosynchronous orbit at 22,300 nautical miles above the Indian Ocean." I believe that a better value would be approximately 22,236.41 international miles for the distance in the preceding sentence. The distance given in your article is about fifteen percent greater than the theoretical altitude.

Roy D. North
Ellicott City, Md.

Saluting the RAF

John W. R. Taylor's article "How Good Is the RAF?" in the October '84 issue ought to be mandatory reading for all Air Force personnel stationed in the UK. It really does outline the RAF organization, mission, and capabilities in "super" fashion.

However, I believe you missed one very critical element of the RAF that has a very direct impact on US security—Ballistic Missile Early Warning System (BMEWS) Site III. Site III, located at RAF Fylingdales in North Yorkshire, comes under 11 Group for day-to-day operations and performs a vital missile early warning mission for the UK, Europe, and the United States. It is the only UK missile warning sensor and, as such, is designed to detect the whole range of SLBMs, IRBMs, SRBMs, and ICBMs targeted against the defended areas—including North America.

In addition to the early warning mission, Site III provides orbital information on space objects to the NORAD Space Computation Center for their analysis and for upkeep of the entire space catalog. This unique sensor system uses three 115-ton tracking radars to perform both scan and tracking functions.

The site has been in continuous operation since 1963 and is commanded and operated solely by RAF personnel. Through the years, these superbly trained troops and their reliable radar system have shown repeatedly how good the RAF is. I hope future articles on the RAF will not overlook their considerable contribution to both UK and US security.

Maj. James E. Webber, USAF
RAF Fylingdales, UK

AIRMAIL

The Acquisition Controversy

I would like to address myself to the controversy raised by your editorial "An Acquisition Superagency?" that was published in the August '84 issue. Specifically, I would like to address issues raised by Mr. Tom E. Moore in his "Airmail" letter, "Pluck the Eagles," in the October '84 issue *(p. 13).*

I have more than twenty years of experience in the Air Force R&D acquisition business. My last assignment was as head of the European office responsible for the installation and acceptance testing of C³I equipment procured under the auspices of the Electronic Systems Division, AFSC. In this capacity, I had ample opportunity to work closely with the German defense and acquisition agencies in both unilateral and bilateral programs.

My summary observation of the *Bundesamt für Wehrtechnik und Beschaffung* (BWB) is that they are a talented group of hardworking, dedicated civil service personnel. However, their cost and schedule growth problems are as intractable as our own. Their big programs, *i.e.,* Tornado aircraft and C³ software-intensive programs, are as difficult to accomplish within the time and budget allowed as any of ours. A close examination of their actual management practices indicates that most of their reporting and control methods stem from US management ideas, albeit with major changes in scope to reflect the size of their defense program and industrial base.

They have some very fine programs, and a current highlight is the NATO AWACS, which is ahead of schedule and under budget. Much of the credit can be given to outstanding planning and dedication to solving problems by all involved. Based upon my observations, though, the BWB has no unique answers. They, like us, apply management talent and abilities to very tough problems to produce the most mission-effective and cost-effective systems.

As to the more interesting subject raised by Mr. Moore—the role of the military in the system acquisition process—I wish to add the following. He is correct in stating that there are no uniformed military assigned to the BWB. This is a condition of the postwar German constitution. This condition was designed specifically to prevent the prewar situation, wherein the military avoided the research prohibitions of the Versailles Treaty by subterfuge. In other words, it was designed to ensure civilian control over military acquisition. It was not based on any real or imagined inability of military personnel to accomplish the development and acquisition mission.

While all the German military are aware of the reasoning and abide by the restriction, there is a desire in C³ areas—where the challenge is to develop user-friendly, rapidly reconfigurable systems—to have a greater degree of interaction between user and supplier. The US systems program office is widely held to be the way to manage complex systems.

As to my experiences Stateside, I have worked with many fine civilians, but I would say that our personnel policies, or lack thereof, will not allow the fostering of a stable, elite corps of civilian procurement experts. We are having a difficult time in retaining our top talent due to being outbid by industry and to rumors of pay reductions. Retirement infringements do not help. While the theory of a procurement elite has promising features, I sincerely doubt that the system would allow it to come to pass.

Using military people not only provides a constant reminder and a link to the user, who can emphasize the purpose of the acquisition, but also allows the use of new talent to keep the procurement going. The bottom line, in my opinion, is that while there may be examples of hidebound old armchair colonels in buying agencies, there are equally numerous examples of incompetent civilians.

The point is that our current practice of using the best talents of both military and civilian has proven that it can produce the weapon systems our country needs and in a manner that is the example for other countries to follow.

Col. L. J. Hillebrand, USAF
Griffiss AFB, N. Y.

Lowered Standards?

After reading the growing list of comments concerning the cheating incident at the Air Force Academy, I would like to add what I feel to be the long-range ramifications of that decision and several like it.

I am currently an AFIT student, and recently I attended a briefing in which I was informed that AFIT routinely does drug screening (urinalysis) of officers assigned to the unit. It seems that a policy like this represents a basic shift in the values of the officer corps.

Not too long ago, a policy of this sort would have produced widespread criticism within the officer ranks, as it would have been seen as an outright questioning of the integrity of officers. It used to be that an officer was expected to follow the rules, regulations, and traditions and that his word would be questioned only on the basis of substantial evidence to the contrary.

When I look at these two decisions (urinalysis and the Academy cheating decision), it tells me that we have lowered our professional standards to the point that our officers are no longer believed to possess the basic values of duty, honor, and discipline. Decisions such as these two reinforce the image of the new officer corps as dishonest and undisciplined. Shouldn't we rather enforce stricter rules at the Academy and go back to trusting our officers instead of distrusting them?

In the long run, these decisions can lead to a self-fulfilling prophecy that may result in the breaking down of professionalism among the officer corps. This long-term erosion of professionalism will lead to an adversarial system within the officer corps, where senior officers will have to watch their subordinate officers constantly. I believe that this is the possible consequence of these decisions.

It's a good thing that there is time to change this erosion of professionalism.

1st Lt. Michael P. Patenaude, USAF
Hyattsville, Md.

AIRMAIL

Atlantic Mission

During 1942 and part of 1943, I was assigned to the 41st Bombardment Squadron, 25th Antisubmarine Command, at Westover Field, Mass.

While there flying antisubmarine patrol, a training film was made of me and my crew that showed the making, preparation, and execution of an antisubmarine mission. This film lasted about thirty minutes, or perhaps more. The name of the training film was *Atlantic Mission.*

Naturally, I would like a copy of this film. If any readers have any information on how I could obtain a copy of this film, I would like to hear from them.

Lt. Col. James M. Wylie, USAFR (Ret.)
205 Calhoun St.
Clover, S. C. 29710

97th Military Airlift Squadron

The 97th Military Airlift Squadron (Associate) at McChord AFB, Wash., is creating a unit historical display and needs assistance from previous members.

The 97th was constituted as a troop carrier squadron on May 25, 1943, and served throughout the remainder of World War II until deactivated in the European theater on October 18, 1945. The unit was allotted to the Organized Reserve on August 25, 1947, and thereafter followed a series of activations and deactivations. The unit variously held the designations of 97th TCS, 97th Fighter-Bomber Squadron, and 97th Air Transport Squadron until 1966, when it received its present designation.

We are interested in hearing from anyone who has information about our heritage, but there are several items that are of particular interest.

First, we have no information about the period from June 1952 to July 1957, when the unit was assigned to the 440th Fighter-Bomber Squadron at Minneapolis-St. Paul IAP, Minn. Second, the 97th TCS (Medium) was activated for a period of only four days in May 1951. We are interested in the perceptions of unit members of that time. Third, we understand the 97th received a godchild named Claude D. through the Stars and Stripes War Orphans Fund in August 1945. If anyone would care to give any information about this event or what may have happened to Claude D., we would be very interested. Lastly, we would like to make contact with any of our previous commanders, especially Lt. Col. Jack S. Southard, commander from July 1943 to October 1945, and Maj. James M. Collison, 1949–51.

Anyone who wishes to share information, photographs, or other items of historical interest is requested to contact the address below.

Capt. Robert D. Olson, USAFR
97th MAS (Assoc.)
McChord AFB, Wash.
98438-6004
Phone: (206) 984-2907
AUTOVON: 976-2907

Seventh Air Force

I am trying to locate a copy of a book published in the late 1940s titled *Saga of the Seventh: One Damned Island After Another.* I will pay a reasonable price, plus postage.

Also, I am trying to gather any information concerning the 9th Troop Carrier Squadron, Seventh Air Force, during World War II. My father, who recently passed away, was a member of this unit. I have been unable to locate any information concerning his unit.

Any help from readers would be appreciated.

Robert Grant
5617 Valley Meadow Dr.
Arlington, Tex. 76016
Phone: (817) 457-6254

71st AMU

I am attempting to upgrade the history program of the 71st Aircraft Maintenance Unit. We maintain the aircraft flown by the 71st Tactical Fighter Squadron. I would appreciate receiving any information or memorabilia pertaining to the 71st. I am particularly interested in hearing from any of our former maintenance folks.

The 71st originated in 1941 as the 71st Pursuit Squadron and was later redesignated the 71st Fighter Squadron. During World War II, the 71st flew P-38s. The squadron was deactivated in 1945. In July 1946, the 71st was reactivated and flew the P-80. In 1949, the squadron switched to the F-86 and flew that aircraft until 1958. Since then, the squadron has flown the F-102, F-106, F-4, and F-15.

I will gladly return any items that are

lent to us. Please contact the address below.

2d Lt. Greg Meland, USAF
1774-A Eleventh St.
Langley AFB, Va. 23665-1733

WW I Aircraft Engines

I am extremely interested in locating and buying a World War I vintage Gnome or Rhone rotary radial aircraft engine.

I am anxious to build up a portable working test cell using one of these engines to display at the various fairs in this area. It has been my longtime desire to show people how the operation of these engines compares to that of a regular radial engine. Antique engines are always the highlight of all the fairs.

I carry an A&E certificate that I received in 1945, so I am not a "Johnny-come-lately" tinkerer. During World War II, most of my time in the service was spent as a flight chief.

Please contact the address below.

L. R. Van Dusen
E. 11918 Fairview Ave.
Spokane, Wash. 99206
Phone: (509) 928-6898

Making Basic

I am working on a handbook designed to make entry into enlisted Air Force life a little easier for newcomers to the blue suit. Essentially, my book will give those young men and women on their way to Lackland AFB, Tex., the inside scoop on what basic training instructors and commanders will be looking for when they decide whether or not an airman is suited for the Air Force. It will tell how to survive the six weeks with a minimum of misery.

In addition to the sections on the various activities at BMT, I would very much like to personalize the book as much as possible. To do this, I will interview recent graduates, TIs, chaplains, and other personnel at Lackland, but I would also like to include insights and anecdotes from those who went through basic years ago.

I would like to hear from any readers who might wish to contribute humorous anecdotes or jokes, tips, poems or limericks, photos, or cartoons concerning experiences at basic military training. Maybe you can help today's recruit to lose some anxiety and to concentrate on what basic is *really* all about—making that all-important transition from footloose civilian to conscientious airman.

John Wharton
The Global Press
2239 E. Colfax Ave.
Suite 202
Denver, Colo. 80206

AIRMAIL

USAF in Europe

I am writing a book on the history of USAF in Europe and would appreciate any offers of information, clippings, articles, and photos.

In particular, I am looking for information and photographs from the period of 1917–18 concerning the 1st Pursuit Group, the training center at Issoudun, France, the arrival of the 1st Aero Squadron in France in September 1917, and any photos or information about American air operations in the Toul area.

During the period from 1944 to 1970, I am especially looking for photos and information on combat operations in France, Belgium, and Germany, the Berlin Airlift, USAFE during the Hungarian, Berlin, Cuban, and Czechoslovakian crises, operations at Wheelus Field in Libya, the withdrawal from France, etc.

I would appreciate hearing from any pilot, ground crew member, staff officer, or anyone else who served with USAF in Europe and who can furnish me with any information. Material lent will be carefully copied and returned promptly.

Cees Steijger
Grienden 61
3831 HP Leusden
The Netherlands

B-24 Over Ploesti

I am seeking information concerning the markings on B-24J-35CO (42-73346), which was lost on July 9, 1944, over Ploesti while being flown by Medal of Honor recipient Lt. Donald D. Puckett. Other known aircrew include Lt. Robert L. Jenkins, Lt. Guy A. Luttrell, Lt. Leo McElwain, SSgt. Lawrence L. Hood, TSgt. Frank R. Brunton, and SSgt. Joseph E. Angeloni. For a B-24 aircrew, seven seems to be shorthanded a wee bit. There should be more.

I am seeking such information on that aircraft and aircrew in continuance of my research on Medal of Honor aviators. Any assistance would be appreciated.

William J. Bennett
17017 S. Orchard Ave.
Gardena, Calif. 90247

8th AFHS

The members of the 8th Air Force Historical Society recently held a successful reunion in Los Angeles in October 1984. It highlighted the fact that we, as veterans of the "Mighty Eighth" during World War II in the ETO, are not getting any younger.

The work of putting a historically accurate perspective on the accomplishments, sacrifices, and honors of the men of the Eighth is yet to be completed. One way to contribute to this work is to reach those surviving members of the Eighth Air Force and organize them into cohesive groupings. I have taken on the responsibility of locating and organizing those veterans of the Eighth in the Washington, D. C., metropolitan area and in the commonwealth of Virginia. Any veterans of the "Mighty Eighth" in those areas are asked to contact me at the address below.

Igor "Pete" Petrenko
P. O. Box 1613
Springfield, Va. 22151

T-28 Manual

I used to be the "doc" for the 7th Tactical Fighter Squadron, 49th TFW, Holloman AFB, N. M. It was interesting flying the F-4D. . . .

Anyway, since then I've had an SNJ-4, and currently I am becoming acquainted with a T-28F. During my checkout, I used a pilot's manual from a T-28A. On one of my stops at a civilian field near Griffiss AFB, N. Y., I met a USAF T-33 instructor. I asked him if he knew where I might find a pilot's manual for a T-28F, or possibly a D or a C. He directed me to "Airmail."

Can any readers help me find such a manual?

William F. Smith, M.D.
Quaker Rd.
R.D. 1, Box 81C
Andover, N. J. 07821

ACSC Research

The Air Command and Staff College is researching the activities of Robin Olds, Herman F. Ernst, and John J. Voll during World War II.

We would appreciate hearing from anyone possessing period photographs of these individuals and their aircraft. Postage and reproduction costs will be refunded. Time is crucial.

Please contact the address below.

Chief, Warfare Studies
ACSC/EDCJ
Bldg. 1402
Maxwell AFB, Ala. 36112

Collectors' Corner

I collect pictures and information on any type of advanced aircraft. I am quite interested in learning more about such machines.

I would like to receive donations of such material from anyone who can

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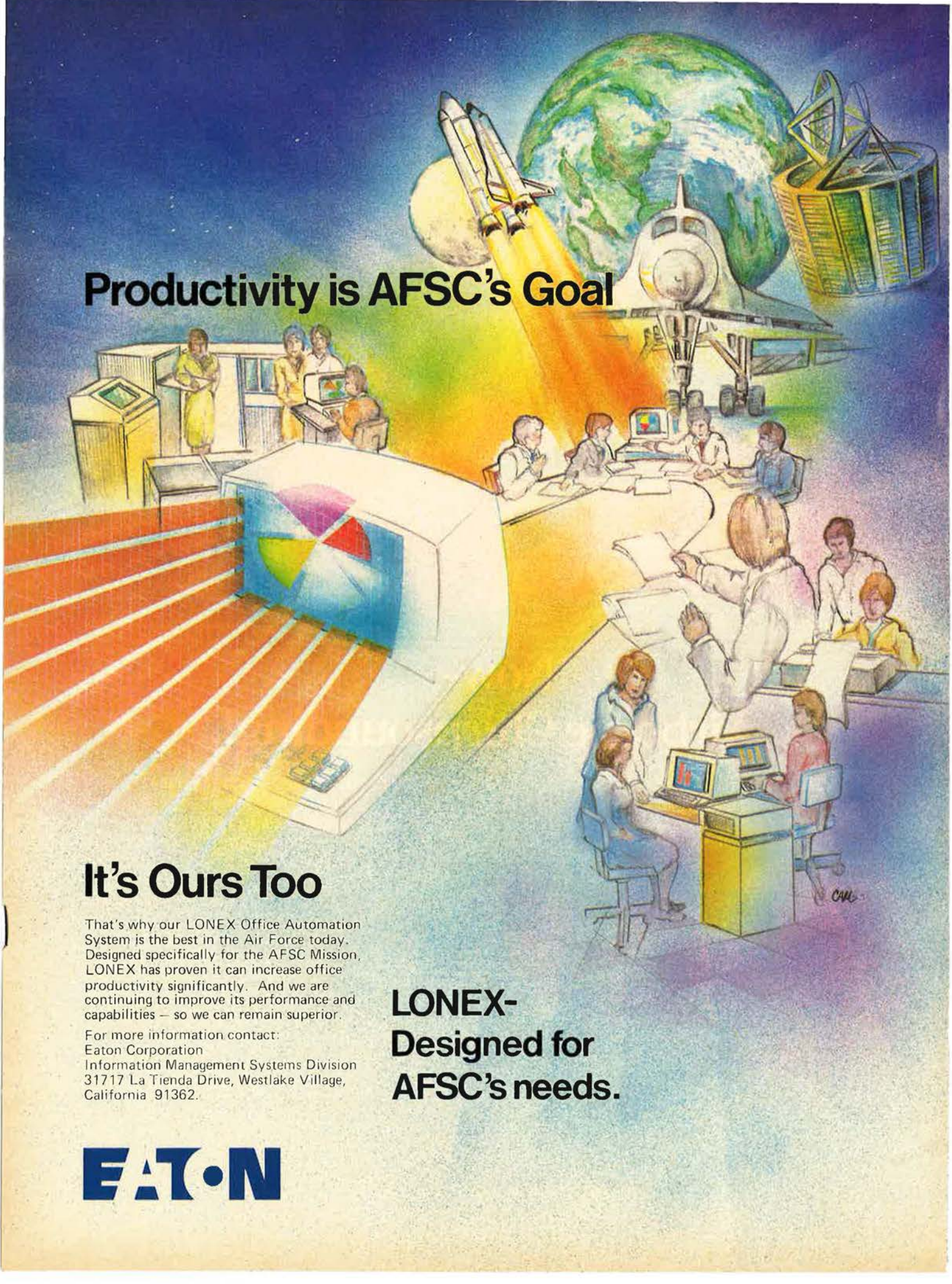
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spare it. Please send any donations to the address below.

Scott Dauenhauer
3856 Split Rock Rd.
Camillus, N. Y. 13031

I have been collecting data regarding the McDonnell Douglas F-4 Phantom and the RF-4 variants. I would appreciate contributions from any readers who may have photographs, flight manuals, or patches of this aircraft.

Please contact me at the address below.

Benjamen D. Eckert
1404 Kevin Dr.
Fairborn, Ohio 45324

I am a collector of worldwide military band phonograph records. I served my military time as a clarinet player (1955 to 1959) in the 702d SAC Band at Offutt AFB, Neb.

I am looking for phonograph records of any Air Force band to add to my collection. Can any readers help me?

Don Chalmers
245 Lee St., Apt. 207
Oakland, Calif. 94610

I have many 35-mm color slides of modern US combat aircraft that I wish to sell. I also have full-color modern USAF squadron patches for trade or for sale.

Anyone wishing to purchase these items should contact me at the address below.

Phillip Huston
1107 Marline Ave.
El Cajon, Calif. 92021

I am interested in trading patches with anyone who desires such an exchange. I am especially interested in obtaining aircrew patches from airlift and fighter units. I am also looking for the "Thud Out" F-105 patch from Hill AFB, Utah.

Thanks for a great magazine. Anyone who wishes to trade patches can contact me at the address below.

Sgt. John Wolf, USAF
PCS #1, Box 3405
Keesler AFB, Miss. 39534

I am a seventeen-year-old French student, and I would like to become a pilot with the French military.

I would like to correspond with any reader who would like to discuss my hobbies of aircraft and aviation. I am already a glider pilot.

Please contact me at the address below.

Thierry Gaillot
Montee du Chateau
69720 St. Bonnet de Mure
France

AIRMAIL

I would like to start a collection of military patches from around the world. I'm new in the Air Force and would also very much like to correspond with other Air Force people around the world.

Any correspondence or patches can be sent to the address below.

Amn. Brian T. Holmes, USAF
3309 El Cortez Dr.
Las Vegas, Nev. 89102

I have in my possession two of the class books for Class 43-J, Blackland Army Air Field and Waco AAF.

Anyone interested in obtaining them for historical purposes should contact the address below. (These books were found in Alaska.)

2K Enterprises
Route 2, Box 458
Buckley, Wash. 98321

I am a collector of badges and patches, both US and foreign.

If any readers could send me spare squadron badges, pins, patches, etc., it would be greatly appreciated! Please send any donations to the address below.

Tom Moloney
68-29 Kessel St.
Forest Hills, N. Y. 11375

I am starting a military and civilian patch collection, and I would like to accept any donations of patches from any readers who may be able to spare them.

Please contact me at the address below.

Wylie A. Mathis
Route 1, Box 405
Altha, Fla. 32421

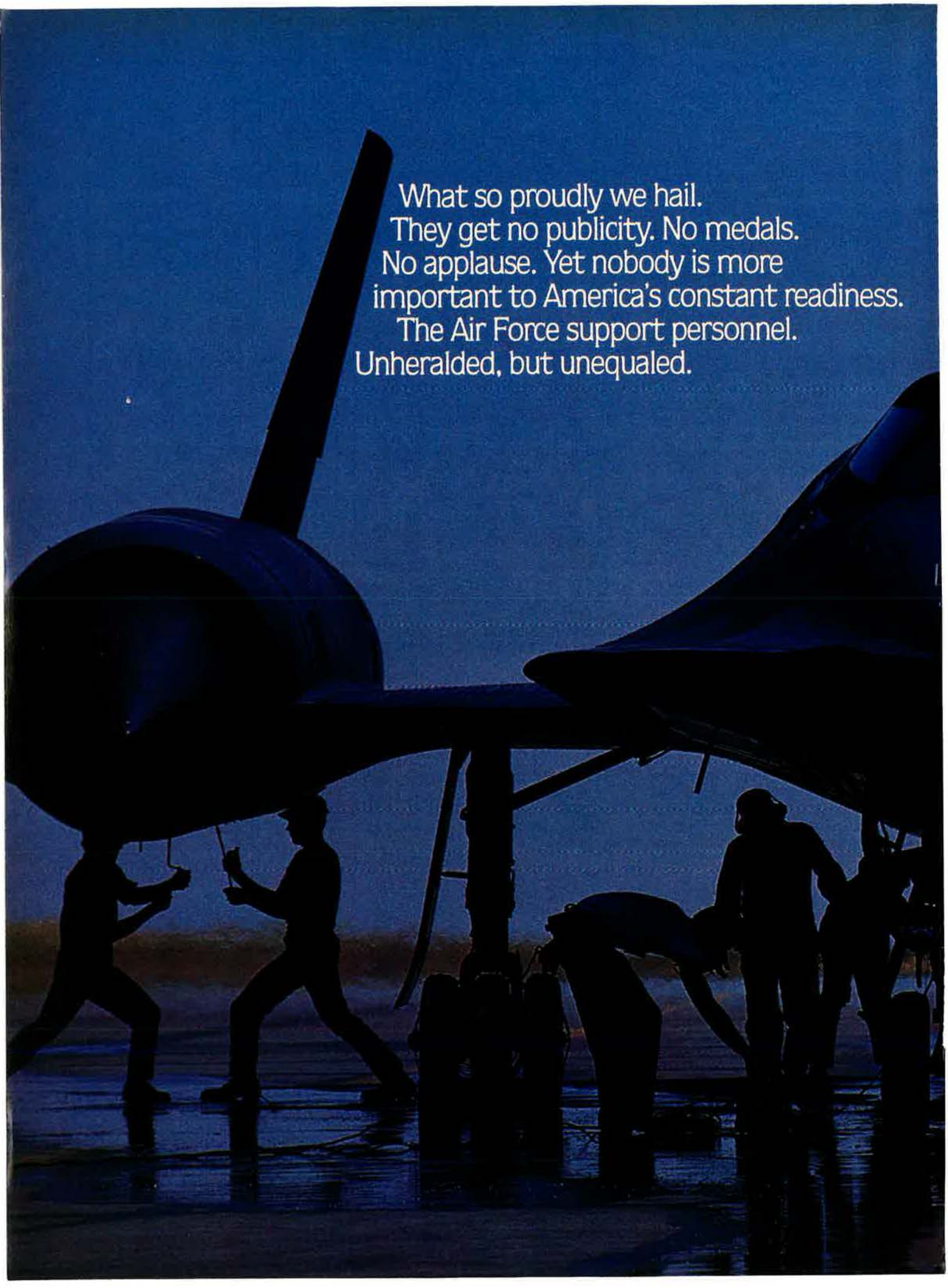
Looking for . . .

I had the distinct pleasure of commanding Flight 4 of the 36th Mobile Reclamation and Repair Squadron in England from 1943 to 1945.

The MR&R concept of supplying depot-type assistance to the fighter wings in the field, I feel, provided a vital part of the maintenance capabilities of the Army Air Forces in Europe.

I would like to hear from my compatriots who served in the 36th MR&RS to rehash the days of our trek from England to Germany.

Lt. Col. Max Kushner,
USAF (Ret.)
101 Kings Croft
Cherry Hill, N. J. 08034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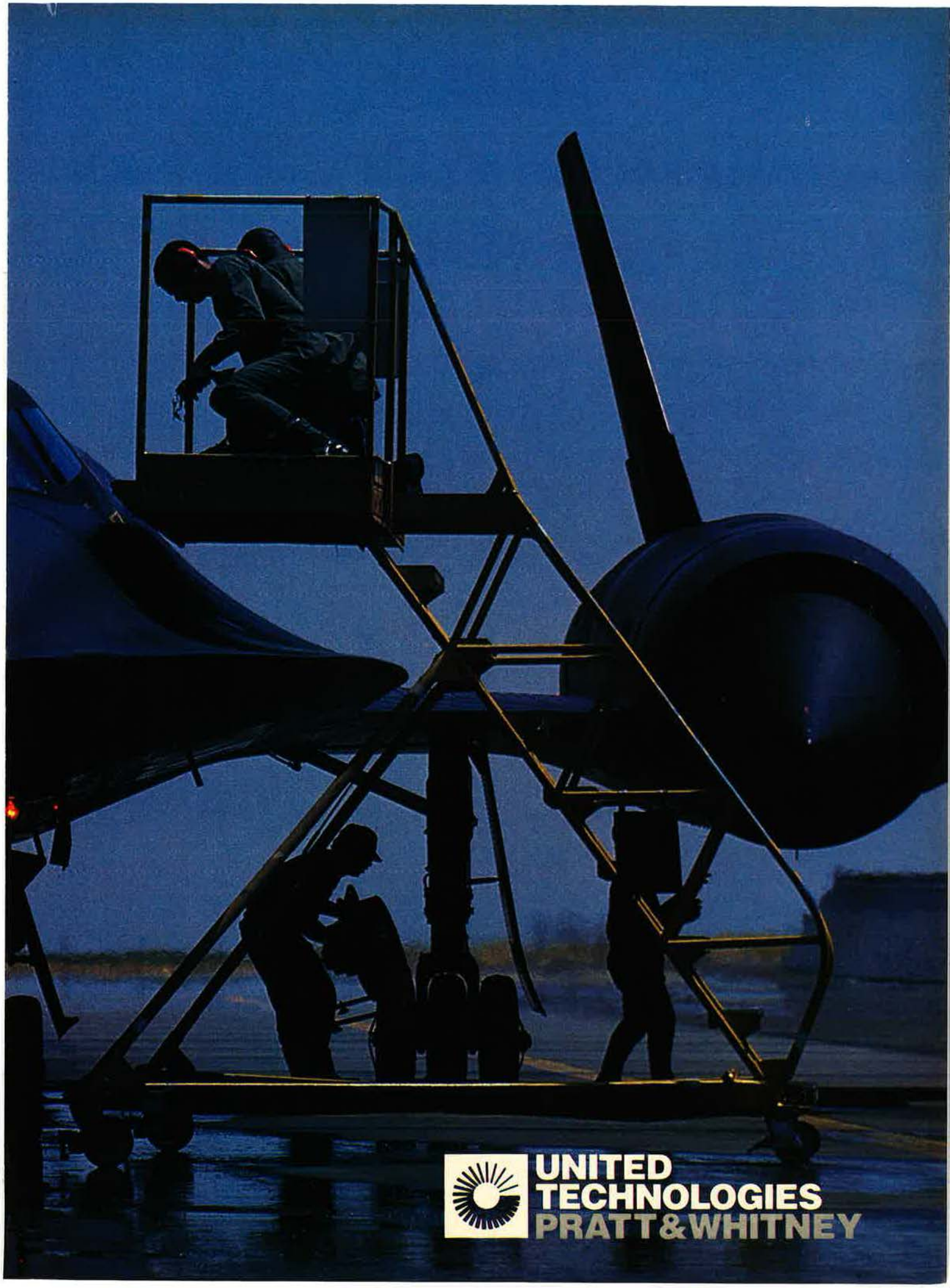
They get no publicity. No medals.
No applause. Yet nobody is more
important to America's constant readiness.
The Air Force support personnel.
Unheralded, but unequaled.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IN FOCUS...

NATO's Stake in US Deterrence

By Edgar Ulsamer, SENIOR EDITOR (POLICY & TECHNOLOGY)

The most likely menaces to Western Europe are intimidation, coercion, and blackmail resulting from the threat of superior Soviet force, General Rogers says.

Washington, D. C., Jan. 2

Given current deficiencies in NATO's conventional warfare capabilities, a massive attack by the Warsaw Pact on Western Europe would force the political authorities of the Alliance to choose between capitulation or the rapid application of theater nuclear weapons. But the choice to resort to nuclear weapons in the European theater clearly entails the risk of strategic nuclear war, Gen. Bernard Rogers, USA, Commander in Chief of the US European Command and Supreme Allied Commander of the Allied Command for Europe (ACE), recently told an AFA-sponsored news conference and symposium.

For some years, General Rogers stressed, "we at SHAPE have been stating—sometimes shouting—that NATO's major weakness is in its conventional leg of the triad. Clearly, we lack adequate conventional forces to deter a purely conventional attack in Western Europe." The most critical weakness of NATO's conventional forces is a lack of sustainability, defined by General Rogers as "insufficient trained manpower, [a] lack [of] skills [among the troops who would replace] battlefield casualties, insufficient ammunition stocks, [and] insufficient prepositioned tanks, howitzers, and so on to replace combat losses."

As SACEUR, he explained, "I have no option [in case of a Warsaw Pact attack] except to ask for the release of nuclear weapons" in line with the Alliance's central strategy of flexible response supported by a triad of military forces: strategic nuclear, nonstrategic nuclear, and conventional. The SACEUR's guidance concerning when he must seek the release of nuclear forces is unambiguous: any time that the cohesiveness of NATO's defenses is threatened, meaning if there were deep penetrations on a broad scale. According to General Rogers, the latter situation would occur "fairly quickly under current conditions. If that happens—if we [then] resort to theater nuclear weapons—I think eventually there will be escalation to a strategic exchange."

In the context of NATO's flexible response strategy and the three associated categories of forces, the SACEUR emphasized that "the first priority must go to the strategic nuclear [capabilities], because they are the ultimate guarantor of our deterrence." If the US strategic force modernization program, along with Britain's strategic modernization effort, continues on schedule, he suggested the credibility of NATO's strategic deterrent will remain high. Boosting the effectiveness of the Western strategic deterrent, he suggested, is the fact that the Soviets "seem to be shifting away in their doctrine from initial attack with nuclear forces to an attack with conventional means and that . . . they are no more anxious to escalate" to strategic nuclear warfare than is the US.

But even if strategic deterrence remains effective, the NATO nations must not mortgage the Alliance's defense to a nuclear response by declining to pay the bill for adequate conventional forces: "That is the message we in uniform have been transmitting, but the message is not prompting action to provide adequate conventional forces."

He cited four imperatives for shoring up NATO's conventional capabilities.

- The first step is to strengthen programs in support of military people, meaning "giving a damn about our troops."
- Second, there is the need to do better with the forces that are already committed to ACE, in the main bringing them up to requisite standards with regard to manning, equipping, training, and sustainability. The peacetime strength of these units should be ninety percent of scheduled wartime manning. While many US and German units meet that requirement, the forces of some other NATO nations do not. NATO's sustainability standards, according to the SACEUR, stipulate, for instance, thirty days' worth of ammunition for each type of weapon in the inventory of the fielded forces. Only the US forces in Europe come close to meeting the sustainability standard, according to General Rogers. But even this fact, he added, is offset in part, because "we have the longest lines of communications."
- The third critical requirement is modernization of weapon systems that can interdict the rear echelons of the Warsaw Pact forces and thereby free manned aircraft for such tasks as close air support, air superiority, and nuclear strikes.
- A fourth imperative is additional force structure, primarily from reserve units, according to General Rogers. About fifty percent of NATO's wartime strength theoretically comes from reserve units, but many of these units have not been formally assigned to ACE, he pointed out.

NATO recently approved a concept known by the improbable acronym of FOFA (for Follow-On Forces Attack), but, so far, according to General Rogers, hasn't gotten around to a decision on how to fulfill the associated research, development, and acquisition requirements. FOFA's task is monumental: "Find the means to reduce to manageable ratios the number of forces that we must defend against from our overall defensive positions."

He explained that "we infantrymen use a general rule of thumb" that posits that if there is enough time to organize the defensive positions properly and that if the ratio between attackers and defenders can be held

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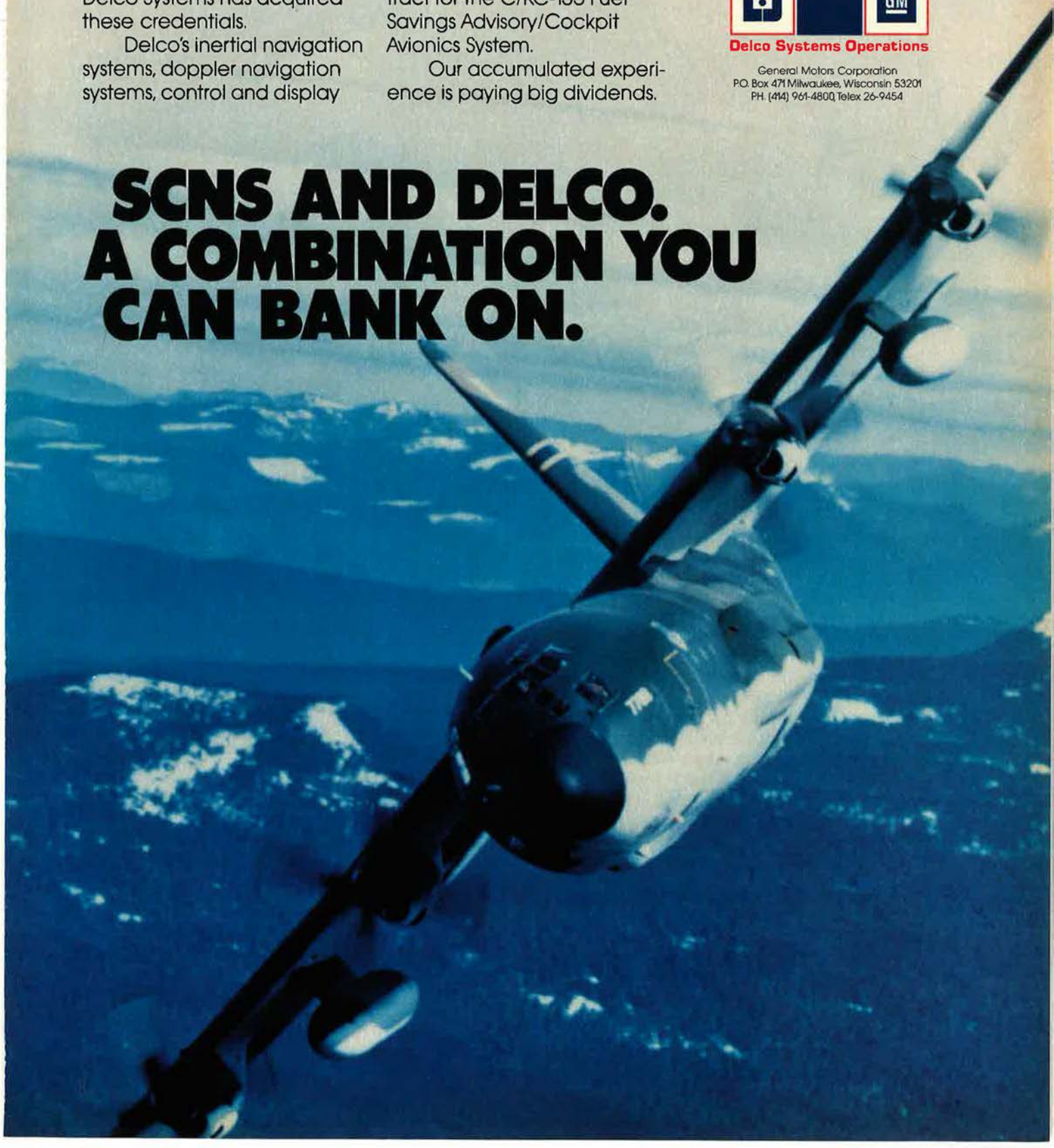

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HF-380 Series			X	X	X	
HF-80 Series			X	X	X	
HF-121/122 Series			X	X	X	X
ARC-190 Series						X
Voice Encryption		X	X	X	X	X
Adaptive Appliques			X	X		X
System Accessories	X	X	X	X	X	X

* International Defense Review 8/1981, pg 1038.
** Reprinted from Communications International, June 1982, pg. 58.

COLLINS DEFENSE COMMUNICATIONS DIVISION.

DEFENSE ELECTRONICS OPERATIONS

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to "three of them against one of us, then you have a chance of succeeding in your defense." FOFA, he added, is meant to provide both the time and manageable force ratios for successful NATO defenses.

In operational terms, FOFA is to provide the means to reach some 300 kilometers behind the Warsaw Pact's forward deployed forces to destroy bridges, railroad tunnels, and other transportation nodes and thereby create chokepoints that can then be exploited by long-range, conventionally armed, unmanned standoff weapons. In essence, this means stacking up the mass of the attacker's second echelon forces behind chokepoints and then attacking these concentrations with swarms of antipersonnel and antimateriel submunitions of various degrees of "smartness." FOFA, General Rogers pointed out, does not fundamentally reshape NATO's defensive tasks: "We are just trying to do the job better and to implement our strategy more efficiently. We always intended to strike [the rear echelons] and whatever targets we thought were important there, including weapon systems."

But present technology, he suggested, offers the chance to perform these missions with unmanned standoff weapons, without tying up combat aircraft that are needed for other critical missions. He theorized that the Army's Lance ballistic missile, by incorporating new technologies, appears capable of accuracies three times its present level and of traveling five times its present range. Generically, the Lance missile features high penetrativity, meaning "it can get through" and carry out its assigned task. He added that, under FOFA, such an upgraded Lance would carry a payload of antimateriel submunitions, each of which "might be able to seek out individual tanks."

While he acknowledged that, from an operational point of view, such weapons might be too expensive or not cost- or mission-effective, he stressed that some other simpler technologies appear sufficiently mature for application now. Included here, he said, is the MW-1, a pod that fits underneath the Tornado fighter-bomber and that "spews out between 600 and 700 submunitions."

The West Germans are bringing this weapon into the inventory of their forces and use a mix of antipersonnel and antimateriel submunitions, depending on mission requirements. Such a system, the SACEUR said, appears well-suited to the task of neutralizing troops and armor blocked by knocked-out bridges or similar obstacles. If the MW-1 system indeed turns out to be as effective as the initial tests suggest, probably all NATO interdiction aircraft should be equipped with these submunition dispensers, he urged.

Offensive counterair strikes, such as knocking out enemy airfields, are another key concern of FOFA. In this context, the SACEUR pointed to the JP-233 "runway buster" that the British forces are bringing into the inventory of some units assigned to NATO. Terming this British system "quite effective," he argued that it should be made available throughout all NATO air forces.

Another candidate for FOFA application might be US-designed precision-guided ballistic missiles equipped with submunition systems developed in Western Europe. Such an arrangement, he suggested, would capitalize on clearly established fields of expertise of various member nations and foster greater collaborative efforts in terms of research, development, and acquisition.

New technology will have to be applied in three specific fields under the FOFA concept, according to General Rogers. These are target acquisition, standoff missilery, and communications spanning the spectrum from target-acquisition information feeding into tactical fusion centers and out again to weapon systems that can be directed against various targets rapidly and reliably.

In this context, the SACEUR came down solidly in support of the Joint Surveillance, Tracking and Attack Radar System (JSTARS) and the Joint Tactical Missile System (JTACMS), developed by the Air Force and the Army, respectively, under a Memorandum of Agreement executed by the Chiefs of Staff of the two services last year. The two mutually reinforcing systems—one a modified Boeing 707 jetliner equipped with a deep-look moving target indicator radar and the other an air- or ground-launchable missile—were termed "absolutely essential" by General Rogers: "Frankly, I think [JSTARS and JTACMS are] the determinants of whether or not we can at least create the perception in the eyes of the Soviets that we might [be able to mount a successful conventional defense]."

FOFA, General Rogers stressed, is fully in accord with the current Soviet doctrine of attacking NATO forces with Operational Maneuver Groups—self-contained forces that evolved from the Red Army's mobile group concept of World War II and that would push through the Western defenses and attack the Alliance's rear areas rapidly and in depth. Alternatively, the Soviets also are exploring the potential for "thickening up" their lead echelons with follow-on forces in instances where the West fails to respond in kind, thereby creating opportunities for breakthroughs by Soviet forward deployed forces.

Whenever NATO forces do respond by thickening up their own general defensive positions, however, the Soviets "will go back to echeloned [warfare by means of] Operational Maneuver Groups" positioned some seventy kilometers behind the front lines, he reported. Militating against a general Soviet doctrine of "thickened-up lead echelons" is the fact that "the terrain can absorb only so many battalions of Warsaw Pact forces and that the rest will have to be follow-on forces," the SACEUR pointed out for the benefit of Western analysts who believe that the Soviets are abandoning the Operational Maneuver Group concept.

It is imperative, General Rogers stressed, that NATO forces in Western Europe be able to augment FOFA-derived capability with B-52s and, eventually, B-1s configured for conventional missions. These could strike the Pact's rear echelons with highly accurate weapons. He added that "it would be very important to us to have [platforms of this type equipped with] air-to-surface missiles" to strike mobile targets, such as lines of tanks and convoys as well as formations slowed at chokepoints.

Washington Observations

★ Dr. Hans Mark, a former Secretary of the Air Force and former Deputy Administrator of NASA, recently suggested a dual-track approach to military space systems during a seminar sponsored by the National Defense University. One category would be designed for peacetime functions and would be unencumbered by extensive survivability features, and the other type would be wartime systems of high survivability but confined to minimum essential functions. Arguing that ICBMs converted to the ASAT role and ground-based lasers, among other systems, make "warfare in space not too difficult," he suggested that it would be possible to use survivably based launch systems, such as modified MX missiles or the Shut-

tle's solid rocket booster (SRB), to place into orbit a bedrock C³I system needed to fight nuclear war on a protracted basis.

Such a system might consist of about fifty MXs or SRBs housed in abandoned Titan ICBM silos or other hardened shelters. These systems could be executed in a "launch-on-warning mode" and would cost about $20 billion. An MX equipped with a suitable upper stage could deliver about 5,500 pounds of payload into equatorial and 3,000 pounds into polar orbits, while the SRB probably "could do twice that."

★ The National Research Council, an agent of both the National Academy of Sciences and the National Academy of Engineering, found in an interim study the "clear possibility" that a major nuclear exchange could produce enough smoke and dust to cause severe temperature drops over much of the earth's northern temperate zone that would last from weeks to months. This phenomenon, referred to as "nuclear winter" by some scientists, might—if triggered in summer—produce temperature reductions ranging from 18°F to 45°F, with normal temperatures restored after about six to twenty weeks.

The "baseline case" assumed by the report involved the detonation of about 6,500 megatons—about half the estimated total world arsenal—of which 1,500 megatons would be released in ground bursts. Of the other 5,000 megatons that would be detonated at altitudes chosen so as to maximize blast damage to structures, 1,500 megatons would be directed at military, economic, and political targets that happen to be located in or near about 1,000 of the largest urban areas in the US, the USSR, and in NATO and Warsaw Pact countries.

The Council's study, launched in early 1983 at the behest of the Defense Department, did not deal with questions concerning radioactive fallout or with possible biological and social effects and instead concentrated on the atmospheric effects of nuclear weapons explosions, "because such effects might threaten populations far removed from target areas and pose major risks to any nation that initiates use of nuclear weapons, even if retaliation is limited."

Three specific atmospheric consequences triggered by the baseline exchange were calculated. The Council's report suggested that "large amounts of dust could be lofted into the atmosphere, large fires . . . initiated, and large amounts of [dangerous chemicals released]."

IN FOCUS...

In the first instance, the Council estimated that about 15,000,000 tons of microscopic dust particles might be lifted into the upper atmosphere, where they would remain aloft for more than a year. These suspended dust particles, acting like tiny mirrors, would reflect the sun's radiation and prevent it from reaching lower altitudes. This dust screen is likely to cause measurable surface cooling over land areas.

Even more damaging would be smoke particles produced by massive fires in cities and forests following a nuclear exchange. These fires—in the baseline case assumed to be triggered by weapons with a combined yield of 1,500 megatons allocated to targets in or near major cities—would probably release about 150,000,000 metric tons of soot into the atmosphere. These tiny black smoke particles absorb the sun's radiation and thus keep it from reaching the earth's surface.

While the Council brought out a range of scenario-dependent and other uncertainties concerning the extent and duration of such smoke clouds, it cited some empirical evidence suggesting that soot particles can remain suspended in the atmosphere for many weeks and can travel long distances. In the aftermath of the assumed massive nuclear exchange, the Council warned that light levels might be reduced by ninety-nine percent or more over broad areas of the Northern Hemisphere, causing corresponding reductions in the solar energy reaching the surface. Significant amounts of dust and smoke could drift to and across the equator as early as a few weeks after a nuclear exchange, but the climatic effects in the Southern Hemisphere would probably be less than those in the North.

Lastly, the report suggested that large amounts of nitrogen oxides produced by nuclear weapons could deplete the layer of stratospheric ozone that protects the earth's surface from harmful ultraviolet radiation. The increase of ultraviolet radiation would peak at about fifty percent above normal levels and then decrease to about half that level in about two years.

The Administration plans over the next few years and on a high-priority basis to continue extensive analyses of the effects of massive nuclear exchanges to refine the findings from this initial research effort.

★ Defense Secretary Caspar Weinberger, speaking recently before the Foreign Press Center, dampened European fears about the Strategic Defense Initiative (SDI) tending to "decouple" America from its allies. Stressing that the "security of the US is inseparable from the security of Western Europe," Secretary Weinberger suggested that future SDI-derived strategic defenses, in addition to bolstering the free world's nuclear deterrent, would "also enhance NATO's ability to deter Soviet aggression in Western Europe by reducing the ability of Soviet ballistic missiles to put at risk those facilities essential to the conventional defense of Europe—airfields, ports, depots, and communications facilities. . . . An effective strategic defense would create great uncertainties in the mind of the aggressor, reduce the likelihood of successful conventional attack on Western Europe, and thereby reduce the chance the Soviet Union would contemplate such an attack in the first place."

Refuting allegations that SDI is the nemesis of arms control and of the stability that ensues from mutual deterrence, he stressed that, since the signing of the ABM Treaty in 1972, "the Soviet Union has spent more on strategic defensive forces than on strategic offensive forces. Clearly, the Soviets don't share the MAD philosophy that defenses are bad." In launching SDI, he added, "we will of course not give up our triad of deterrent offensive systems. Rather, we continue to maintain deterrence, and indeed to strengthen and modernize all three elements of our triad, because we do not know when we will actually be in a position to put our strategic defense system in place."

★ Without much ado, the Defense Department formed a National Security Telecommunications Advisory Council about two years ago that comprised some thirty private companies involved in nonmilitary space communications operations. Among the initial products of the Council, made up in the main of chief executive officers, are recommendations on how commercial satellites can be made more survivable and how such systems could be integrated with military systems during crisis conditions. The Council has also urged increased interoperability of commercial satellite systems as well as improved security for ground terminals to reduce the risk of sabotage. ■

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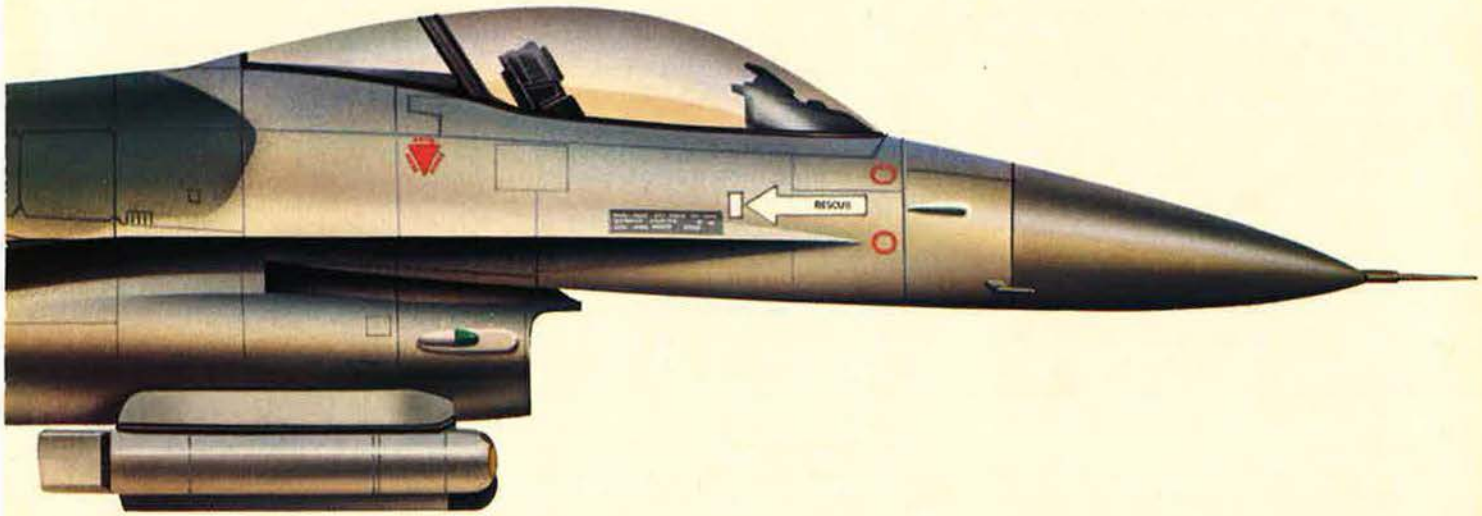

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CAPITOL HILL

By Kathleen G. McAuliffe, AFA DIRECTOR OF LEGISLATIVE RESEARCH

Washington, D. C., Dec. 28

The Outlook for MX

Sen. Barry Goldwater (R-Ariz.), new chairman of the Senate Armed Services Committee, painted a bleak picture for MX in the next session of Congress. The Senator said in a letter to the President that "we do not have the votes in the Senate or the House to pass the MX," and he discouraged the President from requesting MX funding. The House and Senate will vote about April 1 on the authorization and appropriation of $1.5 billion in FY '85 funds to buy twenty-one MX missiles.

Some DoD officials think Senator Goldwater's statements could prove devastating to the MX. But White House sources believe Senator Goldwater will support the missile in the next go-around, although he claims never to have been "one hundred percent for it." They want the Senator, however, to use his powerful position to take an active role in lining up pro-MX votes.

A number of senators plan to ask the President to state the case for MX in his State of the Union message. Undoubtedly, any such message would link MX inextricably to the future of the arms talks set to begin in January. Linkage to a possible arms-control agreement with the Soviets has rescued MX in the past, and it could prove decisive again.

Sen. John Warner (R-Va.), chairman of the strategic and theater nuclear forces subcommittee, responding to recent MX developments, expressed confidence that Congress would not act "prematurely" to kill the program in light of the favorable arms-control climate. The Senator wants to "ensure that the prospects for success in Geneva are enhanced through the maintenance of a credible and viable MX program."

Rep. Les Aspin (D-Wis.), architect of past MX-saving compromises, said that the Soviets "don't give up something for nothing. If we unilaterally cancel our weapon systems, like the MX, they are not likely to reduce their equivalent systems." He cited as a corollary to MX the lessons of the ABM, "the antiballistic missile that was used as a bargaining chip to gain the 1972 treaty effectively banning all ABMs."

FY '86 Defense Budget

The President expects to submit to Congress in January a DoD spending plan for FY '86 that has been cut $11.1 billion and $8.7 billion from previous budget authority and outlay projections, respectively. The cut is part of the Administration's deficit-reduction plan.

The new budget of $313.7 billion in budget authority and $277.5 billion in outlays reflects about a six percent real growth for DoD.

Secretary of Defense Caspar Weinberger described the defense cut as a "substantial contribution toward deficit reduction." The $8.7 billion outlay cut was somewhat larger than the Office of Management and Budget sought from DoD in FY '86. However, no additional defense reductions were included for FY '87 and FY '88, as OMB wanted. The FY '86 cuts will be reflected in those outyears, with outlays reduced by $9 billion and $10 billion, respectively.

The new spending figures are more than $1 billion lower than the budget Congress projected for the Pentagon in FY '86. Despite the Secretary's hope that this should be of "some considerable encouragement" to Congress, many members of Congress expressed disappointment that the defense cuts were not larger. Many Capitol Hill pundits think a six percent defense growth is unrealistic in light of a possible freeze on other areas of government spending and that a real increase of no more than three percent is likely.

The proposed defense cuts would be achieved primarily by a civilian pay freeze and a five percent civilian pay cut. The military will receive a previously approved four percent pay raise on January 1, 1985, and another three percent hike on July 1, to be followed by a freeze. The remaining savings will come from reestimates of inflation and fuel costs and from $2.5 billion in as yet unidentified programmatic reductions.

Senate Leadership Changes

The changes in the Senate GOP leadership for the Ninety-ninth Congress could have significant impact on Administration plans for national defense. Overall, the new leadership team, particularly Majority Leader Sen. Robert Dole (R-Kan.), is seen as more independent than their predecessors and less likely to allow the White House to direct Senate actions.

Senator Dole will take the lead in finding a credible deficit-reduction package for FY '86 and beyond. A spokesman for the new Majority Leader said the $8.7 billion defense cut by the President was a "good first step," but that the Senator was concerned about the failure of the Administration to address defense cuts in the outyears. Senator Dole views as dim the chances of Congress approving the President's budget package.

Further, the loss of Sen. Ted Stevens (R-Alaska) from the leadership chain is seen as a significant problem for Administration defense plans. As the Assistant Majority Leader in the first term of the Reagan presidency, Senator Stevens spoke for the GOP leadership as chairman of the defense appropriations subcommittee. This gave defense a big boost, since he was usually in sync with the Administration. Senator Stevens's loss of a leadership post means that Sen. Mark Hatfield (R-Ore.), chairman of the full Appropriations Committee, will become more powerful on defense issues. Senator Hatfield has not been a proponent of increased defense spending or of many force-modernization programs.

The change in the Armed Services Committee could also prove significant. Sen. Barry Goldwater, who has always been a strong defense booster, replaces Sen. John Tower (R-Tex.) as chairman. Senator Tower was perhaps the Pentagon's best friend in the Senate, but was charged by critics as too willing to give the military everything it wanted. Senator Goldwater recently expressed skepticism about MX and told the President he thought "very highly" of the budget freeze concept. ■

SCIENCE/SCOPE

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Britain's air defense system is being improved so it can detect and track targets automatically. The UK Air Defense Ground Environment (UKADGE) is comprised of air defense radars, computers, displays, and other electronic subsystems. Sightings are transmitted through data links to data processing centers, where computers identify, automatically track, and report a target's speed, altitude, and course. The system is being produced by UKADGE Systems Ltd. (UKSL), a company owned by Hughes, Marconi, and Plessey. UKSL is staffed by personnel from the three companies and performs system design, integration, testing, and program management. Hughes is also responsible for the system's central data processing equipment, software, and large-screen display. UKADGE is being completed in increments through 1985. As the world's most experienced developer of air defense systems, Hughes has built or managed systems for over 20 nations.

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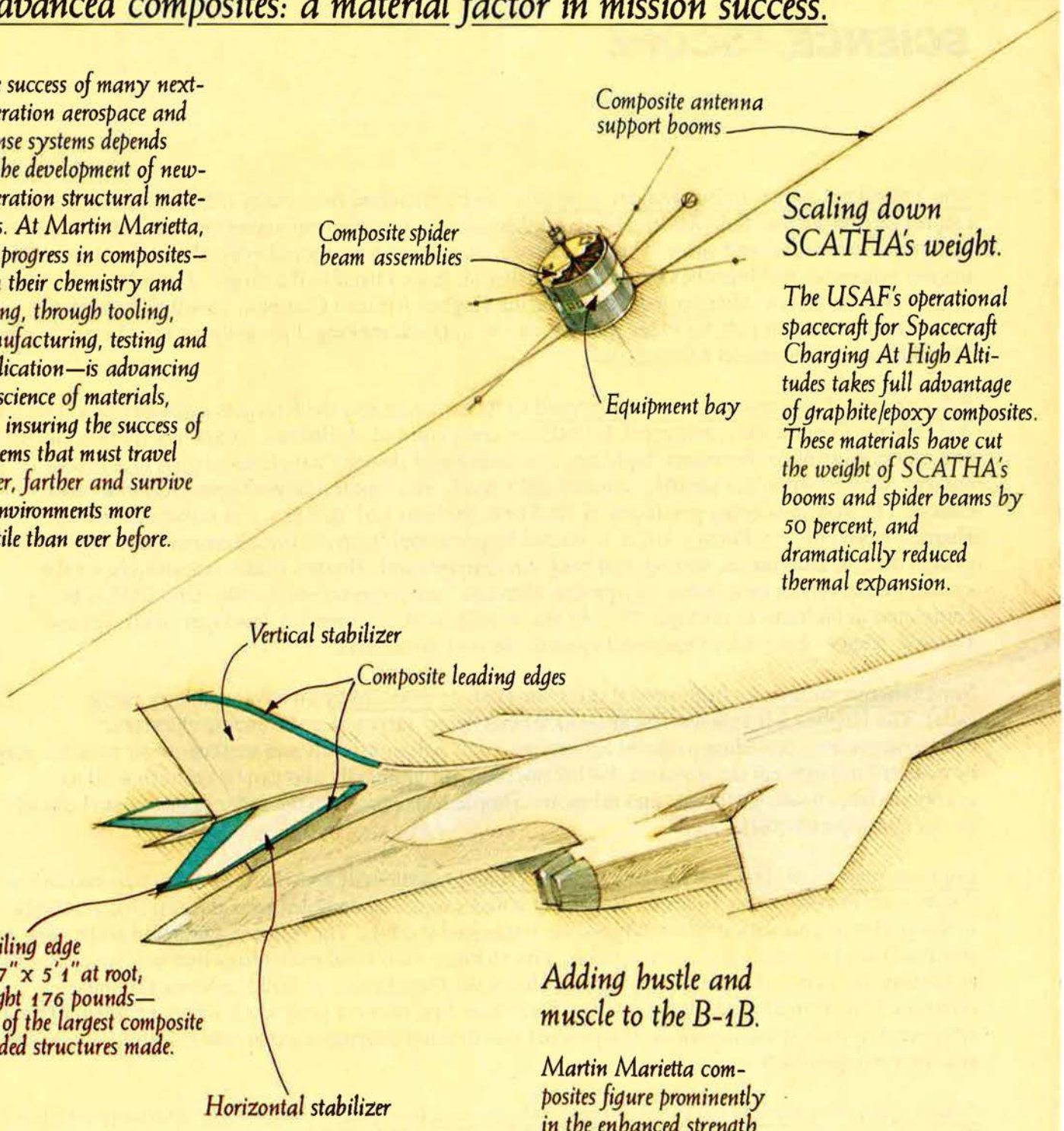

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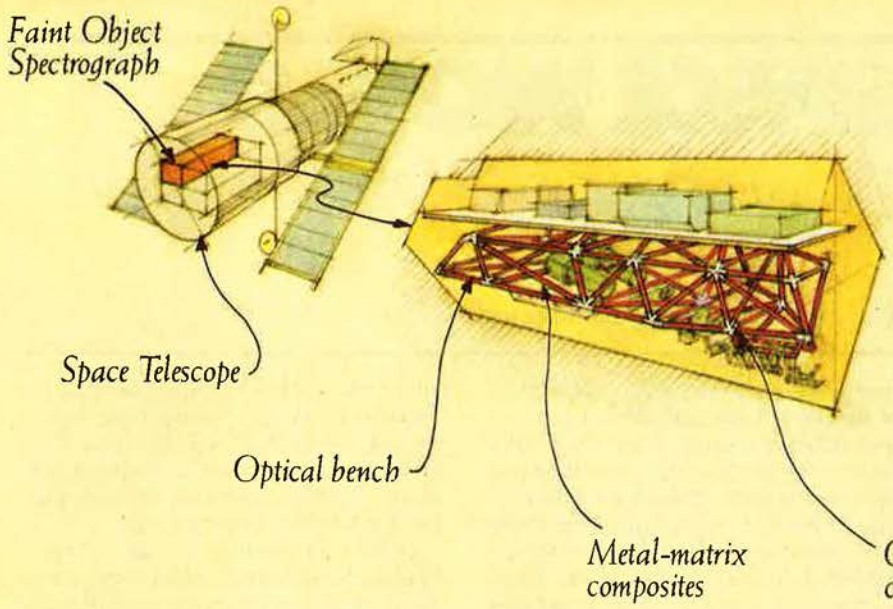

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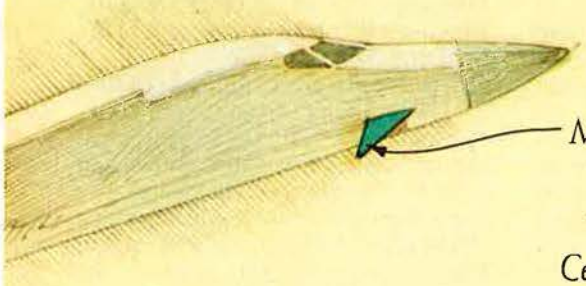

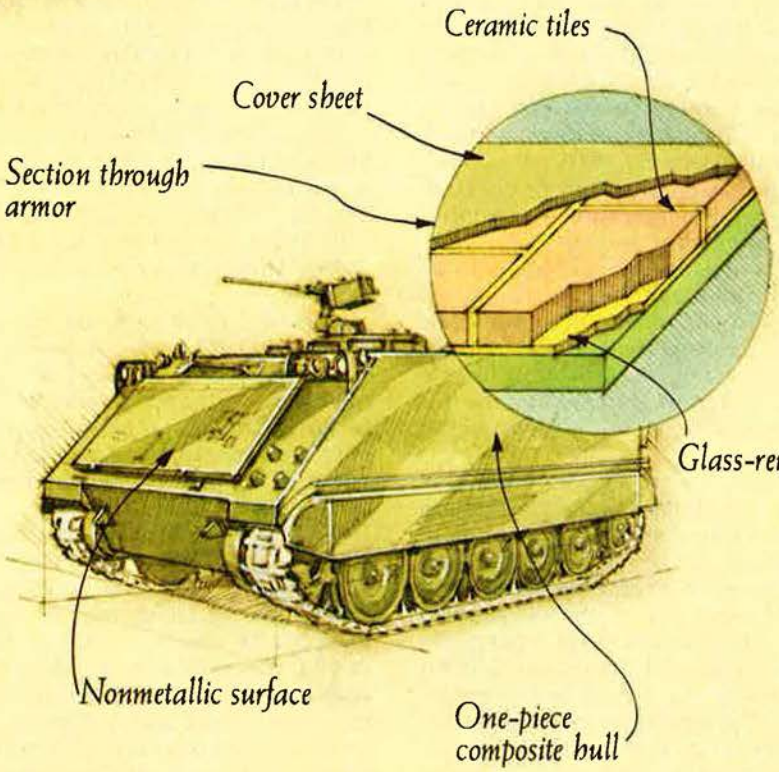

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AEROSPACE WORLD
News, Views & Comments

By James P. Coyne, SENIOR EDITOR

Washington, D. C., Dec. 27

★ Development of a Trident II missile "to rectify the current inability of our submarine-launched ballistic missiles to hit hardened Soviet assets" is part of the US strategic modernization program described in a "1984 DoD Brief Year-End Assessment" distributed to correspondents in the Pentagon. The report also says talk of canceling the land-based MX/Peacekeeper is "naïve."

Six successful MX test flights prove the missile is performing at or above expectations, the report states, in a program that is "on schedule and on cost." The report then calls on Congress to recognize the program's success and to release deployment funds. "Our nation has no other near-term solution that responds effectively to the Soviet challenge," the report says.

"To date, the success of the Peacekeeper program has played a key role in convincing the Soviets to resume the arms-control dialogue. We cannot jeopardize these initial discussions with naïve talk of unilaterally canceling the only real near-term lever the US has with the Soviets—the only tool we now have to convince them that we are serious about redressing the imbalance in strategic forces."

The report points out that modernization of all three legs of the strategic triad continues, including installation of cruise missiles on B-52s, production of the B-1B, and development of the Advanced Technology Bomber (ATB).

Overall, it states, notable improvements in readiness and sustainability have been made. In FY '84, ninety-three percent of new recruits in all services had high-school diplomas, the highest percentage ever, up from less than seventy percent in FY '80. Retention is up significantly, with the enlistment rate increasing from fifty-five percent in FY '80 to sixty-eight percent in FY '84. First-term reenlistments have jumped by thirty-five percent since FY '80.

People are getting more training. USAF tactical aircrews average 21.5 hours of flying time per month, up from sixteen hours four years ago, while Navy flyers get almost twenty-four hours a month. Navy ships now steam an average of almost thirty-five days per quarter, compared to thirty-two days four years ago. The Army sent twenty-four battalions through the National Training Center in FY '84, compared to only sixteen battalions in FY '82. This provided realistic battle training to fifty percent more troops than before.

Increased funding for repair parts and maintenance has significantly improved the immediate operational availability of equipment. Since FY '81, funding for supplies needed for daily operations and maintenance has been increased by twenty-five percent. Mission-capable rates for USAF aircraft have improved seven percent during the past four years. Since FY '80, greater availability of spare parts has helped to increase the number of tactical combat sorties that can be flown in Europe by sixty-two percent, and since January 1981, the number of Navy ships rated fully or substantially ready has improved by more than twenty-five percent.

Increased logistical support has significantly improved sustainability. Since FY '81, munitions inventories have increased fourteen percent for the Army, fifty-eight percent for the Navy, sixty-two percent for the Air Force, and twenty-four percent for the Marines.

Overall, the report says, the United States is emphasizing modernization rather than a major force structure expansion, although it notes important changes are taking place, such as the expansion of the Navy to 600 ships and addition of two light infantry divisions to the Army, but without increasing the Army's end strength.

Army modernization includes improvement of antiarmor capabilities, tactical mobility, and command control and communications (C^3) support. Procurement of the M1 Abrams tank, the M2/3 Bradley Fighting Vehicle, the AH-64 Apache attack helicopter, and the Multiple-Launch Rocket System continues.

Navy modernization includes revitalization of the amphibious assault capability by procuring new high-speed, air-cushioned landing craft and two new classes of amphibious ships. Procurement of the F-14 and the F-18 fighters continues.

USAF's modernization of the tactical air forces emphasizes procuring systems that allow rapid, multiple engagements beyond visual range, along with high maneuverability and lethality in close-in engagements. Procurement and improvement of the F-15 and F-16 continue.

The report says that the United States has increased strategic mobility capabilities by thirty-five percent in the last four years and has invested more to improve sealift in the last four years than in all the other years since World War II. By 1990, the US goal is to have increased airlift capacity by eighty percent, sealift by 110 percent, and the amount of prepositioned materiel in key locations by 150 percent.

New emphasis is now being placed on special operations forces uniquely suited for low-intensity conflict. This includes activation of new Army Special Forces Groups and Navy SEAL Teams, and development of new joint doctrine.

Reserve components are continuing to play larger roles in developing our conventional capabilities. This will continue, the report says, as they receive more of the most modern systems, such as the M1 tank, the M198 howitzer, FF-1052 and FFG-7 frigates, and F-16 aircraft.

Overseas, the US scored a major achievement in December 1984 in obtaining NATO agreement to increase infrastructure funding from $4 billion to nearly $8 billion, which can result in vital improvements in NATO conventional forces. But there is much to do in NATO, the report stresses, including more cooperation in armaments production and encouraging higher defense spending by European members of NATO. "To succeed," it states, "we must lead by our example and not resort to threats of US troop withdrawals."

Two other accomplishments alluded to were the creation of the Stra-

tegic Defense Initiative Organization (SDIO), which is to develop space-age technology to neutralize the threat of nuclear ballistic missiles, and the open-ended offer to negotiate arms reductions with the Soviets.

Finally, the report pointed out that improved DoD management reforms have helped reduce costs and acquisition times while increasing the stability and efficiency of the defense acquisition process. For example, the B-1B successfully completed its maiden flight in October 1984, five months ahead of schedule and within its budget. Program stability has been improved by introducing multiyear procurement in thirty-two programs, which will yield estimated savings of $4.7 billion through FY '85.

Comprehensive audits and close management have significantly reduced spare parts overpricing, resulting in refunds to the government of more than $2.1 million from some 250 contractors. Since April 1981, more than 68,000 internal audits to detect and curb waste, fraud, and abuse have been completed with potential savings of about $7.9 billion.

The report quotes the Congressional Budget Office as estimating that annual cost growth on selected major systems had been reduced from fourteen percent in 1980 to only one percent by the end of 1983.

★ The French Mirage 2000 has been equipped with a new long-range air-to-air missile permitting interception of penetrating aircraft at any altitude between sea level and 80,000 feet and at speeds up to Mach 3.

A French Mirage 2000 releases a new MATRA Super 530D long-range air-to-air missile, capable of snap-up or snap-down interceptions of targets at altitudes from the deck to 80,000 feet. It replaces the Super 530F.

The missile, which the French say is extremely effective in snap-up or snap-down interceptions, is the MATRA Super 530D. It replaces the Super 530F, which has been in service since 1979.

Two examples that illustrate the capabilities of the new weapon were given. Both were snap-up interceptions. In the first, a target ingresses at Mach 2.5 at 75,000 feet and is acquired by surveillance radar. The Mirage is scrambled and climbs at Mach .95. At 25,000 feet and eighty kilometers from its base, the Mirage acquires the target, still 110 kilometers away. The Mirage executes a snap-up, firing the missile from 40,000 feet. At this point, horizontal distance between fighter and target is about twenty kilometers. The Mirage continues to illuminate the target, climbing to about 47,000 feet, breaking off the attack as the missile impacts the target.

In the second example, the target enters at Mach 1.5 at 40,000 feet. This time, the Mirage initially stays on the deck, then executes a Mach .95, almost vertical climb about eight kilometers after taking off, when the target is thirty kilometers away. The Mirage fires the missile at 10,000 feet, when the aircraft are about eighteen kilometers apart. The Mirage continues to climb, illuminating the target with its radar, until the missile strikes the target. The Mirage then breaks off the attack at about 20,000 feet.

Lt. Col. Don Rodewald, USAF (Ret.), first paraplegic to fly around the world, completed the 35,000-mile trip in his Piper Comanche in four months. "Rode" founded Wheelchair Aviators for handicapped pilots with special flying licenses.

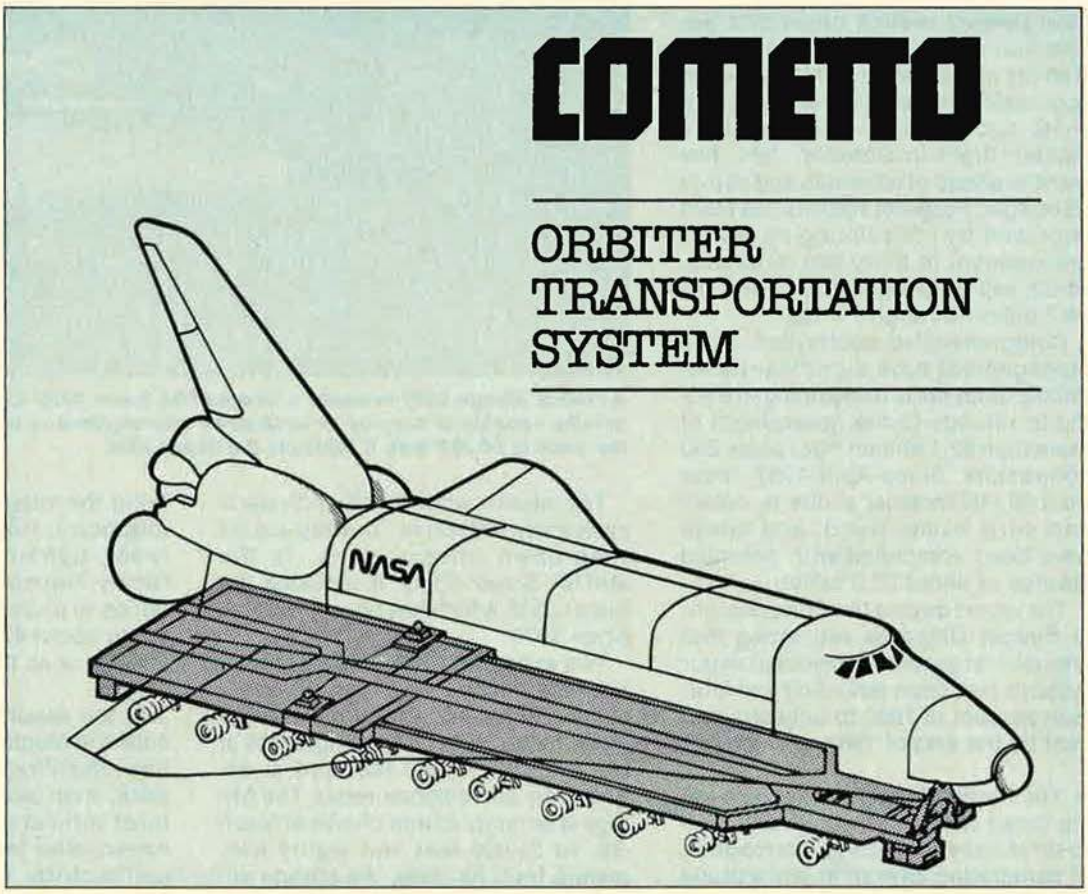
★ Retired USAF Lt. Col. Don (Rode) Rodewald has become the first paraplegic to fly around the world. Rode, sixty-six, is an AFA member, a former Flying Tiger, and the founder of Wheelchair Aviators, a group of more than 300 handicapped pilots who have special FAA licenses to fly.

Flying his red, white, and blue Piper Comanche, he covered 35,000 miles in four months, completing his journey at Washington National Airport in December 1984.

A resident of Lake City, Colo., Rode flew with the Flying Tigers' American Volunteer Group in 1941 and 1942. He also flew F-86s in Korea. He has been in a wheelchair since crash-landing an F-80 at Andrews AFB, Md., on January 11, 1954.

He financed his round-the-world trip with $30,000 from his own funds. His aircraft is fitted with a hand-controlled rudder.

★ A huge new vehicle to provide ground transportation for the Space Shuttle in a horizontal position has been received at Vandenberg AFB, Calif., from its Italian manufacturer, Cometto Industriale.



Ground transportation for the Space Shuttle at Vandenberg AFB, Calif., will be provided by this giant new vehicle, which will transport the Shuttle over nineteen miles of existing roads between assembly and work areas, the launch site, and the landing runway.

The vehicle will be used at Vandenberg to transport the Shuttle along approximately nineteen miles of existing roads between assembly and work areas, the launch site, and the landing runway.

The giant vehicle, twenty feet wide and more than 100 feet long, rolls on ten sets of wheels, nine of which are steerable. (The sixth group of wheels, in the middle of the vehicle, is fixed.) The unit is self-propelled by a diesel motor driving three sets of wheels. A two-seat driver's cab is located at the lower front of the frame, which can be raised and lowered hydraulically. The vehicle has a top speed of about ten miles per hour.

AEROSPACE WORLD

★ The aerospace industry posted a near-record year in sales for 1984, despite a serious drop in the civil aircraft market, according to Aerospace Industries Association President Dr. Karl G. Harr, Jr. Strong sales of military aircraft, missiles, and space products and services more than compensated for the lagging civil market.

Total sales in 1984 were a projected $83.1 billion, up from $75.8 billion in 1983. Profit after taxes is estimated at a record $3.6 billion, compared with $2.8 billion in 1983. Profit rate was 4.3 percent, up from 3.5 percent in 1983.

The Department of Defense is the principal customer responsible for the sales increase, Dr. Harr said, with purchases of military aircraft, missiles, and space equipment totaling $47.7 billion in 1984, a twenty-one percent increase over 1983. Aerospace sales to NASA and other US government agencies increased only slightly more than the rate of inflation.

Commercial sales, on the other hand, decreased ten percent as a result of depressed sales of all civil aircraft to both domestic and foreign customers and declines in exports of military aircraft, engines, and related parts. Commercial space sales continued to increase, but are a relatively small proportion of total industry activity.

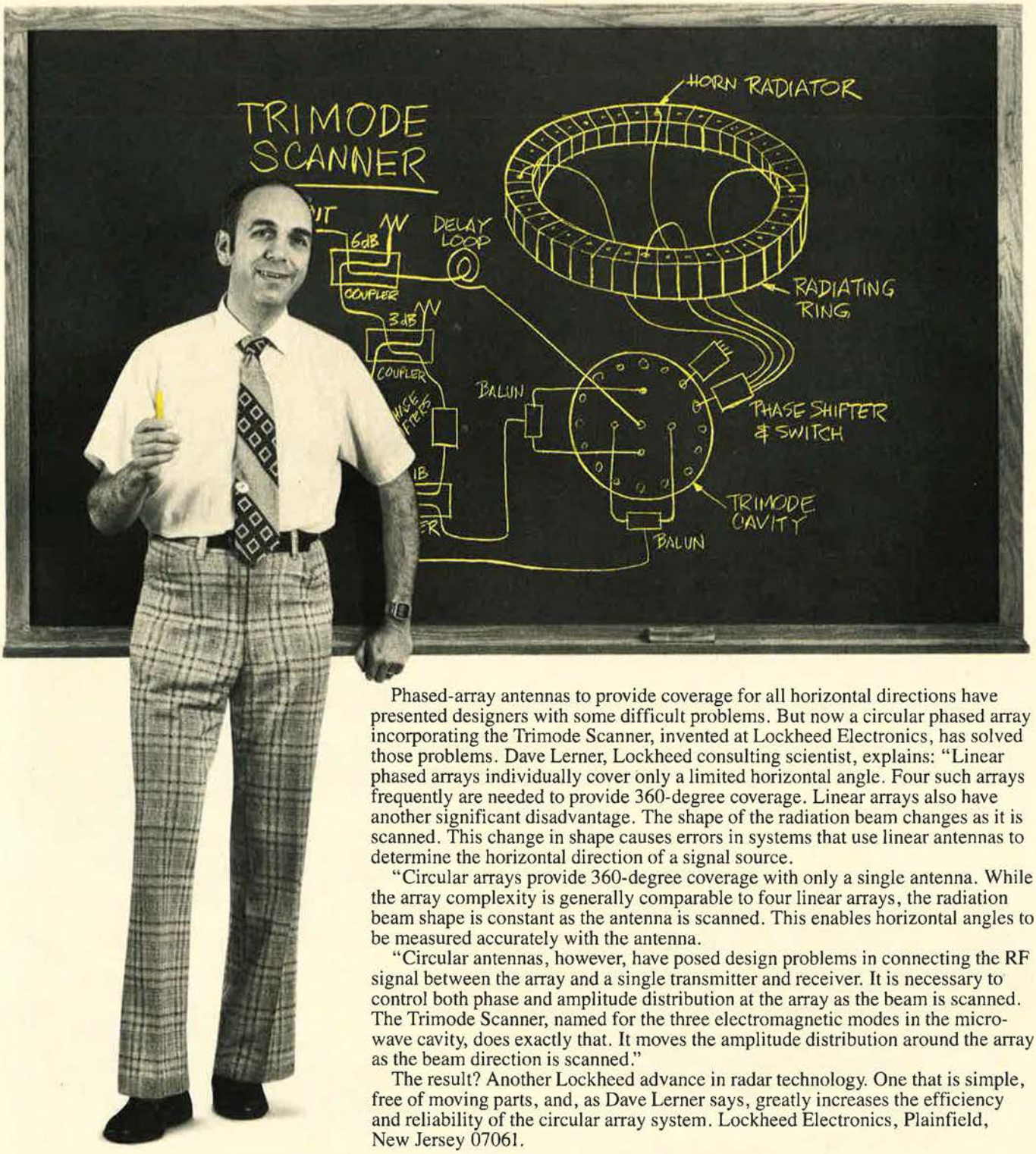
Both export sales and the aerospace international trade balance were below 1983 levels, Dr. Harr said. Based on preliminary figures, the total 1984 aerospace export volume was $15 billion, compared with $16.1 billion in 1983 and $17.6 billion—the record—in 1981. Aerospace imports increased to $4.7 billion in 1984, up from $3.4 billion in 1983. This gives a 1984 favorable trade balance of $10.2 billion, down from $12.6 billion in 1983, $11 billion in 1982, and $13.1 billion in 1981.

Following the usual pattern, aircraft production predominated in an analysis of industry sales by product group. Aircraft production accounted for $42.8 billion, or 51.5 percent. Military aircraft sales totaled $33 billion, up substantially from $29.1 billion in 1983. Civil aircraft sales dropped from $12.2 billion in 1983 to $9.8 billion in 1984.

Space sales reached an all-time high of $16.8 billion, a twenty-one percent increase over the previous high, $13.9 billion in 1983, due principally to continued growth in military space spending. Missile sales amounted to $11.4 billion, an increase of $2.3 billion over the previous year.

Radar Technology on the move.

Dave Lerner on a new approach to omnidirectional coverage.



Phased-array antennas to provide coverage for all horizontal directions have presented designers with some difficult problems. But now a circular phased array incorporating the Trimode Scanner, invented at Lockheed Electronics, has solved those problems. Dave Lerner, Lockheed consulting scientist, explains: "Linear phased arrays individually cover only a limited horizontal angle. Four such arrays frequently are needed to provide 360-degree coverage. Linear arrays also have another significant disadvantage. The shape of the radiation beam changes as it is scanned. This change in shape causes errors in systems that use linear antennas to determine the horizontal direction of a signal source.

"Circular arrays provide 360-degree coverage with only a single antenna. While the array complexity is generally comparable to four linear arrays, the radiation beam shape is constant as the antenna is scanned. This enables horizontal angles to be measured accurately with the antenna.

"Circular antennas, however, have posed design problems in connecting the RF signal between the array and a single transmitter and receiver. It is necessary to control both phase and amplitude distribution at the array as the beam is scanned. The Trimode Scanner, named for the three electromagnetic modes in the microwave cavity, does exactly that. It moves the amplitude distribution around the array as the beam direction is scanned."

The result? Another Lockheed advance in radar technology. One that is simple, free of moving parts, and, as Dave Lerner says, greatly increases the efficiency and reliability of the circular array system. Lockheed Electronics, Plainfield, New Jersey 07061.

Engineers interested in contributing to advanced electronic systems are invited to write Employment Manager at LEC, Plainfield, New Jersey 07061.

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AEROSPACE WORLD

Aerospace employment was at an estimated 1,242,000 at the end of 1984, up from 1,171,000 at the end of 1983.

Dr. Harr predicted sales will grow to $98 billion in 1985, which will be the aerospace industry's peak year. This prediction is based on evidence that the civil aircraft production curve is beginning to climb.

★ As a result of the crash of a prototype B-1 in August 1984, a center of gravity (CG) warning light is being added to the B-1B instrument panel at eye level. An Air Force accident investigation board determined that the crash was caused by aircrew error when the crew failed to transfer fuel manually to keep the aircraft's CG within safe limits while the wings were being pivoted from the sweptback to the forward position.

A fuel transfer caution light was illuminated on the instrument panel, but its position was so low the aircrew's view of it was obstructed by the copilot's knee. A detent is being added to the B-1 wing-sweep lever so that changing the sweep will become a two-step operation.

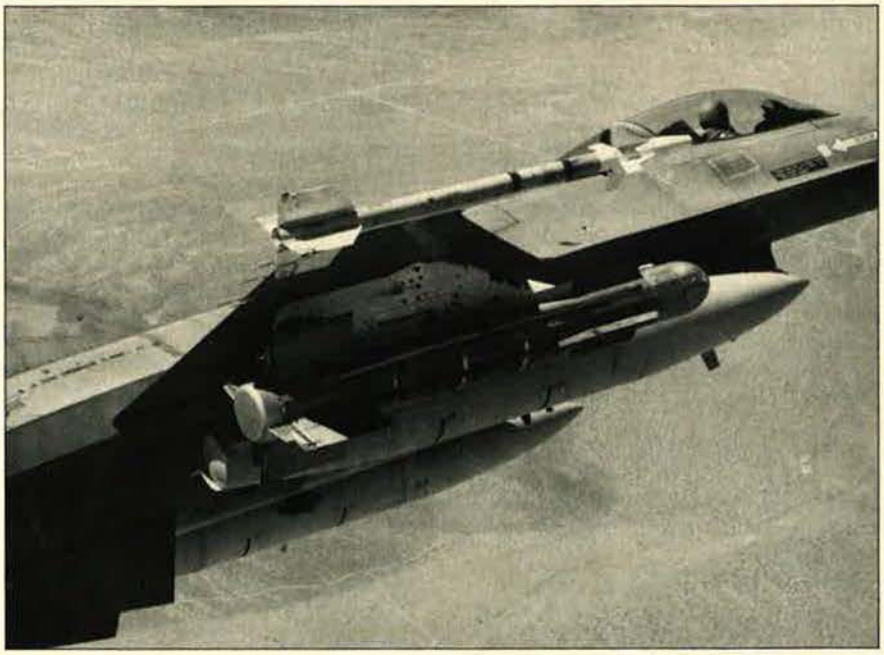
★ Hughes Aircraft Co. is modifying the TOW weapon subsystem of the Army's Bradley Fighting Vehicle System to fire the new TOW 2 missile. The TOW 2 has an improved guidance system and a new, more potent warhead designed to penetrate enemy armor.

Hughes is delivering TOW subsystems, which include an integrated day/night sight unit, to FMC Corp., the Bradley developer and system integrator. Deliveries of the TOW 2 compatible subsystems are scheduled to begin in mid-1986.

A new TOW 2 antiarmor missile is fired from the newly modified TOW weapon subsystem of the Army's Bradley Fighting Vehicle. The TOW 2 is more accurate than the earlier TOW system and has a more potent warhead.

★ NASA announced it has developed a new device for hanging weapons from the wings of such lightweight fighters as the F-16. The device—an improved version of the standard pylon, which carries weapons, fuel tanks, and other external stores—is called a decoupler pylon.

The pylon was designed to reduce flutter, which is a dangerous bending and twisting of aircraft wings carrying external stores at certain speeds. In extreme cases, the vibrations between the wing and the stores can cause flutter so severe that the stores can be ripped off—or an entire wing could fail.



An F-16 carries heavy ordnance on a new decoupler pylon in tests at Edwards AFB, Calif. The pylon reduces high-speed flutter, which, under certain conditions, can cause structural failure of the weapons carriage equipment or failure of the wing under which the external stores are carried.

The new pylon uses a special spring to keep the vibrations of stores and the wing carrying them from combining into a single vibration that could contribute to the onset of flutter.

In flight tests conducted at Edwards AFB, Calif., with an F-16 carrying a 2,250-pound bomb, flutter with a standard pylon began at 515 mph. With the decoupler pylon, flutter was eliminated at all speeds up to 700 mph, the maximum speed tested. The flight tests also proved the decoupler pylon can keep a store aligned with the wing during hard maneuvers, a requirement for any pylon.

★ Krafft A. Ehricke, sixty-seven, father of the Centaur space-launched vehicle and a key developer of the Atlas intercontinental ballistic missile project, died in December at his home

in La Jolla, Calif., following a long illness.

Mr. Ehricke was one of the German rocket scientists who were secretly brought to the United States after World War II to work in the US space program.

He led development of the Centaur when he worked for General Dynamics-Convair from 1956 to 1965. In May 1984, he was awarded the Goddard Astronautics Award by the American Institute of Aeronautics and Astronautics for "visionary contributions to astronautics."

★ The first C-5A to be "owned" by an Air Force Reserve unit was turned over to the organization in December. Gen. Thomas M. Ryan, Jr., Commander in Chief of Military Airlift Command, flew the aircraft to the 433d Tactical Airlift Wing at Kelly AFB, Tex.

The aircraft is the first of sixteen C-5A Galaxys to be assigned to the 433d. General Ryan said the aircraft is "a symbol of a long and valuable partnership."

★ The first production version of the Advanced Medium-Range Air-to-Air Missile (AMRAAM) was fired at White Sands Missile Range in New Mexico in December.

Launched from an Armament Division F-16 at 40,000 feet at a speed of Mach 1.2, the missile flew a preprogrammed course for evaluation of its aircraft separation characteristics and control system. It did not have a target seeker, but instead was flown over a prescribed route by a programmed autopilot.

AMRAAM will replace the radar-guided AIM-7 Sparrow missile now widely used by USAF and the Navy. The AMRAAM system will provide the capability for an interceptor to track and fire at several targets at the same time.

★ William Gene Sizemore has been appointed the new Executive Director of the Navy League of the United States, the League's National President, Albert H. Friedrich, has announced. Sizemore will direct day-to-day administration of the nonprofit, educational foundation.

He retired as a rear admiral in the US Navy in September 1982. His last active-duty assignment was Deputy Director of the Defense Nuclear Agency.

★ The oldest activated airlift squadron, the 4th Military Airlift Squadron, will celebrate its fiftieth anniversary at McChord AFB, Wash., March 29 to 31. First activated at Rockwell Air Depot, Calif., on July 8, 1935, the squadron currently flies the Lockheed C-141 StarLifter.

During World War II, the squadron flew airborne assault missions at Sicily, in Myitkyina, Burma, and in southern France and supported partisans in northern Italy and the Balkans. In the Korean conflict, the 4th provided aerial transport from the United States to Japan and then from Japan to Korea.

The 4th flew missions in Southeast Asia and participated in Operation Homecoming, which brought the released American POWs back from Vietnam. The first C-141 to land on Grenada during the US military operation there in October 1983 belonged to the squadron, and 4th aircrews evacuated US citizens attending the medical college on Grenada.

AEROSPACE WORLD

★ "Air Force Reserve and Air National Guard medical forces will double by 1990 and represent one-third of the Air Force's total wartime medical requirement," Dr. (Maj. Gen.) James Tucker, USAFR, told delegates to the ninety-first annual meeting of the Association of Military Surgeons of the United States (AMSUS) in San Diego recently.

General Tucker, mobilization assistant to the Air Force Surgeon General, said active-duty personnel cannot meet the critical Air Force medical service wartime shortfall without the Guard and Reserve.

"By 1990, we hope to have eighty-nine percent of our needed manpower, of which thirty-five percent

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AEROSPACE WORLD

would come from the Air Guard and Reserve," he said. Adjustments have been under way for some time to anticipate new medical requirements in wartime, General Tucker said. "For the last two years, all of our major commands—including reserve forces—have been at work organizing deployable medical units. It's not an easy task, considering that we are rapidly transitioning from a fixed medical service to a mobile medical service."

The requirement for a mobile medical service springs from new emphasis on having theater-wide medical capabilities. Air bases, for example, are now recognized as prime targets in the first stages of a war. They will be a source of casualties, but their targeting also means medical facilities and services must be rapidly deployable to other locations before attack and redeployable afterwards.

★ One hundred and three airmen and noncommissioned officers have been selected to attend colleges and universities across the nation under the Airman Education and Commissioning Program (AECP), the Air Force has announced. A selection board considered 366 applicants. Another selection board will meet before the end of FY '85.

Selectees will enter technical or engineering academic programs. On graduation, they will attend Officer Training School (OTS) and be commissioned second lieutenants.

The majority of those selected had already accrued thirty to fifty-nine college semester hours and boasted an average grade point average of 3.34 on a 4.0 scale. The average selectee was a staff sergeant between twenty-five and twenty-nine years of age.

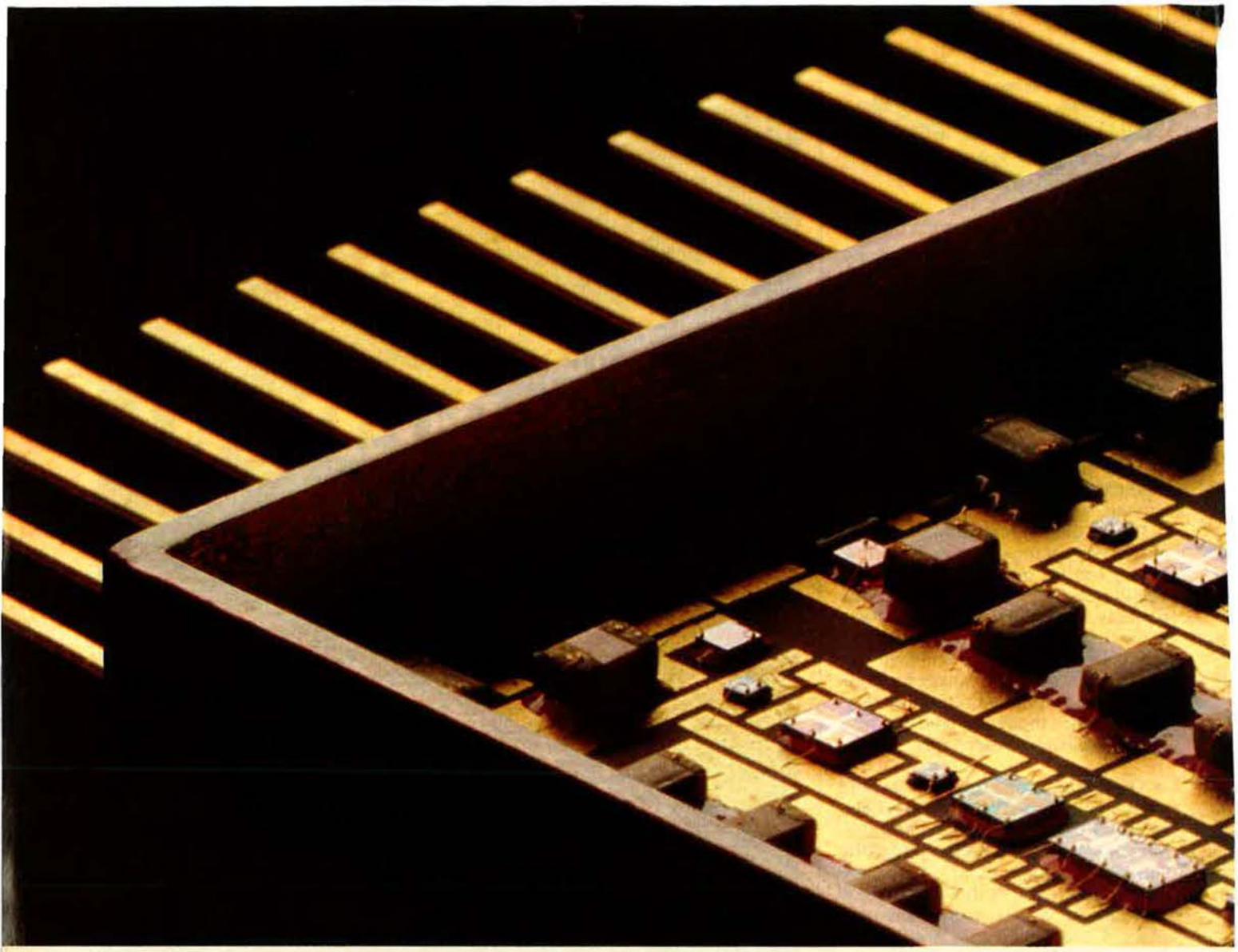
Eighteen were selected for computer technology programs, nine for aeronautical engineering, nine for astronautical engineering, four for civil engineering, forty-five for electrical engineering, four for industrial engineering, seven for mechanical engineering, two for nuclear engineering, and five for meteorology.

★ In tests conducted in December, the US Army evaluated the air-to-air fighting capabilities of current helicopters in anticipation of possible future confrontations between attack helicopters. The tests were the third in a series initiated by the Army's Applied Technology Laboratories in 1983.

During the tests, which were conducted at Patuxent River NAS, Md., the helicopters engaged in all types of air-to-air confrontations. Maneuvers included acceleration and deceleration at a constant altitude, dives and rolling pullouts, turns, climbs and pushovers, and bob-ups, rearward flight, and accelerating climbing turns.

Air combat maneuvers included horizontal scissors, wingover attacks, high and low yo-yos, side flares, and quick stops. Helicopters in the latest test included the Hughes Model 530F, a German-built MBB BK-117, and the Army's AH-1S Cobra and OH-58A.

Participants in the test were from the Applied Technology Laboratory, the US Naval Test Pilot School, the Army Engineering Flight Activity, the Marine Aviation Weapons and Tactics Squadron One (MAWTS-1), and the 5th and 17th Cavalry. ■



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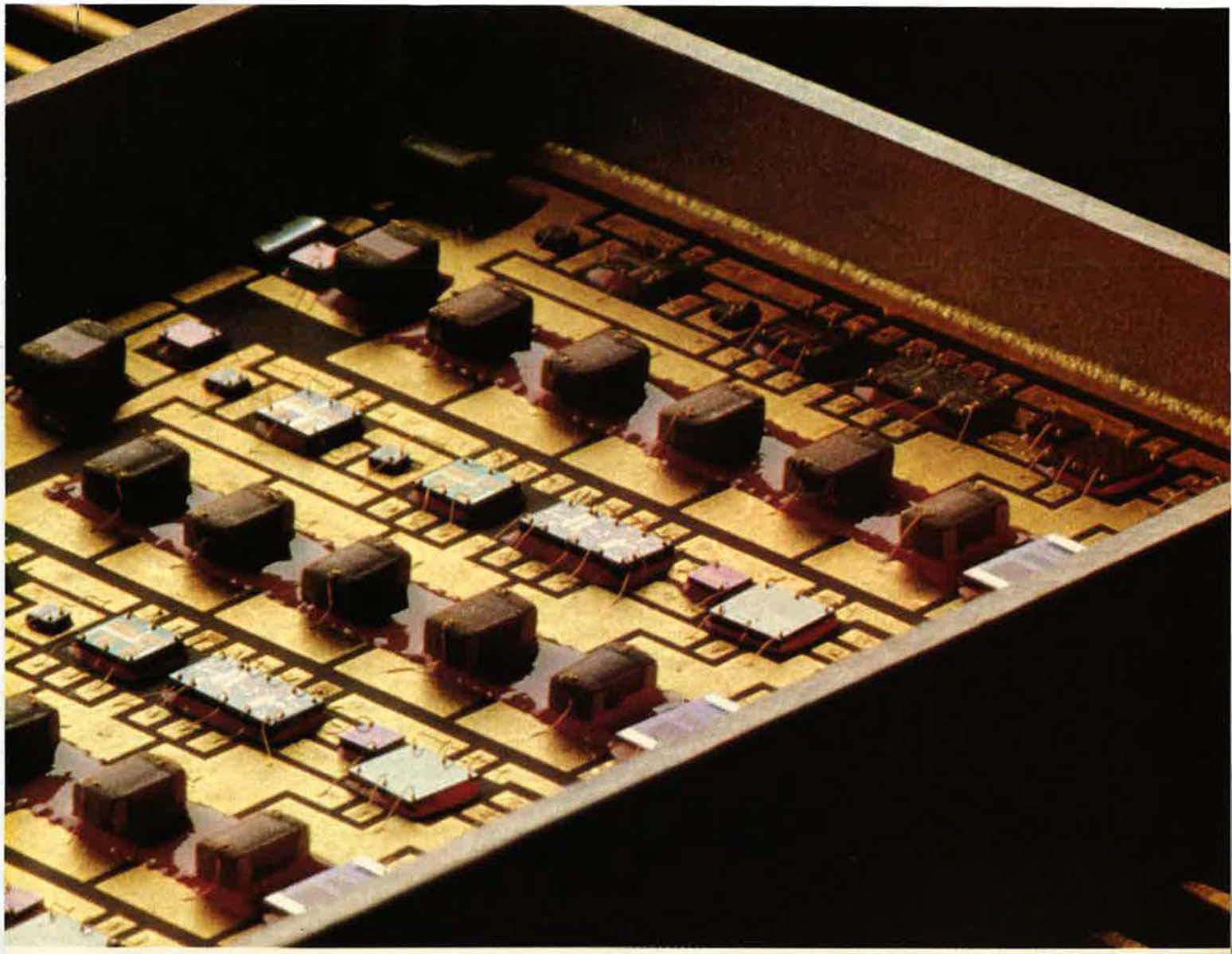

spectrographic and electron micrographic techniques are used to analyze and evaluate a variety of surface conditions and effects. And it's paying off with sharpened eyes for space sensors and improved performance and reliability for many other electronic devices.

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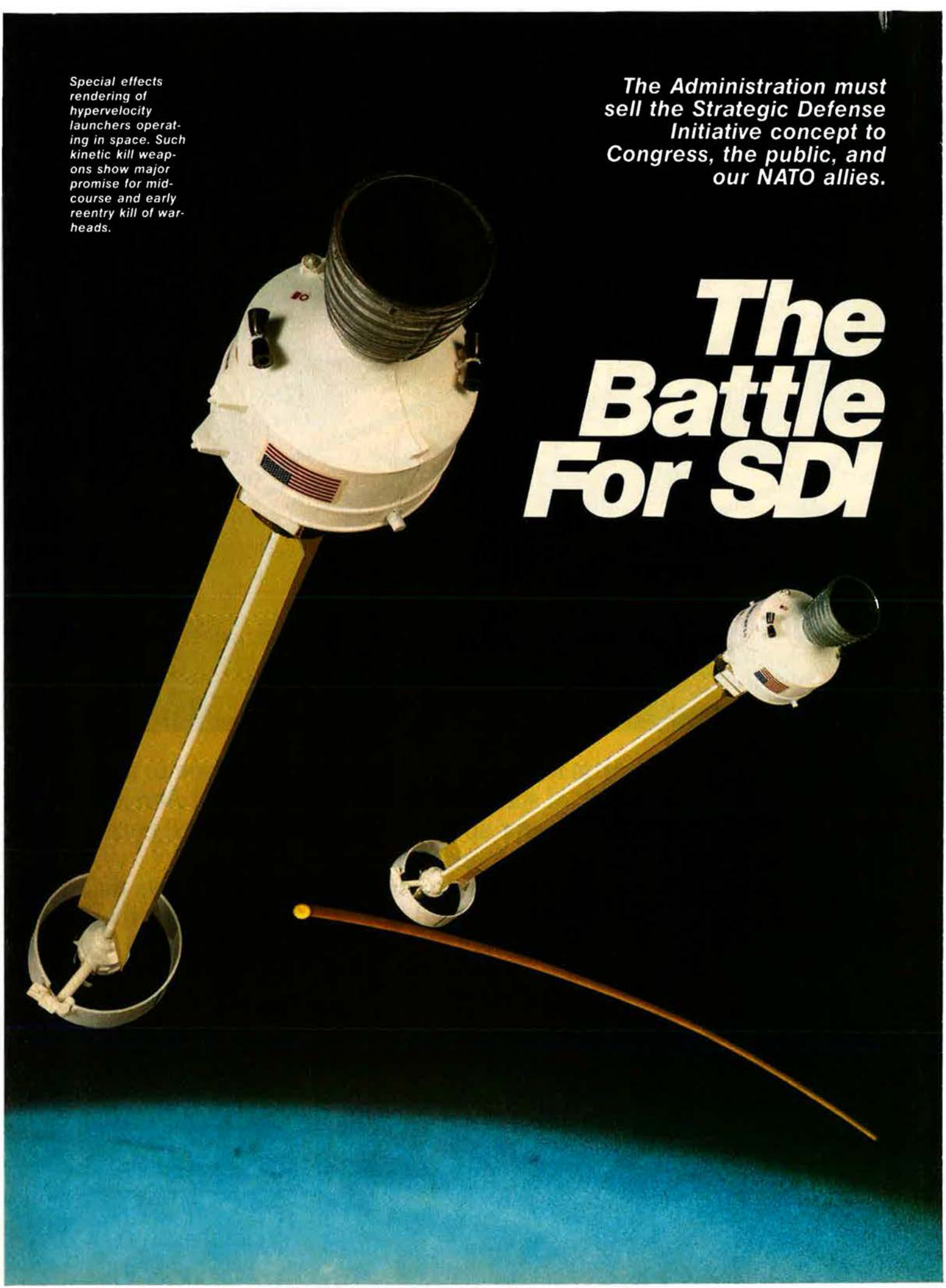
The Administration must sell the Strategic Defense Initiative concept to Congress, the public, and our NATO allies.

The Battle For SDI



BY EDGAR ULSAMER
SENIOR EDITOR (POLICY & TECHNOLOGY)

THE Strategic Defense Architecture (SDA-2000), the Pentagon's new, long-term roadmap to integrated air, space, and ballistic missile defenses, and its high-profile keystone component, the Strategic Defense Initiative (SDI, or "Star Wars"), are likely to run into crucial roadblocks in the months ahead. For one, Congress—which, in the past year, cut the funding of the nascent SDI program by about twenty-two percent and reserved the option to exercise line-item review over how and where to administer the necessary reductions—is not likely to be more generous in 1985 than it was in 1984. Reinforcing this likelihood is the fact that the money sought for SDI in FY '86 is more than twice what the Administration requested—but did not get in full—last year.

In addition, Soviet hysteria—probably staged for foreign consumption—over the potential impact of modern US aerospace defenses on the strategic equilibrium is bound to make termination of the SDI program the principal Soviet goal in pending arms-control talks. It would seem to follow that the fate of this nation's aerospace defenses—and especially of the SDI program—rests on the skill and resolve with which the Administration makes the case on Capitol Hill, with the public at large, and with the principal NATO allies for the associated fundamental reorientation of the free world's nuclear deterrence strategy.

Making the case will entail dispelling a host of pernicious misconceptions. Some of them were carefully floated by opponents of this strategic deterrence formula, which seeks to shift from purely offensive forces to a combination of offensive and defensive capabilities in the first go-around and eventually to a largely defensive force structure.

The relative merits of SDI aside, there can be no arguing that the SDI decision has already been made—not in Washington, but in Moscow. The Soviet Union not only operates the world's only antiballistic missile (ABM) system, but is upgrading it rapidly and probably in violation of the SALT I ABM treaty. As Brig. Gen. Robert R. Rankine, USAF's special assistant for SDI, puts it, the Soviets are poised to deploy rapidly a new, nationwide ABM system. Also, they have taken new ABM technologies to power levels that approach weapons-grade requirements, which is something "that the US has not done. That gives the Soviet Union a lead—perhaps not in science, but in engineering—because [as a result] they understand the difficulties associated with accomplishing these feats." Lt. Gen. James A. Abrahamson, Director of the SDI Organization (SDIO), stresses in similar fashion that the SDI is not "a unilateral US decision" because the Soviets are already well along in some of the key activities that "we plan in SDI." Advanced, comprehensive Soviet ABM technologies have matured to a point where Moscow could "creep out" from the 1972 ABM treaty at will.

Bumper-Sticker Logic

Two of the myths that employ what General Abrahamson terms "bumper-sticker logic" and that tend to diminish support for SDI pivot on the claims that weapons of this type would militarize space and that such a defensive array must be totally leakproof in order to be militarily effective. Deputy Secretary of Defense William H. Taft IV points out that to "prove the potential of a defensive deterrent—the first goal of SDI research—we need only show that we can make the success of any attack so uncertain that an adversary would not hazard aggression." Even a partially effective defense, he suggests, "can be an effective deterrent. No rational aggressor is likely to contemplate nuclear conflict when the ability to penetrate our defensive system and destroy our retaliatory capability remains so uncertain." On the other hand, "in the case where the irrational does occur—either through the failure of deterrence, accident, or a launch by some unstable government—defense would offer the only hope of protecting our people," in Secretary Taft's view.

Rankine: The space segment must be survivable.

Just as the Strategic Defense Initiative can strengthen deterrence by reducing the military utility of nuclear ballistic missiles, it can also enhance the opportunity for arms reductions, according to Secretary Taft: "For by devaluing nuclear ballistic missiles, we can create powerful incentives for sharp reductions in their numbers—reductions that would enhance the security of the United States, its allies, and the Soviet Union."

The Deputy Assistant Secretary of Defense for Nuclear Forces and Arms Control Policy, Frank J. Gaffney, Jr., concedes that the "myth of keeping space pristine has considerable public appeal." He expects this myth to endure at least until the public finds out that space, far from being pristine, "has been a major theater of military operations for quite some time for both the US and the Soviet Union." Deputy Under Secretary of Defense for Strategic and Theater Nuclear Forces T. K. Jones

argues that SDI does not raise questions of whether or not weapons will be used in space—the Soviet ASAT system has been an operational reality for years—but rather whether "we will defend the US against weapons that transit through space en route to their targets [in this country or in allied territory]." SDI, Secretary Jones points out, "is not some abstract 'Star Wars' game, but instead represents what most Americans want."

The Morality of SDI

Alluding to questions raised by the Conference of US Catholic Bishops about the morality of the SDI objective, he posited that "defending our country against nuclear weapons is more moral than trying to deter nuclear war by the threat of retaliation." Secretary Taft, in similar fashion, termed SDI a "prudent hedge against a surprise that could be far more devastating than Pearl Harbor—a sudden Soviet breakout from the ABM treaty." SDI points the way toward the "option to protect our people and our allies by deploying a strategic defense system that would enormously enhance stability and the safety of the world."

Abrahamson: Up against "bumper-sticker logic."

Extending the SDI rationale to the issue of "nuclear winter"—the Ice Age-like aftermath of a major nuclear exchange, as postulated by the scientific community—Secretary Jones suggested that there were only two alternatives to this concern: One is an extreme reduction in the nuclear arsenals of the two sides; the other is dependent on defenses that prevent large numbers of nuclear weapons from detonating in the lower atmosphere. But, as he points out, "The Russians have rejected even moderate reductions [of offensive weapons in arms-control talks with the US], leaving defensive measures as the only remaining alternative to the concerns about nuclear winter."

Vice President George Bush, speaking before a symposium sponsored by the National Defense University, suggested that "we are compelled by logic and morality to find an alternative to the grim reality of the nuclear arms race." In the Administration's and the Pentagon's view, the only means to that end is SDI, he said. He stressed that "we don't see an antinuclear defense as a substitute for either deterrence or arms control." On the contrary, it may turn out "that ultimately only a defensive shield can provide the climate of security and confidence on both sides that will make it possible, finally, to eliminate—or virtually eliminate—our nuclear stockpiles." Pointing out that advanced technology has served historically as America's trump card, he suggested that, through SDI research, "we should utilize it to its utmost to keep deterrence as secure and also as cost-effective as possible."

Taft: A partial defense can be an effective deterrent.

Pentagon Thumbs-Up

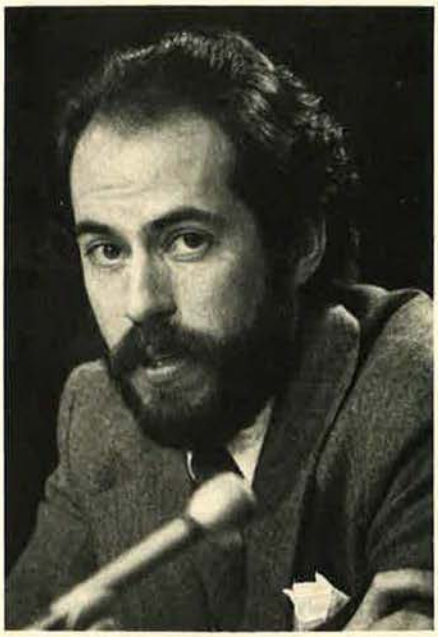
A high-level Defense Department study recently concluded that the real result of the 1972 ABM treaty—which rules out all but token ballistic missiles defenses—is "that by guaranteeing the Soviets that [because of no US defenses] their missiles will be 100 percent effective, we encourage them to build more, not fewer" ICBMs.

At the time it was signed, the ABM treaty was touted as an incentive to limit the arms race in offensive nuclear weapons on both sides and, better yet, actually to reduce the nuclear arsenals of both countries. History made hash of this postulate, according to Secretary Jones. Over the intervening years, the Soviets boosted the number of ICBM warheads "by 400 percent, and we increased ours by fifty percent. The Soviets deployed nine new ICBMs, and we deployed one." Also, the Soviets launched and completed thirteen major modification programs of ICBMs, compared to one on the US side during this period.

In examining four obvious approaches to deterrence and arms reduction, the Pentagon's analysts concluded that only an SDI-derived ABM, linked to strong air defenses as envisioned by SDA-2000, would result in broadly improved deterrence. At the same time, only SDI folded into SDA-2000 tends to stop nuclear war at relatively low levels of violence, in the event deterrence fails. Defenses of this type also help strengthen the effectiveness of "conventional forces by protecting the otherwise vulnerable rear areas." None of the other

three alternatives examined by the Pentagon's analysts—continuing on the present course, enhancing the retaliatory threat, or enhancing the survivability of the retaliatory forces by means of advanced technology—offered comparable gains in increased strategic stability and deterrence, according to Secretary Jones. SDI, he stressed, "may be our only opportunity to break Soviet intransigence on arms control."

In exulting over the moral superiority of a defensive deterrence concept, SDI/SDA-2000 advocates should probably beware of tagging offensive strategic deterrence with the label of immorality, however. As Dr. James R. Schlesinger, former Secretary of Defense, points out, "Within the Air Force, within the Administration, within society as a whole, we should not begin to talk about the immorality of deterrence in our quest for the Strategic Defense Initiative, because we are going to rest on deterrence for the balance of our days."



Gaffney: Space is already a military theater.

Jones: SDI may break intransigence on arms control.

Such "loose rhetoric" about the immorality of deterrence solely or largely based on offensive nuclear capabilities is "reckless," Dr. Schlesinger says. He warned that "there is no leakproof defense. Any defense is going to suffer some erosion, at best, and an effective opponent will develop defense suppression techniques and punch a hole in whatever defense is deployed." Reminding the Air Force of its often-stated tenet that "air defenses [are] penetrable," the former Defense Secretary suggested that, if it were otherwise, there would be no need to build new strategic bombers and nuclear-armed cruise missiles. From the premise that there is "no serious likelihood of removing the nuclear threat from our cities in our lifetime, or in the lifetime of our children," Dr. Schlesinger argues that, "if those cities are going to be protected, they will be protected by the forbearance of those on the other side or through effective deterrence. And it is for that reason that cries of the immorality of deterrence are premature and pernicious."

The real case for SDI-derived ABM and associated air defense capabilities rests on the as yet unproven ability of such defensive forces to "improve deterrence and [on whether or not] the mix of offense and defense will lead to a more stable world—a plausible argument." Equally "plausible," in Dr. Schlesinger's view, is the proposition that making ICBMs "reasonably secure" against preemptive destruction by an adversary by means of ABM defenses is desirable and will increase stability.

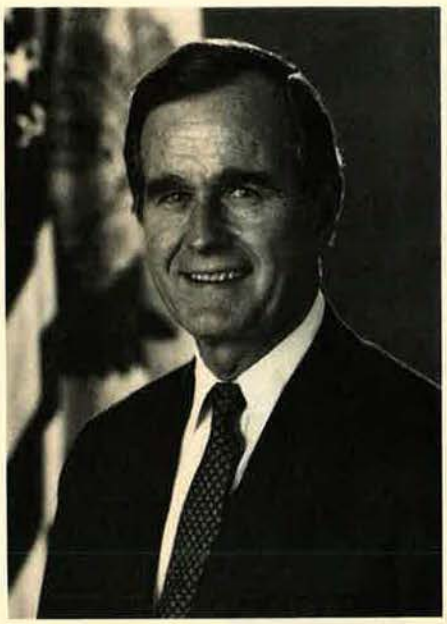
Conservative, Phased Program

The SDI program, which President Reagan triggered on March 23, 1983, when he challenged the defense community to take a long-term look at options to the exclusively offensive character of nuclear deterrence of the past four decades, is, as General Abrahamson points out, a research and technology program "only." As such, the SDI program—which is expected to cost about $26 billion over the first five years of its life—has only one central objective: "To eventually allow a development and, possibly later, a deployment decision for a defensive-based strategy." Nobody with oversight responsibility for the concept harbors the illusion that SDI can take a gigantic leap toward an "Astrodome over the United States [or] an Astrodome over an MX missile field in Wyoming or over New York City."

What the program should eventually answer is whether or not ballistic missile defenses could be developed "cost-effectively [to] span the entire arc from an [ICBM] rising anywhere in the USSR to an SS-20 being launched in Eastern Europe against NATO" to an SLBM being fired from below the sea anywhere on the globe. In order to enable a future administration to decide early in the 1990s whether or not such a strategic defense can be developed cost-effectively, the Defense Department plans to spend about $3.79 billion in FY '86, $4.99 billion in FY '87, $6.26 billion in FY '88, and $7.415 billion in FY '89.

SDI is not, according to its Director, a latter-day Manhattan Project or an ideological crusade for "a perfect weapon system, or a panacea." In essence, SDI is to point the way toward a better "safety net" than that provided by an offense-oriented deterrent.

The measures of merit that will make or break the SDI program involve three distinct considerations, according to General Abrahamson. Key is the ability to increase the effectiveness of the US strategic deterrent at a time when broadly adverse trends "tend to take away from the credibility of our offensive deterrent—such [as Moscow's ability to] put small missiles in garages all over the Soviet Union." SDI must deny a potential attacker high assurance of successfully realizing strategic military objectives so "that he won't do what he otherwise might want to do." Also, SDI must create an



Bush: Antinuclear defense is not a substitute for deterrence or arms control.

equilibrium "better than what we have today: sitting here with guns pointed at each other's forehead with a six-minute trigger or less on them." The second criterion that will determine whether or not an SDI-derived defensive system should be developed is the system's ability to "control escalation, which is something we can't do now." An effective defense would provide such a "survival option." Lastly, SDI must be able to reduce to "low levels—we don't yet know just how low—the value of the [adversary's] offensive component [of his strategic forces] and thereby increase the chance for dramatic arms reductions."

Cost Leverage

The *sine qua non* of the SDI concept—and its most demanding challenge—is to come up with defenses that, according to Secretary Jones, can destroy nuclear warheads at "about half the cost of building them." If this can be done, the "cost-leverage would increase to four to one in favor of SDI-derived defenses," after allowance is made for cross-targeting and other operational factors. Under these circumstances, he argues, it would be "foolish" economics "for the Soviets to launch a new arms race in response to SDI." In-depth strategic defenses might well "make it possible to defend ourselves for less than what it would cost to continue on the present course." SDI, he suggests, is therefore more likely to slow down the arms race on both sides than to speed it up.

Elaborating on this point, General Abrahamson explained that the SDI effort is "not just aimed at establishing the technical feasibility of the concept, but also to provide the motivation for the Soviets, first, to stop investing in obsolete weapons, second, to direct their time and effort toward [creation] of a defense-based nuclear deterrent, and, third, to create a climate where both sides might be more inclined to negotiate away their destabilizing [offensive strategic] weapons." It follows from this cost-effectiveness equation that the defense must be able also to negate or offset countermeasures to its weapons for less than what it costs the attacker to field them, according to General Abrahamson.

Donald C. Latham, Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (C^3I), warns that "over the next five to ten years, we will have to prove lots of things in various weapon and C^3 areas to weave together an ABM system coupled to a vigorous air defense system as well as . . . systems to defend our space assets of whatever type." The Pentagon, he points out, is looking at "this problem as an integrated defense initiative that couples air, space, and ABM." Secretary Latham is quick to admit that "much remains to be proven in terms of subsystems, and even at the component level, [to substantiate] that such a system can be made to work." Various technologies need to be shown effective so that, if compatible, they could be combined to result in a system that provides a strong, albeit somewhat "leaky," defense against Soviet ballistic missile attack.

The SDIO's Deputy Director and Chief Scientist, Dr. Gerold Yonas, suggests that if the current exploratory phase of SDI culminates in a decision to develop strategic defenses, the program will have to be tackled in several phases: "We need to think about Soviet responses not just in terms of what the Soviets might have in ten or twenty years, but over a longer period." These are likely to include a near-term phase, another one that comes up with additional technologies that can neutralize Soviet responses, and lastly a phase that generates the means to counter even the most sophisticated Soviet responsive threats.

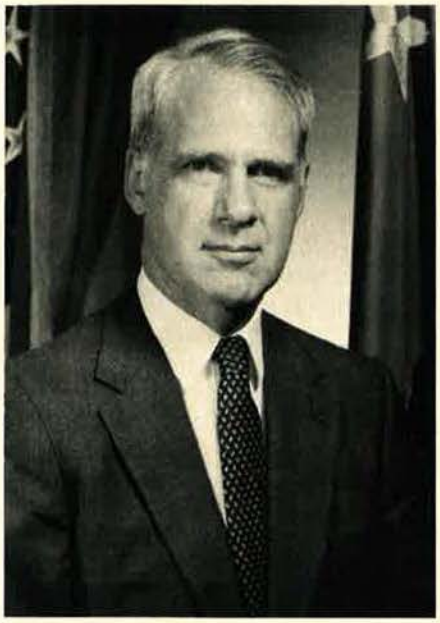
Serendipity of Timing

The SDI concept, according to General Abrahamson, seeks to define the broad architecture for going after ballistic missiles from the moment they "are launched in the Soviet Union, Eastern Europe, or wherever," until they approach their targets. For the time being, there is no "defined program in terms of knowing what the weapons, sensors, C^3 systems, and support elements will be."

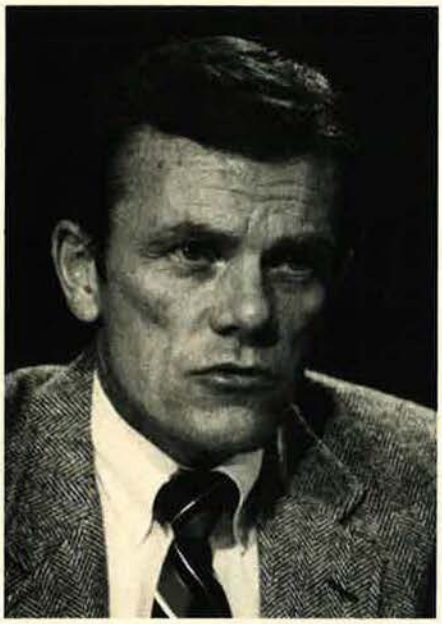
He, along with other SDI proponents, points out a basic difference between the situation in the early 1970s when the US Army's Safeguard ABM system was canceled and the one prevailing now: "In 1972 and 1973, we had a very thin layer of defense [drawn from a] stretched technology base that couldn't meet the threats of the future." In contrast, "we are now blessed with the serendipity of various key technologies approaching the point of operational feasibility simultaneously." The result could be a shift toward greater leverage in favor of the defender because of an attacker's increased uncertainty about reaching fundamental military objectives and because of the significant reductions in what he might hope to gain from a preemptive strike.

The objective behind SDI is to go after ballistic missiles and their warheads during all phases of a ballistic missile's trajectory. During the boost phase, when the missile's rocket engines accelerate the payload through and out of the atmosphere, the "leverage," or payoff, of ABM defenses peaks because, as General Abrahamson points out, if "we knock out one SS-18, or a similar follow-on ICBM, we would kill ten or more reentry vehicles and perhaps hundreds of decoys."

In the subsequent post-boost, or bus deployment, phase, the post-boost vehicle spins off its payload of perhaps as many as fourteen warheads, in the case of SLBMs, and hundreds of decoys. SDI's task, therefore, is somewhat tougher in terms of the number of targets that will have to be dealt with in the post-boost and the midcourse phase that follows, but there is time "to set up two or three nets to catch these things that are floating along hundreds of kilometers above earth at high speed." The plus that accrues to the defense during both the post-boost and midcourse phases of a ballistic missile's trajectory is that the warheads have to remain on a particular path "because they have to go after specific targets and, thus, because of natural law, don't have the luxury of evasive action."



Schlesinger: Loose rhetoric is reckless.



Latham: Human decision-makers stay in the loop.

Finally, in the reentry and terminal phase of the trajectory, the warheads and penetration aids reenter the atmosphere and descend on their targets. During that phase, atmospheric drag slows down the warheads, while the searing heat of reentry causes most of the penetration aids to burn up. Those that don't burn up will be slowed down markedly in relation to warheads by the natural process of "atmospheric sorting," thus facilitating discrimination by the defenses.

The SDI concept capitalizes on the distinctly different aspects of the various phases of ballistic trajectories by tailoring specific defensive systems to each segment. As Dr. Yonas points out, none of the individual layers of the umbrella system "needs to be perfect." Because of the synergistic effect of the individual elements on one another, even relatively leaky layered defenses will be of "military value" in the aggregate.

Several additional pluses accrue to SDI from this layered, defense-in-depth approach. Because each layer is different, the adversary needs to field separate, tailored countermeasures against each defensive segment. Also, because each defensive layer will employ autonomous sensors to boost SDI's survivability, the system's overall C^3I capabilities will be extremely difficult to overcome. The sensor system of each defensive layer will be able "to pass kill information on to the next" component, according to General Rankine. The ensuing requirement for radiation-hardened computers and associated software capable of "crunching numbers at the rate of one billion [operations per second]," he admits, will pose significant technological challenges.

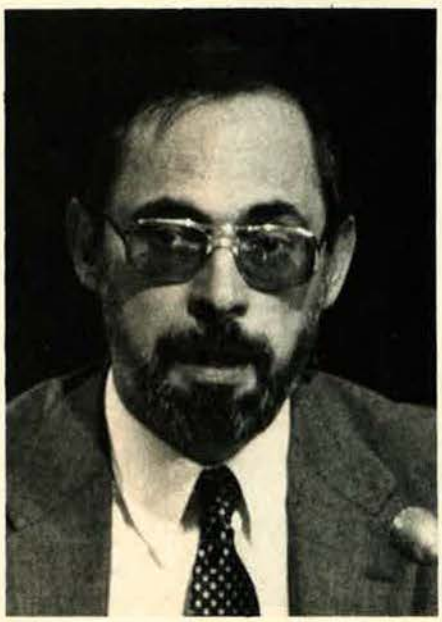
HOE: The First Step

Aside from the distinct defensive layers of SDI that are matched to trajectory phases, three discrete echelons are implied by the program's basic mission: defense against counterforce attack; protection of industrial, transportation, and other types of targets required to sustain the warfighting effort; and shielding the civilian population hermetically from nuclear attack. Obviously central in a deterrence sense—and probably most "doable" technically—is defense against counterforce attack. If such a defense is perceived by the attacker as denying him his military objectives, the utility of a preemptive nuclear strike is thwarted and strategic stability strengthened.

Defense of counterforce targets by interception of attacking reentry vehicles just above the atmosphere (exoatmospheric) or within the atmosphere (endoatmospheric) has for years been the domain of the US Army's Ballistic Missile Defense program. Now a part of SDI, the BMD effort is well into the hardware testing stage. In June of last year, the Army's Ballistic Missile Defense Systems Command, assisted by AFSC's Ballistic Missile Office and other DoD components, proved that, as General Abrahamson puts it, "we can hit a bullet with a bullet more than a hundred miles above the ground at a closing velocity of more than 15,000 mph." The incoming "bullet" was an inert RV that had traveled almost 4,200 miles from Vandenberg AFB, Calif., to the

Marshall Islands Kwajalein Missile Range, where the intercepting "bullet," the Army's optically guided Homing Overlay Experiment (HOE) vehicle, pulverized the target.

The experiment's pacing technologies were the HOE's longwave infrared (LWIR) sensor and its guidance computer that in combination detected and locked on the target from hundreds of miles away. The HOE interception demonstrated the feasibility of late midcourse interception by nonnuclear, kinetic means. HOE, according to General Abrahamson, demonstrated



Yonas: Individual layers need not be perfect.

that there is a "solid technological base for kinetic energy [space] weapons, that LWIR is a mature and working space sensor, and that we have the C^3 and software to allow nose-to-nose intercepts at more than 15,000 mph closing velocity."

SDI's Army component is scheduled to stage the first test-flight of the endoatmospheric counterpart to the exoatmospheric HOE within a few months. That experiment, the SR (for small radar) -HIT, along with HOE's follow-on, the ERIS (exoatmospheric reentry vehicle intercept subsystem), will germinate integrated exo- and endoatmospheric missile systems that are now in concept definition. The Ballistic Missile Defense Systems Command plans to issue RFPs (requests for proposals from industry) later on this year to launch the demonstration phase of these programs.

A pivotal experimental program managed by the Army for SDI is the AOA, or airborne optical adjunct, a Boeing 767 jetliner equipped with a massive optical array that is meant to provide reliable atmospheric surveillance in support of terminal ABM systems. A system of this type is essential, according to General Abrahamson, because ground-based and other radars "might not work in a nuclear-disturbed environment." AOA, he suggests, will combine "the precision of optics [with] radar signals so that we will be able to track with a very high degree of accuracy for nonnuclear kill devices." Such a system can be used to support terminal defense radars in the US or could "support tactical ABM systems in Europe or elsewhere" in the way that AWACS provides theater air defense support. No decision has been made as yet about which service will operate these aircraft, according to the SDI Director.

Other elements of the Army's Ballistic Missile Defense Systems Command that have been assigned to SDI include directed-energy weapons research, a unique, large millimeter-wave radar at Kwajalein, and such hush-hush data-collection systems as the shipborne Cobra Judy phased-array radar and the "Queen Match" project.

Survivability in Space

Except for terminal and late midcourse ABM systems, all other SDI component systems will probably be space-based or space-dependent. This poses problems. As General Rankine points out, "If the space segment of SDI is vulnerable to preemptive attack, the consequences are destabilizing because one side might be left with a useless defense and the other with functioning offensive forces."

SDI's space segment will presumably consist of many and varied satellites and weapons platforms. In the latter rubric are likely to be spaceborne rocket pods, kinetic-energy systems, and directed-energy weapons. Battle management, C^3I, and a plethora of sensor systems will be in the former category. All these spacecraft will presumably be vulnerable in terms of their orbital components, their cross-links to other satellites or their downlinks to the ground, and their ground-control facilities.

An attacker has various options for going after one or all of these elements, according to Brig. Gen. Donald J. Kutyna, USAF's Director for Space Systems and C^3, Office of the Deputy Chief of Staff for Research, Development and Acquisition. Orbital components could be attacked directly, a step that is tough, obvious, expensive, and, therefore, probably not logical. Space mines—"something on orbit that looks like something else, such as a commercial satellite, but, when the time comes, approaches and kills its target"—would obviously be more clandestine and operationally effective, especially against SDI elements in geosynchronous (stationary) orbits. Space mines shadowing targets in lower orbits are conspicuous because "you would see the bird and wonder why it is following ours." The third way of neutralizing orbital components of space systems is to take control of the satellite by "getting into its command links, [which is] called spoofing, to make yourself the owner of the enemy's spacecraft."

The options for going after ground-based mobile or fixed terminals are obvious and varied, ranging from precursor attacks to sabotage. The command and communications links are vulnerable in terms of jamming, disruption of relay systems, and communications blackouts that are caused by high-altitude nuclear bursts and that can last between thirty and sixty minutes.

The case for the defense, General Kutyna points out, is not unrelievedly bleak. It might be possible, for instance, to protect orbital assets by capping both sides' space weapons through negotiations. Enforcing compliance would be problematical, but might keep the Soviets "from overtly practicing how to get our assets." Another approach might be through deterrence, which presupposes that the defender has the means to negate what the attacker does not want to lose. Technically and operationally, attacks on spacecraft in geosynchronous

orbit by ground-launched ASATs would take between three and six hours, but neither the US nor the USSR has developed such a weapon as yet. Also, because the defender would be aware of the attack long before the warhead arrived, there is a good chance for the targeted spacecraft to take evasive action.

Other means open to the defender include hardening all three segments of space systems and elimination of vulnerable single nodes. Hardening of the space component could provide protection against laser and EMP (electromagnetic pulse) threats. On-board radar or other sensors might help fend off ASATs through maneuvering or other countermeasures. Reducing the radar and optical cross section of spacecraft, along with boosts in their autonomy of operation and hence reduced dependence on cross-links, can also contribute to the survivability of orbital assets. Lastly, of course, a demonstrated capability to reconstitute the orbital forces might go a long way toward forestalling a space attack because it denies the aggressor's military objectives in unambiguous fashion.

Kutyna: Defending space assets is tough—but not impossible.

Protection of C^3 links appears possible to some extent through "frequency-hopping," high-frequency, narrow-beam transmissions, and deception that keeps the enemy's jammers from knowing which cross-links go to what relay satellites.

Kinetic Kill Mechanisms

While media attention centers mainly on directed-energy weapons of the "Star Wars" kind, HOE-derived and other kinetic kill mechanisms will probably enter SDI's arsenal long before lasers and neutral particle beam weapons. Kinetic weapons show major promise for midcourse and early reentry kill of warheads. A key candidate here is the electromagnetic rail gun that is being operated by the Army at a test facility and that the Air Force, according to General Abrahamson, plans "to put in space."

Kinetic weapons come in two varieties, chemically propelled and electrically propelled projectiles. Advanced chemically propelled systems might achieve velocities of up to ten kilometers per second; electrically propelled guns are likely to attain velocities in excess of thirty kilometers per second—a gain that, in the SDI context, is priceless.

As its name implies, an electromagnetic rail gun propels a shell by means of moving electromagnetic fields rather than by a large charge of chemical propellants. The Army's operational test article has attained velocities of about eight kilometers per second, according to General Abrahamson, with the prospect of gaining velocities of up to thirty-five kilometers per second in the offing. The goal is to develop a system that can propel a vehicle in space weighing between six and seven pounds at this rate of speed over cross-ranges of from 3,000 to 5,000 kilometers. The rail of such a space-based weapon might be about 150 feet long and fire a homing vehicle equipped with its own guidance system and some maneuver capability. An electromagnetic rail gun of this type would be equipped with an integral power generator and should be able to point itself rapidly to various targets, according to the SDI Director.

The kill mechanism of HOE-derived exoatmospheric homing interceptors could be either a metal "net" that unfurls prior to impact or a high-explosive warhead. Shaped like the frame of an umbrella, the net's ribs are studded with weights that hit the onrushing warhead at extremely high closing velocities with destructive impact. Such a net, or any other purely kinetic kill mechanism, requires direct impact, but poses no fuzing problem. A high-explosive warhead, on the other hand, could pack greater lethality, but requires perfect timing in terms of detonation because of the extremely high closing rates.

Directed-Energy Weapons

Directed-energy weapons under consideration by SDI range from a variety of lasers based either in space or pumping their lethal energy from the ground to space-based relay mirrors, to neutral particle beam accelerators, to nuclear-driven X-ray weapons in space. The appeal of a directed-energy weapon to SDI's technical experts is not the pizzazz of such futuristic devices, but rather their promise of effective ballistic missile inter-

cept during the "high-leverage" boost phase, before the missile has spun off its multiple payload.

Boost-phase interception requires almost instant kills over great distances. High-energy lasers kill with the speed of light (about 300,000 kilometers per second); space-based neutral particle beam weapons are somewhat slower, shooting hydrogen molecules at about 60,000 kilometers a second, or one-fifth the speed of light. Neutral particle beam weapons drive hydrogen molecules with lethal speed deep into the structure of the target, causing implosions that destroy electronics and other essential components.

A neutral particle beam accelerator, far smaller than required for weapon application, is operating at the Department of Energy's Los Alamos National Laboratory. A certain irony attends this design, according to General Abrahamson: "We had a reverse technology flow here. We stole from [the] Soviet open literature the idea for several of the [system's] components, improved on them, and incorporated them in this test-bed." This "plagiarism" occurred seven years ago, indicating the advanced state of Soviet particle beam weapons technology.

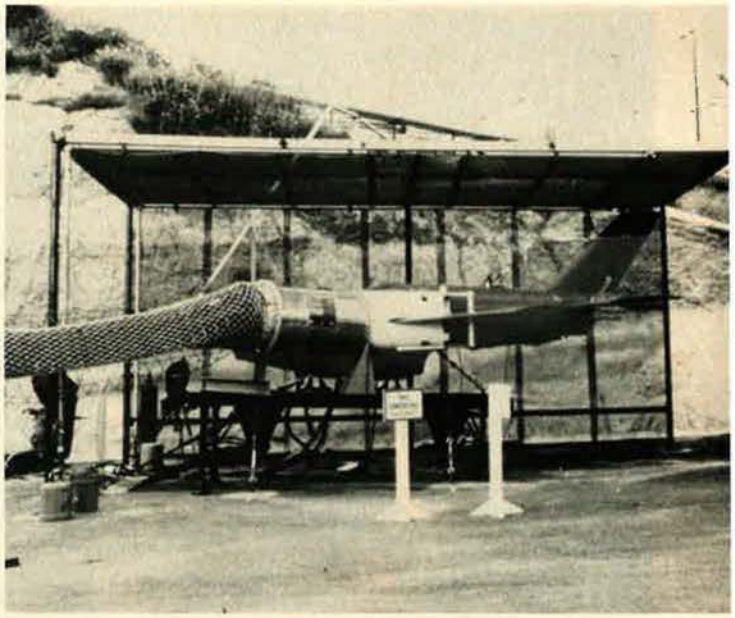
General Abrahamson leaves no doubt that workable particle beam weapons are years away from production: "The problem is to scale up such a small test-bed to weapon levels and to operate it in space." Stressing that such a system can operate only in space, he points out that "we don't know yet how far down it could reach in the upper atmosphere. What is clear already is that such a weapon would be deadly in space, but could not threaten anything in the lower atmosphere." Progress on this branch of the family of directed-energy weapons, he says, is coming "very fast."

High-energy lasers kill targets without the benefit of mass, relying instead exclusively on thermal energy to burn or vaporize them. Representing a more mature technology than neutral or charged particle beam devices, laser weapons come in a range of varieties that fall in the main into two general categories, short-wavelength and long-wavelength devices. Short-wavelength systems usually emit their energy in pulses, while long-wavelength laser weapons radiate in continuous waves. Both types of laser weapons are being considered for SDI applications.

Yet to be resolved is the question of whether the power source of high-energy laser weapons should be operated on the ground or in space. The basic engineering and operational tradeoffs between self-contained designs in orbit and ABM lasers that beam their energy from power generators on the ground to mirrors in space (USAF's test-bed is codenamed "Bifocal" and the Army's "Monocle") that then reflect that energy against the target will be a major SDI undertaking. There is no doubt that the power requirements—not just huge amounts of power, possibly generated by nuclear means, but the power conditioning needed by directed-energy weapons—represent a major development challenge.

Another area that will need intensive work revolves around the relative merits of various lasers and the size of mirrors they require. Long-wave, chemically powered lasers depend on larger mirrors than do short-wave designs, typified by excimer and free-electron systems. Getting large mirror arrays into space poses a logistics problem. Also, such large structures tend to be more susceptible to countermeasures than do smaller ones. Long-wave systems, on the other hand, might make it possible to achieve substantially greater range with reasonable power levels as compared to short-wave systems. Chemical lasers, General Abrahamson suggests, could be used cost-effectively in space to "eliminate large numbers of decoys." Also, they can fire down through the atmosphere and thus show some potential for boost-phase interceptor operations, "but they can be countered in some areas."

BELOW: A drone is readied for a test of the US Navy's MIRACL laser. RIGHT: It took only a few seconds for the laser to burn off the tail of the drone. In the case of ICBMs, times on the order of tenths of seconds will be required.



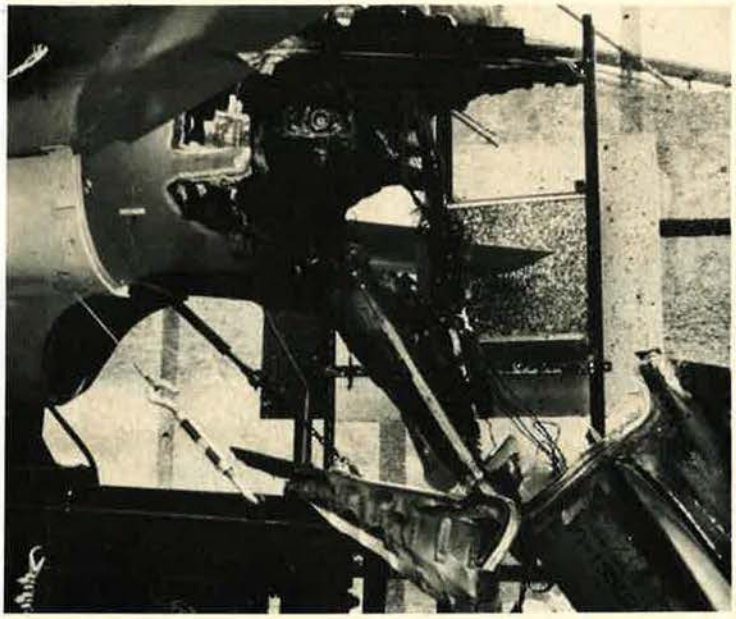
Technological Feasibility

The SDIO's relatively bullish view on directed-energy weapons, according to the SDI Director, stems from the fact that the feasibility of all fundamental technologies has been demonstrated: "We don't have to invent any of these proven technologies. But we do have to find ways to make these systems cost-effective" so that the Soviets can't offset US investments in ABM weapons with offensive systems that cost less.

Among the important advances in laser weapons technology was the ability of the Navy's large chemical MIRACL laser to burn off the tail of a drone "in about three seconds." This is not good enough for SDI purposes, though, according to General Abrahamson: "We need to be able to do it in perhaps one-tenth of a second" in the case of ICBMs. Also, a pulsed excimer laser (a design that uses rare gases as the lasing element) operated at the Western Research Corp.'s facility in San Diego is showing that it is possible to drive down the cost

of the energy a laser can deliver on its target "considerably."

Until recently, the cost of delivering a unit of laser energy—expressed as one joule (the equivalent of one watt per second)—hovered around $10,000. The pulsed excimer laser—an outgrowth of research associated with energy generation using nuclear fusion—has driven that cost down to about "$40 per delivered optical joule," the SDI Director points out. Work underway might lead to further cuts down to the $5-per-delivered-joule range, he believes.



Equally significant are tests at a facility in the Hawaiian Islands of ground-based lasers transmitting energy through the atmosphere to relay mirrors and then down to "cooperative targets" that simulate ballistic missiles in their boost phase, according to General Abrahamson. Tests against real ballistic missiles, he stresses, are outlawed by the ABM treaty.

SDIO has come in for considerable criticism on Capitol Hill recently for readjustments of the so-called laser triad that consists of three interrelated programs called Alpha, Talon Gold, and Lode. *(See "The Military Imperatives in Space," January '85 issue, p. 92.)* Congressional supporters of the laser triad effort, which has been under way for several years, claim that the associated technologies lend themselves to a full-up demonstration of a laser weapon in space within five to seven years. General Abrahamson admits that there is some validity to these claims, but points out that there were good reasons for taking "the management decisions we did."

Talon Gold, an experiment designed to demonstrate the steering and tracking functions associated with a space-based laser weapon, was started in 1976 in connection with ASAT applications, according to the SDI Director: "I made the decision to cut back, and it was tough. But our success to date [with Talon Gold's ground tests, without going into space] showed that it could do the job. Also, because of schedule slippage, it was becoming a $700 million experiment that we couldn't fly before 1988 or 1989." Lastly, Talon Gold had gotten "out of sync with Alpha and Lode, and since [Congress cut the FY '85] SDI funding, I had to cancel it."

While it appears possible to flight-test a space-based demonstration laser based on the laser triad in the early 1990s, General Abrahamson questions the purpose behind such an experiment: "What could it do? It is better to use more advanced technology that can cope with countermeasures more effectively. Over the near term, I believe it is better to go after kinetic-energy systems" and to weed out those programs that slip.

Battle Management and C^3

In the coming years, more than fifty percent of all SDI funding will go toward work not directly involved in the weapons part of the program. A major portion of the nonweapon work will be directed at battle management, which poses serious challenges in terms of architecture, software structure, and especially with regard to the tremendous data-processing requirements.

Two of the crucial elements of SDI's battle management/command control and communications (BM/C^3) task are the Boost-Phase Detection and Tracking System and the Space Surveillance and Tracking System. AFSC's Space Division is in charge of both programs and deals with them on a "high-priority basis," according to General Abrahamson. The Boost-Phase system, previously known as the Advanced Warning System, will, he points out, be doing double duty by not only serving SDI but also by providing upgraded hardware for follow-on Early Warning Satellites of the Defense Support Program (DSP).

SDI's BM/C^3 systems are inextricably tied to surveillance, acquisition, tracking and kill assessment (SATKA) functions that range from sensing the information that triggers defense engagements to assessment of the status of forces before and during the engagement. All these functions should be autonomous in each phase of the engagement, yet feed into a cohesive battle management system. The reason for this approach is that detection "misses" must not occur across the overall C^3 function if leakage is to be held to a minimum. While most of the BM/C^3/SATKA approach won't be resolved for some time to come, one overriding rule is firm, according to Secretary Latham: "We will always have a human decision-maker in the loop, just as we have today with the Attack Warning and Assessment System."

Current funding of the SDI program comes mainly out of the budgets of the individual services, with the Army contributing forty percent, the Air Force thirty-five percent, and the Navy three percent. The remainder is split among the Defense Advanced Research Projects Agency, SDIO, and the Defense Nuclear Agency. By the end of the current Five-Year Defense Plan, the Air Force's share in SDI funding will have reached fifty percent and remain at that level thereafter, General Rankine believes. According to Dr. Yonas, there is a possibility of close cooperation with the European NATO members, Japan, Canada, and other allies in developing SDI hardware and doctrine.

Of all the uncertainties facing SDI, none is greater than Congress's willingness to provide funding on a sustained basis, according to General Abrahamson: "The key threat is to stretch the program over and over again, for that could be the end of SDI."

The new Congress will likely have much to say on this score. ■

All along the budget front, USAF digs in to defend its carefully conceived plans for weapons and force structures. A major question is how strategic modernization will play with SDI.

Protect The Pri

BY JAMES W. CANAN, SENIOR EDITOR

THE Pentagon will almost certainly take heavy fire in this year's battle of the budget, now shaping up as the fiercest in a long time. Some key defense programs will be threatened and may be forced to compete with one another for funding. To hold its own in such competition, the Air Force will be called upon to answer tough questions.

Foremost among them are:

- Does the Air Force really need to build up to forty combat-coded tactical fighter wings, as it claims it does? Or can it make do with the thirty-six wings it now has?

In keeping with that, should the Air Force be permitted to go ahead with plans for the F-16F? The F-16F will probably be an offshoot of the F-16XL, a version with cranked-arrow wings that lost out to the F-15E in USAF's Dual-Role Fighter (DRF) competition last year. So why is USAF now claiming, much more openly than before, that it will need the F-16F to go along with the F-15E to perform a swing air-superiority/deep-inderdiction mission?

If it does procure both aircraft, will it actually need to develop the follow-on Advanced Tactical Fighter (ATF) as quickly as it insists it must?

- What about strategic forces? In view of the heavy philosophical and funding emphasis now being placed by the Administration on its $26 billion Strategic Defense Initiative (SDI) technology program for eventual defense against ballistic missiles, has the time come—in a deficit-battling budget crunch—to start slowing down USAF's strategic modernization program?

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The B-1B bomber (above) is a key element of the strategic modernization program that USAF will defend as its top priority in the coming battle of the budget.

RIGHT: MX Peacekeeper ICBM poised for one of six successful test flights. It will be touch and go for the MX program.

LEFT: USAF's anti-satellite (ASAT) weapon on an F-15. The ASAT program denotes Air Force attention to space as a combat medium.

That program, meaning bombers, ICBMs, and cruise missiles, has the very highest priority in USAF. It ranks above tactical modernization, mobility modernization, readiness, and space.

But how will it play with SDI, the new star on the Administration's strategic stage?

- In this context, does the nation need both the MX Peacekeeper ICBM and the small ICBM (SICBM)? Given MX's longstanding political vicissitudes, should the Air Force be made to give it up or put it on hold?
- With the B-1B bomber now in production and looking good, does the Air Force need to forge ahead all that fast with the multibillion-dollar development of its Advanced Technology Bomber (ATB)? On the other hand, could B-1B procurement be stretched in order to save some money in each individual budget year (at the risk of much higher total costs but spread out over more time) while the ATB is brought along briskly?
- What about mobility? Should USAF start spending big dollars ($265 million in FY '86 and going up sharply after that) on final development and production of a new fleet of C-17 airlifters? Or could it hold off and live with its existing mobility forces—now being augmented by new C-5Bs and KC-10s, and by re-engined KC-135s—longer than it deems prudent?
- Space is a big question, too. Given the outside chance of an arms-control deal with the Soviets and questions about how SDI will play with Air Force space programs, should the Air Force be permitted to stay singularly on track with its own antisatellite (ASAT) development and testing program?
- In view of all the foregoing, should the Air Force be granted funds for the 9,400 more military personnel and the 9,500 more civilians it plans to add in FY '86? Can't it subsist on the personnel it already has?

Fateful Year for USAF

On Capitol Hill—and even in some Administration circles—USAF will be strenuously pressed to justify its position on all those questions and more in the weeks and months ahead.

This year of the drive to get the deficit down by sharply curtailing the federal budget will be a fateful one for the Air Force, a year that the service's uniformed and civilian leaders agree is shaping up, in the words of one USAF general officer, as "difficult at best." The E-3A AWACS program is already a victim. There is no money for it in the new defense budget.

USAF's leaders emphasize that their absolutely first order of business is to keep the Air Force's strategic modernization program from being hurt. And now, it seems, President Reagan has weighed in with them.

Late last year, the President wrote a "Dear Cap" letter to Secretary of Defense Caspar W. Weinberger "to reaffirm my deep-seated support of strategic modernization across the board." Promising his "maximum effort to gain congressional approval" for keeping MX on course, Mr. Reagan declared:

"It is important that the senior leadership of the Department of Defense, and particularly of the Air Force, both uniformed and civilian, understand my deep commitment to the mutually supportive goals of strategic modernization and arms reduction."

The political potency of that commitment, and of USAF's supportive rationale for strategic modernization, will soon be put to the test.

Late next month, Congress is scheduled to vote up or down on $1.5 billion for an FY '85 buy of twenty-one MX missiles that it put in abeyance last year. Meanwhile, Congress will be mulling the Administration's total FY '86 request for MX funding ($3.7 billion at this writing). The going will be rough.

President Reagan's letter landed on Secretary Weinberger's desk at a time of unverified but persistent rumors of a tradeoff between MX and SDI.

According to the rumors, some Administration officials hoped to be able to urge the President to relent in his push for MX. Such a ploy, it was said, would gain much-needed support for the $3.8 billion being requested for SDI because it would mollify members of Congress who are opposed to or undecided about MX and who are fence-sitting on SDI. Pentagon officials discounted the validity of the rumors, but acknowledged that they had heard them and found them disquieting.

Then came a thunderbolt. Sen. Barry Goldwater (R-Ariz.), having just succeeded pro-MX Sen. John Tower (R-Tex.) as chairman of the Senate Armed Services Committee, proclaimed in an interview that he flat-out favored killing MX. Compounding this "very bad news," as one senior DoD official described it, is the fact that Sen. Sam Nunn (D-Ga.), the committee's senior and generally pro-defense Democrat, has given MX only lukewarm support in the past.

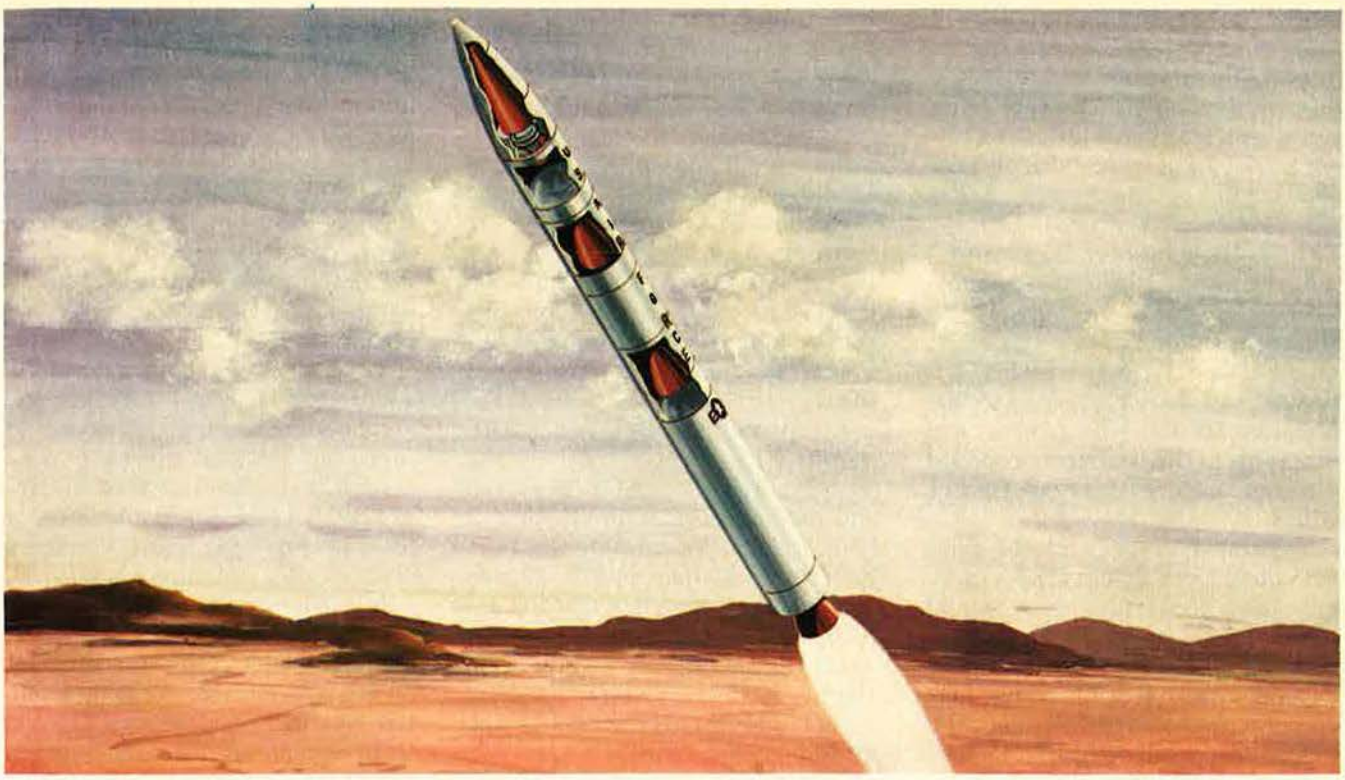
USAF is still confident, however, that it can get MX over the hump in Congress this year. Its officials are at pains to point out that the MX program is already well along in funding (Congress appropriated funds for the first twenty-one MX missiles in FY '84) and is going very well, as demonstrated by six successful test flights out of Vandenberg AFB, Calif.

"We will give them [Congress] a superb MX missile if they want to deploy it," one such official declares.

Moreover, the MX program still has going for it the solid political and strategic underpinning and strong support of the report by the bipartisan Presidential Commission on Strategic Forces. That panel, commonly called the Scowcroft Commission, recommended in 1983 that USAF deploy one hundred MX missiles in silos while proceeding apace with the development of SICBM—a single-warhead, probably land-mobile missile—for deployment in the 1990s.

The Scowcroft Commission report was instrumental in persuading Congress to approve the onset of MX production. Congress took a fancy to SICBM as a missile whose deployment could be easily verified under any warhead-counting strategic arms treaty with the USSR, and which, with its mobility, would be relatively safe from attack. So Congress made clear that its support for the MX program at the time hinged in great measure on the Air Force taking SICBM into the bargain seriously.

The Air Force can prove that it has done so. Without fanfare, it has adhered strictly to the Scowcroft



Artist's concept of USAF's single-warhead small intercontinental ballistic missile (SICBM).

Commission's recommendations for SICBM development, and some heartening things have been happening at a firmer, faster pace than is generally recognized.

Outlook for the Small ICBM

Design of the missile and design and scale-model testing of its "hard-mobile" basing vehicles are firming up. The $650 million of funding that USAF planned to request for the SICBM program in FY '86 should propel both the missile and its mobile launcher into full-scale development in FY '87—not bad for a program that got its first significant funding only a year ago.

SICBM is shaping up as a legitimate hard-target killer. Its warhead will be the same as that destined for the ten-warhead MX. Its guidance system will probably be a smaller version of the Advanced Inertial Reference Sphere (AIRS) system aboard MX. Ring-laser gyroscopes are also being examined as a possible SICBM guidance refinement. To keep SICBM's weight down (Congress imposed a 33,000-pound weight limitation), USAF is investigating lightweight, very strong casing materials for the missile's propulsion system.

Designed to take a 10,000-pound payload 6,000 miles, SICBMs more than likely will be deployed aboard highly blast-resistant wheeled, tracked, or air-cushioned vehicles. Four companies or company teams—General Dynamics, Bell Aerospace, Boeing/Goodyear, and Martin Marietta/Caterpillar—are competing for mobile-basing development contracts expected to be awarded fairly soon.

At the same time, superhardened silos are also looking more and more attractive for SICBMs. Tests of superhardening technologies and techniques have gone extremely well.

USAF plans to decide on SICBM's basing mode—mobile vehicles, superhard silos, or both—in just two more years. That timing will coincide with the deactivation and dismantling of the last of the venerable, single-warhead Titan II ICBMs.

Proclaiming the successes of the SICBM development program poses a problem for USAF. It risks impinging on the MX program by giving MX opponents and undecideds in Congress a reason—or an excuse—to vote against MX. Their rationale would be that SICBM is more for real and coming along faster than they had anticipated—therefore, MX is unnecessary.

This is why the Scowcroft Commission report, which casts both programs as inextricable components of a coherent strategic modernization program embodying all naval strategic systems as well, may yet again prove to be a lifesaver for MX.

The Scowcroft Commission also heartily endorsed USAF's two bomber programs. Here again, USAF is following through in earnest.

The FY '86 Air Force budget calls for enough money to procure the final forty-eight B-1B bombers and to continue flight-testing. But it also requests hefty funding for continued development of the ATB, which, in the words of one top Pentagon official, is "proceeding at a vigorous pace" toward initial deployment, as planned, in the early 1990s.

The Air Force is expected to re-

affirm to Congress this month that it fully expects the ATB, incorporating low-observable technologies that will give it a very small radar signature, to be capable of penetrating Soviet air defenses well into the next century.

The Tactical Fighter Roadmap

Just as the Scowcroft Commission report serves as the well-reasoned basis of USAF's strategic modernization effort, USAF's Tactical Fighter Roadmap serves as justification for the jelling of tactical programs in the service's proposed buildup to forty tactical fighter wings.

The roadmap spells out the numbers and mix of fighters that USAF believes it needs, how many should be air-to-air or air-to-ground or both, and the special capabilities of certain types. It culminates in a classified depiction of what the total fighter force will look like and be capable of doing by 1993.

USAF first presented the roadmap to Congress last year. It was well received. But it also raised some potentially threatening questions that USAF is ready to begin answering on Capitol Hill—in an updated, expanded version of the roadmap—the first of this month.

An awful lot is riding on the persuasiveness of USAF's answers. The setting is as follows:

Since 1980, USAF's inventory of F-15 and F-16 fighters has nearly doubled, up to almost 1,400 of those aircraft. In the new defense budget, the Air Force was preparing to seek FY '86 funding for forty-eight F-15s and for 180 F-16s.

Forty of the F-15s will be the C and D variants now in production. The remaining eight will be F-15Es now in development. They will mark the start of an F-15E procurement program for 236 of the fighters through FY '90.

The F-15E program would not stop there, however. USAF officials indicate plans to continue buying that dual-role fighter through FY '94 (about the time that the Advanced Tactical Fighter is planned for production) until there are 392 F-15Es—four wings of seventy-two aircraft each, plus backups—in the force.

All F-16s planned for procurement in FY '86 will be the recently rolled-out single-seat C and dual-seat D variants that are wired—as the F-15E will be—for the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) avionics system and for the Advanced Medium-Range Air-to-Air Missile (AMRAAM).

It now seems likely that the Air Force will assign more than 400 F-16Ds, to be outfitted with special sensor pods, as replacements for F-4s in the tactical reconnaissance role.

At this writing, DoD and USAF planned to order a total of 180 F-16Cs and F-16Ds in FY '87 as well and then to increase production of both types of the aircraft to 216 in FY '88. After that, in FY '89, the Air Force is proposing that the extended-range, heavy-payload F-16F enter the picture. It would begin sharing production with F-16Cs and F-16Ds and would be procured well into the 1990s.

Throughout, F-4E fighters would be replaced in the active forces and transferred to the Air National Guard as replacements for older F-4Cs and F-4Ds. F-15As and F-15Bs, having been supplanted by F-15Cs and F-15Ds, would be transferred to Air Force Reserve squadrons.

Congress has raised questions about this schematic, however. For example, the Senate Appropriations Committee, in its FY '85 report of last year, had this to say, in part:

"Although the committee supports F-16F development, it is concerned that there may be an overlap in F-15E and F-16F mission requirements, and that development of both may crowd out scarce R&D dollars for the Advanced Tactical Fighter."

Moreover, the committee noted that it had "not been told how many F-16Fs the Air Force intends to buy, and consequently cannot verify the mix of F-16Fs and F-16Cs and Ds."

Sorting Out the F-16F

Expressing concern that the F-16F may turn out to be too heavy to get adequate thrust from currently available fighter engines, the committee also exhorted the Air Force to explain its plans for higher-thrust fighter engines—and to tell the committee right off the bat this year just how the development of such engines will dovetail with the proposed F-16F program.

At this point, the exact configuration and characteristics of the F-16F have yet to be decided, according to USAF and General Dynamics officials. They indicate, however, that the fighter will probably bear a close resemblance to the F-16XL, featuring an elongated fuselage and cranked-arrow wings for long range and big payload.

The F-16F "will have a primarily air-to-ground role," explains one Air Force general. Its attributes of range and payload will have to be convincingly demonstrated to Capitol Hill, and this is why the thrust of its engine-to-be is fast becoming a crucial factor in getting it approved.

It is also why the Air Force, having emphasized durability and maintainability in its development of the new Pratt & Whitney F100-PW-200 engine and General Electric F110 engine, is now concentrating on getting greater thrust out of them for the F-16F.

"If you take the median of thrust between the two engines, what we are looking for is about a fifteen percent increase of that median," an Air Force official explains.

The F-16F is expected to begin entering the operational force in the early 1990s, followed in fairly short order by the ATF. By then, the Soviet Union will have deployed at least seven new, increasingly capable types of fighter and ground-attack aircraft, USAF officials predict.

In justifying the Tactical Fighter Roadmap as the way to get there with superior fighter forces before the Soviets do, USAF is also on its mettle in the House of Representatives at this very moment.

Last year, in its FY '85 report, the House Appropriations Committee ordered USAF to expand the roadmap "to address current and future capabilities of other aircraft [other than F-15s and F-16s] rather than just focusing on new aircraft."

In this vein, the House panel wants to know, among other things, about the feasibility of putting conformal fuel tanks on aircraft other than the F-15E, which is designed for such tanks.

The committee also ordered up a detailed explanation from the Air Force of "the capabilities of the ATF." And it asked pointedly

whether or not "the decreasing rate of inventory losses due to more modern aircraft" might enable USAF to scale down the number of new fighters now deemed necessary to expand to forty tactical fighter wings.

That question is a key one. In effect, it challenges the arithmetic, which is based partly on attrition rates, that the Air Force uses to calculate future fighter requirements.

USAF claims that each of its tactical fighter wings requires an inventory of one hundred aircraft in order to ensure that seventy-two of them—the everyday operational number in each wing—are always ready for combat. To compensate for the aging and for the peacetime attrition of its fighters, USAF figures it needs six and a half new ones each year, per wing, just to keep the average age of its fighter fleet at no more than ten years.

To build up to forty tactical fighter wings, and also to sustain its air defense interceptor force (now the equivalent of 3.75 wings), the Air Force says it will need to take delivery of 260 to 280 new fighters each year for some time to come.

A buildup to forty wings is the best the Air Force believes it will be permitted, given tightening budget constraints. In fact, however, it would much prefer forty-four wings as optimal in the face of the growing Soviet threat and of possible future deployment demands in tinderbox regions of the globe.

As the defense budget's rate of growth declines, high-priority Air Force programs may very well wind up competing fiercely with one another for funding.

Declares an Air Force general officer: "If we can stay on track with our roadmap, we should arrive at forty tactical fighter wings in five years or so. But we've got our strategic, mobility, readiness, and space priorities to consider, too."

How Mobility Force Measures Up

USAF's mobility force measures up much better than it did four years ago. Officials claim its capacity has improved by better than one-third since 1980. Wings of all seventy-seven C-5As will have been strengthened by FY '87. All C-141s have been stretched. Repair of the wings of older C-130s—to fix problems of corrosion and stress—is coming right along.

By 1990, USAF expects to have added fifty new C-5B airlifters and forty-four new KC-10 tankers to its fleet and will have modified nineteen commercial aircraft to carry military cargo, if called upon to do so.

But something big is still missing—production of the C-17, USAF's top-priority mobility modernization program.

The Air Force is on a budget and development track that would put the C-17 into production in FY '88. It is requesting at least a doubling of C-17 funding in FY '86 to begin full-scale development and is planning another, even sharper rise in the following year to move into initial production.

To keep the C-17 program on course, USAF and DoD are reemphasizing to Congress this year that the aircraft will be vitally important to reinforcing US and allied troops in Europe and to deploying US troops and equipment to, and within, potential combat theaters elsewhere, notably Southwest Asia.

The C-17 program remains politically dicey, however.

"There will be heavy pressure on us this year to find an alternate solution," acknowledges a high-ranking Air Force officer. "We will keep on pressing our point that we badly need the C-17's intertheater and intratheater versatility. We've just *got* to get on with it."

This officer, like others, also notes that space systems and space support "will become an ever-bigger part of our [Air Force] budget." He warns that "we are going to have to figure out just what it is we want to do in space, how we want to do it, and with what."

There is some movement toward those ends.

In the research and development arena, for example, all of the conceptual and design work on future manned, combat spacecraft has been consolidated within Air Force Systems Command, headquartered at Andrews AFB, Md.

One such concept is that of the Transatmospheric Vehicle (TAV). AFSC's Aeronautical Systems Division at Wright-Patterson AFB, Ohio, has brought the TAV through

USAF's Personnel Plans and Problems

USAF's personnel plans and problems will figure heavily in this year's defense budget debate on Capitol Hill.

The Air Force is becoming apprehensive about its ability to keep pilots and other crucial personnel in uniform at the high retention rates of the past few years. Retention of pilots in the important category of those with six to eleven years of service has begun to slip from the very high—three out of four—level enjoyed by the Air Force from FY '82 through FY '84.

The slippage is especially striking and alarming in the Military Airlift Command. In the current fiscal year, the rate of MAC pilots giving notice of their planned departures has been running twice as high as it did in FY '84.

More broadly, first-term reenlistment rates throughout the service are down a bit in the current fiscal year from the very high level of FY '82 through FY '84.

These ominous signs are all the more reason why the Air Force plans to fight very hard against any move in Congress to slash military pay and benefits, even though the Administration itself was expected to propose some cuts in those categories.

Deep cuts "could cause this high-quality force we now have to disappear very rapidly," a high-ranking Air Force official declares. "We could have another hemorrhage of people with sortie-producing skills, just as we did in the 1970s."

Evidence of a downturn in retention also makes Air Force plans for additions of personnel that much more important to push and protect this year.

At this writing, USAF planned to add 9,400 military personnel and 9,500 civilians, for a total of 612,600 and 256,265, respectively, in FY '86.

concept definition and is currently working with a set of contractors to refine the TAV's variously proposed designs and to begin defining its mission and its capabilities.

The TAV program no longer exists as an independent entity. It has been enfolded in USAF's newly created Advanced Aerospace Vehicle (AAV), or "spaceplane," program under the immediate control of Hq. AFSC. ASD and Space Division will divide all "advanced military spacecraft technological development" within the centralized AAV program, Air Force sources say.

At this early stage, the technologies themselves may be less significant than the Air Force's plan to get potential users involved in examining and developing them with an eye to future requirements and missions. This means that Space Command, SAC, TAC, and MAC, each of which sees the Air Force in space from its own special perspective, will be included in this process.

The Air Force planned at this writing to ask Congress to begin funding the AAV program in FY '86. Dollar amounts would be small at first, but could grow like Topsy once USAF gets a better handle on space as a combat-mission arena and starts developing combat machines to operate there.

ASAT and Our Space Assets

USAF's ASAT program is a start on that.

Central to the mission of defending US space assets, the ASAT weapon is an Air-Launched Miniature Vehicle (ALMV) on a two-stage rocket and is launched by an F-15 toward the path of an enemy satellite bent on attacking one of ours. As the ALMV approaches its target satellite, it homes in on the satellite's radiated energy.

One ASAT test has been conducted successfully. Aimed only at taking the ALMV to a predesignated point in space, it demonstrated the system's propulsion and nonterminal guidance capabilities.

Additional testing is dependent on congressional approval, which may be conditioned by possible US-USSR negotiations on arms limitation and possibly space weaponry. Assuming such approval, however, USAF plans to complete the testing and evaluation phase of its ASAT program in FY '87.

The line between that program and the DoD SDI program may become blurred before too long. The ASAT ALMV is a kinetic-energy weapon. Its technology is transferable to the SDI program, which is subdivided into five technology categories—kinetic-energy weapons, directed-energy weapons, surveillance and target-acquisition systems, battle-management systems, and support systems.

Cross-fertilization of the antisatellite and antiballistic missile missions will undoubtedly come to pass in another way as well. Directed-energy weapons, such as lasers now being developed under SDI for missile defense, could easily double as weapons against hostile satellites orbiting too far away in space for the Air Force ALMV to reach.

Complicating matters even further—in terms of sorting out priorities—is the prospect that "the Air Force undoubtedly will be called upon to do most of the execution of the SDI system," as an Air Force official puts it. This in itself could add to the future strain on Air Force budgets and could siphon funds, however indirectly, from the Air Force's high-priority nonspace and nondefensive programs.

All this is why many Air Force officials stress the need to keep the SDI program in proper perspective—as the possible cornerstone of only one part of the Administration's five-part strategic modernization program—that of strategic defense. By the same token, they emphasize that SDI must not be permitted to become such an overweening priority that it cannibalizes funds from other parts of that modernization program, such as ICBMs and bombers.

If some officials see SDI as a potential threat to offensive strategic systems, others see it as a potential victim. For example, a fervently pro-SDI Administration official puts it this way:

"The real strategy the Russians are up to is to find some way to get at SDI, including through the Air Force's ASAT program. One could envision a scenario wherein posturing by the [US] military services to protect their turf [against SDI encroachment], combined with an offer by the Soviets to draw down their offensive systems in return for our drawdown of SDI, could make SDI come to a screeching halt."

Within the Air Force, there is plentiful disagreement with that viewpoint. It is based on the belief that the Soviets—for the time being at least—are far more respectful of the deterrent power of MX than of SDI.

"The real issue in SDI is not its technology," asserts an Air Force general, "but, rather, what does it *mean* to have strategic defense. For example, is it worthwhile to do some parts of strategic defense that you can do and not do other parts that you find you can't do?

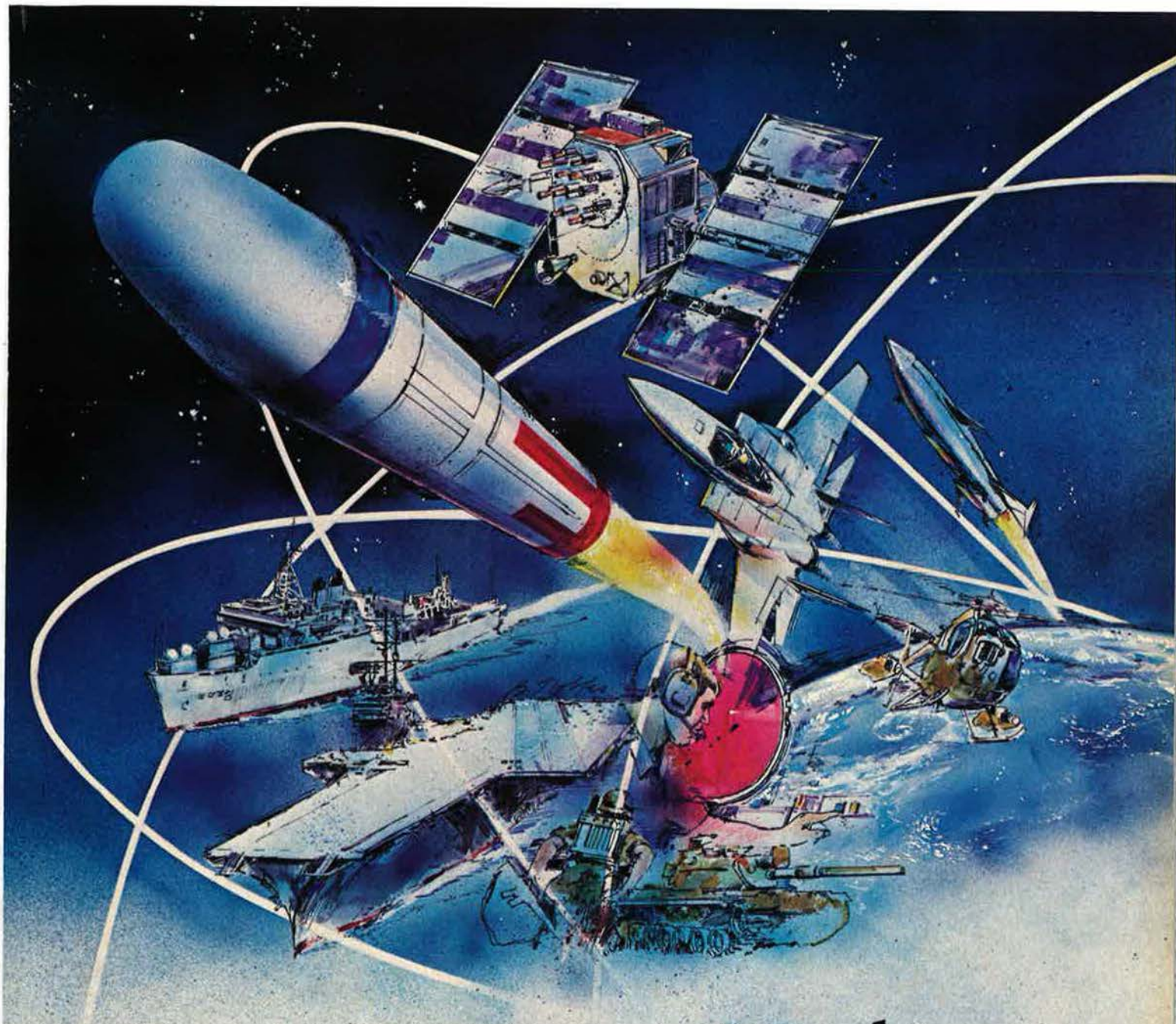
"The point that really needs to be asked is what do we *really want to do* with SDI? And will what we want to do have an effect on strategic weapons?

"The concept needs to be debated at the same level, and in the same forums, as the MAD [Mutual Assured Destruction] concept was years ago. It needs to be challenged and then, as a result, rigorously defined. Once that gets done, guiding the R&D for SDI becomes a whole lot easier."

Given the $3.8 billion magnitude of the Administration's SDI funding request for FY '86, this session of Congress could well become the forum for just such a debate and challenge of SDI in the context of competing defense priorities and strategies. ■

The Battle Begins

Erosion of the defense budget was already evident as this issue went to press. Late last year, at President Reagan's reluctant urging, Secretary of Defense Caspar W. Weinberger agreed to cut $11.1 billion from the budget that the Pentagon was preparing for submission to Congress in early 1985. Of that amount, $2.5 billion was earmarked for extraction from the military services' proposals for hardware programs in FY '86. At this writing, USAF was in the process of deciding on its portion of the total reduction, and stretch-outs of some vital programs were reportedly in the offing.



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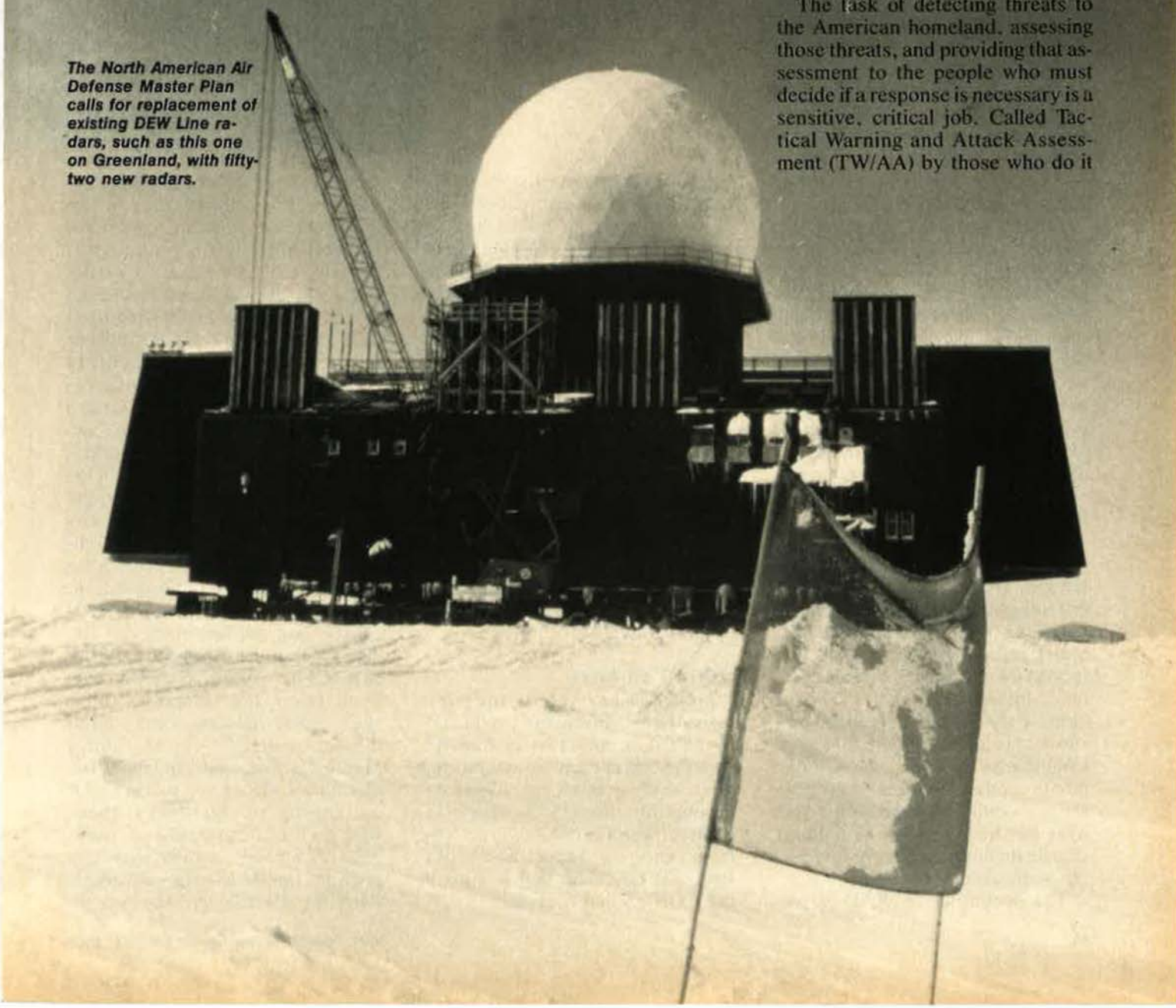
Warning and attack assessment gets renewed attention.

Defensive Watch

BY LT. COL. RICHARD S. CAMMAROTA, USAF

When North American Aerospace Defense Command (NORAD) sensors detect a missile launch, they automatically transmit the launch data to the NORAD Cheyenne Mountain Complex for evaluation. To determine whether or not a missile launch is a valid threat, the NORAD Command Director immediately communicates with sensor sites worldwide. Simultaneously, the National Military Command Center at the Pentagon starts a Missile Display Conference with the NORAD and SAC Command Posts. The NORAD Command Director quickly tells all conferees if the missile launch is a threat to North America. The NORAD tactical warning and assessment system routinely repeats this scenario as it responds to foreign missile launches.

The task of detecting threats to the American homeland, assessing those threats, and providing that assessment to the people who must decide if a response is necessary is a sensitive, critical job. Called Tactical Warning and Attack Assessment (TW/AA) by those who do it



The North American Air Defense Master Plan calls for replacement of existing DEW Line radars, such as this one on Greenland, with fifty-two new radars.

and use it, it involves those systems we have established and planned for detecting "air-breathing" threats—bombers and cruise missiles—and ballistic missile threats, both ICBMs and SLBMs. As Edward C. Aldridge, Under Secretary of the Air Force, told a recent AFA Space Symposium, "The Tactical Warning and Attack Assessment functions have become critical in a modern world where the consequences of surprise can be disastrous."

In the early days of the Soviet bomber threat, the United States maintained not only an extensive, ground-based radar network (256 radars), but also EC-121s, Texas Tower radar stations offshore, picket ships, Bomarc and Nike-Hercules missiles, and interceptor aircraft to warn and defend against intruding bombers. The original North American air defense radar system was built with Canada in the 1950s. It consisted of more than 400 radar stations that provided overlapping coverage for the US and Canada. Part of that system included the radar stations the US and Canada built across Arctic Alaska, Canada, and Greenland to form the Distant Early Warning (DEW) Line.

Today, the Texas Tower radars, missiles, and EC-121s are gone (although limited in numbers, the Airborne Warning and Control System fulfills the role of the EC-121s and does more), and the few radar stations left can give us a picture of what goes on in our airspace under *normal* situations. In general, during the past several decades, we have seen a decline in our overall air defense capabilities.

Renewed Attention

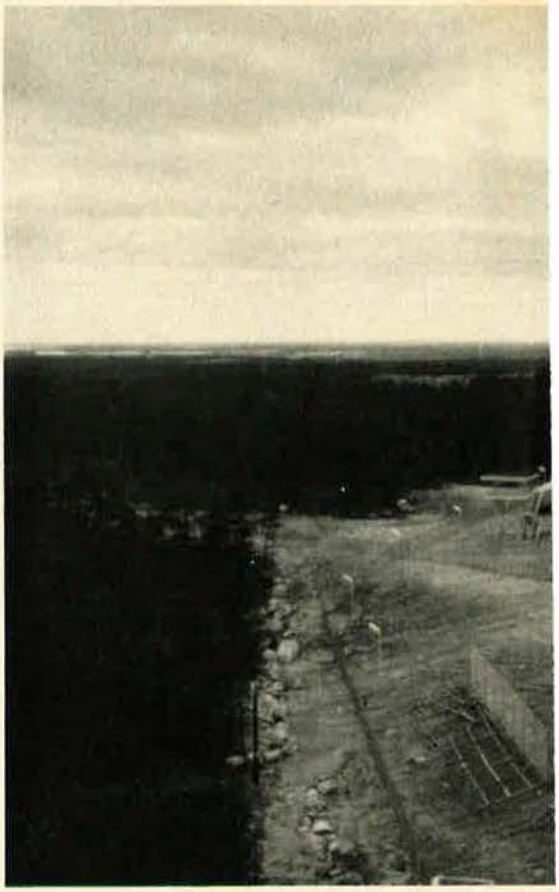
However, strategic aerospace defense is now receiving renewed attention. The current emphasis is on providing a thorough warning capability against ballistic missiles, cruise missiles, and bombers. Although the President's Strategic Defense Initiative (SDI) has renewed interest specifically in ballistic missile defense, Gen. Robert T. Herres, Commander in Chief of NORAD, points out that "it doesn't make any sense to build a house with a roof over our heads—such as ballistic missile defense—while we forget to put walls around the sides."

The decline of NORAD air defense capabilities in the 1970s has amplified concerns about the rapidly improving Soviet bomber force. The Soviets continue to produce the Backfire as well as a Bear cruise-missile carrier—and they are flight-testing a B-1 look-alike Blackjack heavy bomber. These aircraft, together with a growing family of Soviet cruise missiles, pose an increasing, serious problem for NORAD planners and operators. As General Herres has said, "We need bomber and cruise-missile warning for a balanced deterrent posture and to eliminate the no-warning bomber option that could be attractive to a Soviet war planner."

Where do we stand today in our ability to detect and respond to the Soviet strategic air threat?

NORAD on Alert

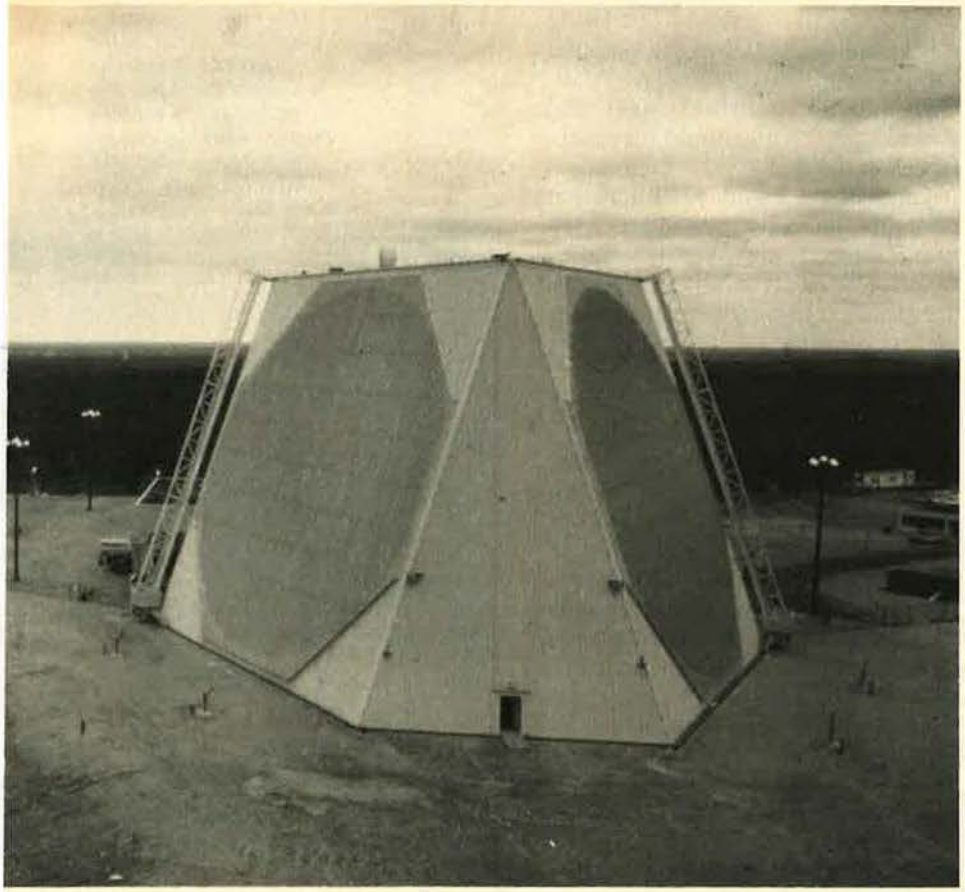
NORAD has thirty-one alert sites; twenty-nine in the US (including Alaska), and two in Canada. Two fighters at each are on constant alert, ready to intercept any incoming aircraft. Should the threat increase, these alert units will get help from other Air Force, Navy, Marine, and Canadian fighter units in the CONUS and Canada.



The dual-faced phased-array Pave Paws radar at Otis ANGB, Mass., is one part of an array of sensors that guard against the ballistic missile threat. Another Pave Paws radar is located at Beale AFB, Calif., and two more are planned for the southeast at Robins AFB, Ga., and the southwest near San Angelo, Tex.

The US has about 280 planes devoted to air defense—five active and eleven Air National Guard fighter-interceptor squadrons. Many are twenty-year-old F-106s and F-4s. The Air Force has begun to convert active F-106 squadrons to F-15s and to modify air defense F-16s to carry the all-weather AMRAAM missile. It also plans to assign F-16s to our Air Guard squadrons. Also, Canada has converted one CF-101 squadron and is converting a second to CF-18s (twelve aircraft in each squadron).

The aging SAGE network has been replaced by the Joint Surveillance System (JSS). Shared with the Federal Aviation Administration, JSS has forty-seven sites with 2,000 people assigned (including the Region Operations Control Centers—ROCCs) in addition to the Alaskan Seek Igloo and Canadian radar sites. These sites are connected to the seven ROCCs—at McChord, March, Griffiss, and Tyndall AFBs, plus one in Alaska and two in Canada. During an emergency, these ROCCs are augmented with AWACS aircraft, which also help provide "low-level gap" coverage. Also, the AWACS can take over the



command and control responsibilities for a region, if necessary. In fact, NORAD people at Tinker AFB, Okla., train regularly with AWACS crews, flying on all NORAD AWACS missions to interface training.

The problems with our air defense system are fairly basic. Existing radars can't see far enough out from our coasts to give adequate advance warning. And second, because we have fewer radars, Soviet planes and cruise missiles could slip through the gaps. Consequently, the United States and Canada, through NORAD, have developed a master plan to renovate and strengthen the air defense of this continent.

The Master Plan

The North American Air Defense Master Plan calls first for Over-the-Horizon Backscatter (OTH-B) radar systems to be installed on the east and west coasts and covering southern approaches to the continental United States (CONUS). The east coast radar system is being built by General Electric Co. The OTH-B will bounce radar beams off the ionosphere and back down to earth and can look out from 500 miles to 1,800 miles across a 180-degree swath.

The east coast OTH-B, under construction in Maine, will be operational in the next few years; the west coast OTH-B and a central US radar site (looking south) should reach initial operational capability in the 1990s. As now planned, the whole OTH-B program will cost around $2.4 billion.

Second, the plan calls for a renovation of the DEW Line. The "North Warning" program will fill those low-level gaps while modernizing equipment. The plan will replace the existing DEW Line with fifty-two new radars. Thirteen General Electric FPS-117 minimally attended long-range radars and thirty-nine unattended short-range radars will reduce manpower requirements by two-thirds and operation and maintenance costs by more than half.

The high-altitude, long-range FPS-117 will replace radars we deployed almost twenty-five years ago at strategically located sites in the DEW Line. The unattended, short-range radars will be used to fill the gaps and will be sited to assure continuous low-level coverage.

NORAD Computers

Because of several highly publicized false alarms, a lingering skepticism remains with some critics about the safety and sureness of the warning system. In 1979, a test computer disk was inadvertently loaded into the operational system, producing a false attack warning. The warning error took NORAD officials only three minutes to realize and correct.

Months later, in 1980, a forty-six-cent faulty chip on a circuit board displayed false attack signals on SAC and National Military Command System (NMCS) monitors. Within a minute or two, other sources proved the signals to be false. Neither event was significant from the standpoint of potentially leading the world into a nuclear war. However, some changes were obviously needed.

To correct the first problem, NORAD built a separate Off-Site Test Facility near the Cheyenne Mountain site. Tests and other necessary drills of the system are now worked apart from the active system. To correct the second problem requires an extensive replacement of the dated computer capabilities at NORAD—and that project is in the program definition stage. The current system consists of several different computer systems that don't interrelate easily. The new designs will make each subsystem function as a subset of one main computer system. It will, however, take several years to complete, and each changeover will occur with both old and new units on line simultaneously, with no interruption in the system's protection.

In the meantime, NORAD has developed and installed a cyclical redundancy check in the computer software to ensure the validity of each message sent. Now NORAD monitors what it is seeing and—at the same instant—what its users (SAC and the NMCS) are seeing. At all points in this system, humans play a vital part, checking and verifying data.

In November 1980, experts from the Department of Defense and the computer community gave the NORAD computer system an exhaustive test. It passed convincingly and has performed flawlessly since.

Missile Warning

The other side of Tactical Warning and Attack Assessment is the threat from ballistic missiles. The United States maintains an elaborate array of sensors to guard against that threat. They include satellite resources, the Ballistic Missile Early Warning System (BMEWS), Pave Paws, the AN/FPS-85, the AN/FSS-7, the Perimeter Acquisition Radar, Attack Characterization System (PARCS), and Cobra Dane.

Early warning satellites usually provide the first indication of an ICBM launch. Clearly, the sensitivities of our satellite missile-detection capabilities emphasize the importance of satellite survivability and protection. This early warning capability is obviously a prime first target in any planned attack.

Minutes after initial satellite detection, radar detects the missile, confirms the attack, and predicts impact locations. No significant action occurs (except in cases of early, substantial single-source evidence) until another source besides satellites verifies the sighting. A missile indication, for example, will show up soon after on Cobra Dane, Pave Paws, or one of the other warning systems.

BMEWS provides TW/AA information to NORAD from three sites specifically located to detect ballistic missile attacks from the Sino-Soviet landmass, most Arctic Ocean areas, Soviet SLBM fleet ports, and northern patrol areas. The sites are Thule AB, at North Star Bay on the west coast of Greenland, about 1,550 kilometers from the geographic North Pole; Clear AFS, located about 100 kilometers southwest of Fairbanks, Alaska; and Fylingdales, UK, the Royal Air Force.

All high-speed data circuits from BMEWS travel to NORAD via redundant transmission facilities. NORAD processes BMEWS data and forwards it to the other command centers over the Missile Warning ASCII and Missile Warning Teletype networks. RAF Fylingdales transmits data to both NORAD and RAF operations centers.

Pave Paws radars are dual-faced, phased-array surveillance and tracking systems. One is on the east coast at Otis ANGB, Mass., and the other is on the west coast at Beale AFB, Calif. Two more are planned for the southeast at Robins AFB, Ga., and the southwest near San Angelo, Tex., and should be operational in the late 1980s. Each has a triangular-shaped main building that contains the radar, computer, communications, and support equipment. The two flat antenna arrays are attached to two of the three sides of the building. Each Pave Paws high-speed data circuit is routed two ways from the site to each command center.

The radars are solid-state, electronically steered antennas. When they are tracking, the two faces operate independently according to the number of objects to be tracked. Pave Paws does two important jobs as part of our TW/AA defensive shield. It provides identification, type of object, launch time, and time and predicted location of CONUS impact and tells which Pave Paws site is responding. In addition, the Pave Paws operator passes on his or her confidence in the validity of the report.

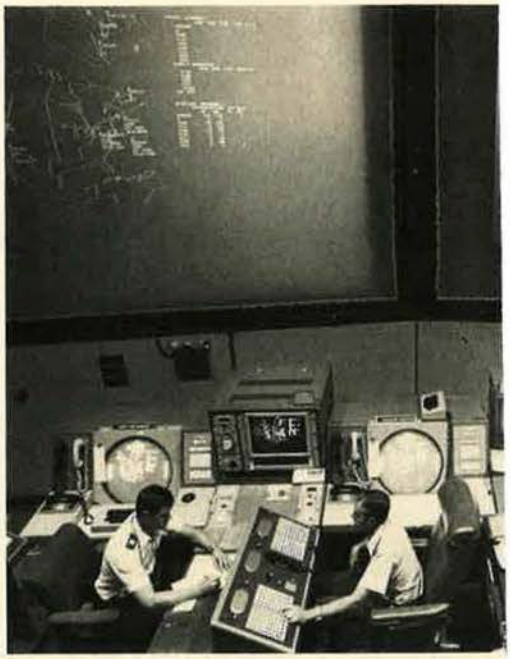
Although Pave Paws is relatively new, the Air Force already has improvements planned to keep up with the surge of technology. Pave Paws Otis and Pave Paws Beale will be modified to provide a power increase to improve count and attack assessment capabilities. The Air Force also plans improvements in signal processing, data processor throughput, memory capacity, and software.

Looking South

The AN/FPS-85 is a single-plane, phased-array radar system located at Eglin AFB, Fla. Until the Robins and Goodfellow Pave Paws sites are complete, AN/FPS-85 is our only southern-facing missile detection system. Its information is also sent two ways directly to NORAD; NORAD then forwards the processed data to the other three command centers over the Missile Warning ASCII and Missile Warning Teletype networks. The Eglin AN/FPS-85 is a computer-driven, phased-array radar that uses electron tube technology to watch satellites and SLBMs.

The AN/FSS-7 is a mechanical radar at MacDill AFB, Fla., that sends its warning information to

This command post is the nerve center of the NORAD Cheyenne Mountain Complex. The NCMC is the primary Tactical Warning and Attack Assessment (TW/AA) command center.



NORAD when the target parameters indicate the radar has acquired an SLBM.

An AN/FPQ-16, north-looking, single-faced, phased-array radar at Cavalier AFS, N. D., about thirty-two kilometers south of the Canadian border, PARCS was originally part of the Army's Safeguard antiballistic missile system. Its mission is to provide warning and assessment of SLBM attacks against the CONUS and southern Canada originating from the near-Arctic areas behind BMEWS. The secondary mission is to provide warning and attack characterization of an ICBM attack from the Sino-Soviet landmass. Its tertiary mission, like most of the others, is to provide surveillance, tracking, reporting, and space object identification data to the NORAD Space Surveillance Center.

At the tip of the Aleutian Island chain is Cobra Dane, a single-faced, phased-array radar system used to watch Soviet ballistic missile tests. This 100-foot-high radar also provides early warning of ICBM launches and detects and tracks satellites. It communicates digitally with command centers to receive operational directives and transmit

radar data and reports on missile events. Like the other resources, its information is routed two different ways to NORAD. Also like the other resources, when Cobra Dane detects and verifies a target, it performs a correlation check; for missile targets, it computes predicted impact points.

Primary Command Centers

The data from all these systems has to be handled quickly and smoothly. The command center structure of this system does this job effectively. The primary TW/AA command center is the NORAD Cheyenne Mountain Complex (NCMC) in Colorado Springs, Colo. NORAD is responsible for providing warning and assessment for missile and air-breathing threats to the North American continent. The SAC Command Center at Offutt AFB, Neb., the National Military Command Center at the Pentagon, and the Alternate National Military Command Center at Fort Ritchie, Md., all use the information the NCMC collects and provides them.

Deep within Cheyenne Mountain south of Colorado Springs are fifteen steel buildings resting on huge antishock springs and interconnected by steel walkways. Some 1,400 people operate the NCMC on a twenty-four-hour basis; if necessary, it could be completely self-sustaining for thirty days.

The SAC Command Center exercises command and control of land-based bomber and ICBM forces, strategic reconnaissance, and the EC-135C aircraft that function as the airborne alternate command posts.

The National Military Command Center supports the President, the Secretary of Defense, and the Chairman of the Joint Chiefs of Staff. It is the primary command center for the National Military Command System. Day-to-day operations of the NMCC are performed by five rotating teams who monitor crises, assemble information, analyze it, and brief decision-makers.

The Alternate NMCC is 130 kilometers north of the Pentagon (thirty minutes by helicopter—ninety minutes by auto). Logistics and support are provided by Fort Ritchie, Md.

The National Emergency Airborne Command Post uses four nuclear/EMP-hardened E-4Bs whose main operating base is Offutt AFB, Neb. The command and control of the E-4B is the responsibility of the Director of Operations, OJCS.

The Ballistic Missile Early Warning System (BMEWS) provides TW/AA information to NORAD from this site at Clear AFS, Alaska, another in England, and a third on Greenland.

Communications and Coordination

TW/AA information relies on four main communications systems to pass data between sites and command centers: the Defense Communications System, the commercial telephone system, special purpose systems, and the Defense Satellite Communications System. The Ground Wave Emergency Network (GWEN) and the Milstar communications system are planned improvements. In most of these cases, the data travels encoded.

To coordinate all aspects of the complex job of strategic defense, including warning and assessing possible attacks, DoD has begun a Strategic Defense Architecture (SDA-2000). The first phase of SDA-2000, dealing with the projected strategic air threat, is complete, and Phase II—which will treat ballistic missile and space defense and update air defense—is just beginning.

As technology adapts science to even faster and more precise military uses, the importance and accuracy of tactical warning and attack assessment will increase geometrically. The implications alone of the role of computers in deciding instantaneous defensive response will generate heated debate. Until the technology of the Strategic Defense Initiative (SDI) is reality, TW/AA will remain our only true defense against ballistic missile attack. Even then, some form of existing TW/AA systems will be central to the final SDI architecture. ■

Lt. Col. Richard S. Cammarota, USAF, has been the Deputy Chief of the Secretary of the Air Force's Staff Group since 1983. He holds a bachelor's degree from Union College, Schenectady, N. Y., a master's from Columbia University, and a Ph.D. from Pennsylvania State University. During his Air Force career, he has served as Associate Professor of English at the Air Force Academy and as Special Assistant to the Commander of Air Force Logistics Command.

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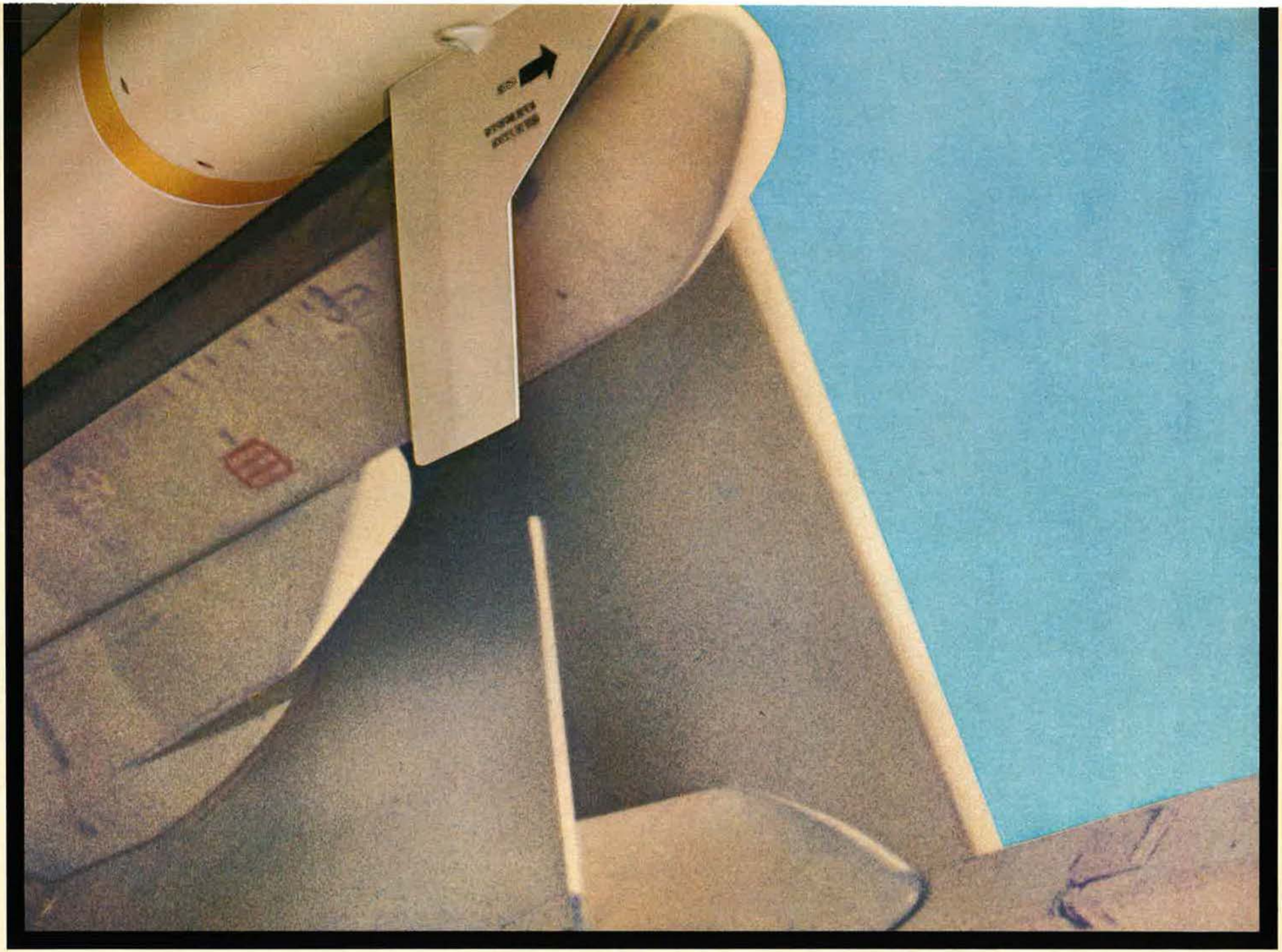
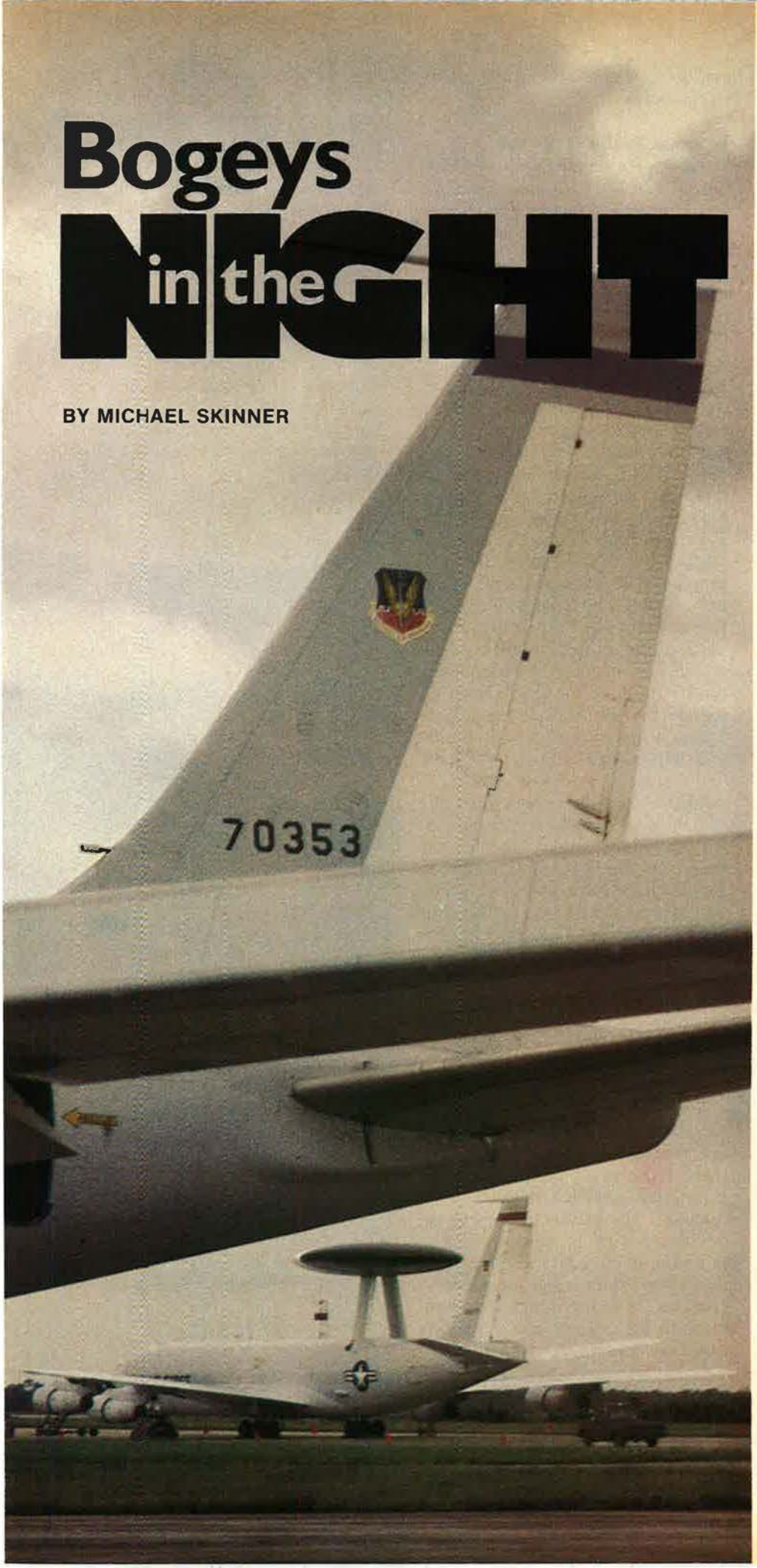


The huge, rotating disc on top of the AWACS gathers radar reflections, enabling "the unblinking eye of the electronic cyclops to spot its targets."

The Blue air defense forces, aided by AWACS, win this round in Copper Flag.

Bogeys in the NIGHT

BY MICHAEL SKINNER



WE ARE Sentry One Zero, spiraling in slow ovals over Dothan, Ala. Twilight wraps around the cockpit, the steel blues and smoky grays out of a distant thunderhead forged into an anvil in the furnace of sunset. On the western horizon, the fading sun glows red, then orange, yellow, gold, and the sky turns to deep blue and then to the final dark as the cool moss and sparkled green of the countryside ignite into the bonfire of the night's cities. And above, the tiny lights of distant stars.

Night means nothing to the AWACS. Distance means little. Through the gloom at 29,000 feet, the unblinking eye of the electronic cyclops is fixed not on the scrubland of southern Alabama but on the serene waters of the Gulf of Mexico more than a hundred miles away. In the gray tube, the wizards of AWACS are unaware that day has cooled into night. They are only slightly conscious of the fact that they are droning through space at 360 knots, chasing their tail on a fifty-eight-mile orbit that takes twenty minutes to complete.

Their attention is elsewhere, on the green diamonds of phosphorescence that betray anything that dares travel more than a hundred miles an hour: the stray Cessna, the odd commuter jet, the gaggle of intruders streaking toward America's sovereign airspace.

It is, of course, just another dry run: Copper Flag, the latest in the Tactical Air Command's series of realistic air exercises. In fact, the intruders staged from Tyndall AFB on Florida's Gulf coast, just as Sentry One Zero did hours ago. No matter. The AWACS deals in facts. These are intruders. They must be paired

with defenders. Dragnet, the controlling agency aboard Sentry One Zero, acts as a flying marriage broker to make sure all the bogeys are engaged.

The Curtain Rises

The bad guys buzz off the coast, awaiting the word to make their run. Each Copper Flag is "sponsored" by one of the four air divisions of Air Defense, Tactical Air Command (ADTAC), and each is run by the division's battle staff and presents the kind of threat they're likely to encounter in a wartime situation. In this case, units from the 25th Air Division, headquartered at McChord AFB near Tacoma, Wash., have made the long trip from the chilly northwest to the sunny south. The scenery might have changed from pine trees and the chilly waters of Puget Sound to palms and the warm Gulf of Mexico, but the threats are still the same. Here they come.

India 273 separates itself from the gaggle of intruders pacing out of bounds. Gathering speed in a long, swooping turn, it penetrates the southwest corner of the exercise boundary. By now it is screaming, 600 knots over the waves and gathering speed. The crew dogs aboard the AWACS nod to one another. This could only be one of the F-111Ds from Cannon AFB, N. M., playing the starring role as Backfire simulators. This is big game.

Dragnet sends out Fishy 02, an F-4 from the 147th Fighter Interceptor Group patrolling the westernmost air defense lane off Panama City. The idea of a fighter from Texas on station off the coast of Florida to defend against a simulated attack coming from over the Pole is not as counterproductive as it first seems; the 147th's wartime mission is to deploy from Houston to Kingsley, Ore., to reinforce the air defenses of the Northwest.

In any case, Fishy won't catch India 273. He's just shot down a cruise missile faker, one of the T-33s that are as thick as seabirds around Tyndall. Chugging back to Black Charlie, his CAP point, it's all he can do to wag a wing at the bogey streaking by.

Whoops in the Headset

Things are heating up now. Dragnet calls on Edgy 01, an F-106 of the 5th Fighter Interceptor Squadron from Minot AFB, N. D. But somebody's jamming the radio! The controller hears only electronic Pac-Man whoops in his headset. He can only hope Edgy gets the message. He does, but it's too late. India 273 is too fast, too far away. Besides, Edgy has other things on his mind: two more of the ubiquitous T-33/cruise missiles have just entered the Brown lane. Edgy wisely calls "Skip it" to Dragnet and plots an intercept course to the new bogeys.

Dragnet's last hope is Kang 02, an F-15 returning to Tyndall from its station on Yellow Kilo, the easternmost lane. Kang has lots of gas and missiles left, so he joins the chase. But it's too late. India 273 is a black streak in the moonless night. Kang is not exactly cruising, either, but by the time the Eagle from Elmendorf AFB, Alaska, comes into Sparrow launch parameters, hunter and hunted are almost over land, and the attack is broken off.

The F-15 pilot peers into the darkness for a last look at India 273. He can almost make out the twin fires from the F-111's afterburners, glowing like snake eyes in the night. The guy is really smoking, heading for the bridge at Apalachicola. The folks who live on this section of the Florida coast are used to screamers, but not boomers. Later, there will be complaints.

Kills Don't Count

The AWACS controllers forget about India 273. There are too many targets out there to worry about the one that got away. Like Red Flag, there is no score at Copper Flag. But unlike Red Flag, there is no kill removal. The idea is to present the defenders with as many targets as possible, so intruders who are "shot down" by outer zone interceptors continue to drone inland like zombies. In fact, some of the fighters that were in perfect position to intercept India 273 were busy with targets that had already been killed once. Or they had launched all their missiles at targets, some of which had already been shot down. At Copper Flag, kills aren't counted, but missiles are.

So war is not fair. What else is new? Even with the odds stacked against them, the Blue force players say they still get about eighty percent of the low, fast targets that give them the most trouble. Besides, the idea is to practice the most difficult shots, the worst-case scenarios. India 273 is an aberration. Blue won the war tonight. Nearly all the Red bogeys were swatted from the Florida sky.

Michael Skinner, formerly with the St. Petersburg Times *and the Washington* Star, *is currently on the staff of the Cable News Network in Atlanta, Ga. He is the author of two books,* USAFE: A Primer of Modern Air Combat in Europe *(1982) and* Red Flag: Air Combat for the '80s *(1984).*

After more than eight hours on station, Sentry One Zero pulls out of its racetrack orbit and heads for home. There's a traffic jam over Tyndall as friend and foe try to land in time for the late night briefing. We're the last ones in.

Blue spiders of Saint Elmo's fire crackle across the windscreen. As we make the approach, the private lightning is replaced by the glittering lights of Panama City Beach, first stop on the "Redneck Riviera" that stretches from Panama City to Biloxi, from Tyndall to Keesler. Wheels down, the big E-3A plows through the heavy ocean air. Touchdown at Tyndall. Sentry One Zero is home. ■

An F-111D prepares to take off and assume the role of a Backfire on a supersonic attack against the US.

The Aeronautical Systems Division uses simulators to help design the cockpits and airframes of tomorrow.

Flying With ASD's Indoor Test Pilots

BY JAMES P. COYNE, SENIOR EDITOR

Realistic, cost-effective, data-gathering missions are flown inside the big blue ball of the LAMARS (above) and in the LANTIRN-equipped F-16 simulator (opposite page).

How would you like to try landing a high-performance fighter configured for the Air Force's new short takeoff and landing (STOL) technology, fly a four-engine specially modified transport through an instrument approach and landing at San Francisco International Airport, leap off on a series of high-speed terrain-hugging attacks in an F-16 equipped with the new LANTIRN all-weather weapons employment system, and then get a glimpse into the cockpit of the future—all in one day? You can do it.

You can, that is, in the simulators at the laboratories of Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio.

ASD is in the forefront of the movement to utilize simulators for the cost-effective development of techniques, procedures, and hardware that have application in all kinds of space-age operations. Digital computers, combined with new visual and motion systems, have given realism in simulator training a quantum leap for developmental, operational, and test flying.

First, I flew the Large-Amplitude Multimode Aerospace Research Simulator (LAMARS). LAMARS is used as a design tool at Wright-Pat. After flying it, a test

pilot can input into the design of the flight vehicle long before the final configuration is decided. Flying it, the pilot is presented with realistic visual and motion cues while he responds to controlled and variable mission conditions and aircrew tasks. Armed with information he has gained during the flights, he can work with engineers during preliminary design and preflight evaluation phases for new aircraft and equipment.

Ball on a Beam

The LAMARS consists of a single-place fighter cockpit inside a "ball" twenty feet in diameter. Three-dimensional visual cues—sky, ground, weather, buildings, runways, and the like—are displayed on the inside of the ball. The ball is mounted on a horizontal beam thirty feet long. The beam is gimballed and driven by powerful hydraulic actuators at the end of the beam opposite the ball to provide vertical ball motion of ten feet up or down. The ball is also gimballed on its end of the beam to provide angular rotation of plus or minus twenty-five degrees in pitch, yaw, and roll motion. The LAMARS is enclosed in a large room with a solid concrete floor and a ceiling thirty feet high.

Next to the motion room is another smaller room, up high, with a big window looking out on the motion room. In the smaller room are monitor and control consoles, interface computers, and software to drive the simulator and utility support equipment. Also incorporated is a radar homing and warning system and equipment to simulate terrain following or avoidance and threat detection and avoidance. There are terrain boards with closed-circuit movable television cameras mounted above them to provide the imagery displayed inside the ball. In the ball, the pilot has a wide field of view, 266 degrees from side to side, and up to 108 degrees above the horizon. The visual cues and the motion of the ball provide realistic flying sensations.

Various Cockpits

At different times, the LAMARS has been fitted with cockpits from the F-16, the F-15, the X-29 Advanced Technology Demonstrator, and other aircraft. For my flight, however, it has a "generic" fighter cockpit. When I get into the cockpit, I note it has a strong resemblance to the T-38.

Before my flight, I am briefed by two young aero-

nautical engineers, Air Force 2d Lts. Steven R. Sturmer and Michael Rosenbleeth. They explain they have been doing research for the Air Force's new short takeoff and landing demonstrator project *(see* AIR FORCE *Magazine, December '84, p. 40).* Col. Richard A. Borowski, F-15 STOL program manager, explains: McDonnell Douglas has been contracted to build an F-15 STOL demonstrator with canards and engines that have variable and reverse thrust nozzles. The aircraft will be capable of takeoff with full internal fuel and a 6,000-pound payload from a 1,000-foot runway. Landing roll with payload expended will be less than 1,250 feet on a wet runway. The ultimate purpose of the program is to provide an Air Force capability to operate from cratered runways, using undamaged surfaces between the craters. *(See chart, opposite page.)*

This F-15 will be capable of making a very steep approach at a relatively low speed. The STOL F-15 will have special guidance equipment, probably on board the aircraft, that will enable the pilot to crack a 200-foot ceiling and hit the desired touchdown point precisely, using symbology in his head-up display (HUD) on the windscreen. Part of the technique will be to use a high rate of descent (ten to fourteen feet per second) to just before the touchdown point, with a flare to slow the final rate of descent to about eight feet per second. A normal fighter final rate of descent to landing is two to three feet per second.

Empty Pockets

For my flight, I will be using a normal glide slope, but the touchdown point is only 300 feet from the threshold of the runway, far short of the usual touchdown point, 1,000 feet down the runway. Too long and I'm in the bomb craters. Too short, I'm in the mud. Just before I go into the motion room, I am briefed by a technician who reminds me to take everything out of my pockets so that if I bounce, I won't "have change flying around the cockpit, falling into the avionics."

I am momentarily nonplussed, because, in flying the F-15, the F-4, the A-7, and other fighters, as well as the motion-capable simulators that went with them, I don't recall ever having to empty my pockets. Then I remember—in those days, I wore a flying suit and the pockets were all zipped up. I enter the motion room, climb down some steps to the floor, then up a ladder into the ball. In the ball, I step into the cockpit. The technician makes sure I'm strapped in securely.

I put on the white helmet with a boom microphone and get ready to go. Lieutenant Sturmer's voice comes through my headset: "We'll set you up on final. Let me know when you're ready." I look through the windscreen. I have a horizon line in my HUD, a Flight Path Marker that looks like a head-on view of a little airplane, and the usual altitude and airspeed symbology. In front of the cockpit is what looks like the runway at Wright-Patterson on a cloudy day. No bomb craters. I'll just simulate their being there. I remember I'm supposed to hit the 300-foot mark for landing. The computers will produce a printout of data from each run.

Into the Crater

"Let's go." I can feel the simulator start to "fly." Now I'm moving down the glide slope. Airspeed, 130 knots. There's a little line on the HUD that acts like the instrument landing system indicator. It shows I'm high. I talk to myself. Bring it down. About two miles out. Now I'm a little low. Bring it up. On glide slope—no, going high again! This thing is surely sensitive. Couldn't be me. A mile out now. Looks too low. No, I'm supposed to hit just past the threshold. But from here, I'll land too soon. Bring it up! Too much! Bring 'er down. Not that fast! We hit. We bounce, making metallic sounds. We stop.

"Well, not too good that time, Lieutenant. How far down the runway did I land?" "You touched down about 900 feet past the desired point." In a real aircraft, I'd have rolled right into the bomb craters. Good thing they're only simulated.

"Well, let's try it again." I try it again, several times, but I keep landing long, dropping it in and bouncing. It's caused by an overcompensation from trying not to land short. The lieutenants change the flying conditions by varying the winds. The rate of descent is as high as twenty feet per second. Finally, on run number five, I'm only a little long and only bounce once. The next time I'll nail it. Number six is acceptable: rate of descent, 10.8 feet per second (STOL parameters ten to fourteen feet per second). I land seventy-eight feet short of my point and six feet off centerline. And no bounce. We terminate the tests. It is obvious that STOL pilots are going to need all the precision landing aids they can get, plus a lot of practice.

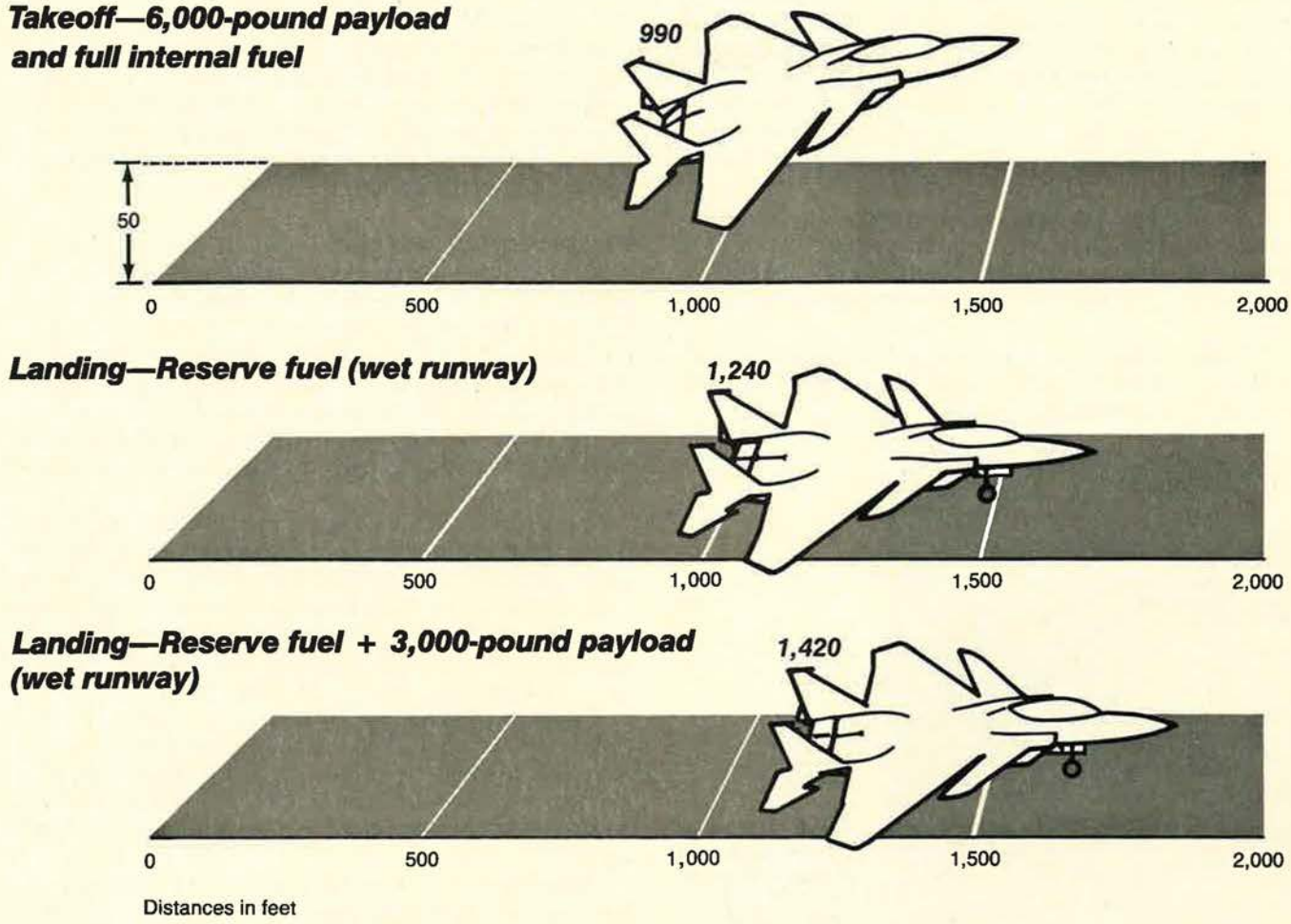
It is easy to see that the LAMARS can be a very realistic and very useful learning and design tool. Its cost has been amortized easily in savings in flying-hour costs that would have been incurred if the early tests had been run in a real aircraft.

Crew Station Design

I move to the next stop, the Crew Station Design Facility, headed by Program Manager Richard Geiselhart. Dick is an experimental psychologist by training and a human factors engineer by profession. He left the academic world "for a little while" back in the early sixties and has been in the human engineering business at Wright-Patterson ever since. Dick has been deeply involved in crew station design on a number of Air Force aircraft, including fighters like the A-10, the F-111, and the F-4, and such large aircraft as the C-5, the C-141, and the KC-135.

Currently, the Crew Station Design Facility is working with the simulator for training pilots in the new EC-18B Advanced Range Instrumentation Aircraft (ARIA) and another simulator used to design avionics and weapons employment equipment in the F-16.

We will fly the ARIA first. It is not really a new aircraft because the ARIA configuration uses the basic Boeing 707-320 airframe. In fact, says Col. J. K. Glenn, who is the Commander of ASD's 4950th Test Wing, the four ARIAs now becoming operational were purchased from American Airlines, where they were standard airliners. The aircraft are being highly modified to perform the ARIA mission, which is gathering, recording, storing, and retransmitting data in worldwide support of unmanned space launches, cruise missile tests, Army and Navy ballistic missile tests, and the Space Transportation System (Shuttle) program. The ARIA is easily recognized because it looks like a standard C-135 transport



The F-15 STOL Demonstrator aircraft will prove the feasibility of operating from bomb-damaged runways, utilizing a path between craters as narrow as 50 feet, taking off in less than 1,000 feet, and landing in less than 1,500 feet.

fitted with a huge, underslung bulbous nose housing a seven-foot ARIA acquisition antenna. (The aircraft are modified "in house" by the test wing's Directorate of Aircraft Modification at Wright-Patterson.)

When the decision was made in 1982 to purchase the new aircraft, Dick Geiselhart and his people immediately began converting the facility's C-135 simulator into an ARIA. The Boeing 707 aircraft has a longer fuselage, bigger engines, larger tail and wing surfaces, and, in the cockpit, a flight engineer's position. It took more than a year to make the simulation conversion—most of that time in the development of software to simulate flying characteristics of the new aircraft. It will soon be used to train new crews.

Approaching San Francisco

I am briefed on my flight by my copilot, Maj. Andrew J. Courtice, who has extensive KC-135 and ARIA experience. We enter the ARIA from the rear, through a standard door. We are immediately transported into the darkened cockpit of the ARIA on a night flight into San Francisco. At 2,000 feet, it's easy to identify the bay, the San Francisco Bay Bridge, the Oakland–San Francisco Bridge, and the airport. It is a clear night, smooth as glass. The stars above combine with the reflections in the water and flickering lights of the city to make a beautiful moving picture.

"You got it," says Major Courtice. "It handles just like a KC-135." I have never flown a KC-135, but I have flown a lot of other airplanes and the principles are the same. I feel the nose trying to come up, and I use my left thumb on the trim button to put some nose-down trim on the aircraft. I put in too much, and we start to descend. I put in opposite trim. There seems to be a rather long delay between application of trim and aircraft response. We go from 200 feet low to 200 feet high. Our assigned altitude is a fond memory that only becomes a reality we pass through on the way to 200 feet up or down.

"You have to develop an instinct for it," says Major Courtice. "It comes with practice." We fly a box pattern and line up on final. "Just fly the ILS," directs Major Courtice. He adjusts the throttles for me, then lowers the gear and flaps, at the same time coaching me as I bring this jet-propelled behemoth down to the runway. Like a real ILS, the closer we get, the more sensitive the indicator becomes.

I am breathing hard as we come over the flashing strobes of the runway lighting system. A little crosswind sends us off a few yards to the right. Left bank. Not too much. . . . It was too much. Back the other way. Can't seem to get this thing trimmed for the approach speed. "Hold her off," the Major says, reducing the throttle setting to idle. We're on the runway. "Use the nosewheel steering wheel by your left knee to keep us straight on the rollout," he says. "Be careful—it's pretty sensitive."

I give the wheel a little tweak to the right. The nose swerves sharply right and I overcorrect back to the left. We roll to a stop, veering left and then right but still on the runway. The rollout was as challenging as flying the pattern.

"Thanks, Major. I'll try to come back and do better next time." Dick Geiselhart and I step out of the door of the ARIA back into the real world.

One simulator in the Crew Station Design Facility is used to train aircrews for the new EC-18B Advanced Range Instrumentation Aircraft (ARIA), which houses special mission equipment in its distinctive bulbous nose.

Simulator from Salvage

But only for a moment. Because just a few feet away is the F-16 simulator. This simulator, Dick says, was built right there in the Design Facility. It is actually a salvaged real F-16 cockpit that was saved from the junkyard to become a simulator. It does not have motion, but I soon find that the view through the windscreen gives me a real feeling of flying as I zip up and down hills and mountains and along river valleys, destroying every target in my path.

The seat in the F-16, canted back thirty degrees, looks uncomfortable. But once you're in it, it feels fine. You can see how a pilot can pull more Gs in this seat because his knees are elevated above his waist and, since he's semireclining, the G forces would tend to be pulled across his body, front to back, rather than down, from head to waist. The elevated knees keep a lot of blood pooled in his midsection, and this, in combination with the constriction of his G-suit, is the most important factor in raising his G tolerance. (I experience no G forces in the simulator.)

The stick is on the right side of the cockpit, poking up out of the console. There is a contoured armrest behind it to support my arm and hand during high-G maneuvers. The stick moves, but almost imperceptibly. Sensors take their cues from pressures my hand exerts on the stick grip. During the flight, it is very easy to keep the aircraft on course and altitude—when I follow commands from the navigation and weapons employment systems transmitted to me on the HUD—because the aircraft response to my control stick pressures is so precise. Trim is automatic, set for the pilot by the flight control computer system.

Demonstrating LANTIRN

The F-16 simulator is set up to demonstrate the capabilities of LANTIRN—Low-Altitude Navigation and Targeting Infrared for Night—a new attack system now going through final tests before coming into the active Air Force inventory. By using infrared emissions to gather imagery that is then displayed in front of the fighter pilot as he flies his mission, LANTIRN gives the tactical air forces an under weather, around-the-clock attack capability.

The technicians set me up for a night attack at 250 feet over rolling and mountainous terrain. The view is totally black, as black as the night sky over the mountains of Laos during Night Owl missions in the war in Southeast Asia. In that war, at night we often used flares to light up the target—but often the attacking aircraft were lit up as well, making them targets for ground fire.

Then, the LANTIRN system is activated. What a difference. Literally from night into day. The scenery is revealed in what I would call bright twilight, just after the sun has gone down and, if you're driving your car, you're just starting to think about turning on the headlights.

Before takeoff, I had entered into the computer the latitude and longitude coordinates and the altitudes above sea level of five targets. They include bridges, road intersections, and an airfield. I take off and level at 250 feet above the terrain. In the HUD, symbology tells me when I am above or below 250 feet, and it is not hard to stay close to it. As I approach each target area, a diamond appears in the HUD, overlaid on the target. As I start each weapons delivery pass, a vertical line appears in the HUD as a guide to the best heading to follow to deliver my ordnance. All I have to do is keep the little aircraft symbol on the line as I depress the weapon release button and execute a pullup, following a pullup signal.

At the appropriate point, the weapon releases and I turn away from the target and its defenses. I make one pass level at 2,000 feet, and my weapon hits the target. The other four weapons deliveries are made out of "pop-up" maneuvers. Results: five targets destroyed out of five attempts. At night, too. This was made possible by LANTIRN, which enabled me to see each target and to make any required refinements to my weapons delivery passes. A the conclusion of my flight, there is no doubt in my mind that LANTIRN is an answer to all-weather, day-and-night weapons employment requirements.

Cockpit of the Future

After leaving Dick Geiselhart and his wonder machines, I am briefed on the cockpit of the future—or at least several concepts that will appear in future fighters.

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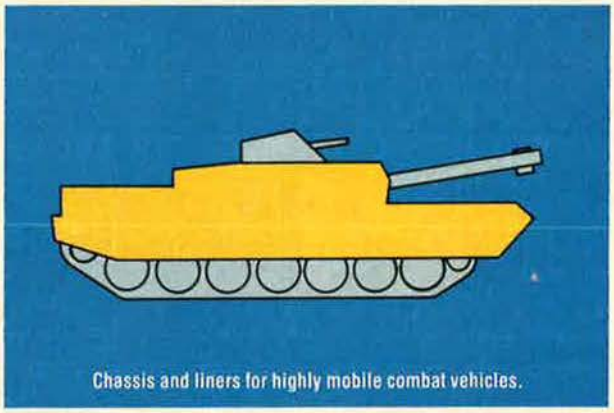

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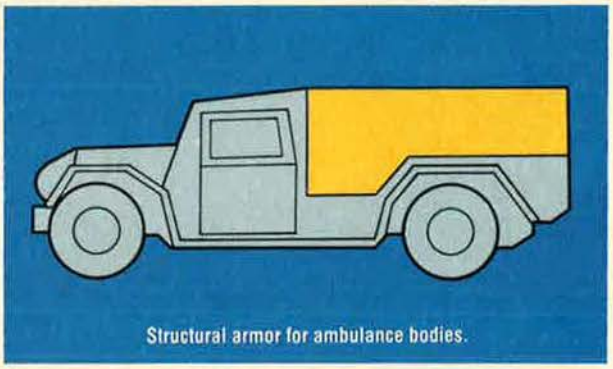

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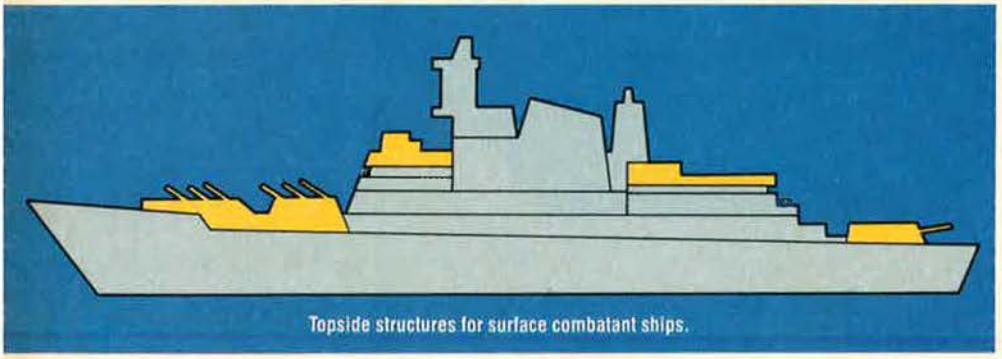

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I visit 1st Lt. Gretchen Lizza, a research engineer, who is working with MAGIC—Microprocessor Application of Graphics with Interactive Communications. The MAGIC simulator is used to explore possible future cockpit displays, controls, and symbology. They will be needed to help the pilot of the future, whom scientists in the Flight Dynamics Laboratory see not as today's traditional "hands-on controller" but as a mission executive or systems manager. He will exercise his control of the aircraft and its systems through cathode-ray tubes (CRTs), pictorial push buttons, or other control actuators—even by voice command.

The MAGIC simulator is a mockup of a generic, single-seat fighter cockpit about the size of an F-15's. In front of the pilot are two CRTs, one above the other. Above them, on top of the glare shield, is another CRT that provides HUD symbology. Below each screen is a row of four light-emitting diode (LED) switches. The information on the face of the switches can be programmed to change so that the twelve switches can be used for a myriad of tasks.

MAGIC (Microprocessor Application of Graphics with Interactive Communications) tests the usefulness to aircrews of electro-optical devices, multifunction control units, and voice-command systems during missions flown in the cockpit of the future.

There are other push-button switches on either side of the CRTs, and on the lower left side of the cockpit is a small keyboard that can be used to enter in numbers or letters when required, but the legends on the keyboard can be made to change to complete words, depending on what tasks the pilot is performing. Just above the keyboard is another CRT for displaying "videodisc" images, and on the far right of the cockpit is another CRT for imagery.

Cockpit equipment also includes a throttle with a microphone button on the left side of the cockpit, and on the right side there is a side-stick flight controller (like that on the F-16) with weapons release switches and a trim button. To a pilot who started out in the F-86, this cockpit is a quantum leap forward in flight management technology. To the MAGIC experts, it's merely evolutionary. But it is based on extensive, in-depth research with today's aircrews. Lieutenant Lizza is confident that pilots will be quite at home in this cockpit full of electro-optical devices and multifunction control units.

Pilots Prefer Voice

One of the experiments conducted in the MAGIC simulator was aimed at discovering the best way to tell the pilot of emergencies and malfunctions. In "flights," subjects were informed of emergencies by voice, by words displayed before them, or by pictorial means. For example, the pictorial method would display a picture of a system (hydraulic, electrical, etc.) and show where a malfunction was occurring. The experiment showed that pilots preferred to have a voice informing them of emergencies ("Your oil pressure is low") more than any other method, but analysis showed that they did not react significantly differently to either pictures or the spoken word.

Another test program that will run through 1986 is evaluation of the use of pictorial push buttons for target location and stores management. The buttons can be programmed to display a variety of targets the pilot might encounter during a mission. When he decides on his target—for example, a train—he simply pushes the button with a locomotive displayed on it. By computer, the correct weapons will be selected from those he is carrying, and settings for fuzing, drop interval, and so on will be made automatically. The computer would also select the best course to the target and the best course for getting the aircraft there on time while avoiding threats. In MAGIC terminology, this enables the pilot to operate "at the level of intention" and to keep his head up and out of the cockpit most of the time.

Lieutenant Lizza and her colleagues are firmly convinced that the concepts they are developing in MAGIC will influence cockpit layouts and aircraft systems control for decades to come. She emphasizes that digital avionics and associated multifunction controls can be vital assets to aircrews, but only if they're designed to meet the specific needs of the crew. So she and her colleagues are learning how to tailor the equipment and supporting software to each mission phase and specific operator requirement, whether the crew member is a pilot, navigator, or weapon system operator. And as long as they keep that in mind, they are on the right track. ■

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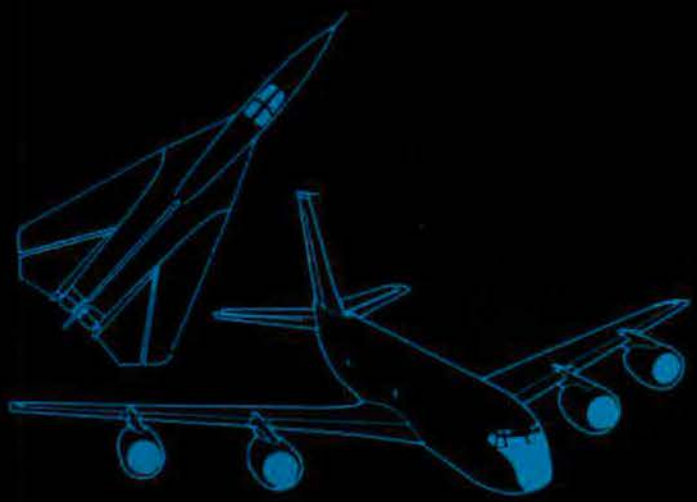

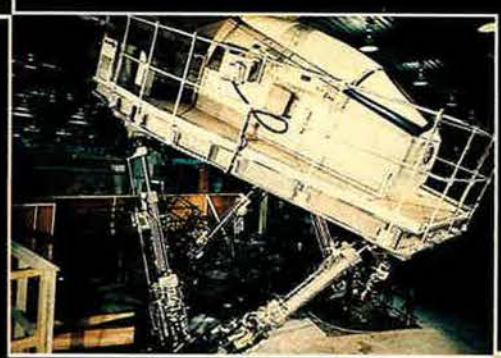

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GARRETT

Sgt. Mary Eiche discusses meal-serving procedures with a medical technician during the first overseas flight by an all-female Air Force flight crew. (Photo by SSgt. Marvin D. Lynchard)

The day is fast approaching when female "firsts" will no longer be news in the Air Force.

Finishing The Firsts

BY THE HON. VERNE ORR
SECRETARY OF THE AIR FORCE

On May 7, 1429, a force of 4,000 French soldiers attacked the British at the fortified bridgehead that was the key to Britain's siege of Orléans. The commander was seriously wounded by an arrow, but continued to lead assault after desperate assault. And by nightfall the French were victorious; the British blockade was broken. The leader of this valiant brigade? A seventeen-year-old woman named Joan.

Admittedly, Joan of Arc played a somewhat more active combat role than most women before or since, but from Cleopatra's squadron of sixty warships at the Battle of Actium on September 2, 31 B.C., to Clara Barton's heroic exploits during the Battle of Antietam in our own Civil War, women have, indeed, played crucial parts in the military affairs of states. In our country's history, names like Molly Pitcher, Dr. Mary Walker, and Jacqueline Cochran are as heralded as those of their male contemporaries.

Other exploits are less well known. In World War II, the Soviets had three fighter units staffed entirely by women. They compiled a formidable record of thirty-eight kills, boasted two aces, and played an important part in keeping Hitler from conquering Russia. However, despite this experience, the Soviets have no women fighter pilots today. In fact, the entire Soviet armed forces have only 10,000 women (enlisted and officer) out of 4,400,000. The US Air Force recruits that many in one year!

Since World War II, the Israelis have perhaps become the most noticeable champion of the role of women in the military, giving them a broad range of duties long before the first American woman walked into our academies. Even so, like the Soviets, the Israelis do not permit their women to serve in a combat role, and out of a total armed force of 158,000, only 8,000 (five percent) are women.

American military tradition has never included women in direct combat, but the role of women across the remainder of the spectrum of specialties is growing even as we review this topic. I want to examine briefly the milestones that have brought women to where they are in the Air Force today and to consider what—if I may try to predict—the future may hold.

Nurses and WASPs

The role women have played most often in the American military, as the names Pitcher and Barton suggest, has been as nurses. And as nurses, they started their formal association with the military in 1901 with the Army Nurses Corps; the Navy followed in 1908 (also with an auxiliary). During World War I, small groups of women went overseas as contract employees—telephone operators, clerical workers, chauffeurs—with the American Expeditionary Force, but the War Department turned down a 1918 request for a military women's corps.

Between the wars came three separate studies; only one called for a military, not auxiliary, agency for women. The Air Corps reply in 1930 to questions about using women pilots was that it was "utterly unfeasible"; women were "too high-strung for wartime flying." General Arnold, despite his admiration for their work, twice turned down suggestions for a women's air corps.

Not until May 1942, with the nation embroiled in what turned out to be the largest conflict in history, did Congress establish a Women's Army Auxiliary Corps (WAAC). Soon afterward, the Women's Auxiliary Ferrying Squadron started, and, in August 1943, the Women's Airforce Service Pilots (WASP) was established under Jacqueline Cochran. That same summer, Air Corps women achieved full military status with the Women's Air Corps (WAC). Not surprisingly, at the peak of WAC enrollment, about half of the WACs held administrative office jobs.

The key legislative turn came in June 1948 when President Truman signed Public Law 625, creating a permanent place for women in each service. At that time, the Air Force had only 168 women line officers and 1,433 enlisted women. Even then, the Women in the Air Force (WAF)—unlike the WAAC—was not a *separate* agency; that is, they were called the WAF but competed with men for promotions and assignments. Also, the law imposed a two percent ceiling on the number of women on active duty.

Over the years, the Air Force has been a leader in women's programs. Seven months after P.L. 625 was signed, the Air Force began the country's first coed officer commissioning program, the Air Force Officer Candidate School (OCS) at Lackland AFB, Tex.

Even though numbers of women in the military started to grow, challenges remained. In 1949, of the forty-three enlisted career fields established for the Air Force Job Classification System, only thirteen were "fully suitable" for women; in addition, 158 specialties out of 349 were closed to women—almost half! (By the early 1970s, that figure was down to thirty percent.) Another problem was promotions. As late as 1968, of more than twenty WAF lieutenant colonels eligible for promotion, only one was selected for colonel.

In 1967, and at the Air Force's suggestion, Congress lifted the two percent ceiling on regular strengths. Air Force recruitment percentages had grown slowly but steadily during the late '60s. In 1972, a DoD AVF Task Force recommended that all the services double their women's programs by the end of Fiscal Year 1977. The Air Force Chief of Staff announced the Air Force would *triple* the number of line women by the end of 1977.

These moves coincided with the rise of national interest in the Equal Rights Amendment and women's rights that encouraged women to join our new All-Volunteer Force (AVF) in larger and larger numbers.

The number of enlisted women doubled by 1975 and tripled by 1978; the number of line women officers almost doubled by 1978 and more than tripled by 1980. Line women growth—particularly officers—was slowed because of early release programs affecting male *and* female junior members during post-Vietnam force drawdowns. But growth continues today, and the percentage of women (including health professionals) in the total active force (more than eleven percent) has more than doubled since 1975 (when the figure was five percent). Comparatively, the Army now has 9.7 percent women, the Navy 8.6 percent.

We also continue to increase our enlisted accession goals. We plan to recruit seventeen percent women in 1985, up from fifteen percent in 1984. At this accession rate, by September 1988 the percentage of women in the active force will be a little more than twelve percent.

Significant milestones have marked the growth and development of women in the Air Force. In 1969, women first enrolled in AFROTC. Two years later, Jeanne Holm became the first woman Air Force general officer (she subsequently retired as a major general). Other important events occurred rapidly in the second half of the decade of the '70s. In 1975, the Air Force said it would no longer force a woman to leave the Air Force

when she became pregnant. More significantly, in June 1976, the Air Staff's Office of Director, WAF, was dissolved. Since then, women matters have been handled as a normal function of our personnel system.

That same summer, the first women arrived at the Colorado Springs campus to begin four years of officer preparation as cadets at the Air Force Academy. Later that year, the first twenty women arrived at Williams AFB in Arizona to begin forty-nine weeks of undergraduate pilot training; the first six women navigator candidates began training in March 1977. Today, these women and their successors serve on the crews of KC-135s, AWACS, C-5s, and KC-10s. Titan missile crew duty is also available (since 1977), and most recently, I have opened the security specialty to women.

In the last several years, we have seen some interesting trends. While the personnel career field has doubled its percentage of women since 1978, the percentage of women vehicle maintenance specialists has multiplied more than three and a half times. Similarly, munitions, not generally regarded as a "traditional" career field for women, has grown by *a factor of eight*. Also, the number of enlisted women in aircrew operations has more than tripled since 1981. Three years ago, no women held "aircrew protection" jobs; today, more than 200 do. And the number of enlisted women in education and training has gone from 376 in FY '81 to 675 this year.

Today, more than 11,200 of our 106,000 Air Force officers are women. Of those, about 6,500 (fifty-eight percent) are line officers. The remaining 4,700 include nurses, legal officers, physicians, biomedical services corps officers, and chaplains (yes, we have thirteen women chaplains). Of the line number, 422 women are pilots, navigators, or in training for those jobs.

LEFT: Three of the first eleven members of the Women's Airforce Service Pilots (WASP) confer following completion of the nine-week transitional flight-training course for B-26 operations. The WASPs were established in August 1943 under Jacqueline Cochran. RIGHT: 2d Lts. Dale Hawthorne, left, and Julie Tizard in a KC-135 simulator at Wright-Patterson AFB, Ohio. Today's Air Force women serve on the crews of KC-135s, AWACS, C-5s, and KC-10s. (Photo by TSgt. Wayne Specht)

Collectively and individually, women have contributed to Air Force history through their accomplishments. More than a year ago, the first all-women crew flew a C-141 from McGuire AFB, N. J., to Ramstein AB, Germany, and back. Last year, the first woman to become Wing Commander of the cadet wing at the USAF Academy went on to become a Rhodes scholar.

Recent Trends

The assignment of women to specialties in the Air Force differs from the approach of the Army, Navy, or Marine Corps. While the other services place greater restrictions on the career fields a woman may enter, thus raising the percentage of women in each open field, the Air Force has tried to open as many of its fields as possible, except the handful closed by combat exclusions. This approach has more slowly distributed women among Air Force specialties and has allowed women joining the Air Force to choose from virtually *all* the officer fields (although a few officer positions are still closed) and from a wider variety of enlisted skills (ninety-eight percent) than are available in the other services. For example, large concentrations of our enlisted women are in communications, intelligence, and scientific and technical careers. Although the "traditional" administrative career field continues to draw many women, nearly as many are in maintenance and transportation jobs. Another of the most popular fields for enlisted women is supply.

Our nurse corps remains fairly constant—just over thirty-three percent, or 3,619 of our women officers, are nurses—but an unexpected trend has begun to emerge in this traditional "female preserve." Today, the Air Force has 4,637 nurses—and of these, more than a thousand, or twenty-two percent of them, are men! The number of male nurses has shown a steady climb over the last few years.

By and large, Air Force women have education comparable to our men. About ninety-nine percent of our enlisted force—men and women—have a high school diploma or equivalent or more, and nearly three percent have college degrees. Considering line officers only, the educational background of women officers is similar to that of the men, with a few exceptions. While fifty-eight percent of the men compared to seventy-eight percent of the women have completed only a bachelor's degree, forty-one percent of male officers and twenty-two percent of women officers have completed master's degrees or above. However, women officers as a group tend to be more junior than men. If you compare men and women line officers with less than ten years of service, the statistics are virtually the same (bachelor's: men, eighty-six percent, women, eighty-four percent; master's or above: men, fourteen percent, women, fifteen percent).

Career Areas for Women

Enlisted

	Number of Women	Percentage of All Enlisted Women
Logistics (Career areas 31, 32, 39, 40, 42, 43, 44, 46, 47, 60, 61, 62, 63, 64, 65, 66)	17,631	31.9
Personnel Resource Management (34, 70, 73, 74, 75)	12,357	22.3
Medical (90, 91, 92, 98)	7,483	13.5
Communications-Electronics (29, 30, 36)	3,947	7.1
Operations (11, 12, 27)	2,824	5.1
Intelligence (20)	2,506	4.5
Comptroller (67, 69)	1,572	2.8
Civil Engineering (54, 55, 56, 57)	1,433	2.6
Security Police (81)	1,337	2.4
Audiovisual (23)	538	1.0
Other	3,707	6.7
TOTAL	**55,335**	

Officer

	Number of Women	Percentage of All Women Officers
Medical (Career areas 90, 91, 92, 93, 94, 95, 97, 98, 99)	4,531	40.3
Personnel Resource Management (70, 73, 74, 75)	1,302	11.6
Logistics (31, 40, 60, 62, 64, 65, 66)	1,190	10.6
Operations (10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22)	877	7.8
Scientific & Development Engineering (23, 26, 27, 28)	745	6.6
Intelligence (80)	561	5.0
Communications-Electronics (30)	465	4.1
Computer Systems (51)	422	3.8
Comptroller (67, 69)	240	2.1
Commanders & Directors (00)	26	0.7
Other	788	7.0
TOTAL	**11,147**	

As of the end of FY '84, this was the distribution of Air Force women by career specialty areas.

The Top Ten Fields

Enlisted

	Number of Women	Women as a Percentage Of the Career Field
Dental (Career area 98)	1,078	31.0
Administration (70)	8,181	28.1
Accounting & Finance (67)	1,481	27.2
Contracting (65)	428	27.0
Medical (90, 91, 92)	6,405	26.1
Personnel (73)	2,938	25.6
Public Affairs (79)	296	23.8
Communications Operations (29)	2,061	20.8
Supply (64)	5,316	20.6
Intelligence (20)	2,506	19.0

Officer

	Number of Women	Women as a Percentage Of the Career Field
Nurse (Career area 97)	3,654	78.0
Administration (70)	690	28.7
Management Analysis (69)	54	24.1
Personnel (73)	441	22.8
Services (62)	95	22.7
Public Affairs (79)	120	21.1
Intelligence (80)	561	18.4
Transportation (60)	180	17.8
Biomedical Services (92)	206	17.4
Financial (67)	186	15.5

These were the ten career fields with the highest representation of enlisted women and women officers at the end of FY '84.

Of course, no large institution can sustain a structural change, like the increase in the role of Air Force women, without some kind of lasting effect. That increase has brought with it challenges we have not had to face before. Since we lifted the pregnancy restriction, the percentage of women who are pregnant has remained fairly constant (around four percent per year). However, the number of pregnant women has increased as the number

An electrical engineer at work at Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Women entering the Air Force today can choose from virtually all officer career fields and from a wider variety of enlisted skills than are available in the other services. (Photo by Walt Weible)

of military women increased (1,600 pregnant women at the end of 1978 compared to 2,650 at the end of January 1984). Although this situation is manageable now, minimizing the effect of pregnancies on readiness may require more innovative approaches in the future.

In January 1984, around 3,800 (5.7 percent) Air Force women were single with dependents. While the implications of this situation for readiness are serious considerations for any commander, they are not restricted to women. Although less than one percent of our male members are single with dependents, the actual numbers amount to about a thousand more men than women.

A closely allied change is the increase in the number of military couples. In an Air Force that is today sixty-three percent married, 24,000 of our couples are made up of both husband and wife in blue uniforms, and half of those couples have dependent children. While the total number of people in the Air Force since 1975 has remained relatively stable, the proportion of Air Force women with military husbands is up from twenty-eight percent to thirty-six percent, and the percentage of members with military spouses has risen from 2.8 percent to 8.2 percent.

The complications for our personnel system are evident. Imagine, for example, the woman KC-135 pilot at Plattsburgh AFB, N. Y., who marries an FB-111 pilot. When reassignment time comes, she has a selection of twenty-four bases where KC-135s fly; he is fairly well limited to Plattsburgh AFB or Pease AFB, N. H. Or consider the new recruits at Chanute AFB, Ill., being trained in engine maintenance. When a woman specializing in F100 fighter engines decides to marry a man who will work on J57 engines on the B-52, that's a challenge for any personnel system. Trying to coordinate assignments for two Air Force people, often with different specialties and base possibilities, is complex and gets more so as those couples gain in seniority.

The Future

A military problem common to many nations—including the Soviet Union—is that in 1992 we will reach the low point of the eighteen-year-old pool of males from which to draw recruits. Not surprisingly, the female cohort (the corresponding group of eighteen-year-old eligibles) declines at a similar but slightly faster rate. The concern has been that the '80s will be a difficult time for military recruiters.

For several reasons, we are optimistic that the declining youth cohort will not affect our manpower plans significantly—either for men or women. In the first place, the Air Force has already experienced nearly half of the projected decline. We are learning how to plan better in the competitive environment. In the second, in FY '79 (the highest point in the male cohort population between 1960 and 2000), all services fell short of their recruiting goals by 24,000. Thus, it appears that the availability of eighteen-year-olds is not as major a factor to consider. Finally, the Air Force does not recruit from just a one-year group but from across a wide age range: seventeen to twenty-seven. For example, in FY '83, only fifty-two percent of our new recruits were eighteen- or nineteen-year-olds.

Where might women in the Air Force be, say, fifteen years from now, at the turn of the century? I don't know for sure, but I'll give you some educated guesses.

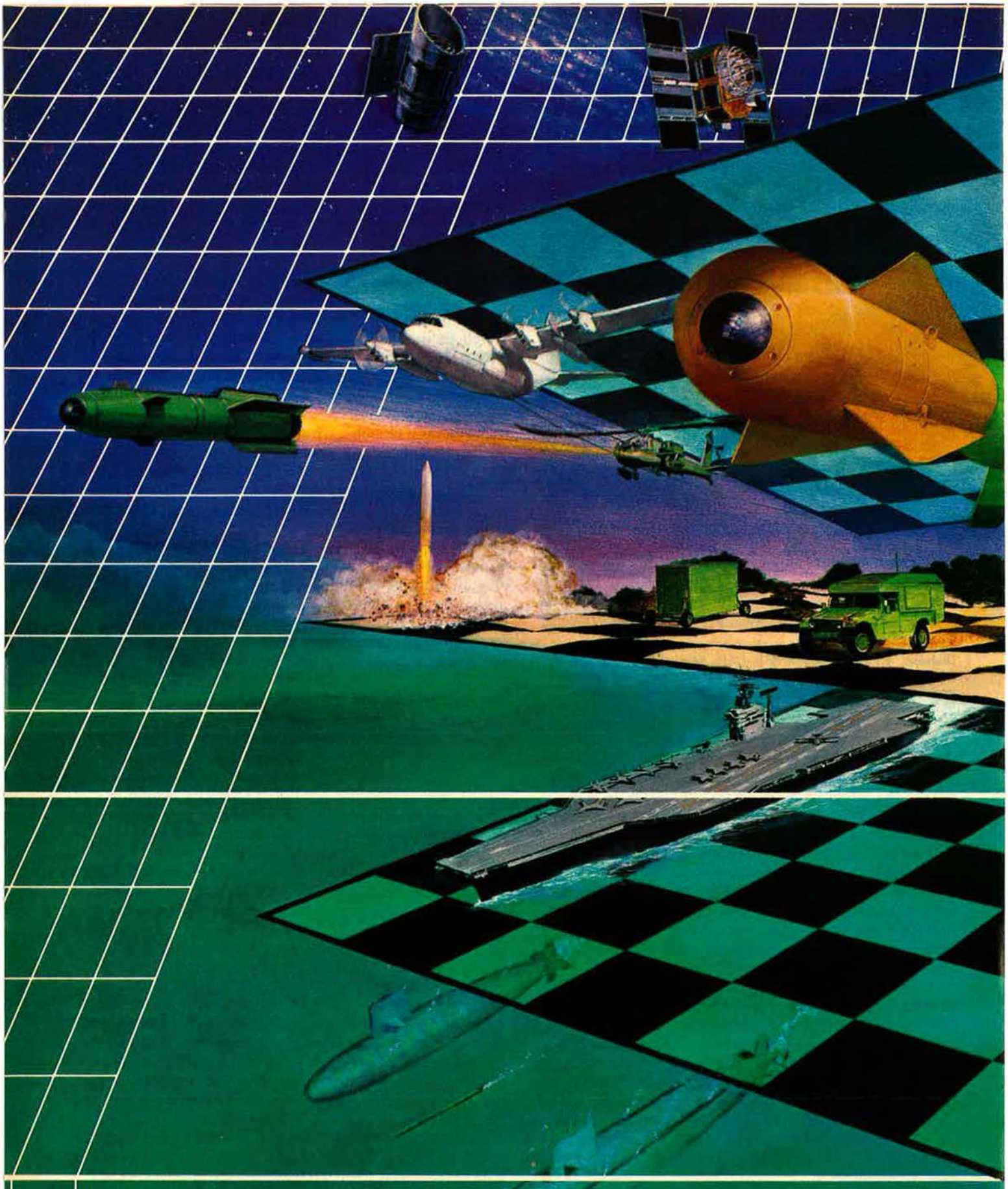
For one, women will continue to choose from the wide range of jobs the Air Force offers its people. Except for those few fields that involve potential offensive combat, every job will be open to women.

Today we have a group specifically charged with evaluating Air Force policies toward women and proposing ways to do things better. I expect their recommendations soon. Part of the task is to reexamine each of the restricted career fields to ensure our policy is thorough, flexible, and fair. This process will be a continuing one as the question of how we use our personnel resources gains importance.

Above all, as we approach the peak of the wave that began in 1972 and see more women staying through at least twenty years, I know women will be competitive for a larger share of flag billets and stars. I look forward to that day when a woman has the same opportunity as her male counterpart to be the Chief Master Sergeant of the Air Force or a MAJCOM commander.

This article has briefly mentioned a few of the notable "firsts" achieved by women. Our long-range goal is to be able to refer to women without noting the "firsts." Only after women become a more accustomed part of the Air Force picture will we have achieved this goal.

In 1976, we dissolved the WAF as a separate organizational management entity. That action was a start. It remains for us to finish the job. ■



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The Air Force a

A fledgling "boomer" in a KC-10 boom operator trainer practices in-flight refueling of an F-15. The KC-10 experience has been so successful that USAF is expanding airline training of Air Force aircrews.

THERE are some things the airlines can do better than the military. No question about it.

That was certainly true in 1934 when President Roosevelt canceled the airlines' mail contracts and ordered Maj. Gen. Benjamin Foulois to use the Army Air Corps to deliver the airmail.

What followed was a nightmare. Ill-equipped for the mission, with only limited experience in bad-weather flying, the Air Corps pilots undertook their new mission in the middle of winter. Within three weeks, nine flyers had been killed flying the mails and others seriously injured.

The cost of flying the mail rose from the airlines' average of fifty-four cents per mile to an average of $2.21 per mile with the Army. The military wasn't prepared or equipped for the job.

In 1941, the Air Corps faced another job for which it wasn't equipped—operating and maintaining an intercontinental airlift force. The Air Corps turned to the airlines, which had already begun acquiring four-engine long-range transports for commercial use. Recognizing the airlines' capabilities, Gen. Hap Arnold decided against commandeering the airlines' aircraft. Instead, he created the Air Transport Command and mobilized the nation's airlines as part of the ATC.

The Airlines in Action

And the airlines came through. Starting with only four Boeing 307 four-engine aircraft owned by TWA, the airlines set out to accomplish the missions assigned: Northwest would build routes to the Aleutians; American and TWA were responsible for the North Atlantic

The commercial carriers perform a wide range of services, including crew training, for USAF.

BY MAJ. PHIL LACOMBE, USAF

nd the Airlines

routes to England; Pan American and American Export flew the Central Atlantic routes to Africa; United and Pan Am shared the Pacific routes to Guam, New Guinea, and Australia; and Panagra (Pan American-Grace Airways) and Eastern flew to Central and South America.

Before the war ended, the airlines and the military proved themselves an able team, with about half of all ATC traffic being handled by each. The modern relationship between the Air Force and the airlines is firmly rooted in the cooperation built by ATC.

Today, Military Airlift Command (MAC) still contracts with the airlines to carry Defense Department passengers and cargo. In fact, eighty-five percent of all DoD international passengers fly on commercial airliners under contract to MAC.

Most of the airlines' military work is routine passenger and cargo airlift flown within the US and overseas. But the airlines also provide special airlift in contingencies and support deployment exercises with contracted airlift sorties. They move a lot of people and equipment for MAC. In FY '83, for example, the airlines flew 760,000 DoD passengers and carried 21,000 tons of DoD cargo.

Most of the $347.9 million paid by MAC to the airlines in FY '83—$299.6 million of it—was for routine airlift. Another $27.9 million went for special airlift missions, and $20.4 million was paid for exercise airlift.

FY '85 Contracts

The partnership will continue in FY '85. MAC, as DoD's single manager of airlift, will pay twelve airlines $220 million for scheduled international airlift. This does not include domestic, exercise, or special airlift. In addition, the command contracts with Canadian and Danish carriers for airlift support of Distant Early Warning (DEW) Line sites and other requirements.

The twelve US international carriers under contract to MAC in FY '85 are: American Trans Air Inc., $362,000; Arrow Air, Inc., $7,036,000; Continental Air Lines Inc., $719,000; The Flying Tiger Line, $59,178,000; Northwest Airlines, Inc., $38,543,000; Pan American World Airways, Inc. $11,780,000; Tower Air, Inc., $703,000; Transamerica Airlines, $31,054,000; Trans World Airlines, Inc., $8,700,000; United Air Carriers, Inc. (doing business as National Airlines, Inc.), $28,160,000; United Airlines, Inc., $3,287,000; and World Airways, Inc., $30,734,000.

The Air Force-airlines cooperation extends beyond contracting airlift. In fact, these routine airlift contracts are incentive contracts, available only to airlines participating in the Civil Reserve Air Fleet, or CRAF. CRAF is a voluntary network of airlines that provides additional airlift capability to MAC. These aircraft operate in the civilian sector during peacetime, but are committed to MAC during war—an arrangement reminiscent of ATC during World War II. Airlines participate in CRAF by designating aircraft, crews, ground support personnel and equipment, and facilities to MAC in three separate stages.

The first stage, known as Committed Expansion, can be initiated by CINC MAC and is used to beef up routine services during small or limited contingencies when MAC's organic airlift capabilities are diverted from routine missions. Airlines have twenty-four hours to pro-

vide the required resources to MAC during this stage.

The second stage is Airlift Emergency, which requires additional aircraft within twenty-four hours but does not actually mobilize the airlines. The Secretary of Defense has the authority to initiate an Airlift Emergency.

A full mobilization of CRAF resources is the third stage. Following declaration of a National Emergency by Congress or the President, the Secretary of Defense orders remaining CRAF resources to be delivered to MAC within forty-eight hours.

Variations in CRAF

The number of CRAF aircraft varies each month according to how many aircraft can be made available by the airlines. As of August 1, 1984, for example, there were twenty-six airlines participating in CRAF with fifty aircraft available for Stage I operations, 108 for Stage II, and 367 for Stage III.

CRAF requirements are varied, and the airlines provide a full range of airlift capability—short-range domestic aircraft, short- and long-range international aircraft, and a special category dedicated to support of Alaska. CRAF has been around for more than thirty years, but has never been activated. In every situation where additional airlift has been needed, however, the airlines have volunteered their resources without waiting for a CRAF call-up.

MAC estimates that CRAF resources will account for about half of DoD's long-range airlift aircraft in wartime. Projections indicate CRAF aircraft would provide nearly all of DoD's passenger capability and approximately one-third of DoD's cargo capability to deploy military forces to overseas locations.

Airline Training Programs

The Air Force has also turned to the airlines for simulator development. Other contractors are involved as well, but the airlines offer the advantage of experience in using simulators, maintaining them, and integrating them into flight instruction programs.

With flying costs so high, the airlines began turning increasingly to simulators years ago. American Airlines, for example, conducted a study in the late 1960s to determine the most effective methodology for aircrew training. Centralized training with heavy use of simulation figured prominently in the recommendations of that study.

A quick look at some of American Airlines Training Corp.'s past programs shows a number of sizable Air Force programs. (AATC is owned by AMR Corp., which also owns American Airlines.) Among them are a contract to modify the computers used in the GP-4 simulator for the F-4 and F-111 by installing an AATC-developed solid-state memory module and a contract to provide camera and model visual systems scaled according to Air Force requirements—along with associated computers to interface simulators and visual systems—to the Air Force's Flight Dynamics Laboratory, to MAC for C-5 and C-141 training, and to Air Training Command for T-37 and T-38 aircraft simulators. American has also provided Air Force Logistics Command with replacement digital function generators for C-130 simulators and has designed, built, and installed a night-only visual system for C-5 and C-141 flight simulators.

Pilot Training, Too

In addition to these "hardware" programs, the airlines are conducting training for some Air Force pilots, especially in those systems the Air Force operates in limited numbers. For example, the Air Force's C-9 is a military version of the popular commercial DC-9 airliner. C-9 initial qualification training and refresher

The airlines first demonstrated the ability to do some things more cheaply than the military when they carried the mail. Leon Cuddeback, above, flew the first scheduled mail in commercial aviation in this Swallow biplane, from Pasco, Wash., to Elko, Nev., on April 6, 1926, flying 487 miles in two hops.

training is provided by Republic Airlines, Inc., for 126 students each year (forty initial training slots and eighty-six refresher training). KLM has a contract with MAC to provide instructor pilot and aircraft commander upgrade training for ten Air Force C-9 pilots each year.

In addition, Western Air Lines, Inc., provides initial qualification training for C-22A pilots, and Pan American provides initial and refresher ground school and simulator training for C-137 pilots. (C-22A is the Air Force designation assigned to a Boeing 727 airliner that was transferred from the FAA to USAF in April 1984. It will be used by US Southern Command as a mission support aircraft.)

But the largest and most extensive airlines training of Air Force pilots is the KC-10A program operated by AATC for SAC. The three-year-old program has already produced about 600 qualified crew members—pilots, flight engineers, and dual-qualified boom operators/loadmasters. The KC-10A program is a hallmark in the relationship between the Air Force and the airlines. Leon Heinle, AATC's Acting Vice President for Marketing, noted, "It marks a significant new direction for the Air Force in training aircrews."

The Barksdale Connection

Basically, the program involves sending Air Force KC-10A student crew members to the AATC training facility at Barksdale AFB, La. The program resulted from an Aeronautical Systems Division study, commissioned by the Air Staff, that found that contractor training of KC-10A aircrews would be more economical than

Air Force training. In fact, the Air Force projects the cost for in-house training of three aircrews per aircraft over a twenty-year period would be about $227.8 million. The American Airlines contracted program will only cost $134 million over twenty years. But the benefits to the Air Force go beyond the dollar savings.

Robert E. Gordon, President of AATC, highlighted some of these benefits for a congressional subcommittee: "The KC-10A contractor instructors have a combined military experience totaling more than 400 years. Rather than being a lost resource, this military experience and expertise is retained through retired personnel. Instruction becomes a career rather than just being one facet of the career of a military member."

Leon Heinle pointed out another aspect of this benefit. "You free pilots for their primary mission—training for combat in their weapon systems. You don't have to mortgage your instructor cadre in the event of crisis or wartime. The instructors are still there, prepared to train additional aircrews without tying up vital Air Force aircrews."

AATC also cites its guarantee to SAC that it will deliver qualified aircrew members—according to SAC standards—without dispute. "If SAC says a student does not meet the criteria, we retrain the student," Mr. Heinle said. "It is that simple."

SAC has a liaison officer stationed at the AATC headquarters at Dallas/Fort Worth Airport and two NCOs at the Barksdale facility. Further, there are semiannual reviews of the program by SAC, and AATC instructors maintain currency in the KC-10 by flying with SAC KC-10 crews.

In the Simulator

The training program itself consists of training in a KC-10A simulator, built by Link-Miles, that provides six degrees of motion and computer-generated high-fidelity visuals. There is also a cockpit procedures trainer (CPT) that is a high-fidelity representation of the KC-10A cockpit and that is used to train Air Force crews in normal, abnormal, emergency, and crew coordination procedures. AATC built the CPT at its new facility in Dallas. There's also a boom operator trainer, with realistic instrument readings, audio effects, and realistic reactions to control inputs. In addition, the visual system replicates the last 300 feet of receiver approach to the KC-10A. Instructors can also introduce various visibility restrictions, turbulence, or other nonroutine situations.

The heart of the training system is a sound-slide system interacting with a computer to provide crew members with training in aircraft systems operations. This system is integrated with all texts and instructor guides and automatically tracks student progress through the course.

Cockpit procedures trainers like this one are an integral part of an American Airlines Training Corp. program that turns out KC-10 aircrew members guaranteed by American to meet the exacting standards of SAC.

The final element in the training system is the cargo load trainer. This one-twelfth-scale reproduction of the KC-10A's cargo space can address any variation of loads that might be required.

Six Separate Courses

AATC actually operates six separate KC-10 courses. There's an initial qualification course, designed to train all crew members to SAC standards. For pilots, this is a seven-week program that includes twenty-one CPT mis-

sions and fifteen simulator "rides." Flight engineer training is also seven weeks long, with twenty-three CPT missions and thirteen simulator missions. Boom operator training is three weeks long, with two CPT missions and eight missions in the boom operator trainer.

A refresher course updates aircrews on changes in systems procedures and expands knowledge of abnormal and emergency operations. An instructor course augments knowledge from an instructor's point of view, and a pilot upgrade course concentrates on the flying skills required in the KC-10 as well as on crew coordination and operational decision-making. AATC also operates a requalification course for those not current in the aircraft and provides a two-week senior staff course to familiarize staff officers with safe operation procedures for the KC-10 and with the use of flight-guidance systems.

The future promises an expansion of the relationship between the airlines and the Air Force, following the success of the KC-10A training experience. That expansion is already under way. United Airlines Aircrew Training, Inc., recently won a fifteen-year $97 million contract to provide C-5 aircrew training. United will provide C-5 simulator training and instruction for about 3,500 Air Force crew members and engine-run maintenance personnel each year.

Future Looks Good

Mr. Gordon painted a rosy future for contractor training of military aircrews: "We are pleased to be a part of the DoD procurement process and to be partners in the business of training a highly skilled warfighting force. . . . The commercial approach to training is working for the KC-10 program. It will also work for the Air Force E-3 program, which was recently contracted to another company [not an airline]. . . . We have heard that the Navy may contract for a commercially operated training program for the E-6 system. We believe that this is the way of the future in providing DoD with cost-effective and quality training for our fighting forces. The end product of a total systems approach to training is a student trained to user-defined standards of proficiency."

Airlines also provide facilities and base services under contract to the Air Force. Pan Am is the leader in this category, with a $109 million contract (FY '84) to operate the Eastern Space and Missile Center's Eastern Test Range and a $67.3 million contract to provide support at Air Force Systems Command's Arnold Engineering Development Center in Tennessee.

Pan Am's leadership began long ago, with its early effort in charting Pacific air routes and establishing bases along those routes. When President Franklin Roosevelt needed to establish air routes to Africa and an African base without using the military prior to the outbreak of hostilities in World War II, he turned to the international aviation leader, Pan Am. Pan Am accomplished the mission, providing a valuable air link for the subsequent war effort.

Just before World War II, the government asked Pan Am's controversial president, Juan Trippe, to assist in wresting control of the South American airlines from the Germans. Pan Am people arrived along with Colombian forces to take control of the Colombian-based SCADTA airline, which had been under German operational control.

In the early 1950s, the Air Force hired Pan Am (through its subsidiary, Pan Am World Services) to assist in providing technical expertise, engineering, services, and facilities to build the Eastern Test Range (ETR—a string of ground-tracking stations extending over 4,000 miles from the Eastern Space and Missile Center headquarters at Patrick AFB, Fla., to Ascension Island).

World Services General Manager Timothy J. Moriarty described Pan Am's mission on the test range: "The Air Force Eastern Test Range mission is to test and launch missiles. We are a mission-oriented project. The Air Force mission is our mission."

At the test range, Pan Am World Services handles a variety of tasks required to support the Air Force. The company's technicians work in such technical specialties as telemetry, timing, and firing techniques and in support services, including food service, security, and maintenance.

Pan Am also provides meteorological services for NASA and Air Force launches. The company has launched more than 10,000 small weather rockets to determine weather conditions at altitudes up to 300,000 feet.

The most important aspects of Pan Am's launch support function are providing accurate impact data to the Air Force Range Safety Officers and directing and coordinating all contractor range support elements. Pan Am's people also provide a variety of support services at Patrick AFB and operate ETR's downrange tracking facilities.

Pan Am World Services has another AFSC contract to provide base support for Arnold Engineering Development Center. At AEDC, Pan Am has about 1,400 employees supporting the Air Force's jet and rocket test facilities with various personnel, management, maintenance, security, and medical services.

Heritage and Partnership

The base support and range support services provided by Pan American for the Air Force are only a portion of the airline's total support for the Defense Department's mission. Pan Am has other DoD contracts as well, which, when added to the two Air Force contracts and the airline's airlift contract, make Pan Am the leading airline contractor in DoD. Pan Am is the only airline listed among the top 100 DoD contractors for FY '83. The airline ranks forty-first with prime contracts worth $449,992,000.

The relationship between the airlines and the Air Force has come a long way. Today, the airlines figure more prominently in the Air Force mission than at any time previously.

In a very real sense, the airlines are partners of the Air Force—partners with a common heritage molded by the early aviation pioneers who flew in both communities. ■

Maj. Phil Lacombe, USAF, is a career public-affairs officer currently attending Air Command and Staff College at Maxwell AFB, Ala. He was a Contributing Editor of AIR FORCE *Magazine in 1981–82 under the Air Force's Education With Industry Program.*

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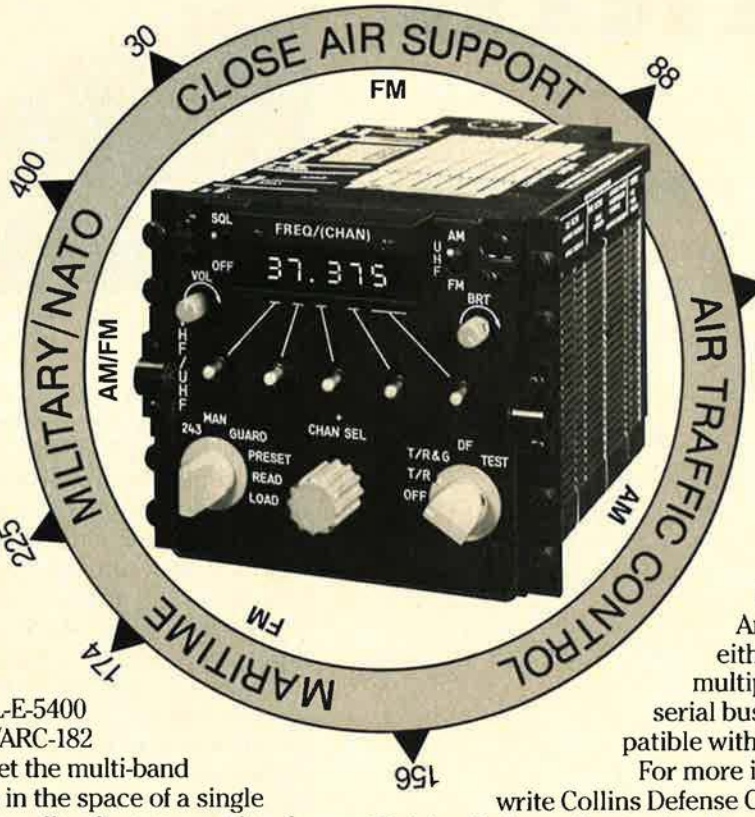

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Eagle Talk

For the past three years, Command and Staff students have heard about history from the aviators who lived it.

BY IRENE W. McPHERSON

THROUGHOUT the ages, the story of mankind has been recorded in heroic deeds. Students study political and military histories that cover centuries of warfare on land and sea, and memorials honor great generals and admirals. Now that newcomer to military organizations—the United States Air Force—has a better idea.

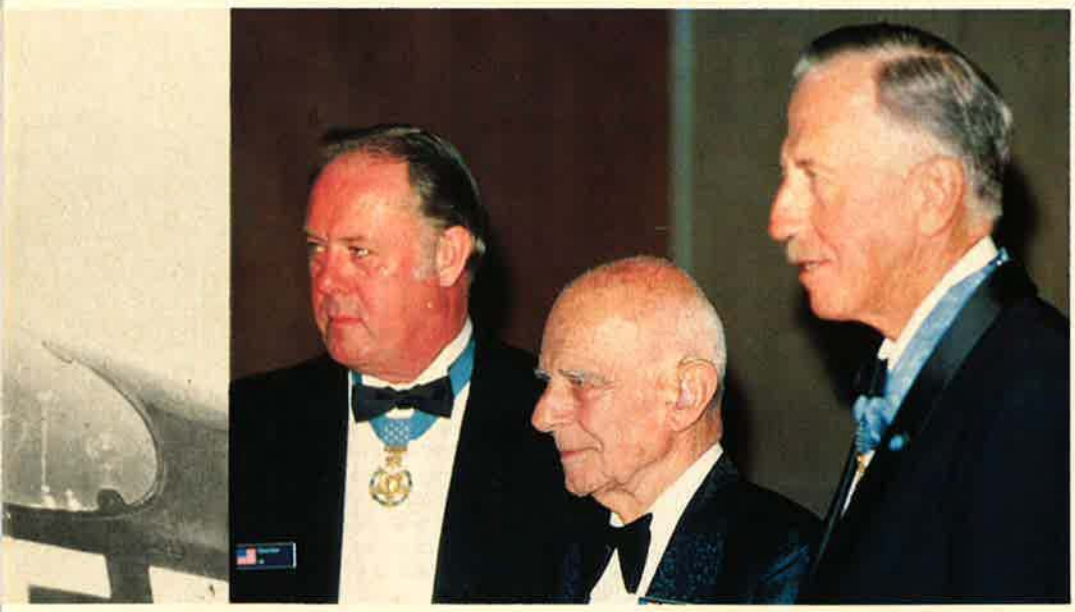
It was not until World War I that combat was waged in the air, and much of aviation history is even more recent. Books and articles have left much unrecorded, though, and, in any case, the printed page is a pale substitute for hearing history from those who made it.

Students at the Air Command and Staff College (ACSC), Maxwell AFB, Ala., are discovering the proud heritage of the Air Force through a program of living history called a "Gathering of Eagles." For the past three years, legendary figures in international aviation have come to ACSC during graduation week to be honored and heard. Among those taking part have been

you're in the Air Force, why you're in a service-oriented profession."

Most of the aviation greats invited to a "Gathering of Eagles" to meet with students react much like Col. Waclaw Makowski, recipient of Poland's highest orders of valor, the *Virtuti Militari* and Cross of Gallantry, and whose experiences in aviation cover forty-six years.

"I am honored," said Colonel Makowski. "I was surprised [to be invited] because I do not consider myself to be either a record-setter or a war hero. It then dawned upon me that I have aviation history in my blood and that I would be enchanted to share my experiences with the newly graduated young staff officers. . . . I am profoundly moved to be once again among the young officers. Once, I drove a horse and buggy across the sky—today they are reaching for the stars. Looking back, I can only say that I did my duty as I saw it, and occasionally had fun doing it, and I hope I have earned my place among those who aim for the sky."



FAR LEFT: Brig. Gen. James H. Howard, USAF (Ret.), won the only Medal of Honor awarded to a World War II fighter pilot in Europe. LEFT: Medal of Honor recipients (from left) Lt. Col. Gerald O. Young, USAF (Ret.); Lt. Gen. James H. Doolittle, USAF (Ret.); and Brig. Gen. James H. Howard, USAF (Ret.), were among the twenty-two aviation greats who participated in the 1984 Gathering.

Gen. Curtis E. LeMay, Lt. Gen. James H. Doolittle, Brig. Gen. Charles "Chuck" Yeager, Neil Armstrong, and Capt. Walter M. Schirra, Jr. Others, some less well known and some all but forgotten, have been there, too.

During the third "Gathering of Eagles" in 1984, twenty-two aviation greats participated. The group included aviation pioneers, space pioneers, record-setters of speed and altitude, airpower strategists, and leading aces.

"Fantastic Experience"

"It's a fantastic experience to be associated with the program and simply to talk with the aviators," says Maj. Michael Dennis Kozak, a student in the 1982 class and now a member of the faculty. "It's interesting knowing what their experiences are and what they have to tell people in the Air Force right now. Their attitudes and philosophies are very refreshing, and it just kind of sparks you with the motivation you have for what you're doing, why

Born in 1897 into a Polish family, Makowski grew up in the Ukraine and Central Russia, where his father, a doctor, was fighting cholera epidemics. Joining the Technological Institute in Kiev in 1914, he watched his senior colleagues conduct experiments under the direction of aviation pioneer Igor Sikorsky. Drafted into the Czarist Army, he flew for the first time as a passenger in a Russian Flying Corps airplane.

When the Czarist Army began to disintegrate after the outbreak of the Russian Revolution, Makowski narrowly escaped to Poland, where the newly organized Polish Army was seeking to regain territory that Russia had controlled for more than 100 years. He became the first pilot to graduate from independent Poland's flying school and went into action against the Bolshevik Army in the fall of 1919. He learned to fly in an Austrian Brandenburg training aircraft, and his first operational aircraft was a German Albatros two-seater biplane—both World War I surplus aircraft.

"In the month of May 1920," says Makowski, "after great seesaw battles against the Soviets, the Polish Army occupied Kiev. . . . Now I flew over the Eastern European plains—dogfighting, watching the enemy's movements, and strafing and bombing his columns. . . . Then the fortunes of war changed again, and, faced with the new Soviet offensive, the Polish Army fell back toward Warsaw."

The Army retreated almost 500 miles, but then, reinforced by a makeshift volunteer army concentrated south of Warsaw, the Polish Army counterattacked against the Soviet left flank.

"It did so with fury," Makowski continues. "The Red Army was destroyed at the gates of Warsaw. I

flew missions from dawn to dusk, first reconnaissance, and then strafing and bombing the retreating Russians. Although it would drag on for some months, the war was over."

Poland enjoyed this period of independence for nearly twenty years. During that time, Makowski helped to found and served as General Manager of the Polish airline "LOT." He also served as President of the International Air Transport Organization, forerunner of the United Nation's International Civil Aviation Organization (ICAO).

Makowski returned to military duty shortly before Germany invaded Poland in September 1939. When Poland collapsed under the German onslaught, Makowski was one of 11,000 Polish airmen who escaped to England. Commanding No. 300 Squadron, the first operational Polish squadron with the Royal Air Force, and flying a Fairey Battle, Makowski led his unit on a mission against German barges massing for Operation Sea Lion, Hitler's planned invasion of Great Britain. In March of 1941, he flew a Vickers Wellington bomber on a mission to Berlin.

Sometimes a visiting "Eagle" is of special interest to a particular student. Such was the case for Maj. Michael H. Engelmeyer, student body president of the 1984 class. Major Engelmeyer's next assignment was to fly F-15s at Camp New Amsterdam (Soesterberg AB), just south of Amsterdam in the Netherlands. He especially welcomed the opportunity during the Gathering to talk with Squadron Leader (Col.) Bram van der Stok, Holland's only ace and most decorated aviator.

The Real Thing

Almost half of the ACSC academic year is taken up with the Warfare Studies part of the curriculum. In the past, the aviation history taught in the course came pretty much from books and lectures. Three years ago, however, an innovative and extremely successful new method of learning was introduced.

"In the fall of 1980," says Brig. Gen. Richard A. Ingram, ACSC Commandant, "we were evaluating our history program, trying to determine if it was relevant—were we studying the right people, were we spending too much time on older campaigns? Actually, [the answer] emerged when we were talking about leadership. I referred to General LeMay as an example of leadership in a particular instance, and it occurred to me—why should we read about it when General LeMay is alive and well and we can ask him about this particular circumstance?"

General LeMay came.

"Also," says General Ingram, "we were looking at a movie called *Twelve O'Clock High*, starring Gregory Peck. That movie is used quite often as a model for leadership in combat, and I remembered that one of the characters in this movie, in the famous bar scene in the RAF Club, was a young major named Paul Tibbets. It occurred to me again—why should we have to read or depend on a movie script when we could ask General Tibbets to come and talk to us about leadership as he saw it?"

So, Brig. Gen. Paul Tibbets, who, commanding the 40th Squadron in England, led the first American B-17 raid over German-occupied Europe, and who, commanding the 509th Composite Bomb Group, carried history's first atomic bomb to Hiroshima, was invited to talk to the 1981–82 class.

"We had an overwhelming response from the students," says Lt. Col. David L. McFarland, Chief of Warfare Studies. "Their ratings were like night and day from the average lecture to Tibbets's lecture—*overwhelming* in their critique forms."

Colonel McFarland is the faculty member who conceived the idea of establishing a class historical project, starting with the class of 1982, to develop an interest in aviation history by involving the students in a "living aviation greats" program. Colonel McFarland envisioned a project that would involve the whole class in a study of history yet that would be the project of just a few students—a "staff problem-solving project" involving research, communications, and planning.

"It's a thorough staff problem-solving project," says Colonel McFarland, "because the project officers have to go into everything that's involved. There is a tremen-

FAR LEFT: Col. Waclaw Makowski, whose experiences in aviation cover forty-six years, was the first pilot to graduate from independent Poland's flying school. LEFT: Colonel Makowski met with ACSC students at the 1984 Gathering of Eagles.

dous amount of research—very precise research—to get down to the specific tail number, for instance, of an airplane that an individual flew on a certain mission. Some of the well-known people are easy, but to come up with a Polish ace's [Colonel Makowski's] airplane that he flew in 1919 on the Lithuanian front in Poland against the Russians, to come up with an airplane that we *know* he flew! I didn't believe that it could be done, but it was."

Echo of D-Day

"We also tracked down Gen. Matthew Ridgway's pilot [Chester A. Baucke] who flew the plane that Ridgway jumped out of on D-Day, and we invited him here," says Maj. Robert L. Gregory, a project member in the 1983 class and now a faculty member and project advisor. "First of all, we didn't have a name. We knew what base he flew out of, and that's where we started. He got out of the service in 1946, right after the war, as a captain, and nobody had heard of him since then. But we found him, contacted him, and brought him here."

General Ridgway, a pioneer of airborne operations, was himself honored at the ACSC gathering in 1984.

Work on the "Gathering of Eagles" begins soon after the start of the school year. Four or five class members, selected by faculty advisors from a group of volunteers, plan and execute the project.

Only a handful of the aviation greats contacted during the past three years has declined to participate. On the contrary, most of the "Eagles" invited have accepted enthusiastically, and many have actively supported the program by returning throughout the academic year to meet with ACSC classes.

Evening social gatherings, buffet dinners, and barbecues give the students the opportunity to meet their guests and to discuss subjects informally that are of interest to them. The guests also meet each other and discuss their experiences, as students gather around to ask questions or just to listen and learn.

Medal of Honor winners like the Army's CWO Michael J. Novosel or the Air Force's Lt. Col. Gerald O. Young, who flew helicopter rescue missions in Vietnam, reminisce with "Uncle Wiggle Wings"—Col. Gail S. Halvorsen—who flew rescue missions of another type. His "Candy Bomber" went repeatedly into Soviet-blockaded Berlin in 1948 to deliver food, coal, and supplies. But he's best remembered for the miniature parachutes he dropped that carried candy for the children.

Astronauts Walter Schirra, Jr., and Brewster H. Shaw chat with aviators like Douglas Campbell, who flew the Nieuport 28 and who became the first American-trained ace of World War I, and George A. Vaughn, Jr., the World War I ace with thirteen victories in the British S.E. 5A and the Sopwith Camel.

These aces meet other aces from later wars. Brig. Gen. James H. Howard, USAF (Ret.), an honoree in 1984, won the only Medal of Honor awarded a World War II fighter pilot in Europe. As a major in the Army Air Forces in England, he engaged in what has been called "the greatest display ever seen of combat flying."

On January 11, 1944, as squadron commander with the 354th Fighter Group, Howard put his P-51B Mustang *Ding Hao!* through a series of maneuvers in actual combat that sorely tested the Mustang's reputation for speed, range, maneuverability, and structural integrity. Leading a group of fifty fighters in escort of a B-17 bomber force, he shot down one attacking Messerschmitt Bf 110, but became separated from his group.

Alone and facing thirty Luftwaffe fighters attacking the Flying Fortresses of the 401st Bomb Group, he confronted them single-handedly in a violent, thirty-minute battle, downing three fighters, scoring one probable, and damaging at least two others. When his ammunition ran out, he continued his attacks by diving in feints at the enemy fighters to break up their attacks. He gave up and headed home only when his fuel became dangerously low. The *Ding Hao!* received only one hit, and that a stray .50-caliber from one of the B-17s. Not one B-17 was lost.

Squadron Leader (Col.) Bram van der Stok is Holland's only ace and its most decorated aviator.

At the graduation dinner, students and their guests view rare pictures of the "Eagles" on a giant screen and listen to the accompanying soundtrack of words and music, and it is a stirring moment when the aviation greats on the dais are introduced. Col. Clyde C. Deckard, Jr., USAFR, who has moderated three of these events, says:

"They are like time bombs, just bursting to tell their stories, to impart their wisdom and knowledge to people who care and who will really listen. They are sources of information that are just unbelievable, and there is so very, very much to be learned from them. They are our heritage!" ■

Irene W. McPherson is a free-lance writer living in the Washington, D. C., area. An Air Force wife for thirty-three years, she is proud to have been a witness to the early growth of the US Air Force as a separate service. Now retired from duty as an active Air Force wife, she devotes her time to her writing, her husband, and her nine grandchildren.

VIEWPOINT

Gazing South With Myopia

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

Given half a chance, Central America need not fear a Marxist takeover. It may be denied that half a chance, though.

Campaign rhetoric bears a certain resemblance to the burning of incense. Both serve a ritualistic purpose; neither has lasting effect. As proof, recall the words of John F. Kennedy in one of his celebrated television debates with Richard Nixon. Kennedy took the Eisenhower Administration to task for permitting the establishment of a Communist base "only ninety miles off the coast of the United States."

Admittedly, this particular bit of campaign rhetoric was translated, later on, into the effort at the Bay of Pigs, but not with any real conviction. That venture will stand as an example of irresolute behavior on the part of the United States. What could have been an easy little amphibious operation was doomed by the last-minute denial of air superiority. The subsequent fiasco put Fidel Castro firmly in place as the USSR's Caribbean surrogate, and the New Frontier went on to other things. Two decades later, we face growing danger to the south.

Our Latin American policy has been one of inconsistency and uncertainty, with the single exception of Grenada, a splendid small triumph carried off too quickly for mobilization of the usual opposition. In all fairness, occasional displays of ineptitude like that of the CIA guerrilla manual have strengthened opponents' hands, but the basic opposition to an anti-Communist Caribbean policy needs no encouragement. It is firmly entrenched in various religious groups, in academia, and in a curious assortment of organizations staffed with the same earnest types who made a career of opposing the war in Vietnam.

Opposition to any decisive Latin American policy has been effective enough, thus far, at least to make any Central American opposed to Marxist revolution think twice before signing on to a US-backed operation. Congressional abandonment of the Nicaraguan FDN, or *contras,* for instance, stirs up unhappy memories of other halfhearted US ventures into counterrevolution, memories of the Cuban unfortunates at the Bay of Pigs, and—even more poignant—of the hill tribes of Indochina who joined our side.

It should now be clear to most people that the favorable judgments of Castro made early on were dangerous miscalculations, ones that allowed him to consolidate his power under the benign, if myopic, gaze of Uncle Sam. The Sandinistas are presently consolidating their revolution, and so they still talk of pluralism, and press freedom, and other democratic passwords.

Their actions, however, are the true indication of the direction in which they are moving, which is precisely in the same direction taken by Cuba. Because the *contras,* even with shaky support, have kept the Sandinistas busy, Nicaragua is still a seedy Marxist backwater, unable to do much in the way of exporting revolution, but that is plainly on the agenda. El Salvador first, then Guatemala and Honduras, with the rest falling like ripe mangoes.

It is difficult to understand the emotional support in this country for the Sandinistas and the FMLN revolutionaries of El Salvador. While it is true that government forces have committed atrocities, the guerrillas have caused a great deal more hardship and have had their full share in the killings. General Vidas Casanova has made much progress toward an effective and disciplined Salvadoran military while supporting President Duarte in the best democratic tradition.

Duarte, with his unblemished liberal, even left wing, credentials, should have the automatic support of American liberals in his efforts to end the destructive war. That he has, instead, the concerted opposition of liberal America, along with influential segments of the press and television, is a reflection either of mass liberal confusion or hypocrisy. Take your pick.

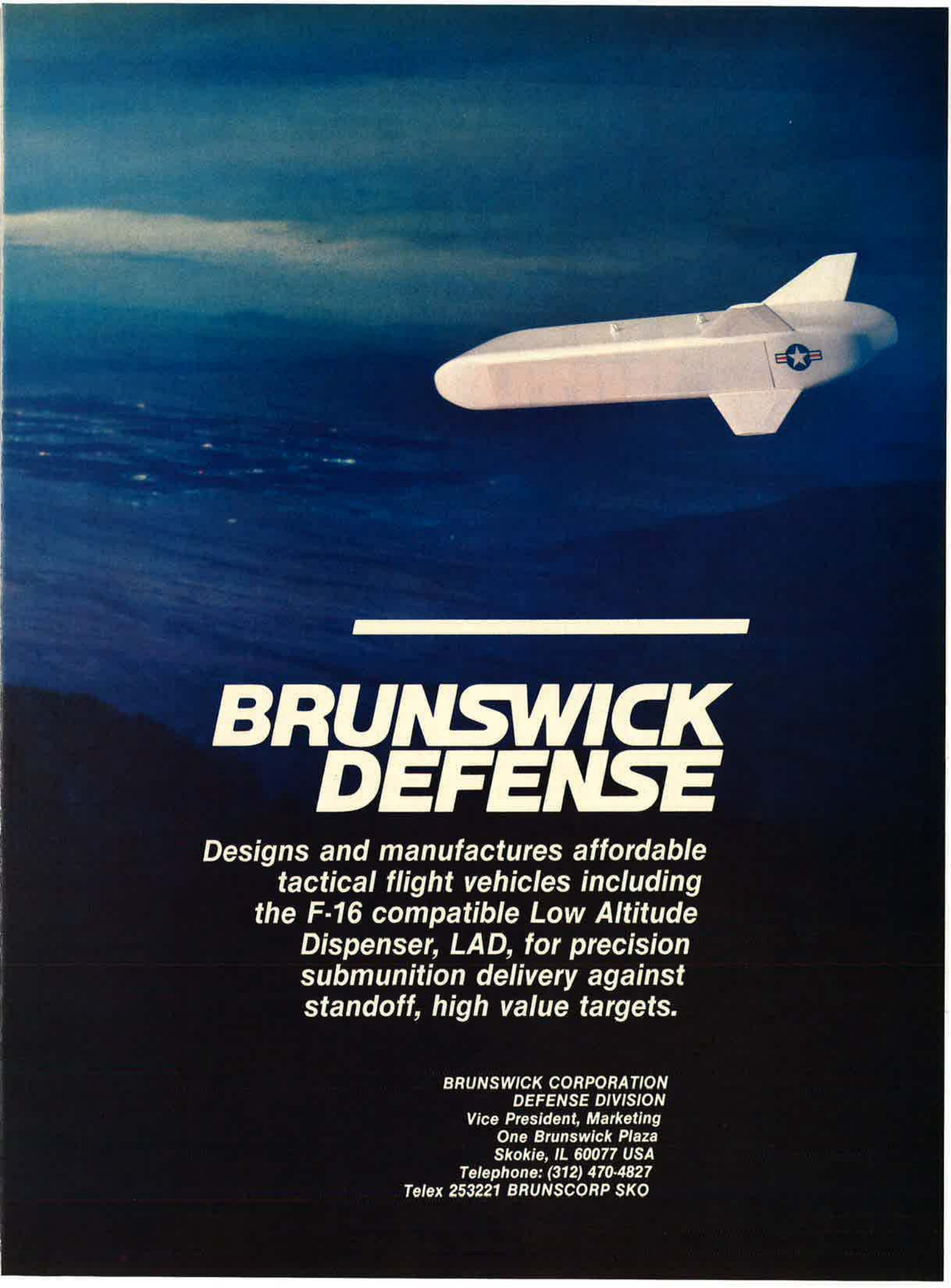
Across the border in Nicaragua, the Soviets are providing Hind helicopters and other modern weapons in quantity to the 50,000-man regular army and 200,000-man militia. Together with the weapons come a few hundred Soviets and East Germans and at least 1,500 Cuban advisors. All this to put down the FDN and, it goes without saying, to keep the population in line. Once the *contras* are taken care of, full attention can be given to El Salvador.

The sad thing about this story is that Central America, given half a chance, need not fear a Marxist takeover. A region once dominated by authoritarian military figures is now increasingly democratic. El Salvador held free elections and chose Duarte. Honduras has a democratically elected president, and even Guatemala will have free elections in 1985. Panama is democratic after its fashion, and Costa Rica has long been a democracy.

South America is moving along on the same path. In all of Latin America, only Chile, Paraguay, and Fidel Castro's Cuba have truly authoritarian regimes. Nicaragua is headed that way, but the Sandinistas have not yet snuffed out the opposition, nor has any real power figure emerged.

The trend is definitely toward freely elected governments and away from dictatorships, either of the right or left. No one can claim credit for this, but a strong United States interest in Latin America must have had something to do with it. Like politicians everywhere, those in Latin America talk one way for publication, another off the record. Off the record, they have been heard to applaud the military exercises in Honduras, the naval presence off Nicaragua's shores, and the new high profile of the US Southern Command, once a tropical old soldier's home.

If there is continued, effective, and nonclandestine US interest in Latin America, the Soviets and Cubans will be left, at best, with a down-at-the-heels Communist outpost in Nicaragua. ■



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JANE'S

ALL THE WORLD'S AIRCRAFT SUPPLEMENT

FEBRUARY 1985

Artist's impression of the British Aerospace experimental aircraft programme (EAP) technology demonstrator

BRITISH AEROSPACE

BRITISH AEROSPACE AIRCRAFT GROUP, WARTON DIVISION: Warton Aerodrome, Preston, Lancashire PR4 1AX, England

Major activities of this Division of British Aerospace include design and development of the experimental aircraft programme (EAP) technology demonstrator. This embodies features of the British Aerospace proposal for the EFA five-nation European fighter aircraft for the 1990s.

BAe EAP

British Aerospace exhibited at the 1982 Farnborough Air Show, and again at the 1983 Paris Air Show, a full-scale mockup of what was then known as the Agile Combat Aircraft (**ACA**). It represented the result of several years of private venture research and development by BAe, with industry support from Rolls-Royce, Dowty, Ferranti, Lucas, GEC Avionics, and Smiths Industries, at a total estimated cost of £25 million by mid-1983. MBB of Germany and Aeritalia of Italy had also contributed to the project.

No government support for the ACA was forthcoming, but, at the 1982 Farnborough show, the UK government announced that it would make a financial contribution to an experimental aircraft programme (**EAP**) technology demonstrator based on the ACA design. Required to fly in 1986, this "would bring together current component elements of demonstrator work and further advance our (UK) knowledge of the demanding technologies foreseen as essential to the high-performance requirements of future, advanced, fixed-wing combat aircraft of either STOVL or conventional design".

On 26 May 1983, BAe announced that a contract had been signed with the UK government for the design, development, and construction of a single demonstrator aircraft which would be used to prove three basic new technologies: advanced structural design, including extensive use of carbonfibre com-

posites; active fly-by-wire controls to ensure extreme agility; and an advanced electronic cockpit.

The EAP demonstrator is being developed and will be flown at BAe's Warton Division. It is funded by the UK Ministry of Defence, BAe, and its industrial partners. About 80% of the design, and more than 80% of the manufacturing content, are British. The remainder is mostly Italian, with German participation confined largely to certain avionics.

The original ACA mockup displayed in 1982–83 had twin fins; the EAP now has a single large fin similar to that of the Panavia Tornado ADV. There have also been changes to the air intakes and foreplanes, not necessarily as shown on the accompanying official artist's impression. Assembly of the fuselage was well advanced at Warton in late 1984, together with a second fuselage for static testing. The carbonfibre wings were being manufactured by BAe at Preston, with a second set under construction by Aeritalia in Italy for static tests. The fly-by-wire system will control the canards, wing leading-edge control surfaces, flaperons, rudder, and nosewheel steering.

Equipment will include a three-CRT cockpit with displays by Smiths Industries, VDO, and Teldix, GEC Avionics flight control and head-up display of the F-16 Lantirn type, control surface actuation by Dowty and Liebherr, a BAe Dynamics SCR 300E flight data recorder, and a Ferranti FIN 1064 inertial navigation system of the kind being retrofitted in RAF Jaguars. It is expected that the aircraft will be used for weapon system trials, and that alternative avionics from other manufacturers will also be evaluated. Power plant of the EAP will be a pair of advanced Turbo-Union RB199-104 afterburning turbofans.

With the UK committed to participation in the international programme for a European fighter aircraft (EFA), the relevance of the EAP is that it is designed to demonstrate a complete weapon system that would meet a generally similar requirement. Its first flight is scheduled for May 1986.

DIMENSIONS, EXTERNAL:

Wing span	11.17 m (36 ft 7¾ in)
Length overall	f4.70 m (48 ft 2¼ in)

AREA:

Wings, gross	52.0 m² (560 sq ft)

FMA

FÁBRICA MILITAR DE AVIONES: Avenida Fuerza Aérea Argentina Km 5½, 5103 Guarnición Aérea Córdoba, Argentina

The first flight in October 1984 of FMA's new Argentine Air Force jet trainer, the IA 63, is one of several recent events which indicate that a systematic updating of the nation's military aviation is under way. In the Air Force, a number of two-seat IA 58A Pucará ground attack aircraft have already been converted to single-seat configuration. More may be planned, and a prototype has been completed of a new single-seat version, the IA 58C, which will have an air-to-air defence capability. One Boeing 707, already in service, has been converted by Israel Aircraft Industries for ECM/sigint duties, and two others are to be modified by IAI as in-flight refuelling tankers. Under a programme known as SINT (Sistema Integrado de Navegación y Tiro), the nav/attack capability of the Fuerza Aérea's Dagger fighter-bombers (IAI-modified Dassault Mirage IIIs) is being upgraded by the installation of modern avionics which include an Elta 2001 radar and a cockpit head-up display.

Beginning with a small batch for the Comando Antartico, the Argentine Army has recently begun to receive up to 24 Aérospatiale AS 332 Super Puma troop transport helicopters from France, and is adapting its Agusta A 109s to carry Mathogo anti-tank missiles. The Army is also reportedly disposing of its three Aeritalia G222 twin-turboprop fixed-wing transports, although up to the end of 1984 no decision had been taken to proceed with the domestically designed ATL military light transport (described in the October 1983 *Jane's* Supplement), for which a South American partner is still being sought.

Formation of IA 58A Pucará two-seat combat aircraft of the Argentine Air Force

The following details for the IA 58 Pucará and IA 63 update those given in the August 1982 and October 1983 *Jane's* Supplements respectively.

FMA IA 58 PUCARÁ

This twin-turboprop light attack aircraft, named after a type of stone fortress built by the early South American Indians, flew for the first time on 20 August 1969 with 674 kW (904 ehp) Garrett TPE331-U-303 turboprop engines. It was followed on 6 September 1970 by a second prototype, powered by 761 kW (1,022 ehp) Turboméca Astazou XVI G turboprops, which were adopted as standard for the initial production version.

Four versions of the Pucará have been built, as follows:

IA 58A. Initial (two-seat) production version, first flown on 8 November 1974. Total of 60 ordered originally for the Fuerza Aérea Argentina (FAA), which subsequently ordered 40 more, and others to replace about 24 aircraft lost during fighting in the South Atlantic in 1982. Deliveries to the FAA began in the Spring of 1976, and only four of this version remained on the assembly line by August 1984, to which are added six for the air force of Uruguay. Currently in service with the FAA's III Brigada Aérea at Reconquista (2° and 3° Escuadrons) and the IX Brigada (4° Escuadron) at Comodoro Rivadavia. Early production IA 58A described in 1983–84 and previous *Jane's*. Some early production aircraft recently converted to single-seat configuration, with extra fuselage fuel tank in place of rear seat; further similar conversions may be planned.

IA 58B. As early IA 58A, but with more powerful built-in armament, in a deeper front fuselage, and updated avionics. Prototype only (AX-05), which first flew on 15 May 1979. Forty ordered for FAA in 1980, but cancelled subsequently in favour of continued production of IA 58A. Details in 1982–83 *Jane's*.

IA 58C. Newly developed single-seat version, described separately.

IA 66. Prototype (AX-06), developed to establish alternative source of power plant and first flown in late 1980. Converted from an early IA 58A, it was fitted with 746 kW (1,000 shp) Garrett TPE331-11-601W turboprops and had completed 100 hours' flying by Spring 1983. The original Dowty Rotol three-blade propellers were then replaced by McCauley four-blade propellers, with which testing resumed. Intended originally to follow IA 58A as export production version, in single-seat and two-seat forms. Future now seems uncertain following more recent development of IA 58C. Details in 1984–85 *Jane's*.

The following description, which applies to the current production IA 58A, differs in several respects from that of earlier aircraft as given in the August 1982 *Jane's* Supplement:

TYPE: Twin-turboprop close support, reconnaissance, and counter-insurgency aircraft; structural design based on MIL-A8860 to 8870 specifications.

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 two-spar semi-monocoque fail-safe structure of duralumin, with 075 ST upper and 024 ST lower skins. All-dural electrically controlled hydraulically actuated trailing-edge slotted flaps, inboard and outboard of each engine nacelle. Modified Frise ailerons of duralumin, with magnesium alloy trailing-edges, actuated by push/pull rods. No slats. Balance tab in starboard aileron, electrically operated trim tab in port aileron.

FUSELAGE: Conventional semi-monocoque fail-safe structure of duralumin frames and stringers, built in forward, central, and rear main sections. Upper part of nosecone opens upward for access to avionics and equipment.

TAIL UNIT: Cantilever semi-monocoque structure of duralumin; two-spar rudder and elevators have magnesium alloy trailing-edges. Fixed incidence tailplane and elevators mounted near top of fin. Curved dorsal fin. Rudder and elevators actuated by push/pull rods, and each fitted with electrically operated inset trim tab.

LANDING GEAR: Hydraulically retractable tricycle type, with emergency mechanical backup. All units retract forward, steerable nose unit (33° left and right) into fuselage, main units into engine nacelles. Kronprinz Ring-Feder shock absorber in each unit. Single Dunlop wheel on nose unit, twin wheels on main units, all with Dunlop Type III tubeless tyres size 7.50-10. Tyre pressure 3.10 bars (45 lb/sq in) on all units. Dunlop hydraulic disc brakes on mainwheels only. Parking and emergency brake. No anti-skid units. Landing gear suitable for grass strip operation. Provision for 80 m (262 ft) take-off run using three JATO bottles attached to underfuselage pylon.

POWER PLANT: Two 729 kW (978 shp) Turboméca Astazou XVI G turboprop engines, each driving a Ratier-Forest 23LF-379 three-blade variable-pitch fully-feathering metal propeller with spinner. Water injection system, flow rate 150 litres

(33 Imp gallons)/h for 2 min. Electric de-icing of engine air intakes. Fuel in two AMC fuselage tanks (combined capacity 772 litres; 170 Imp gallons) and one AMC self-sealing tank in each wing (combined capacity 508 litres; 111 Imp gallons). Overall usable internal capacity 1,280 litres (281 Imp gallons). Gravity refuelling point for all tanks on top of fuselage aft of cockpit. Fuel system includes two accumulator tanks, permitting up to 30 s of inverted flight. A long-range auxiliary tank, usable capacity 318 or 1,000 litres (70 or 220 Imp gallons), can be attached to the fuselage centreline pylon, and a 318 litre (70 Imp gallon) auxiliary tank on each underwing pylon. Possible external fuel loads are therefore 318, 636, 954, 1,000, or 1,636 litres (70, 140, 210, 220, or 360 Imp gallons); max internal and external usable fuel capacity is 2,916 litres (641 Imp gallons). Oil capacity 11 litres (2.4 Imp gallons).

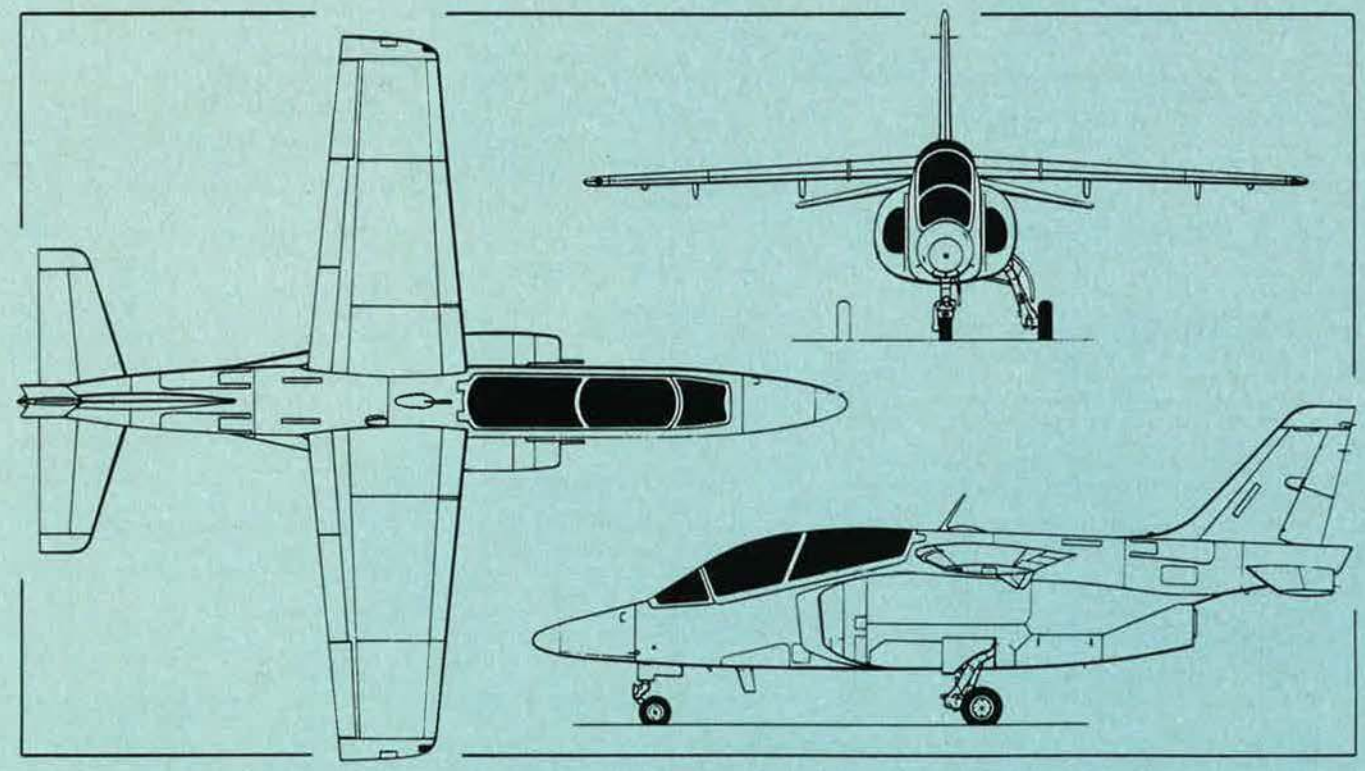
ACCOMMODATION: Pilot and co-pilot in tandem on Martin-Baker AP06A zero/zero ejection seats beneath single AMC moulded Plexiglas canopy which is hinged at rear and opens upward. Rear (co-pilot) seat elevated 25 cm (10 in) above front seat. Rearview mirror for each crew member. Teleflex heated and bulletproof windscreen, with wiper. Armour plating in cockpit floor, resistant to 7.62 mm ground fire from 150 m (500 ft). Dual controls and blind-flying instrumentation standard. Cockpits heated and ventilated by mixture of engine bleed and external air.

SYSTEMS: Air-conditioning, de-icing, and anti-*g* systems optional. Hydraulic system, pressure 207 bars (3,000 lb/sq in), supplied by two engine driven pumps, actuates landing gear, flaps, nosewheel steering, and mainwheel brakes. Independent pneumatic (compressed air) system on each engine to supply water injection, fuel system, inverted flight accumulators, auxiliary fuel tank transfer, and (port engine only) Dunlop canopy sealing system. Electrical system includes two 28.5V 5kW Turboméca engine driven DC starter/generators; two 250VA Flite-Tronics static inverters (main and standby), fed from DC emergency busbar, for 115/26V single-phase AC power at 400Hz; and a 24V 36Ah SAFT Voltabloc 4006A nickel-cadmium battery. No APU. Main oxygen system uses 5 litre (1.1 Imp gallon) Bendix liquid oxygen bottle and lox converter; separate gaseous oxygen supply for emergency use. L'Hotellier fire detection and extinguishing system, with Graviner extinguisher bottle.

AVIONICS AND EQUIPMENT: Standard avionics include Delta VOR/LOC/ILS, Smiths magnetic compass, Sperry gyro compass and dual artificial horizons, Bendix DFA-73A-1 ADF receiver, Bendix RTA-42A VHF com transceiver, SunAir RE-800 HF com transceiver, Bendix RNA-34 VOR/LOC/glideslope receiver, SunAir ACU-810 HF coupler/amplifier, Delta audio amplifier, and intercom. Optional avionics include ECM, weather radar, IFF, inertial navigation system, Machmeter, and VHF-FM tactical communications system. Standard equipment includes dual Pioneer airspeed and vertical speed indicators, dual Kollsman altimeters, dual Air Precision turn and bank indicators, dual Bendix accelerometers, dual attitude indicators (plus standby), dual bearing/distance/heading indicators, flap position indicator, dual landing gear position indicators, Air Precision chronometer, dual Jaeger engine rpm and AMC torque indicators, dual Brion Leroux propeller pitch indicators, dual Jaeger fuel and oil temperature indicators, dual Faure Herman fuel flow and AMC fuel quantity indicators, heated pitot intake, three pitot static ports, GE landing light in leading-edge of each underwing pylon, AMC taxying light on nosewheel strut, fin-tip anti-collision light, wingtip navigation lights, instrument panel lights, and warning lights.

ARMAMENT: Two 20 mm Hispano DCA-804 cannon, each with 270 rds, in underside of forward fuselage; and four 7.62 mm FN-Browning M2-30 machine-guns, each with 900 rds, in sides of fuselage, abreast of cockpit. Alkan 115E ejector pylon on centreline beneath fuselage, capacity 1,000 kg (2,205 lb); Alkan 105E pylon, capacity 500 kg (1,102 lb), beneath each wing outboard of engine nacelle. Max external stores load 1,500 kg (3,307 lb), including gun and rocket pods, bombs, cluster bombs, incendiaries, mines, torpedoes, air-to-surface missiles, camera pod(s) or auxiliary fuel tank(s). Typical loads can include twelve 125 kg bombs; seven launchers each with nineteen 2.75 in rockets; a 12.7, 20, or 30 mm gun pod and two 318 litre drop tanks; six 125 kg bombs and sixteen 5 in rockets; six launchers each with forty 74 mm cartridges, plus onboard ECM; twelve 250 lb napalm bombs; three 500 kg delayed-action bombs; or two twin-7.62 mm machine-gun pods, plus three launchers each containing nineteen 2.75 in rockets. SFOM 83A3 reflector sight permits weapon release at any desired firing angle; optional Bendix AWE-1 programmer allows release in step or ripple modes of single weapons, pairs, or salvos.

DIMENSIONS, EXTERNAL:	
Wing span	14.50 m (47 ft 6¼ in)
Wing chord:	
centre-section (constant)	2.24 m (7 ft 4¼ in)
at tip	1.60 m (5 ft 3 in)
Wing aspect ratio	6.94
Length overall	14.253 m (46 ft 9⅛ in)
Fuselage:	
Length	13.675 m (44 ft 10½ in)
Max width	1.32 m (4 ft 4 in)
Max depth	1.95 m (6 ft 4¾ in)
Height overall	5.362 m (17 ft 7⅛ 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	3.885 m (12 ft 9 in)
Propeller diameter	2.59 m (8 ft 6 in)
DIMENSIONS, INTERNAL:	
Cockpit:	
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)	2.00 m² (21.53 sq ft)
Trailing-edge flaps (total)	3.54 m² (38.10 sq ft)
Fin, excl dorsal fin	3.88 m² (41.76 sq ft)
Rudder, incl tab	1.15 m² (12.38 sq ft)
Tailplane	4.60 m² (49.51 sq ft)
Elevators (total, incl tabs)	2.612 m² (28.11 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	4,020 kg (8,862 lb)
Max fuel load:	
internal	1,000 kg (2,205 lb)
external	1,280 kg (2,822 lb)
Max external stores load	1,500 kg (3,307 lb)
Max T-O weight	6,800 kg (14,991 lb)
Max landing weight	5,600 kg (12,345 lb)
Max zero-fuel weight	4,546 kg (10,022 lb)
Max wing loading	224.4 kg/m² (45.97 lb/sq ft)
Max power loading	4.66 kg/kW (7.66 lb/shp)



FMA IA 63 two-seat basic and advanced jet trainer *(Pilot Press)*

PERFORMANCE (at AUW of 5,500 kg; 12,125 lb except where indicated):
Max critical Mach number at max T-O weight 0.77
Never-exceed speed at max T-O weight Mach 0.63 (405 knots; 750 km/h; 466 mph)
Max level speed at 3,000 m (9,840 ft) 270 knots (500 km/h; 310 mph)
Max cruising speed at 6,000 m (19,680 ft) 259 knots (480 km/h; 298 mph)
Econ cruising speed 232 knots (430 km/h; 267 mph)
Max speed for landing gear extension (all weights) 150 knots (278 km/h; 172 mph)
Stalling speed, flaps and landing gear down, AUW of 4,790 kg (10,560 lb) 78 knots (143 km/h; 89 mph)
Max rate of climb at S/L 1,080 m (3,543 ft)/min
Service ceiling 9,700 m (31,825 ft)
Service ceiling, one engine out 6,000 m (19,680 ft)
Min ground turning radius 6.50 m (21 ft 4 in)
T-O run 300 m (985 ft)
T-O to 15 m (50 ft) 705 m (2,313 ft)
Landing from 15 m (50 ft), landing weight of 5,100 kg (11,243 lb) 603 m (1,978 ft)
Landing run, landing weight as above 200 m (656 ft)
Attack radius at T-O weight of 6,500 kg (14,330 lb), 10% reserves of initial fuel:
with 1,500 kg (3,307 lb) of external weapons:
lo-lo-lo 135 nm (250 km; 155 miles)
hi-lo-hi 189 nm (350 km; 217 miles)
lo-lo-hi 216 nm (400 km; 248 miles)
with 1,200 kg (2,645 lb) of external weapons:
lo-lo-lo 216 nm (400 km; 248 miles)
hi-lo-hi 350 nm (650 km; 404 miles)
lo-lo-hi 378 nm (700 km; 435 miles)
with 800 kg (1,764 lb) of ordnance and 450 litres (99 Imp gallons) of external fuel:
lo-lo-lo 378 nm (700 km; 435 miles)
hi-lo-hi 485 nm (900 km; 559 miles)
lo-lo-hi 540 nm (1,000 km; 621 miles)
Ferry range at 5,000 m (16,400 ft) with max internal and external fuel 1,641 nm (3,042 km; 1,890 miles)
g limits +6.0/−3.0

FMA IA 58C PUCARÁ

First details of this new single-seat Pucará variant, which is to begin flight testing in early 1985, became available in the Autumn of 1984. Its development, based on experience gained during the Falklands/Malvinas campaign of 1982, is intended to extend its attack capability against such targets as helicopters and surface vessels, and to enable it also to carry out a low level air defence role.

Unlike the single-seat IA 58A conversions described in the preceding entry, it is the front cockpit which is deleted in the IA 58C. This enables the existing built-in armament of two 20 mm and four 7.62 mm guns to be supplemented by a 30 mm DEFA cannon with, initially, 240 rounds of ammunition. (This may be increased later to 500 rounds.) Externally, provision is made to carry CITEFA Martin Pescador (Kingfisher) supersonic tactical missiles, or a pair of Matra Magic air-to-air missiles for self-defence, on two additional Alkan launchers mounted under strengthened outer wings. Corresponding improvements and additions to the avionics include a predictor sight, a new and locally manufactured nose radar, an Omega navigation system, a radar warning receiver, and new cockpit displays including an HSI.

The IA 58C retains the same power plant as the A version, except that the Astazou XVI G engines are fitted with four-blade propellers; maximum take-off weight is not substantially affected. Cruising speed at sea level (presumably at max T-O weight) is estimated at 250 knots (463 km/h; 288 mph), and payload/range capability is expected to be increased by up to 20 per cent. Some Argentine Air Force officials have been quoted as saying that the FAA plans to retrofit its 70 or so IA 58As to IA 58C standard, but at the time of writing (November 1984) FMA was still waiting to learn whether this would be so, whether a production order would be placed for new-build aircraft, or whether re-equipment would involve a mixture of both. At the end of 1984, IA 58A production was at the rate of one a month, although the FMA's Grupo Fabricación is capable of producing up to three and a half Pucarás per month. Deliveries of the IA 58C are planned to begin in about July 1985.

First prototype of the FMA IA 63 Pampa

FMA IA 63 PAMPA

The origins of this new Argentine Air Force jet trainer were detailed in the October 1983 *Jane's* Supplement, and the first prototype (EX-01) was rolled out on 14 August 1984. It made a successful first flight on 6 October, piloted by Major Horacio Armando Oréfice, and four further test flights were completed before, on 10 October, an 'official' first flight was made by Vice Comodoro Genaro Mario Sciola, director of the company's flight test centre, to mark the 57th anniversary of the foundation of FMA. Second and third prototypes are due for completion in May and August 1985; a fourth flying prototype will follow.

Present plans are to complete flight testing and certification by October 1986, enabling the first 12 production aircraft to be in service for basic and advanced flying training with the FAA's Escuela de Aviación Militar at Córdoba by December 1987. The initial FAA order is for 64 aircraft, primarily to replace about 35 Morane-Saulnier Paris III jet trainers and a roughly equal number of piston-engined Beechcraft T-34A Mentors. Production is planned to reach three per month by the Autumn of 1988, when the IA 63 will also become available for export.

For weapons training, the IA 63 can be equipped with a 30 mm DEFA gun pod and underwing practice bombs. Development of an armed version for the light close support role, probably with an uprated engine such as the 19.13 kN (4,300 lb st) TFE731-5, is under consideration.

TYPE: Single-engined basic and advanced jet trainer.

AIRFRAME: As described in October 1983 *Jane's* Supplement.

POWER PLANT: One 15.57 kN (3,500 lb st) Garrett TFE731-2-2N turbofan engine, installed in rear fuselage, with twin lateral air intakes. Standard internal fuel capacity of 980 litres (215.5 Imp gallons) is contained in an integral wing tank of 580 litres (127.5 Imp gallons) and a 400 litre (88 Imp gallon) flexible fuselage tank with a negative *g* chamber. An additional 400 litres can be carried in auxiliary tanks installed inside the outer wing panels, to give a max internal capacity of 1,380 litres (303.5 Imp gallons). Single-point pressure refuelling system. Engine air intakes anti-iced by engine bleed air.

SYSTEMS, AVIONICS, DIMENSIONS, AND AREAS: As described in October 1983 *Jane's* Supplement.

WEIGHTS AND LOADINGS:
Weight empty 2,627 kg (5,791 lb)
Fuel load:
wings (incl auxiliary tanks) 792 kg (1,746 lb)
fuselage 323 kg (712 lb)
Design gross weight 3,200 kg (7,054 lb)
T-O weight, 'clean' configuration:
980 litres internal fuel 3,518 kg (7,756 lb)
1,380 litres internal fuel 3,814 kg (8,408 lb)
Max T-O weight with external stores 4,654 kg (10,260 lb)
Typical landing weight 3,330 kg (7,341 lb)
Wing loading:
at 'clean' T-O weight:
980 litres internal fuel 225.08 kg/m² (46.12 lb/sq ft)
1,380 litres internal fuel 244.02 kg/m² (50.00 lb/sq ft)
at max T-O weight with external stores 297.76 kg/m² (61.02 lb/sq ft)
Power loading:
at 'clean' T-O weight:
980 litres internal fuel 226.5 kg/kN (2.22 lb/lb st)
1,380 litres internal fuel 244.9 kg/kN (2.40 lb/lb st)
at max T-O weight with external stores 299.0 kg/kN (2.93 lb/lb st)

PERFORMANCE (initial flight tests, at T-O weight of 3,800 kg; 8,377 lb):
T-O speed 95 knots (176 km/h; 109 mph)
Optimum climbing speed Mach 0.45 (210 knots; 389 km/h; 242 mph)
Approach speed, flaps and landing gear down 120 knots (222 km/h; 138 mph)
Landing speed, flaps and landing gear down 100 knots (185 km/h; 115 mph)
Max rate of climb at S/L 1,158 m (3,800 ft)/min
T-O run 500 m (1,640 ft)
Landing run approx 700 m (2,296 ft)

PERFORMANCE (estimated, ISA, at design gross weight with 50% normal fuel, except where indicated):
Max limiting Mach number at 9,500 m (31,170 ft) 0.75
Max level speed:
at S/L Mach 0.61 (403 knots; 747 km/h; 464 mph)
at 7,000 m (22,965 ft) 442 knots (819 km/h; 509 mph)
Max cruising speed at 4,000 m (13,125 ft) 403 knots (747 km/h; 464 mph)
Max rate of climb at S/L 1,626 m (5,334 ft)/min

Time to 11,000 m (36,000 ft)	10 min 54 s
Turn rate (max sustained) at 4,000 m (13,125 ft)	12.9°/s
Service ceiling	12,900 m (42,325 ft)
T-O run at T-O weight of 3,490 kg (7,694 lb)	400 m (1,312 ft)
T-O to 15 m (50 ft) at S/L, T-O weight of 3,518 kg (7,756 lb)	640 m (2,100 ft)
Landing from 15 m (50 ft), landing weight of 3,330 kg (7,341 lb)	830 m (2,723 ft)
Landing run at landing weight of 3,330 kg (7,341 lb)	515 m (1,690 ft)
Range at 300 knots (556 km/h; 345 mph) at 4,000 m (13,125 ft), 980 litres internal fuel	542 nm (1,005 km; 624 miles)
Max endurance at 300 knots (556 km/h; 345 mph) at 4,000 m (13,125 ft), 1,380 litres internal fuel	2 h 48 min
g limit (max sustained) at 4,000 m (13,125 ft)	+3.5

BOEING

BOEING MILITARY AIRPLANE COMPANY: 3801 South Oliver, Wichita, Kansas 67210, USA

BOEING BRAVE-200

Brave-200 (Boeing Robotic Air VEhicle) is the designation of a series of low-cost multi-purpose RPVs, of which the YCGM-121A Pave Tiger *(see following entry)* is one variant. Powered by a 21 kW (28 hp) 438 cc flat-twin engine with a four-blade pusher propeller, the Brave-200 can be configured for such missions as ECM, defence suppression, and reconnaissance. Built of moulded plastics, it can be serviced, programmed, and launched by a two-man crew.

The central electronics unit, just forward of the fuel tank, interfaces with the payload, located in the nose of the vehicle. The Brave-200 can be surface launched from train, truck, or ship, and has 1.1kW of regulated power available for payload use. Zero-length rocket-assisted launch was chosen for simplicity, reliability, and rapid fire rate. A three-axis control system, developed by BMAC, integrates a yaw-to-turn capability into the digital autopilot, simplifying tracking and target alignment.

While a dead reckoning navigation system is an integral part of the Brave-200, alternative navigation systems can also be integrated into the vehicle if necessary. On a typical mission, Brave-200 would climb to an altitude of 2,500–3,500 m (8,200–11,500 ft) and proceed to the target area. The vehicle can loiter in the target area for the duration of its flight or move to another area and re-initiate its assigned mission.

The Brave-200 vehicles are designed for long-term storage and are programmed and launched on their 'fire and forget' mission by a small ground crew. The wings are folded along the fuselage to permit denser packaging during storage. They are sized so that 15 vehicles would fit in a 2.44 × 2.44 × 6.1 m (8 × 8 × 20 ft) standard international container.

DIMENSIONS, EXTERNAL:

Wing span	2.59 m (8 ft 6 in)
Length overall	2.13 m (7 ft 0 in)

WEIGHTS:

Payload plus fuel	approx 50 kg (110 lb)
Max launching weight	120 kg (265 lb)

PERFORMANCE:

Range (depending upon payload/fuel ratio) more than 347 nm (644 km; 400 miles)

BOEING PAVE TIGER

US Air Force designation: YCGM-121A

In certain high-risk missions, according to the USAF Aeronautical Systems Division's Deputy for Tactical Systems, the effectiveness of the tactical fighter force can be enhanced by the use of unmanned weapons systems, and the US Air Force "recognises the advantages of using expendable aircraft in this supplementary role". An outcome of that recognition is a QRC (quick reaction capability) programme, known as Pave Tiger, for a near-term operational system of sufficiently low cost to permit its deployment in significant numbers.

As a result of company-funded research begun in mid-1979, and which included test flying of a private venture mini-RPV during 1980–82, Boeing was well placed to meet this requirement, and received an initial $14 million development contract for 14 vehicles (12 for testing, plus two spares), the first of which began flight trials in 1984. A production contract is expected to follow the completion of flight testing.

The Pave Tiger vehicle is a ground-launched expendable mini-RPV, intended for use against specific high-priority ground targets with a variety of payloads such as ECM, warheads, or sensors, in non-nuclear theatres of war. Boeing Military Airplane Company at Wichita undertakes manufacture and assembly of the RPV, while the company's operation at Huntsville, Alabama, is responsible for integration of the avionics and mission equipment.

TYPE: Expendable tactical mini-RPV.

AIRFRAME: Constant chord sweptwing monoplane, with wings upswept at tips to form fins and rudders; non-swept canard surfaces, with elevators. Construction mainly of injection moulded composite materials including glassfibre, resin, and polyurethane. Wings are of modified GAW-1 section (thickness/chord ratio 13%), with 30° sweepback at quarter-chord. Incidence 0°. No anhedral or dihedral. Wings have glassfibre spars and skin with moulded foam core, and fold forward when in launch container, deploying on exit. No flaps or ailerons; roll control spoilers of composite construction above wings at 55% chord. Canard surfaces have same construction, aerofoil section, and thickness/chord ratio as wings, but are set at 3° angle of incidence. Short, pod shaped monocoque fuselage. Fins have NACA 0012 aerofoil section, with thickness/chord ratio of 12%. No landing gear.

POWER PLANT: One 21 kW (28 hp) Cuyuna Eagle two-cylinder two-stroke inline engine, mounted at rear of fuselage and driving a Boeing fixed-pitch pusher propeller with four blades made of injection moulded thermoplastics. NACA type flush air intake on top of fuselage. Fuel tank in centre of fuselage (capacity classified); consumption approx 3.8 litres (1 US gallon) per hour. UPCO underfuselage rocket motor, which burns for approx 1.7 s, boosts aircraft to approx 70 knots (130 km/h; 81 mph) and 61 m (200 ft); then piston engine takes over.

LAUNCH AND RECOVERY: Air vehicles are stored in a GPU powered 2.44 × 2.44 × 6.1 m (8 × 8 × 20 ft) multiple missile container (MMC), in which 15 drones can be stored, if necessary, for 5 to 10 years without maintenance. Each of the 15 compartments contains an RPV, launch rail, and electric starter motor. To launch a drone, the compartment door is jettisoned and the RPV emerges on its zero length launch rail. The wings are then unfolded, the RPV fuelled, electrical power connected, the RPV checked out by launcher test equipment, and the mission programme fed in. The rocket booster is then fired electronically to launch the drone. The entire system can be handled by a two-man launch crew. No recovery system (drone is for expendable missions).

GUIDANCE AND CONTROL: Normally pre-programmed, controlled by a Boeing autopilot, but can be re-programmed in the field by tactical commanders. Onboard sensors and microprocessor guide drone along flight path to its destination. Engine driven alternators; passive homing system for some missions; air data (speed and attitude) sensor boom projecting from starboard fin leading-edge; no data link. Details of nav/com and sensors classified, but most believed to be developed by Melpar Division of E-Systems Inc as integrated warhead/guidance payloads.

MISSION EQUIPMENT: Payload bay in nose, nearly half of overall fuselage volume. Payloads can include non-nuclear warhead or modular ECM or sensor packages. No external stores.

DIMENSIONS, EXTERNAL:

Wing span	2.56 m (8 ft 5 in)
Wing chord, constant	0.37 m (1 ft 2½ in)
Wing aspect ratio	6.97
Width, wings folded	1.12 m (3 ft 8 in)
Length overall	2.12 m (6 ft 11.4 in)
Fuselage:	
Length	1.78 m (5 ft 10¼ in)
Max width	0.31 m (1 ft 0.2 in)
Max depth	0.52 m (1 ft 8.4 in)
Height overall	0.61 m (2 ft 0 in)
Propeller diameter	0.58 m (1 ft 11 in)

AREAS:

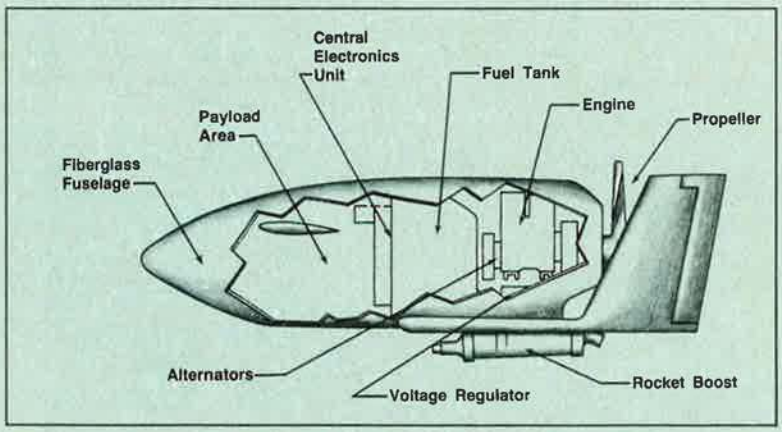
Wings, gross	0.93 m² (10.0 sq ft)
Foreplanes (total, incl elevators)	0.37 m² (3.99 sq ft)
Spoilers (total)	0.03 m² (0.36 sq ft)
Fins (total)	0.325 m² (3.50 sq ft)
Rudders (total)	0.07 m² (0.75 sq ft)

WEIGHTS:

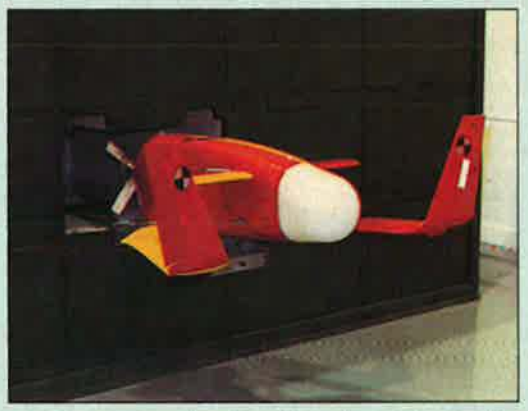
Basic operating weight empty	113 kg (250 lb)
Max payload package	27.2 kg (60 lb)
Max launching weight, excl booster	127 kg (280 lb)

PERFORMANCE:

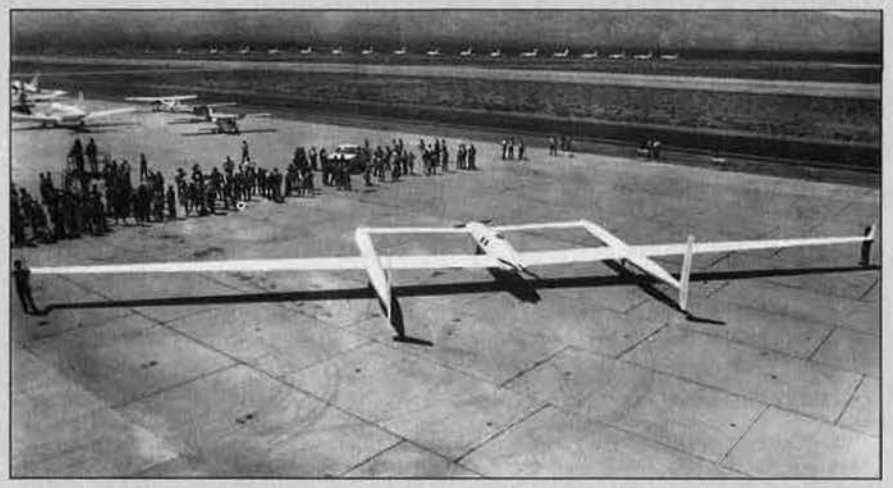
Cruising speed	100 knots (185 km/h; 115 mph)
Typical endurance	8 h



Cutaway drawing of the Boeing Brave-200 mini-RPV



Pave Tiger emerging from launch container, with wings still partially folded



The twin-engined Voyager, designed to fly round the world non-stop without refuelling in flight *(Don Dwiggins)*

VOYAGER

VOYAGER AIRCRAFT INC: Hangar 77, Mojave Airport, California 93501, USA

VOYAGER AIRCRAFT VOYAGER

Voyager Aircraft Inc was formed in March 1981 by Richard 'Dick' Rutan, brother of designer Burt Rutan, and Jeana Yeager to build and fly an aircraft designed specifically for a non-stop, unrefuelled flight around the world. The aircraft, then known as the Rutan Model 76, was designed in 1981 by Burt Rutan. In mid-1982 Voyager Aircraft Inc and Rutan Aircraft Factory agreed to a plan whereby construction and flight testing of the aircraft would be undertaken by RAF, but that subsequent fitting out with special engines, propellers, navigational and ancillary equipment for the world flight would be carried out by Voyager Inc.

Construction began in the Summer of 1982 and was undertaken by Bruce Evans, an experienced builder of Rutan's all-composite canard designs, Dick Rutan, Jeana Yeager, and volunteer members of the RAF staff at Mojave Airport. The aircraft, by then named Voyager (N269VA), was rolled out at Mojave on 2 June 1984 and made its first, 30-minute flight on 22 June, piloted by Dick Rutan. A second, three-hour flight was made on 24 June, and the first long-duration flight of some eleven hours airborne time was completed by early July. In August 1984, on its eleventh flight, with Dick Rutan and Jeana Yeager aboard, Voyager flew from its base at Mojave, California, to the EAA Convention at Oshkosh, Wisconsin, with a single stop at Salina, Kansas.

To meet FAI requirements for certification as an international record, Voyager will have to fly a distance of at least 19,850 nm (36,786 km; 22,858 miles) on its round-the-world flight. Voyager Inc's plans call for a flight of more than 21,711 nm (40,234 km; 25,000 miles), following a Southern Hemisphere route eastwards from the United States, passing the southern tip of Africa, across Australia and Hawaii. Ninety-five per cent of the planned route is over water, and apart from weather avoidance it is intended to conduct much of the flight at an altitude of around 914 m (3,000 ft) amsl. The flight is expected to last 12 days, starting and finishing at Edwards Air Force Base in California. The route will be optimised and updated by Lockheed's Dataplan flight planning system, with weather information provided by the company's Metplan service via a portable onboard terminal. Prior to the record flight attempt, which is planned to begin no earlier than the Spring of 1985, Dick Rutan and Jeana Yeager will make an endurance flight up and down the coast of California to test propulsion, food, and environmental systems aboard the aircraft before embarking on a flight from Puerto Rico to Australia to test the Dataplan system and Voyager's communications equipment. The project is expected to cost a total of $400,000, which is being raised by private donations and commercial sponsorships.

TYPE: Two-crew, twin-engined centreline thrust long-range aircraft of 'trimaran' configuration.

WINGS: Cantilever, high aspect ratio surfaces with solid, oven-cured carbon graphite main spars. Surface skinning from carbon graphite sheets laid up over Nomex paper honeycomb cores, with some Kevlar/glassfibre/epoxy laminate material. Trailing-edge of wing made from balsa wood with ColorTex heat-shrunk plastic covering. Small vertical winglet at each tip. Wing section: Roncz 10-80 at root, Roncz 10-82 at tip. Forward canard surface, with slight forward sweep, of similar construction to wing. Canard section, Roncz 10-46. Ailerons on outer panels of main wing, full-span elevators on forward canard.

FUSELAGE: Structure from carbon graphite/Nomex honeycomb composite. Two tailbooms of similar construction.

TAIL UNIT: Single vertical fin mounted on each tailboom. Rudder in port side fin only.

LANDING GEAR: Retractable tricycle type, tyre size (all) 6.00-6, pressure 10.34 bars (150 lb/sq in). Retraction mechanism is manual and operates independently for each wheel unit. Nosewheel retracted by pulling on D-handle; mainwheels retracted by stainless steel cable with ratcheted pulley, locked by bracket clamped over cable. Manually operated brake on nosewheel only.

POWER PLANT: Two horizontally opposed piston engines, make and model not disclosed, mounted fore and aft of centre fuselage/cabin pod in centreline thrust arrangement, and driving two-blade wooden fixed-pitch propellers. Front engine believed to be 149 kW (200 hp), rear engine 74.5 kW (100 hp). Both engines used for test flying will be replaced with new units for record flight attempt. Front engine will be used primarily for take-off and initial high-speed cruise, but will be shut down for much of the record flight attempt. Total fuel capacity 5,636 litres (1,489 US gallons), contained in 17 integral fuel tanks formed by the aircraft's primary structure. Feeder tank forward of cabin area has a sight gauge for contents; all fuel in other tanks pumped selectively via the feeder tank. Tank switching accomplished by disconnecting/reconnecting appropriate fuel lines. No provision for fuel dumping. Fuselage bladder tank, containing fuel to be burned on first day of flight, will be folded away to provide sleeping area for crew.

ACCOMMODATION: Centre-section of main fuselage pod contains a cockpit/cabin area with a single pilot's seat on the starboard side. Bunk for crew rest and sleep to rear of pilot's position, used initially for first-day fuel in foldaway bladder tank. Two square windows on each side of fuselage adjacent to cockpit. Small bubble canopy in cockpit roof for forward vision during take-off and landing. Accommodation is unpressurised.

AVIONICS AND EQUIPMENT: Final choice of avionics for record flight attempt undecided at press time, but will be supplied by King Radio and is likely to include an autopilot; VLF Omega; weather radar, mounted in forward end of right boom/fuel tank; and an 'Argos bug' transponder that will be interrogated by two satellites in polar orbits for position pinpointing at world flight command post in Washington, D.C. Other equipment being considered for the aircraft includes a portable oxygen system to permit climbing above adverse weather during the essentially low-altitude flight; a solar panel to provide backup electrical power; and an electronic system to damp out structural oscillations in turbulent air.

DIMENSIONS, EXTERNAL:

Wing span	33.77 m (110 ft 9½ in)
Wing aspect ratio	33.8
Canard span	10.15 m (33 ft 3½ in)
Canard aspect ratio	18.1
Fuselage:	
Length	7.74 m (25 ft 4¾ in)
Max width	1.00 m (3 ft 3½ in)
Fuel tank boom length (each)	8.90 m (29 ft 2½ in)

DIMENSIONS, INTERNAL:

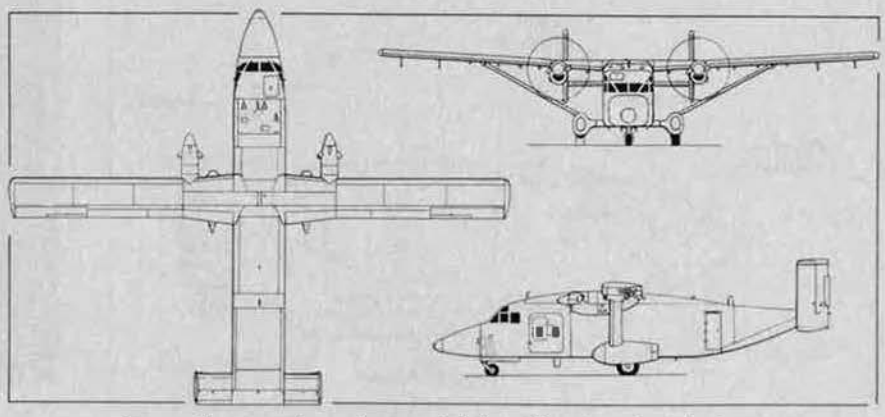
Cabin:	
Length	2.29 m (7 ft 6 in)
Width	0.61 m (2 ft 0 in)
Cockpit:	
Length	1.71 m (5 ft 7 in)
Width	0.55 m (1 ft 9½ in)

WEIGHTS:

Structural weight	426 kg (939 lb)
Weight empty	843 kg (1,858 lb)
Weight of fuel	4,052 kg (8,934 lb)
Max T-O weight (world flight)	5,137 kg (11,326 lb)
Landing weight (world flight)	1,032 kg (2,276 lb)

PERFORMANCE:

Cruising speed (demonstrated)	80 knots (148 km/h; 92 mph)
Cruising speed range (world flight)	70–100 knots (130–185 km/h; 81–115 mph)
Range, max fuel	more than 22,579 nm (41,843 km; 26,000 miles)



Shorts Sherpa twin-turboprop freight/utility aircraft *(Pilot Press)*

SHORTS

SHORT BROTHERS PLC: PO Box 241, Airport Road, Belfast BT3 9DZ, Northern Ireland

SHORTS SHERPA

US Air Force designation: C-23A

The prototype of the Sherpa (G-BKMW) was flown for the first time on 23 December 1982, and on 2 March 1984 the US Air Force ordered 18 for use by the 10th Military Airlift Squadron (322d Military Airlift Wing) of MAC in the EDSA (European Distribution System Airplane) logistics support role. The fleet (16 primary and two backup aircraft) will be based at Zweibrücken in West Germany, with standard routing to warehouses at RAF Kemble (UK) and Torrejon AB (Spain), to transport high priority spares among more than 20 peacetime US Air Force bases in Europe. The Sherpas will be flown by Military Airlift Command pilots, acting under the operational control of USAFE.

The EDSA requirement called for an 'off the shelf' STOL turboprop transport, able to operate in European weather conditions (including, if necessary, flight at altitudes below 300 m; 1,000 ft), and capable of flying 700 nm (1,297 km; 806 mile) stage lengths with such bulky items as a complete J79 or F100 jet engine.

The initial contract was valued at $165 million and included ten years' logistic support and servicing. In addition, USAF has taken options on a further 48 aircraft which, together with supporting services, could take the value of the overall contract to $495 million.

The Sherpa is a freighter version of the Shorts 330-200. It retains many features of the all-passenger version, to allow utility passenger transport operations to be undertaken. The forward freight door and wide-body hold of the 330-200 are unchanged, but the Sherpa's design incorporates a full width rear cargo door, which permits through loading.

The hydraulically actuated rear ramp door, which is operated from inside or outside the aircraft, can be lowered to a variety of positions to simplify loading from a wide range of ground equipment. The forward baggage compartment of the Shorts 330-200 is retained and this, being lockable, is suitable for high value cargo. Standard airline containers can be accommodated in the main cabin, up to the size of the LD3, making the Sherpa particularly suited for the operation of short-haul cargo feeder services. Typical loads can include two LD3 containers and nine passengers; four LD3 or seven CO8 containers; two half-ton vehicles in the class of the Land-Rover, using load spreaders; and a wide range of bulky cargo. The cabin is suitable for the installation of specialist role equipment and, for example, lends itself readily to onboard sorting of letters and small packages. Roller conveyor systems, including pallet locks which pick up on the aircraft's standard seat rails, are available optionally (standard on C-23A).

The first Sherpa, designated C-23A in the EDSA role, made its first flight on 6 August 1984; with the second aircraft, it was delivered on 2 November 1984. The remaining 16 aircraft are due for delivery by August 1985.

TYPE: Twin-turboprop freight/utility aircraft.

AIRFRAME: As for Shorts 330-200 (see 1983–84 *Jane's*) except for constant width rear fuselage with hydraulically actuated rear loading ramp/door.

POWER PLANT: Two 893 kW (1,198 shp) (max continuous rating 761 kW; 1,020 shp) Pratt & Whitney Canada PT6A-45R turboprop engines, each driving a Hartzell five-blade low-speed propeller. Fuel in main tanks in wing centre-section/fuselage fairing, total usable capacity 2,182 litres (480 Imp gallons; 576 US gallons). Single-point pressure refuelling. Provision to increase total fuel for special requirements.

ACCOMMODATION: Crew of two on flight deck plus flight mechanic. Dual controls standard. Flight deck air-conditioned. Main cabin air-conditioning optional. Baggage compartment in nose (1.27 m³; 45 cu ft) with external access. Passenger door at rear of cabin on port side. Cargo door at front of cabin on port side. Hydraulically actuated full width rear loading ramp door. In an all-cargo configuration the cabin can accommodate up to seven CO8 or four LD3 containers. Cabin floor is flat throughout its length and is designed to support 181 kg (400 lb) per foot run at 610.3 kg/m² (125 lb/sq ft). The locally reinforced centre cabin area is able to carry 272 kg (600 lb) per foot run at 732.4 kg/m² (150 lb/sq ft). A further 272 kg (600 lb) total load can be stowed on the ramp door. Seat rails can be used as cargo lashing points. Freight loading is facilitated by the low-level cabin floor.

AVIONICS AND EQUIPMENT (C-23A): Single UHF and HF radios, dual VHF-AM/FM, two flight directors, dual VOR/ILS, a Litton LTN-96 ring laser gyro inertial navigation system, Tacan, dual ADF, flight data recorder, cockpit voice recorder, IFF transponder, GPWS, radar altimeter, and a Collins RNS-300 colour weather radar with terrain mapping.

DIMENSIONS, EXTERNAL:

Wing span	22.76 m (74 ft 8 in)
Wing chord (standard mean)	1.85 m (6 ft 0.7 in)
Length overall	17.69 m (58 ft 0½ in)
Height overall	4.95 m (16 ft 3 in)
Tailplane span	5.68 m (18 ft 7¾ in)
Wheel track	4.24 m (13 ft 11 in)
Wheelbase	6.15 m (20 ft 2 in)
Propeller diameter	2.82 m (9 ft 3 in)
Propeller ground clearance	1.83 m (6 ft 0 in)
Cabin floor height above ground	0.94 m (3 ft 1 in)
Passenger door (port, rear):	
Height	1.57 m (5 ft 2 in)
Width	0.71 m (2 ft 4 in)
Forward cargo door (port):	
Height	1.68 m (5 ft 6 in)
Width	1.42 m (4 ft 8 in)
Rear loading door:	
Height	1.98 m (6 ft 6 in)
Width	1.98 m (6 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin:	
Max length	9.09 m (29 ft 10 in)
Max width	1.98 m (6 ft 6 in)
Max height	1.98 m (6 ft 6 in)
Volume (all-cargo)	35.68 m³ (1,260 cu ft)
Baggage compartment (nose)	1.27 m³ (45 cu ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped (incl crew of three)	6,680 kg (14,727 lb)
Max fuel (standard tanks)	1,742 kg (3,840 lb)
Max payload (all-cargo)	3,175 kg (7,000 lb)
Max T-O weight	10,387 kg (22,900 lb)
Max landing weight	10,251 kg (22,600 lb)
Max wing loading	246.8 kg/m² (50.55 lb/sq ft)
Max power loading	5.81 kg/kW (9.56 lb/shp)

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

Max cruising speed at AUW of 9,525 kg (21,000 lb) at 3,050 m (10,000 ft)
190 knots (352 km/h; 218 mph)

Econ cruising speed at AUW of 9,525 kg (21,000 lb) at 3,050 m (10,000 ft)
157 knots (291 km/h; 181 mph)

Max rate of climb at S/L	360 m (1,180 ft)/min
Service ceiling, one engine out, AUW of 9,072 kg (20,000 lb)	3,930 m (12,900 ft)
T-O distance (FAR Pt 25 and BCAR Gp A):	
ISA	1,042 m (3,420 ft)
ISA + 15°C	1,295 m (4,250 ft)
Landing distance at max landing weight:	
BCAR:	
normal field	1,225 m (4,020 ft)
short field	960 m (3,150 ft)
FAR	1,113 m (3,650 ft)

Range with max fuel, reserves for 45 min hold and 43 nm (80 km; 50 mile) diversion:
with 3,175 kg (7,000 lb) payload
195 nm (362 km; 225 miles)
with 2,268 kg (5,000 lb) payload
669 nm (1,239 km; 770 miles)

First production Shorts C-23A for USAF

SHORTS 330-UTT

Generally similar to the Sherpa, the 330-UTT is a military utility tactical transport version of the Shorts 330. Orders from the Royal Thai Army (for two) and Royal Thai Police (one) were announced during 1984.

The basic airframe and power plant remain unchanged, but max payload is increased to 3,630 kg (8,000 lb) and max operational necessity T-O weight to 11,158 kg (24,600 lb). Other changes include a strengthened cabin floor and reconfigured avionics panel. Cabin accommodation can be provided for up to 33 troops, 30 paratroops plus a jumpmaster (exit via inward opening rear door each side), or 15 stretchers plus four seated personnel.

PERFORMANCE (provisional, ISA conditions):

Cruising speed at 3,050 m (10,000 ft), AUW of 9,979 kg (22,000 lb):

Shorts 330-UTT military utility tactical transport for Thailand *(Kenneth Munson)*

high-speed cruise, max continuous power
201 knots (372 km/h; 231 mph)
long-range cruise
160 knots (296 km/h; 184 mph)
Max rate of climb at S/L at normal max T-O weight of 10,387 kg (22,900 lb):
two engines 381 m (1,250 ft)/min
one engine 89 m (290 ft)/min
STOL T-O run at S/L, 15° flap
415 m (1,360 ft)
STOL T-O to 15 m (50 ft), 15° flap
644 m (2,110 ft)
STOL landing from 15 m (50 ft) at AUW of 9,525 kg (21,000 lb), flaps down, propeller reversal
488 m (1,600 ft)
STOL landing run, conditions as above
235 m (770 ft)
Range with 30 fully armed assault troops
600 nm (1,112 km; 691 miles)

EDGLEY

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EDGLEY EA7 OPTICA

First flown on 14 December 1979, the Optica is a three-seat observation aircraft, designed particularly for pipeline and powerline inspection; forestry and coastal patrol; police duties; frontier patrol; aerial photography; film, TV, and press reporting; and touring. The cabin configuration is designed to give the best possible all-round view. Power plant is a ducted propulsor unit, offering excellent quietness, both within the cabin and from the ground. A low wing loading, pre-set inboard flaps, and a low stalling speed facilitate continuous en-route flight at low speeds, and the generous flap area confers STOL capability from both hard and soft strips. Stability increases at low speed.

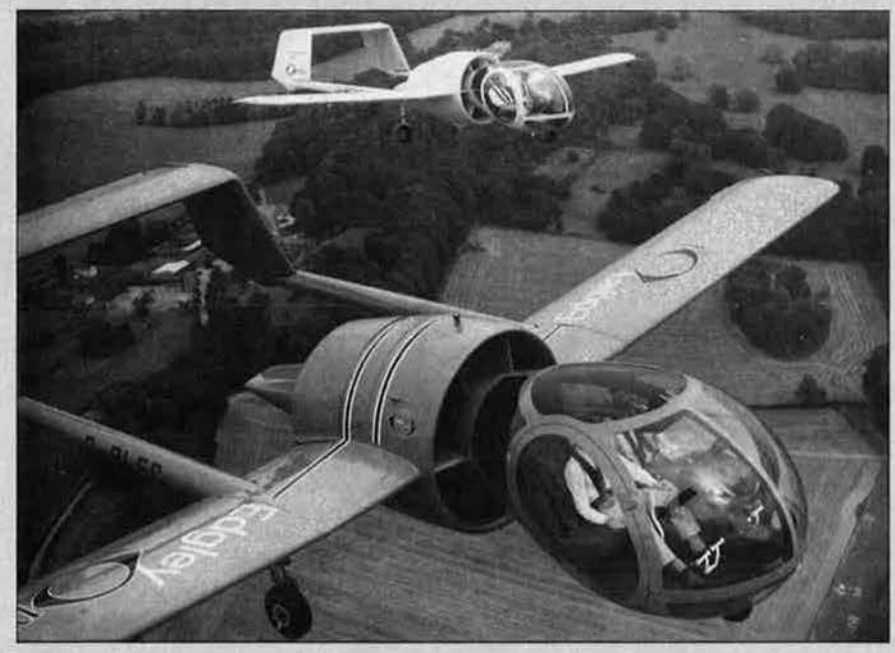
Considerable interest was shown in the prototype (G-BGMW) when it was first exhibited at the Farnborough Air Show, in 1980, and production started in 1983, using computer assisted design and manufacturing techniques. The first production aircraft (Optica No. 3, G-BLFC) flew on 4 August 1984, and was followed by two more completed in September and October. CAA certification was expected in late 1984, after which the rate of production was to increase to five a month by May 1985. Orders for 82 Opticas have been received from customers in 25 countries.

TYPE: Three-seat slow flying observation aircraft; stressed to BCAR Section K (non-aerobatic category) and FAR Pt 23 (Normal category).

WINGS: Cantilever mid-wing monoplane. Wing section NASA GAW-1; thickness/chord ratio 17%. Dihedral 3° on outer panels. Incidence 0°. Constant chord single-spar non-swept wings of aluminium alloy stressed skin construction. Wingtips (also fin/tailplane fillets, nosewheel mudguard, and some power plant fairings) of glassfibre. Fowler trailing-edge flaps (29 per cent of total wing chord) inboard and outboard of tailbooms. Electrically actuated outboard flaps can be set at angles up to 50° for landing; inboard flaps set permanently at 10°, giving the effect of a slotted wing, for continuous low speed flying. Bottom hinged, mass balanced slotted ailerons outboard of outer flaps, operated by pushrods. No spoilers, airbrakes, or tabs.

CABIN: 'Insect eye' shaped structure, built of aluminium alloy with Suntex vacuum formed acrylic windows. Cabin attached to fan shroud and rest of airframe by six stators of steel tube and aluminium alloy shear web construction. Steel tube and aluminium alloy nose beam supports cabin floor. Horizontal window frame member just above floor level, together with nosewheel box, is designed to withstand 9*g* impact. Tinted windows optional.

TAIL UNIT: Twin-tailboom configuration, of aluminium alloy stressed skin tubular construction. Tailboom pick-up points at extremities of wing centre-section. Angular, inward canted fins and balanced rudders. Fixed incidence tailplane, with elevator, bridging space between tops of fins. Inset trim tab occupies port half of elevator trailing-edge; no rudder tabs.



First production Edgley EA7 Optica (foreground) in formation with the prototype

LANDING GEAR: Non-retractable tricycle type, with steerable nosewheel offset to port. Mainwheel legs embody rubber in compression shock absorption. Nosewheel shock absorption by bungee rubber in tension. Single wheel on each unit, tyre sizes 6.00-6 (main) and 5.00-5 (nose). Hydraulic disc brakes on mainwheels.

POWER PLANT: Ducted propulsor unit, with engine and fan forming a power pod separate from the main shroud. Pod is attached to fan shroud with four Lord rubber mountings, and supported by four stators of steel channel and aluminium alloy shear web construction, with steel tube engine bearers. Five-blade fixed-pitch fan, driven by a 194 kW (260 hp) Avco Lycoming IO-540 flat-six engine, mounted in a duct downstream of the fan. Fuel tank of 113.5 litres (25 Imp gallons) in each wing leading-edge, immediately outboard of tailbooms and forward of wing spar. Tanks are of full wing section, but are designed not to be stressed by wing bending and torsion. Total usable fuel capacity 227 litres (50 Imp gallons). Refuelling point in upper surface of each wing. Oil capacity 7.6 litres (1.7 Imp gallons).

ACCOMMODATION: Cabin designed to accommodate up to three persons side by side on fixed seats, with either single- or two-pilot operation (left hand and centre seats). Dual controls standard. Baggage space aft of seats. Alternative accommodation for two stretchers, or one stretcher and one medical attendant, in addition to pilot. Single elliptical door on each side, hinged at front and opening forward. Cabin heated, by hot air from engine, and ventilated.

SYSTEMS: Hydraulics for mainwheel brakes only. Electrical system (24V) includes engine driven alternator and storage battery for engine starting and actuation of flaps.

AVIONICS AND EQUIPMENT: Standard nav/com avionics by Becker and King. Avionics and equipment which have been evaluated for various roles include Barr & Stroud IRI8 Mk II, BAe Linescan 214, Continental Microwave air-to-ground video, FLIR, GEC Avionics TICM II, locator searchlights, Voice in the Sky, target tracker, Vinten and Hasselblad cameras, and Explosafe and Promel fuel tank protection.

DIMENSIONS, EXTERNAL:

Wing span	12.00 m (39 ft 4 in)
Wing chord: basic, constant	1.32 m (4 ft 4 in)
over 10° fixed flaps	1.52 m (5 ft 0 in)
Wing aspect ratio	9.1
Length overall	8.15 m (26 ft 9 in)
Height over fan shroud (excl aerial)	1.98 m (6 ft 6 in)
Diameter of fan shroud	1.68 m (5 ft 6 in)
Diameter of fan	1.22 m (4 ft 0 in)
Shroud ground clearance	0.25 m (10 in)
Height over tailplane	2.31 m (7 ft 7 in)
Tailplane span:	
c/l of tailbooms	3.40 m (11 ft 2 in)
intersection fin chord	2.60 m (8 ft 6½ in)
Wheel track	3.40 m (11 ft 2 in)
Wheelbase	2.73 m (9 ft 0 in)
Doors (each): Long axis	1.35 m (4 ft 5 in)
Short axis	0.96 m (3 ft 1¼ in)
Height to sill	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.44 m (8 ft 0 in)
Max width (to door Perspex)	1.68 m (5 ft 6 in)
Max height	1.35 m (4 ft 5 in)
Floor area	0.72 m² (7.75 sq ft)

AREAS:

Wings, gross	15.84 m² (170.5 sq ft)
Ailerons (total)	1.55 m² (16.68 sq ft)
Trailing-edge flaps:	
inboard (total)	0.61 m² (6.57 sq ft)
outboard (total)	1.49 m² (16.04 sq ft)
Fins (total)	2.59 m² (27.88 sq ft)
Rudders (total)	1.38 m² (14.85 sq ft)
Tailplane	1.62 m² (17.44 sq ft)
Elevator, incl tab	1.26 m² (13.56 sq ft)

WEIGHTS AND LOADINGS (IO-360 engine):

Weight empty	850 kg (1,875 lb)
Max T-O weight	1,236 kg (2,725 lb)
Max wing loading	78.1 kg/m² (16.0 lb/sq ft)
Max power loading	6.37 kg/kW (10.5 lb/hp)

PERFORMANCE:

Never-exceed speed	140 knots (259 km/h; 161 mph)
Max level speed	115 knots (213 km/h; 132 mph)
Cruising speed (55% power)	84 knots (156 km/h; 97 mph)
Loiter speed	53 knots (98 km/h; 61 mph)
Stalling speed:	
flaps up	47 knots (87 km/h; 54 mph)
20° flap	44 knots (81 km/h; 50 mph)
Max rate of climb at S/L	240 m (785 ft)/min
Service ceiling	4,300 m (14,100 ft)
T-O run	300 m (980 ft)
Landing run	250 m (820 ft)
Range with max fuel, at 55% power	469 nm (869 km; 540 miles)
Endurance: at loiter speed	6 h 30 min
at mixture of loiter and cruising speed	6 h
at 55% power cruising speed	5 h 30 min

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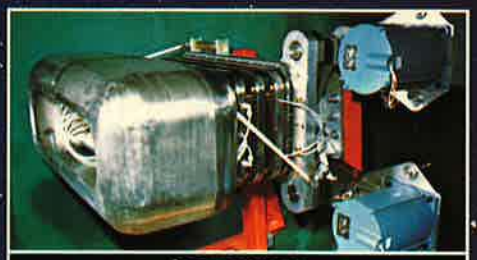

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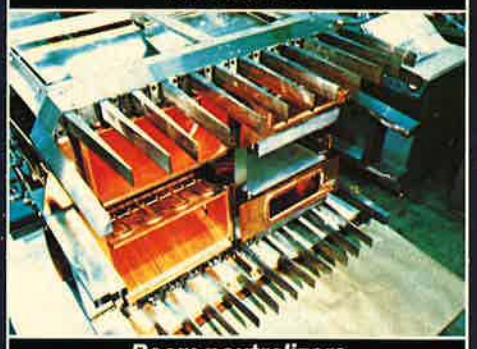

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AIRMAN'S BOOKSHELF

West Meets East

China Policy for the Next Decade, by the Atlantic Council's Committee on China Policy. Oelgeschlager, Gunn & Hain, Publishers, Inc., Boston, Mass., 1984. 445 pages with index. $27.50 cloth; $12.50 paper.

The purpose of this Atlantic Council report is to gather together the thoughts of noted China scholars and to recommend to the Administration a national security policy regarding the People's Republic—one that is acceptable to the Administration, Congress, and the public.

The book comprises twenty-five studies by fifty-eight contributors who make up the Atlantic Council's Committee on China Policy. The Committee sought out and paid careful attention to views from Japan, Korea, Europe, Canada, Australia, New Zealand, and Southeast Asia in analyzing the issues. Discussions were also held with representatives from the Chinese Academy of Social Sciences in Beijing, with members of the Institute for International Affairs in Taiwan, and with other Chinese officials and scholars.

These studies underpin the Committee's "white paper"—a policy paper. This paper attempts the difficult task of defining appropriate policies for the US to pursue with regard to the People's Republic over the next decade. The paper also examines how the relationship between the US and the PRC will affect our European and Asian allies over the coming years.

The resulting studies are outstanding. They benefit greatly from deft organization by the Committee, which included George R. Packard as Rapporteur; China expert Col. Alfred D. Wilhelm, Jr., USA, as Project Director; and former diplomat U. Alexis Johnson as Chairman of the Committee. Ambassador Johnson notes in his preface that "the individual papers, as presented in this volume, constitute the greatest single collection of scholarship on China that has yet been published."

Given the breadth of the issues and the varying backgrounds and interests of the participants, it is somewhat surprising to find that the policy statement evolves into substantial consensus. According to the policy paper, the US should, *inter alia,* seek to enhance cooperation with the PRC in the coming decade; should work from the assumption that an economically healthy, stable, and secure China will contribute to peace and stability in the region; should cooperate with China in trade and *certain* dual-use technology transfers; and should not ally militarily with the PRC but should instead await their lead. In addition, the views of US allies and friends should be considered carefully in the formulation of policy.

In my view, the book is a must for all those interested in US-China relations. It spells out how we got where we are and where we should be going in the coming decade. It constitutes, in effect, *the* current informed source on the subject.

—Reviewed by Andrew B. Anderson, Deputy Publisher, AIR FORCE *Magazine.*

Propular Technology

Thrusting Forward: A History of the Propeller, by George Rosen, with Charles A. Anezis. Hamilton Standard/British Aerospace, 1984. 95 pages, with photos, drawings, and charts.

The aircraft propeller only looks like a simple device. In actuality, it embodies great sophistication, mechanical engineering, and structural design. Leonardo da Vinci had the basic concept in hand as early as 1490, but another four centuries would elapse before the spinning blade was ready to propel man through the skies.

The propeller, we are reminded here, is essentially a wing that converts its "lift" into thrust. With its speed at the tips approaching Mach 0.8 and with centrifugal forces exerting a pull of twenty-five tons on its blades, the modern propeller must be able to tolerate punishing stress.

In this short but wonderfully illustrated book, Rosen and Anezis have packaged all of the basic elements of propeller history and lore and produced a book that is great fun. In words and pictures, they show us how the Wright brothers used a chain-and-sprocket transmission to drive propellers rotating in opposite directions to counterbalance torque and solve major flight-control problems. The thirty-six percent efficiency of the Wright propeller is primitive by today's standards, but nothing approaching it had ever been achieved before.

The employment of aircraft in combat during World War I demonstrated new propulsion requirements for military aviation and led to significant gains in propeller technology. It was in the interwar years, though, that the propeller came of age. Over the next two decades, metal blades replaced wood, and variable-pitch propellers ended the technological tyranny of fixed pitch, which had previously forced a choice between setting blade angles for top performance at takeoff or for top performance in cruise. Variable pitch allowed the pilot to change blade angle in flight. Another development was feathering—pitching the blade at a right angle to the line of flight—so that the windmilling propeller of a malfunctioning engine no longer threatened to tear an ailing powerplant off the aircraft.

World War II was the golden age of the propeller, and then, suddenly, it seemed that the future would belong exclusively to the new jet engines. The needs of general aviation, the coming of the turbine propeller, and then interest in V/STOLs kept the industry going, but it was not until the 1970s that things really began looking up for the propeller again. The oil crisis and the demand for fuel efficiency rejuvenated propeller research.

The book closes with a look ahead to the prop fan, whose advocates say it will deliver up to twenty-five percent savings in fuel while matching the speed and comfort of commercial

jetliners. Da Vinci's classic blade is still thrusting forward.

—Reviewed by John T. Correll, Editor in Chief.

Making It to Mufti

Transition From Military to Civilian Life, by Merle Dethlefsen and James D. Canfield. Stackpole Books, Cameron and Kelker Sts., P. O. Box 1831, Harrisburg, Pa. 17105, 1984. 248 pages, with a Foreword by CMSAF James McCoy, USAF (Ret.), and twenty-four cartoons by Jake Schuffert. $14.95.

The book market is flooded with books telling civilians how to retire, but there are few that cover the unique problems associated with military retirement, which usually coincides with mid-life transition. The changes come together and produce major anxieties and, sometimes, adjustment problems so severe that they require professional help.

This book by Dethlefsen and Canfield starts to fill this void, and, in many ways, it does. The authors illustrate the experiences of others who have made the transition. They point out that most military members who have made a success of their military careers will also make a success of their civilian careers.

The military establishment takes care of the professional side of retirement with the orders, pay, moving, etc., but, so far, none of the services prepares the prospective retiree adequately for the personal side of retirement. This is an excellent handbook for all military personnel who are within five years of retirement.

The authors believe that it takes years to prepare properly for retirement. However, they point out that more than fifty percent of all military retirees wait until approximately six months prior to retirement to make the decision and begin planning. If military members are going to make successful career changes, Dethlefsen and Canfield maintain that they must anticipate what's coming, recognize what is normal, and break the transition into manageable pieces. This allows retirees to cope with the challenges as they occur and to avoid the retirement "syndrome." This syndrome, according to the authors, is often characterized by divorce, excessive consumption of alcohol, and acute depression.

Readers learn that the "retirement syndrome" is not the result of the single shock of retiring, but is caused more by the cumulative effects of a "barrage of small shocks" that occur in an environment that is no longer supportive. The retirement syndrome for the military member often also involves the so-called mid-life crisis. Many people, at this point in their lives, go through a period of intense self-examination, looking at what they have done with their lives, what they really want, and where they are going with their lives.

Together with the stress of retirement and career transition, this can produce a tumultuous inner struggle for military retirees. They question all aspects of their lives. Even for those who make the transition successfully, it can take several years to find new paths or to modify old ones. Those who do not make the transition can fall into the retirement syndrome, *i.e.,* divorce, drinking, and depression. These problems demonstrate the need for planning for military retirement years before the actual date.

Dethlefsen and Canfield point out that civilian industry has recognized the problems associated with retirement. For instance, one of the fastest growing employee benefits in the industrial world is retirement planning. An employee leaving a company is prepared and leaves the company with confidence. The retiree's affairs are in order, the financial situation has been planned, and the retiree has "rehearsed" retirement so that he or she is psychologically prepared for the trauma of retirement.

The services should develop programs for their retirees similar to the ones used by industry. The savings in terms of CHAMPUS payments for "adjustment problems" would more than pay for such programs. However, until this happens, the authors of this book have outlined programs that individuals can develop for themselves in order to make the transition easier.

This book should be required reading for all military personnel who are within five years of retirement.

—Reviewed by Benjamin S. Catlin, AFA Assistant Executive Director for Defense Manpower and Reserve Affairs.

New Books in Brief

Beam Weapons: The Next Arms Race, by Jeff Hecht. This book is an excellent introduction to the topic of directed-energy weapons. Written in down-to-earth language, the book is well suited for readers lacking a technical background. The three technologies of directed-energy weapons—lasers, energy particle beams, and microwaves—are explained and examined for their effectiveness as the primary technology for space weapons. Author Hecht, who has written extensively on lasers and related subjects, draws on his engineering background to forecast the military applications of directed-energy technologies. He also does a credible job of delineating the impact of directed-energy technologies on military strategy and arms control. With photographs, appendix, and index. Plenum Press, New York, N. Y., 1984. 363 pages. $17.95.

Bloods: An Oral History of the Vietnam War by Black Veterans, by Wallace Terry. The book details the experiences of the Vietnam War, as told by twenty black veterans. A strong and revealing work, in this book the reader learns of the personal tragedies suffered by GIs during and after the war. Officers and enlisted men alike from all four services step forward to tell of the horrors of the Vietnam War that still affect the lives of the men who survived them. Author Terry does a sterling job of documenting the heroism of black GIs, who constituted a disproportionate thirty-one percent of US combat troops in the early years of fighting in Vietnam. He also reveals the special pain suffered by black GIs—a pain far deeper than that inflicted by the weapons of war. A number of scenes depicted in the book are gruesome, but their inclusion helps the reader understand the immense horror of war. With photographs, chronology of events, and glossary. Random House, Inc., New York, N. Y., 1984. 311 pages. $17.95.

Royal Air Force: The Aircraft in Service Since 1918, text by Chaz Bowyer; paintings by Michael Turner. This book is the sort that tempts readers to go at it with scissors or straight-edge; the star attractions here are Michael Turner's more than one hundred paintings of famous and other less well known British aircraft. His assiduous hand reveals the aircraft in exacting detail, while his sense of the rush of flight animates the paintings, breathing life into the technically accurate renditions. In the foreword to this volume, Raymond Baxter observes that "aeroplanes come closer to being 'alive' than any other machines." Turner's paintings attest to this elusive quality. With bibliography and index. Published by Temple Press, UK, 1983; Presidio Press, Novato, Calif., US distributor. 208 pages. $20.

—Reviewed by Capt. Napoleon B. Byars, USAF, Contributing Editor.

The Tiger and the Hummingbird

It was David against Goliath when Forward Air Controller Hilliard Wilbanks single-handedly took on a Viet Cong battalion.

BY JOHN L. FRISBEE

CAPT. Hilliard Wilbanks was a fighter pilot. When he went to war, that's the way he wanted to go. But in early 1966, the US was just getting into a major buildup in Vietnam. There was a shortage of pilots, and personal preferences went by the board. In April 1966, Captain Wilbanks arrived in Vietnam as a forward air controller with the 21st Air Support Squadron, destined to fly a most unwarlike plane—the 105-mile-an-hour Cessna O-1 Bird Dog. Aside from additional communications gear and four wing pylons for target-marking smoke rockets, it was the same plane in which aspiring civilian pilots took their first lessons at the local airport on a Sunday morning.

Wilbanks may have been a frustrated fighter pilot, but he was also a professional who knew that the FACs were the key link in providing close air support to ground troops fighting in jungle country. By February 24, 1967, he had survived 487 combat missions and had earned the DFC, seventeen Air Medals, and the satisfaction of knowing that his work in spotting enemy forces and directing fighter strikes against them had saved hundreds of allied lives. Two more months and he would be on the way home to his wife and four small children.

Late on the afternoon of the twenty-fourth, Captain Wilbanks was in the air over the Central Highlands, about 100 miles north of Saigon. He was in radio contact with the senior American advisor of the 23d Vietnamese Ranger Battalion. The Rangers were advancing through a tea plantation that gave little cover when Wilbanks, intimately familiar with the terrain, spotted a trap ahead of them.

A large enemy force was concealed in camouflaged foxholes on a hillside. As Wilbanks radioed a warning to the Rangers, the enemy, knowing they had been seen, opened fire, pinning down two Vietnamese companies. Wilbanks fired a smoke rocket to mark the center of the Viet Cong position, drawing heavy fire on his frail O-1. The VC, knowing that fighters would soon be on the way, left their foxholes and charged down the slope toward the outnumbered Rangers.

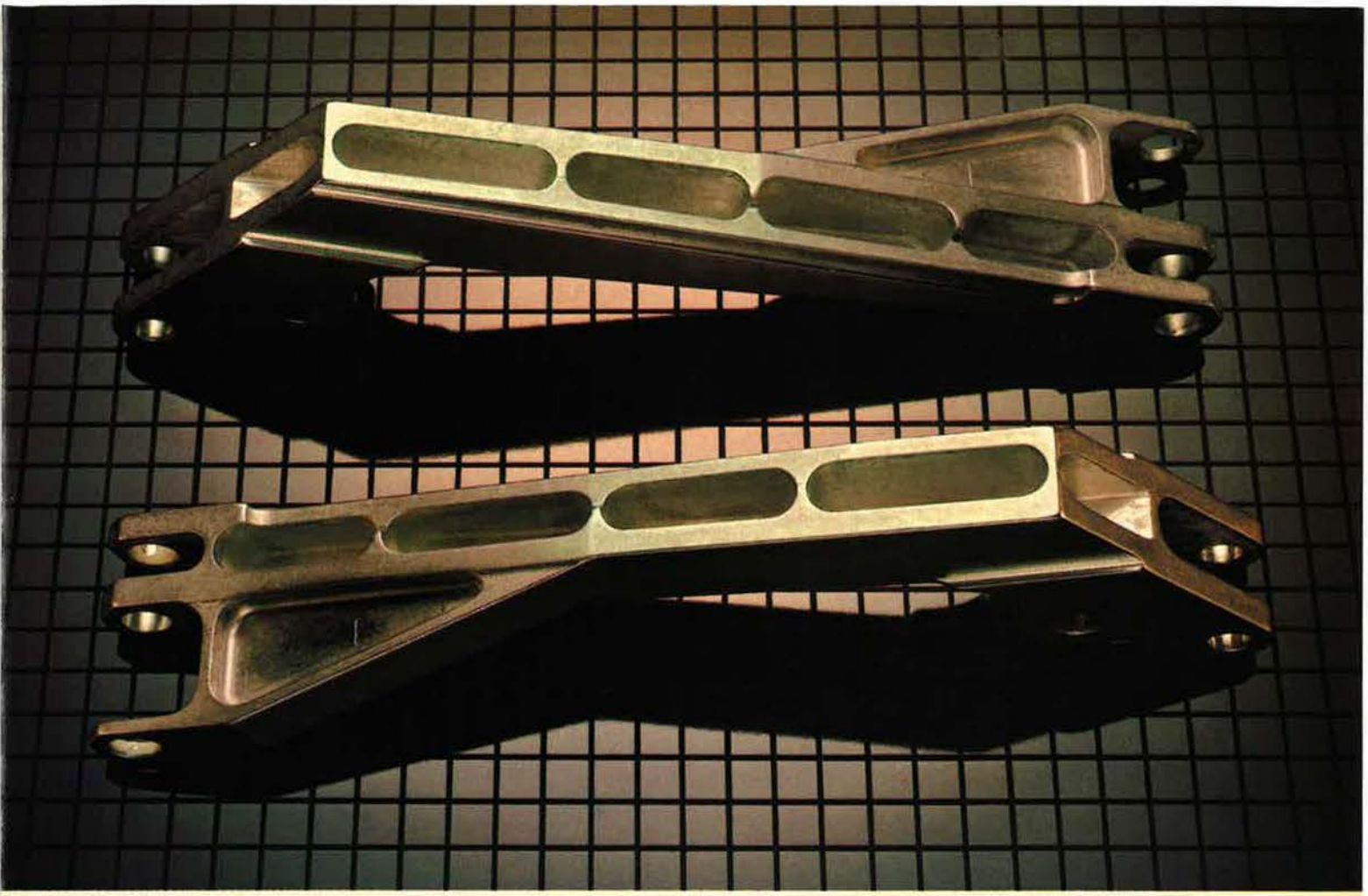
Captain Wilbanks knew the fighters would probably not arrive soon enough to save the day unless the Viet Cong attack could be temporarily disrupted. He had two alternatives: get out of range of Viet Cong fire and hope the F-4s would come in time, or attack with the only aviation ordnance he had—his remaining smoke rockets. Three times he dove through automatic weapons and small-arms fire, each time putting a white phosphorous rocket into the Viet Cong line. The momentarily disorganized attackers now knew that he had no more rockets. They moved forward once more against the Rangers.

USAF Chief of Staff Gen. J. P. McConnell shows Capt. Hilliard Wilbanks's Medal of Honor to Paula and Tommy at the Pentagon ceremony at which Air Force Secretary Harold Brown, left, presented the award to Mrs. Rosemary Wilbanks.

Wilbanks had one last desperate alternative that might slow the attack for the few minutes needed to get fighters on target. He picked up the M-16 automatic rifle he always carried on missions and began a series of strafing attacks from an altitude of 100 feet, firing through the open side window and reloading between passes. Even with violent evasive maneuvers, which weren't possible while he was firing, his chance of survival against the firepower of a battalion-size force was remote. The veteran Wilbanks knew it.

On his third strafing run, the O-1 wavered. Wilbanks slumped over the controls, and his aircraft crashed 100 meters ahead of the Rangers. An Army advisor, Capt. Gary Vote, ran to the plane and pulled the unconscious Wilbanks from the wreckage. Two Army helicopter gunships that earlier had been driven off by enemy fire tried unsuccessfully to land by the crashed plane. Finally, a flight of F-4s roared in to strafe the enemy while a chopper picked up the wounded Wilbanks. He died before reaching a friendly base, but he had given the Rangers time to withdraw to safety.

On January 25, 1968, Secretary of the Air Force Harold Brown presented the Medal of Honor to Hilliard Wilbanks's widow, who was accompanied at the ceremony by two of their four children. In his heroic act of self-sacrifice, fighter pilot Wilbanks died while performing a fighter mission in the slowest and most fragile of USAF's aircraft. He fought his last battle with the heart of a tiger, on the wings of a hummingbird. ■



What's the big difference between these two aerostructure components?

Actually, the biggest difference is in how they were manufactured. The one on top was manufactured by the "Factory of Tomorrow" at Vought Aero Products Division of LTV Aerospace and Defense—and it accounts for the big differences in cost and quality and time. It's called the Flexible Machining Cell, and it's the largest, most sophisticated and advanced manufacturing facility of its type in the world.

The Flexible Machining Cell is a remarkably versatile integration of automated machining centers, cleaning and inspection stations, parts carrousels and chip collection system—all served by a robot transportation system and controlled entirely by computers.

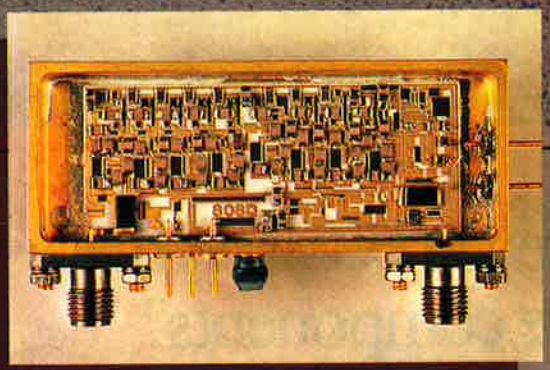
Vought Aero Products uses it to help turn out advanced aerostructures at tremendous savings in time and money. Time and cost and quality. Those are the differences our contract partners look for in a team member.

The B-1B project is a prime example. We're one of the members of the B-1B team, producing the aft and aft-intermediate fuselage sections of the advanced bomber. A portion of that task, which would require 200,000 hours using conventional machining methods, will be done in 70,000 hours in our Flexible Machining Cell. That's a 3-to-1 productivity improvement, which cuts millions off the cost of the B-1B program.

LTV Aerospace and Defense Company, Vought Aero Products Division, P.O. Box 225907, M/S 49L-06, Dallas, Texas 75265.

LTV Aerospace and Defense
Vought Aero Products Division

L T V : L O O K I N G A H E A D



Actual Size

Varian miniature log amplifiers selected for Eaton's AN/ALQ-161

The Eaton Corporation/AIL Division, has selected Varian's new HCL-4 Series log amplifier for use in the AN/ALQ-161. The ALQ-161 is the complete defensive avionic system for the U.S. Air Force B-1B long-range combat bomber.

The new HCL-4 Series log amplifiers are small, lightweight modules meeting the highest reliability standards. The amplifiers are fully compliant with MIL-M-38510 and are screened to MIL-STD-883D.

Utilizing Varian's unique wide band amplifier design, the units provide exceptional log accuracy and stability over a wide temperature range. Unit-to-unit reproducibility is excellent and the amplifiers can be supplied with connectors as drop-in modules.

More information is available from Varian Beverly Microwave Division, or any Electron Device Group worldwide sales organization.

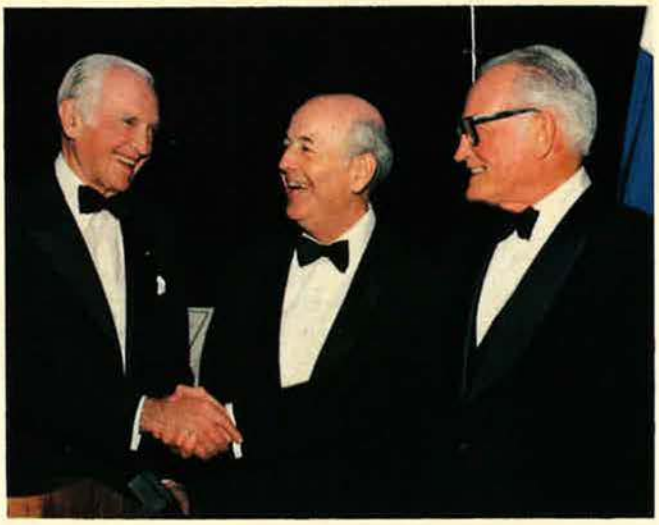
Varian Beverly Microwave Division
8 Salem Road
Beverly, Massachusetts 01915
Telephone: 617•922-6000

varian

B-1B
AN/ALQ-161
Eaton Corporation
AIL Division

The first Secretary of the Air Force is honored at the Fifth Annual Jimmy Doolittle Salute . . .

Celebrating Stuart Symington



Stuart Symington (left) is congratulated by Sen. Barry Goldwater (right), Aerospace Education Foundation Board Chairman, as George Hardy, President of AFA's Aerospace Education Foundation, looks on.

"IT IS to this man that all of us can turn with a feeling of indebtedness for the many things he has done to bring about the Air Force and to enrich and enhance this force as one of the finest military institutions in the world." With these words, Sen. Barry M. Goldwater (R-Ariz.), Chairman of the Board of AFA's Aerospace Education Foundation, introduced Stuart Symington at the fifth annual Jimmy Doolittle Salute held last December at the National Air and Space Museum in Washington, D. C. In attendance were a number of AFA, government, industry, and Air Force leaders, including Under Secretary of the Air Force Edward C. Aldridge, Jr., and Air Force Chief of Staff Gen. Charles A. Gabriel.

The event salutes Medal of Honor recipient Lt. Gen. Jimmy Doolittle, USAF (Ret.), and each year honors a special guest. Earlier Salutes honored General Doolittle himself, Lt. Gen. Ira C. Eaker, USAF (Ret.), Gen. Curtis E. LeMay, USAF (Ret.), and President and Mrs. Ronald Reagan.

During his introduction, Senator Goldwater noted that "Stuart Symington has had a long and distinguished career, the major part of which has been dedicated to furthering the interests of this country." Mr. Symington has served his country in both private industry and government. Prior to entering government service in 1945, he had been President and Board Chairman of Emerson Electric Co., St. Louis, Mo. On September 18, 1947, he became the first Secretary of the Air Force. In 1952, Mr. Symington was elected to the Senate from Missouri, and he held his seat until his retirement in 1977.

Among the distinguished guests at the Salute was Chief Justice of the Supreme Court Warren E. Burger, who was invested as a Foundation Jimmy Doolittle Fellow. AEF President George D. Hardy made the presentation of the Fellowship plaque: "Chief Justice Burger, your Fellowship has been sponsored by AFA's General E. W. Rawlings Chapter in Minnesota, but it comes with the respect and affection of our entire Association. We present this Fellowship with humility—and with deep appreciation for your vital role in our unique American form of democracy."

Mr. Hardy also paid special tribute and recognition to the Foundation's corporate Jimmy Doolittle and Ira Eaker Fellows *(see box)*. Their support enables the Foundation to pursue a variety of aerospace educational endeavors, including the "Roundtables" conducted by its Aerospace Education Center. ■

Honor Roll of AEF Corporate Fellows

Corporate Jimmy Doolittle Fellows

(in order of affiliation)

John M. Olin Foundation *(twice)*
Northrop Corp. *(twice)*
General Dynamics Corp.
Mutual of Omaha Insurance Co.
Vought Corp.
Martin Marietta Aerospace
Boeing Co.
United Technologies Corp.
Garrett Corp.
Fairchild Industries
McDonnell Douglas Corp.
General Electric Foundation
Hughes Aircraft Co.
Textron, Inc.
Lockheed Corp.
Ford Aerospace & Communications Corp.
Loral Corp.
American Telephone & Telegraph Co.
Hughes Helicopter
MITRE Corp.
Reader's Digest Foundation
Avco Corp.
The Singer Co.
The Harry Frank Guggenheim Foundation
(three times)

Corporate Ira C. Eaker Fellows

(in order of affiliation)

Rockwell International Corp.
Pratt & Whitney Aircraft Group
Northrop Corp.
Hughes Aircraft Co. *(five times)*

THE BULLETIN BOARD

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

Vietnam Memorial Statue Dedicated

With a broad representation of veterans groups (including AFA) and Administration and congressional officials, survivors, and those with the best credentials of all—Vietnam veterans—on hand, President Ronald Reagan dedicated the Vietnam Veterans Memorial Statue in Washington, D. C., last Veterans Day.

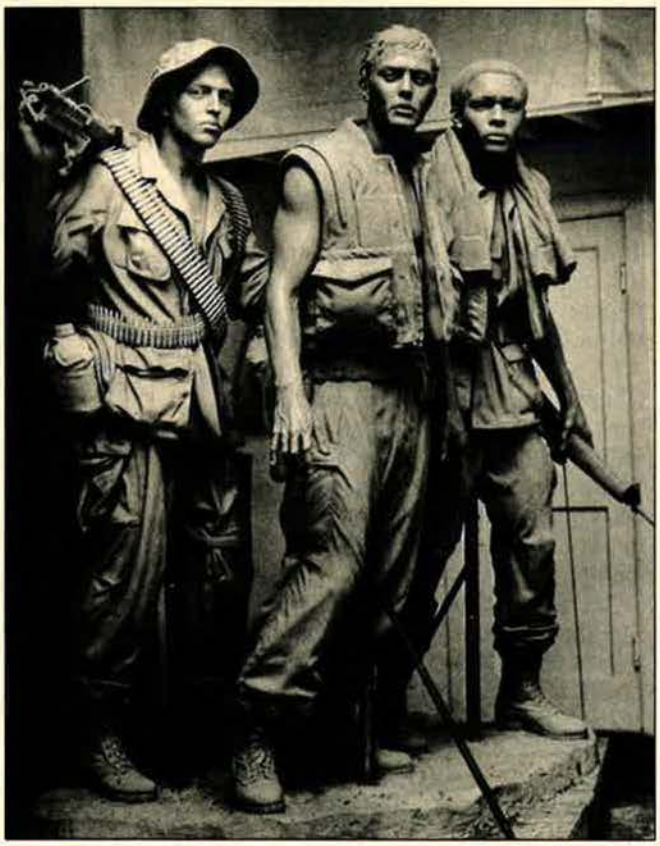
In officially accepting the statue of three "fighting men" for the government *(see photo),* the President praised Sen. John W. Warner (R-Va.) for his "crucial personal support" in bringing the Memorial to fruition.

The President also alluded to the dramatic appeal that the Memorial wall has come to have for the many thousands who visit it each year. "The Memorial reflects as a mirror reflects," he said, "so that when you find the name you're searching for, you find it in your own reflection. And, as you touch it . . . you're touching, too, the reflection of the Washington Monument or the chair in which great Abe Lincoln sits. Those who fought in Vietnam are part of us, part of our history. They reflected the best in us."

The addition of the statue to the Monument, a concession to those who felt a more traditional sculpture was needed to balance the original shiny black marble wall with row upon row of names of the dead and MIA, has generally been applauded by viewers as striking just the right touch.

While, unfortunately, none of the three slightly larger than life size figures can be perceived as airmen—and certainly the air role in that conflict was a major one—the ground forces are well represented by the new addition. As the President said, "We must as a society take guidance from the fighting men memorialized by this statue. The three servicemen are watchful, ready, and challenged, but they are also standing forever together."

(For more on the Vietnam Veterans Memorial, see AIR FORCE *Magazine "Bulletin Board" items in the June 1982 and January 1983 issues.)*



The Vietnam Veterans Memorial Statue was dedicated last fall by President Reagan. The three "fighting men" who make up the group are shown here in a model in the sculptor's studio. The actual figures are slightly larger than life. (Photo by Neshan H. Naltchayan)

A Look at the Veteran

Using statistics just compiled from the 1980 census, the Veterans Administration has drawn a portrait of the veteran population that is interesting if not too surprising.

Including both sexes, one person in six in the US—or 28,500,000—is a veteran. From age forty-five through sixty-three, male veterans outnumber their nonveteran counterparts, with the ratio peaking at almost three to one among males fifty-eight years old. There are a little over a million women veterans. They constitute almost four percent of the total veteran population and about one percent of the civilian female population.

More than eighty percent of the veterans served during wartime—about 12,000,000 in World War II, 4,000,000 in Korea, and 7,000,000 in the Vietnam era. Only about half a million veterans served in World War I.

About four of every five veterans are married, nine percent never married, seven percent are divorced, three percent are widowed, and two percent are separated. Male veterans are more likely than females to be married—only about sixty percent of the women are married.

About thirty-seven percent of the veteran group have some college, but only slightly less than twenty percent hold degrees. Some ten percent hold graduate degrees. Thirty-six percent are high-school graduates, and a little more than twenty-five percent have less than twelve years of education.

A total of 22.8 percent of the group earned $25,000 or more in 1979. One-half earned $10,000 to $25,000, and twenty-seven percent earned less than $10,000. There was a large difference—some $10,000—between average income of male and female veterans, with the males earning more.

The Trapp triplets—from left, Janeen, Jamelle, and Janette—are new USAF enlistees. Behind them are their enlisting officer, Capt. Curtis E. Trullinger, and their recruiter, MSgt. Raymond H. Peterson. (Photo by Dean Curtis, courtesy of Argus Leader, *Sioux Falls, S. D.)*

AFA Board Chairman David L. Blankenship (left) chats with Bob Hope at the Bob Hope Village dedication. Others are Mrs. Hope and Chaplain (Col.) Robert E. Hendricks of Eglin AFB, Fla. Mr. Hope put on a benefit show sponsored by AFA's Eglin and Hurlburt Chapters. (Photo by Larry Vaughn)

These figures parallel society as a whole.

Veterans or others interested in the report may order a single copy—ask for "Veterans in the United States: A Statistical Portrait from the 1980 Census"—from the Statistical Policy and Research Service, VA, Washington, D. C. 20420.

USAF's Triple Trapp Play

Janette, Jamelle, and Janeen Trapp from Milbany, S. D., are three new airmen who show that the Air Force is serious about enlisting women. Doubly serious—or, better yet, triply serious.

The identical triplets *(see photo)* have followed their father and two brothers into the Air Force and are looking forward to striking out on their own after eighteen years of togetherness in their home town of some 4,000 people.

And the Air Force has obliged. After entering the Delayed Enlistment Program in January 1984, they went off to basic training together late last year. Now, Jamelle and Janette, who went to Personnel Specialist Training at Keesler AFB, Miss., have been assigned to McChord AFB, Wash., and Offutt AFB, Neb., respectively. Meanwhile, Janeen has moved to Laughlin AFB, Tex., as a directed-duty assignee in the Recreation Services field.

The women are part of a continually growing contingent of female members that has caused the Air Force to put out a call for new women Military Training Instructors to handle the increased requirements at basic training. If Congress has its way, this trend will accelerate. It recently asked the Air Force to sign up women for nineteen percent of the new recruits in FY '87 and twenty-two percent in FY '88. *(See also "Finishing the Firsts" on p. 85 of this issue.)*

Bob Hope Village Dedicated

Amid pomp and ceremony, the Bob Hope Village of the Air Force Enlisted Widow's Home was dedicated late last year.

On hand were a number of dignitaries *(see photo),* including the famed comedian, who put on his fourth benefit show for the Home. (The benefit show was sponsored by AFA's Eglin and Hurlburt Chapters.)

CMSAF Sam Parish was the master of ceremonies for the dedication. He read a letter of congratulations from President Reagan, who lauded Bob Hope for his "humanitarian endeavors." The President also saluted the retired enlisted people of the Air Force.

Bob Hope Village is expected to be open for up to sixty-five widows this month and sixty-four more in May, filling half of the planned 256 units.

VA Cemetery Space Added

The VA has awarded a million-dollar grant to the state of New Jersey to help establish a state-owned veterans cemetery.

The cemetery, to be located in Arneytown, N. J., near Trenton, will provide an estimated 18,000 gravesites. The VA Cemetery Grant Program, which provides matching funds to aid states in setting up and caring for veterans cemeteries, is an increasingly popular vehicle for increasing the gravesite space that will be needed in the coming years. Eight states have now signed on for the program. Officials are invited to call (202) 389-2313 for more details on the program.

Meanwhile, at the other end of the country, VA plans to reopen the Los Angeles National Cemetery late this year. The site, which had closed in 1976, will receive some twenty acres of land from the VA's Wadsworth Medical Center, which is separated from the cemetery by Sepulveda Boulevard in west Los Angeles.

The additional acreage will provide approximately 20,000 new gravesites for burials. The cemetery land was deemed available after a property review of the medical center was completed. Both are located near the intersection of Wilshire Boulevard and the San Diego Freeway. Los Angeles has the largest population of veterans of any county in the nation.

Notwithstanding the availability of space in other areas, VA fields constant requests for information on burial in Arlington National Cemetery. It would like all veterans to know that those eligible for the limited Arlington space are (1) those who die on active duty; (2) those retired for disability, or who have at least twenty years of active duty or reserve service; (3) honorably discharged veterans who have held certain high government posi-

tions; (4) veterans discharged for thirty percent or more disability before October 1, 1949; and (5) veterans who hold the nation's highest military decorations—Medal of Honor, Distinguished Service Cross, Air Force Cross, Navy Cross, or the Purple Heart. All arrangements for burial must be made through the Superintendent, Arlington National Cemetery, Arlington, Va. 22211.

USAFA Overpowers Bowl Opponent

For the third straight year, the Air Force Academy Falcons football team has gone to a post-season bowl and, for the third time, has racked up a victory.

The Falcons overwhelmed the Virginia Tech Hokies by a score of 23–7 in the Ninth Annual Independence Bowl in Shreveport, La., in December. The Academy gridders were defending their title as last year's Independence Bowl winners. In 1982, they won the Hall of Fame Bowl, 36–28, over Vanderbilt.

The cadets, who brought an 8–4 record into the game, were ranked second nationally with their rushing offense, which had gained 326.5 yards per game. Coincidentally, Virginia Tech was ranked second nationally in rushing defense, allowing an average of only 71.5 yards a game. Its defensive line was anchored by tackle Bruce Smith. The Tech 283-pounder was named the winner of the 1984 Outland Trophy, designating him as the nation's most outstanding lineman. Nonetheless, the Falcons rushed for 221 yards in the winning effort. Ninety-three of those yards were amassed by Air Force quarterback Bart Weiss, who also passed for an additional forty-nine yards in a six-for-seven effort. He was named the game's most valuable offensive player.

Although surrendering the Commander in Chief's Trophy in 1984, emblematic of the best record among the service academies, Air Force had a good season under Head Coach Fisher DeBerry. They beat Notre Dame for the third year in a row and Navy for the second successive year.

Reserve Policy Group Recommends Changes

The Air Reserve Personnel Center/Air Force Reserve Policy and Advisory Council met recently and considered fourteen suggestions from the field for improved utilization of Reserve resources. Six were sent on to the Chief of the Air Force Reserve.

Among those ideas forwarded were recommendations to change DoD regulations so that active-status Reservists might fly space-available on military aircraft, to authorize retired Reservists to become Junior ROTC instructors, to standardize the awarding of Reserve retirement points for all services, and to consider an increase in Reserve recruiting positions.

The Council has been instrumental in changing laws, policies, regulations, and programs. The next meeting is scheduled for May 1985. If you want to submit a suggestion or recommendation for its consideration, use ARPC Form 2 or just plain bond paper. Send ideas to Hq. ARPC/CVR, Denver, Colo. 80280-5000.

THE BULLETIN BOARD

VA Benefits Director Retires

Dorothy L. Starbuck, Chief Benefits Director of the VA, has retired after more than forty-two years of federal service. Since 1977, she has headed the Department of Veterans Benefits (DVB), which is responsible for most of the nonmedical benefits provided by the VA. Her longevity in this job is unmatched.

Starbuck joined the VA as a clerk in the Chicago Branch Office in 1946. An Army veteran, she served on the overseas staff of Gen. Omar Bradley in World War II. Her appointment as Assistant Director of the Baltimore Regional Office in 1962 was the first time a woman had been named to a DVB managerial position. A year later she was named Director of the Regional Office in her native Denver. An associate, commenting on her varied background, told AIR FORCE Magazine, "Nobody in the field kids Dorothy—she's been there and she knows what it takes to get the benefit to the veteran."

During her tenure, she played a major role in bringing computer technology to the claims-processing system. Outreach programs given impetus by her leadership include those designed to help former POWs, unemployed veterans, the elderly, and educationally disadvantaged veterans.

VA Administrator Harry N. Walters said, "The VA is losing a motivated, dedicated leader. Her work and leadership have benefited millions of our nation's veterans, and we all owe her our respect and gratitude." At press time, a successor had not been named.

Among her many, many awards—in 1978, she received the President's Award for Distinguished Federal Service, the highest career federal employee recognition—she received AFA's VA Employee of the Year Award in 1980.

Short Bursts

Sgt. M. Randy Dunham, Wright-Patterson AFB, Ohio, was named **Journalist of the Year for 1984** by judges of the Twenty-Ninth Annual Air Force Media Contest.

McChord AFB, Wash., is the first base to host **a USO lounge in its passenger terminal.** USO volunteers are providing coffee, reading material, television, baby care, and help with hotel reservations for overseas-bound people.

The VA, which oversees the largest medical construction program in the country, has published **a new handbook on barrier-free design** for its health-care facilities, which include hospitals, clinics, and nursing homes. The handbook clearly defines space and dimension requirements to

Cast members of "Tops in Blue" rehearse one of the numbers they performed during halftime of last month's Super Bowl game at Palo Alto, Calif. Each year, a new group of these talented amateurs travels throughout the world, bringing entertainment to remote sites and isolated locations. (Photo by Walt Weible)

ensure accessibility for handicapped persons. Copies of the pamphlet, "Barrier-Free Design Handbook," are for sale by the Government Printing Office, Washington, D. C. 20402.

Dead at fifty-eight from cancer complications is **Chaplain (Col.) Simon H. Scott.** An Air Force chaplain for thirty years prior to retirement in 1981, he was the first and only chaplain in Air Force history to serve as **Command Chaplain for three of the largest commands**—USAFE, SAC, and TAC.

The Navy has opened sixty-four bases, worldwide, to **"McDonald's" concession fast food units.** Standard "McDonald's" menu items will be featured, and a share of the revenue will go to the Navy's Morale, Welfare and Recreation programs.

CMSgt. Darr K. King has been named the **new Commandant of the Air Force First Sergeants Academy** at Keesler AFB, Miss. He will implement new and more rigid dress, appearance, and weight-management standards at the school. "The basic information hasn't changed that much," says Chief King, but more emphasis is being placed on "quality force."

The **Bronx VA Medical Center** has been selected as the site of a research center devoted to the **study of Alzheimer's disease,** an impairment characterized by debilitating memory loss and personality changes. Currently, exact causes are unknown. About 2,000,000 elderly in the US are presently afflicted. Dr. Kenneth Davis, internationally recognized for his research in drug treatment for the illness, will head up the unit.

The **Anheuser-Busch Foundation** has donated $50,000 **to help build the Missouri Unified Veterans Memorial** in Jefferson City, the state capital. The memorial will honor the more than 17,000 Missouri veterans who perished in World Wars I and II, Korea, and Vietnam, as well as the state's 647,000 living veterans.

The **new federal tax law** allows military homeowners who sell their homes in connection with an overseas PCS to wait up to **eight years to buy a new residence**—thus delaying a capital gains tax for that period.

VA Administrator Harry N. Walters is the first VA official to receive a **Citicorp Diners Club charge card** for use in connection with official government travel. Private businesses have long used charge cards as a means of controlling and accounting for business trip costs. The government is testing the concept—VA will try it at twelve field facilities and the Washington Central Office.

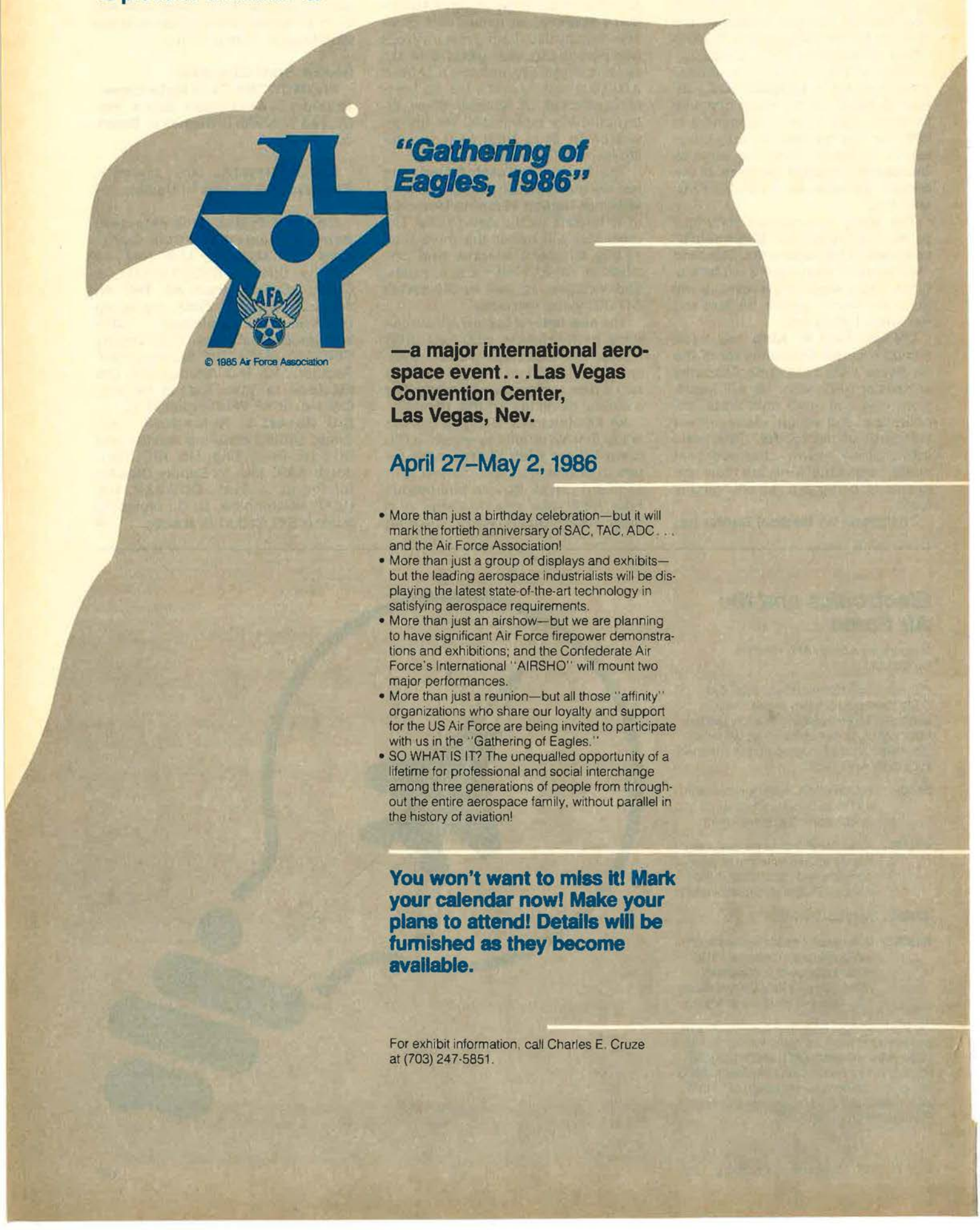
Senior Staff Changes

PROMOTIONS: To be **Major General:** Henry D. **Canterbury,** Jack K. **Farris,** Leo W. **Smith** II, Samuel H. **Swart,** Jr.

RETIREMENTS: M/G James I. **Baginski,** B/G Robert H. **Baxter.**

CHANGES: B/G (M/G selectee) Henry D. Canterbury, from Cmdr., 832d AD, TAC, Luke AFB, Ariz., to Deputy CINC, USSOUTHCOM, & Cmdr., USAF Southern AD, TAC, Albrook AFS, Canal Zone, replacing M/G William E. Masterson . . . **M/G William E. Masterson,** from Deputy CINC, USSOUTHCOM, & Cmdr., USAF Southern AD, TAC, Albrook AFS, Canal Zone, to Spec. Ass't to the Vice C/S, Hq. USAF, Washington, D. C. . . . **B/G Robert L. Rutherford,** from Cmdr., USAF Recruiting Service, and DCS for Recruiting, Hq. ATC, Randolph AFB, Tex., to Deputy Director for Prgms. & Eval., DCS/P&R, Hq. USAF, Washington, D. C., replacing retiring B/G Robert H. Baxter. ■

The Air Force Association is proud to announce its



"Gathering of Eagles, 1986"

—a major international aerospace event . . . Las Vegas Convention Center, Las Vegas, Nev.

April 27–May 2, 1986

- More than just a birthday celebration—but it will mark the fortieth anniversary of SAC, TAC, ADC . . . and the Air Force Association!
- More than just a group of displays and exhibits—but the leading aerospace industrialists will be displaying the latest state-of-the-art technology in satisfying aerospace requirements.
- More than just an airshow—but we are planning to have significant Air Force firepower demonstrations and exhibitions; and the Confederate Air Force's International "AIRSHO" will mount two major performances.
- More than just a reunion—but all those "affinity" organizations who share our loyalty and support for the US Air Force are being invited to participate with us in the "Gathering of Eagles."
- SO WHAT IS IT? The unequalled opportunity of a lifetime for professional and social interchange among three generations of people from throughout the entire aerospace family, without parallel in the history of aviation!

You won't want to miss it! Mark your calendar now! Make your plans to attend! Details will be furnished as they become available.

For exhibit information, call Charles E. Cruze at (703) 247-5851.

AFA INTERCOM

By Robin L. Whittle, AFA DIRECTOR OF COMMUNICATIONS

Charles A. Lindbergh Chapter Honors Secretary Dole

"Most charming, sharp, aware, in command, and delightful," said John Henry Griffin, President of AFA's Charles A. Lindbergh Chapter, about the luncheon honoree. Some 400 community leaders, AFA members, and military guests gathered at "Ottavio's" in Fairfield, Conn., to witness the presentation of the Chapter's "Lone Eagle Award" to Elizabeth Hanford Dole, US Secretary of Transportation, in late September.

In a powerful pre-election address, Secretary Dole criticized the Democratic presidential candidate's intention to cancel the MX and B-1, saying cancellation would mean the loss of thousands of Connecticut jobs in plants with defense contracts. She labeled it a job-reduction plan for Connecticut.

She told the AFA group that her office recently became a space agency and is working on commercializing use of expendable launch vehicles. Use of expendable launch vehicles by industry is not intended, she said, to rival NASA or Air Force programs. She also noted that the project will provide for growth and increased development in the area. "It's not only important to keep the US out in front on space activities, it's imperative," she said.

Secretary Dole was honored by the Lindbergh Chapter for professional achievement as well as pursuit of excellence in the Lindbergh tradition. The Lone Eagle Award is the Lindbergh Chapter's highest honor and has been presented only twice since the Chapter was chartered in 1980. ("Lone Eagle" was the nickname the press gave Lindbergh during coverage of his transatlantic flight.) Recipients were Anne Morrow Lindbergh and Lt. Gen. Leo Marquez, Deputy Chief of Staff for Logistics and Engineering. During the luncheon, Secretary Dole was presented a key to the city of Fairfield by First Selectwoman Mrs. Jackie Durrell. Norwalk High School Air Force Junior ROTC cadets awarded her their school cup. Secretary Dole was praised for being the first woman to head a branch of the military service, the US Coast Guard. On hand were Vice Adm. Paul Yost, Commander, Atlantic Area, USCG, and personnel from the New Haven Coast Guard Station.

US Secretary of Transportation Elizabeth Hanford Dole accepted the Charles A. Lindbergh Chapter's "Lone Eagle Award" from Chapter President John Henry Griffin during a recent luncheon. Secretary Dole was honored for professional achievement and pursuit of excellence in the Lindbergh tradition.

The Lindbergh Chapter—one of AFA's Outstanding Chapters for 1984 and winner of the Donald W. Steele, Sr., Memorial "Unit of the Year" Award in 1983—worked with local community groups, military leaders, and the media to turn out the crowd for Secretary Dole. Representatives from five newspapers, two television stations, and United Press International attended the AFA luncheon, with excellent coverage resulting. Chapter organizers included Richard Anderson, Program Committee Chairman; Dr. Roger Geronimo, Protocol Officer; Ann Marie Super, Membership/Communications Director; Scott Brinckerhoff, Publicity; William Shields, Vice President; Thomas Simonsen, Secretary; Terry Tooley, Treasurer; and Al Hudson, Connecticut State AFA Vice President (and Aerospace Education Foundation Secretary).

Typically, plans are well under way for outstanding programs throughout 1985. Next month, the Chapter plans a meeting with Gen. Robert T. Herres, Commander of Space Command, during which its first "Saber of Excellence" will be presented. Other programs will feature Gen. Lawrence A. Skantze, Commander, Air Force Systems Command; Gen. Bennie L. Davis, Commander in Chief, Strategic Air Command; and Lt. Gen. Melvin F. Chubb, Jr., Commander, Electronic Systems Division, Air Force Systems Command.

How do they do it? Says Lindbergh

President John Henry Griffin, "We plan way in advance, divide up the tasks, coordinate, and communicate." They are also not afraid to ask key speakers to participate. Originally they had asked President Reagan to address the September luncheon. And, finally, they do their homework in the community to attract civic leaders and those "outside the choir"—a key to attracting top talent.

CMSAF Sam Parish Is Given a Copy of *Top Cover for America*

CMSAF Sam Parish was one of the first people to receive a copy of the Anchorage Chapter book on the Air Force in Alaska entitled *Top Cover for America* and authored by John H. Cloe and the late Michael Monaghan, son of AFA National Director Ed and Mary Monaghan. The beautifully designed and well-written book presents the history of the Air Force in Alaska in a detailed and interesting narrative that is graphically illustrated with more than 300 photographs and twenty-seven maps. Every aspect of the Air Force's Alaska experience is detailed, from the first military flight in the state in 1920 to the massive buildup of military forces during World War II to the presence of today's modern fighting force.

Years of exhaustive research went into the book to provide the first accurate, detailed account on record. The dramatic cover art was painted by aviation artist Steve Hillyer and features an F-15A Eagle over the Yanert Glacier's river of ice in the Alaska Range. Denali (the native Alaskan name for Mount McKinley), the highest mountain in North America, looms above low-level clouds.

At a lower altitude is a P-36A Hawk from the 18th Pursuit Squadron—the first operational fighter squadron assigned to the demanding flying environment of Alaska. The painting is entitled "Ready Then . . . and Ready Now!" and was commissioned by the Anchorage Chapter for the cover. A limited supply of 950 numbered and signed prints is available at $25 each from Design Workshop, 3341 Mt. Vernon Court, Anchorage, Alaska 99503, or from Anchorage Chapter officials.

The book is published by the Pictorial Histories Publishing Co., 713 South 3d West, Missoula, Mont. 59801, and is available for $15.45 postpaid. Profits from the sale of the book are earmarked for the Anchorage Chapter's Robert C. Reeve Memorial Scholarship Fund, a nonprofit organization that honors Anchorage high-school students with scholarships each year.

(See p. 181, December '84 issue, for "Airman's Bookshelf" review of this book.)

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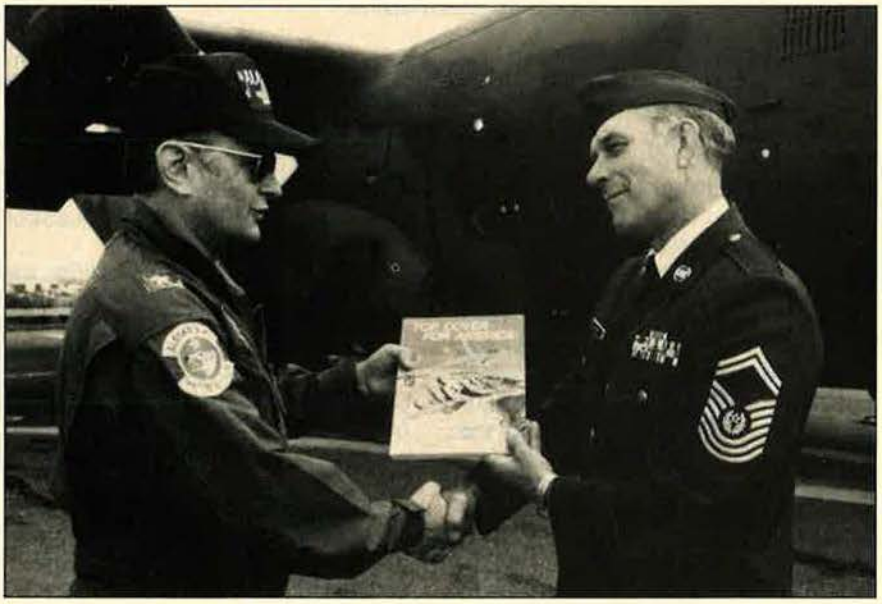
Enjoying New Jersey AFA's Fall Ball were, from left, Col. James LeCleir, 438th Military Airlift Wing Commander; Karen Keesling, Principal Deputy Assistant Secretary of the Air Force for Manpower, Reserve Affairs and Installations; and New Jersey AFA President Gil Freeman. See item.



Chief Master Sergeant of the Air Force Sam E. Parish accepted one of the first copies of the Anchorage Chapter's book* Top Cover for America *from Brig. Gen. Ed Belyea, Alaska ANG, during a recent visit. See item.

New Jersey AFA's Fall Ball Is Called A Fabulous Success

New Jersey AFA's "Fall Ball" in October set a record in attendance, topping last year's figure by more than 300. In fact, the 562 who attended found themselves in the McGuire AFB Recreation Center Ballroom rather than in the Officers' Club, which could not accommodate the crowd. Featured speaker was Karen Keesling, Principal Deputy Assistant Secretary of the Air Force for Manpower, Reserve Affairs and Installations, who discussed key personnel concerns certain to dominate the 1985 congressional year. While the Air Force Honor Guard, Color Guard, and the Air Force Band of the East gave the event a distinctive military flair, many attending were civilians, including industrial, political, and AFA leaders from throughout the Northeast Region.

Gen. Thomas M. Ryan, Jr., Commander in Chief of Military Airlift Command, proudly displays the Aerospace Education Foundation Jimmy Doolittle Fellowship plaque that he received at AFA's Altus Chapter's Fall Banquet, held last year at the Altus AFB, Okla., Officers' Club.

Wichita Falls Chapter leaders who received national AFA awards at a recent Chapter meeting at Sheppard AFB, Tex., were congratulated by USAFE Commander in Chief Gen. Charles L. Donnelly, Jr., left, and Maj. Gen. William M. Charles, right, Commander of the Sheppard Technical Training Center. The award winners are, from left, Charles White, past Chapter President; Bob Haley, current President; and Lee Shofner.

Awards presented during the evening included the New Jersey AFA "Man of the Year" award to National Director Jim Grazioso, the national Exceptional Service Award to New Jersey State President Gil Freeman, and national Medals of Merit to Tom Gilbert, David Gordon, Larry Moody, Stanley Shapiro, and Martin Weigler. A number of New Jersey AFA awards were presented, including Chapter Achievement Awards to the Garden State, Mercer County, and Thomas B. McGuire, Jr., Chapters.

TAC Commander Addresses Langley Chapter Meeting

"Air Force Stronger . . . Air Force Better . . . Air Force Improved" read the banner headlines on Gen. Jerome F. O'Malley's address to 400 Langley Chapter members and civic leaders at a luncheon in November.

If the United States goes to war, the Air Force is much better prepared to fight than it was four years ago, the Commander of Tactical Air Command told the luncheon audience. He noted that the people who join the Air Force today are better educated and more likely to stay in the service than they were in 1980, mostly because of incentive programs designed to attract people to military life.

If incentives are reduced, "We will sail back into the horrible threat that we had back in 1979," General O'Malley warned.

Excellent coverage of General O'Malley's address appeared in the Newport News *Times-Herald*, the Newport News *Press*, and the Norfolk *Ledger-Star*.

Material for "Intercom" should be sent directly to Robin Whittle, AFA Director of Communications, 1501 Lee Highway, Arlington, Va. 22209-1198.

AFA Chapters Are Active in the Evergreen State

Al Lloyd, Seattle Chapter President, says Edith W. Martin, former Deputy Under Secretary of Defense for Research and Advanced Technology, "laid it on the line when she described her generation as the last to get an adequate education in the nation's public schools. Her children are in private school, and she noted that they are getting less of an education than she did."

Dr. Martin, now a senior Boeing Co. official, told Seattle Chapter members and guests about the increasing demands for advanced technology in military systems and for the necessary technical skills that must be honed. The event was held December 11 at the Sand Point Officers' Club, and some 100 people attended.

Purchasing distinctive uniforms for Fairchild AFB's Combat Weapons

INTERCOM

Loading Competition team and contributing $500 to "Operation Warm Heart" to help financially burdened military families at Fairchild purchase food for Christmas dinner and toys for the children are among the recent activities of AFA's Spokane Chapter. President Andy Kelly says the Chapter contributed $3,500 for the uniforms for the Weapons Loading team and a like amount for the "Bomb Group" the following month.

Said Andy, "We're not 'just an officers' club' at Fairchild." In fact, the Chapter and its Blue Ribbon Committee, comprising thirty non-AFA busi-

During AFA's Alamo Chapter's Dan Berkant Awards Banquet, held recently at the Randolph AFB, Tex., Officers' Club, San Antonio businessman Alton Newell, second from left, received the Walter W. McAllister, Sr., Patriotism Award for his efforts to promote military-civilian cooperation. Pictured with Mr. Newell are, from left, Maj. Gen. James P. Smothermon, Vice Commander of ATC; E. F. "Sandy" Faust, Alamo Chapter President and AFA National Director; and Lt. Gen. John P. Flynn, USAF (Ret.), recipient of an AFA Special Citation during the banquet.

AFA STAFF PROFILES

A Busy Intersection

By Edward J. McBride, Jr.
STAFF EDITOR

Every Friday is D-day for the Reproduction/Distribution/Mail Services staff at AFA Headquarters. The weekly pouch mailing to AFA units and field leaders must be ready to go by 4:00 p.m. The job entails labeling and stuffing approximately 450 large envelopes, separating the envelopes according to weight, and ensuring that each envelope has the correct amount of postage. On some Fridays, documents for the week's pouch don't reach the mail room until mid-afternoon. For Rolla F. Gray, Gilbert A. Burgess, Edward L. Walker, and Rodney Sharp, it's just the end of another "typical" week.

The Reproduction/Distribution/Mail Services staff oversees the flow of mail into, out of, and within AFA National Headquarters; fulfills the copying needs of the eighty-person AFA staff; and performs a variety of other jobs that are vital to the daily operations of AFA Headquarters.

At times, the activity in the mail room resembles a busy Washington intersection at rush hour, with the four-person staff directing an enormous volume of traffic. In the average week, more than 11,000 pieces of mail are delivered to AFA Headquarters and more than 2,000 letters and packages are prepared and posted from AFA. Also, anywhere from 30,000 to 50,000 photocopies are produced each week. The numbers are even higher during the annual AFA Convention. In fact, the day before the opening of the 1984 Convention, the staff worked through the night to produce 500 copies each of AFA's Statement of Policy and two policy papers for distribution to the delegates. The total run was a whopping 42,500 copies.

The Reproduction/Distribution/Mail Services team at AFA Headquarters (from left): Assistant Manager Gilbert A. Burgess, mail clerk Rodney Sharp, Manager Rolla F. Gray, and mail clerk Edward L. Walker.

"Keeping everything organized and in its place" is the key, according to Manager Rolla Gray. Born and raised in the nation's capital, Mr. Gray was a press operator before joining the AFA staff in 1971.

Another requirement in managing the inevitable "rush" and "priority" jobs is teamwork. "Each of us pitches in. Each has to know every part of the operation so that, if we're not at full strength, the job will still get done," says Assistant Manager Gilbert Burgess, a North Carolina native who grew up in Washington, D. C. After joining the AFA staff in 1969, he served a two-year tour with the Army before rejoining the staff in 1972. The other members of the team are fellow Washingtonian Ed Walker, who joined the AFA staff in 1979, and Rodney Sharp, a West Virginia native who raised horses before joining the staff last August.

ness leaders in Spokane, were invited to a demonstration of the "loading competition process" and were acknowledged publicly as the sponsors of the uniforms.

AFA's Tacoma Chapter sponsored the fourth annual Howard O. Scott Pro-Am golf tournament for some 200 golfers at McChord AFB's Whispering Firs golf course. Proceeds help support the McChord AFB Youth Activities program and the Chapter's Big John Anderson scholarship fund, which benefits junior and senior AFROTC and Civil Air Patrol cadets. The winning team included Col. Vernon Kondra, Commander, 62d Military Airlift Wing, and Tacoma Chapter President Eugene Nuss. The winning professional and lowest-scoring amateur were guests at the Chapter banquet, during which the $1,000 first-place prize was presented to the professional and the winner's trophy to the amateur. Banquet speaker was Brig. Gen. Alan P. Lurie, Commander, 25th Air Division, TAC.

Spokane Chapter President Andy Kelly presents a hat to Sgt. Thomas Hanselman, who is wearing one of the uniforms purchased by the Chapter for Fairchild AFB's Combat Weapons Loading Competition team. The Chapter contributed $3,500 for the team's uniforms and a like amount for uniforms for the "Bomb Group."

Wanda Scott, First Vice President of AFA's Tacoma Chapter and wife of the late Howard O. Scott, presents a $2,000 check to Gary Tillotson, McChord AFB Youth Center Director. Looking on are, from left, Tournament Director Joseph Tucker, Col. William Martin, 62d Air Base Group Commander, and Eugene Nuss, Tacoma Chapter President. See item.

On the Scene In AFA's Busy and Active Grass Roots

North Dakota AFAer **Maury Rothkopf** has arranged for a group of retired business people, who operate a fish fry for groups, to tour SAC headquarters this month. . . . **Gen. Thomas M. Ryan, Jr.,** CINC MAC, told a dinner meeting of AFA's Abilene Chapter in Texas that Air Force personnel today are prouder than ever and have joined the Air Force for the right reasons. "It makes you blush, they are so patriotic," he said. . . . Erie Chapter President **Frank Juliano** showed the film "Countdown for America" to a Chapter gathering on November 17. . . . Former Under-40 National Director **Mike Wilson** of Jacksonville, Ark., has been named to that state's legislative Joint Budget Committee, which began daily hearings in October, says National Director **Alex Harris.** . . . Former National Vice President (South Central Region) **Chuck Hoffman** gave a stirring address on POW/MIA issues to AFROTC cadets in Fayetteville, Ark., concluding the talk with the POWs' secret tap code that translated to "Good night and God bless." . . . General E. W. Rawlings Chapter officials held their first awards luncheon, featuring **Maj. Gen. John P. Hyde, USAF,** as speaker. **Doyle Larson** is the new Chapter President.

Rep. Steve Bartlett (R-Tex.) addressed the Dallas Chapter's November 16 dinner meeting on what's in store for defense on the Hill in 1985. . . . Dallas Chapter President **Bill Solemene** tells members to "Join the +1 challenge—bring an Air Force friend or business associate to the next meeting." . . . **Wilburt J. Sutton** has been named the Union Morris Chapter's "Man of the Year.". . . Sacramento Chapter members heard **Sergei Sikorsky** speak on the development of rotary-wing aircraft at a November 15 meeting at Mather AFB, Calif. . . . Alamo Chapter leaders **Sandy Faust** and **Kaye Biggar** worked with the AFROTC unit at the University of Texas to present a distinguished lecture program, which featured then AFA National Director **Gen. William V. McBride, USAF (Ret.),** on "Civilian Control of the Military"; AFA Veterans Affairs Advisor **Lt. Gen. John P. Flynn, USAF (Ret.),** on "Military Ethics"; **Maj. Gen. Norma E. Brown, USAF (Ret.),** on "Women in the Military"; **Maj. Gen. Gerald E. Cooke, USAF (Ret.),** on "Professionalism"; and **CMSAF Robert Gaylor, USAF (Ret.),** on "The Role of the NCO." . . . **Dick Doom,** National Vice President (Far West Region), copes with the tremendous size of his region (from Arizona to Guam and from the Mexican border to the California/Oregon border) by appointing several key regional committees—an executive committee, a regional oversight committee, a communications committee, and a regional membership committee.

"History of Aerospace in Our Area" is the theme of this year's national AFJROTC contest sponsored

AFA State Contacts

Following each state name, in parentheses, are the names of the communities in which AFA Chapters are located. Information regarding these Chapters, or any place of AFA's activities within the state, may be obtained from the appropriate contact.

ALABAMA (Auburn, Birmingham, Huntsville, Mobile, Montgomery, Selma): **Jim Patterson,** 802 Brickell Rd., N.W., Huntsville, Ala. 35805 (phone 205-837-5087).

ALASKA (Anchorage, Fairbanks): **Michael T. Cook,** 1001 Noble St., Fairbanks, Alaska 99701 (phone 907-456-7762).

ARIZONA (Phoenix, Sedona, Sun City, Tucson): **Meryll Frost,** 7426 E. Random Ridge Drive, Tucson, Ariz. 85710 (phone 602-298-1580).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Little Rock): **Aaron E. Dickerson,** 710 S. 12th, Rogers, Ark. 72756 (phone 501-636-7460).

CALIFORNIA (Apple Valley, Edwards, Fairfield, Fresno, Hermosa Beach, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Jose, Santa Barbara, Santa Monica, Sunnyvale, Vandenberg AFB, Yuba City): **David Graham,** 29611 Vista Plaza Drive, Laguna Niguel, Calif. 92677 (phone 714-495-4622).

COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo, Waterton): **Thomas W. Ratterree,** P. O. Box 26029, Colorado Springs, Colo. 80936 (phone 303-599-0143).

CONNECTICUT (East Hartford, North Haven, Storrs, Stratford, Westport, Windsor Locks): **Raymond E. Choquette,** 16 Tonica Springs Trail, Manchester, Conn. 06040 (phone 203-646-4818).

DELAWARE (Dover, Wilmington): **Joseph H. Allen, Jr.,** 31 Muirfield Court, Dover, Del. 19901 (phone 302-674-3400).

DISTRICT OF COLUMBIA (Washington, D. C.): **David J. Smith,** 1501 Lee Highway, Arlington, Va. 22209-1198 (phone 703-247-5820).

FLORIDA (Avon Park, Brandon, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Jacksonville, Leesburg, Naples, New Port Richey, Orlando, Panama City, Patrick AFB, Redington Beach, Sarasota, Tallahassee, Tampa, West Palm Beach, Winter Haven): **H. Lake Hamrick,** 206 Sotir Ave., N. W., Fort Walton Beach, Fla. 32548 (phone 904-862-5067).

GEORGIA (Athens, Atlanta, Columbus, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **Wilbur H. Keck,** 116 Stillwood Drive, Warner Robins, Ga. 31093 (phone 912-922-0655).

GUAM (Agana): **Joe Gyulavics,** P. O. Box 21543, Guam 96921 (phone 671-734-2369).

HAWAII (Honolulu): **Don J. Daley,** P. O. Box 3200, Honolulu, Hawaii 96847 (phone 808-525-6296).

IDAHO (Boise, Mountain Home, Twin Falls): **Stanley I. Anderson,** Box 45, Gowen Field, Boise, Idaho 83707 (phone 208-362-9360).

ILLINOIS (Belleville, Champaign, Chicago, Elmhurst, Peoria, Springfield-Decatur): **Kyle Robeson,** P. O. Box 697, Champaign, Ill. 61820 (phone 217-352-3936).

INDIANA (Bloomfield, Fort Wayne, Indianapolis, Lafayette, Logansport, Marion, Mentone, South Bend): **John Kagel,** 1029 Riverside Drive, South Bend, Ind. 46616 (phone 219-234-8855).

IOWA (Des Moines): **Carl B. Zimmerman,** 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

KANSAS (Topeka, Wichita): **Cletus J. Pottebaum,** 6503 E. Murdock, Wichita, Kan. 67206 (phone 316-683-3963).

KENTUCKY (Lexington, Louisville): **Jo Brendel,** 726 Fairhill Drive, Louisville, Ky. 40207 (phone 502-897-7647).

LOUISIANA (Alexandria, Baton Rouge, Bossier City, Monroe, New Orleans, Shreveport): **James P. LeBlanc,** 3645 Monroe St., Mandeville, La. 70448 (phone 504-626-4516).

MAINE (Bangor, Limestone, N. Berwick): **Alban E. Cyr, Sr.,** P. O. Box 160, Caribou, Me. 04736 (phone 207-496-3331).

MARYLAND (Andrews AFB area, Baltimore, Rockville): **James M. Kennedy,** 304 Tantallon Drive, Fort Washington, Md. 20744 (phone 301-292-6066).

MASSACHUSETTS (Bedford, Boston, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **John F. White,** 49 West Eagle St., East Boston, Mass. 02128 (phone 617-567-1592).

MICHIGAN (Battle Creek, Detroit, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): **Robert J. Schaetzl,** 42247 Trotwood Court, Canton, Mich. 48187 (phone 313-552-3280).

MINNESOTA (Duluth, Minneapolis-St. Paul): **Paul G. Markgraf,** 2101 E. 3d St., St. Paul, Minn. 55119 (phone 612-735-4411).

MISSISSIPPI (Biloxi, Columbus, Jackson): **R. E. Smith,** Route 3, Box 282, Columbus, Miss. 39701 (phone 601-327-4422).

MISSOURI (Kansas City, Knob Noster, Springfield, St. Louis): **Orville R. Blair,** 1504 Golden Drive, St. Louis, Mo. 63137 (phone 314-867-0285).

MONTANA (Great Falls): **Ed White,** 2333 6th Ave., South, Great Falls, Mont. 59405 (phone 406-453-2054).

NEBRASKA (Lincoln, Omaha): **Edward A. Crouchley,** 1314 Douglas On the Mall, Omaha, Neb. 68102 (phone 402-633-2125).

NEVADA (Las Vegas, Reno): **Vern Frye,** 4665 Rio Encantado Lane, Reno, Nev. 89502 (phone 702-825-1125).

NEW HAMPSHIRE (Manchester, Pease AFB): **Robert N. McChesney,** Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-664-5090).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, E. Rutherford, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Middlesex County, Newark, Old Bridge, Trenton, Wallington, West Orange, Whitehouse Station): **Gilbert Freeman,** 42 Weirimus Lane, Hillsdale, N. J. 07642 (phone 201-666-5379).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): **Louie T. Evers,** P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

NEW YORK (Albany, Brooklyn, Buffalo, Chautauqua, Garden City, Hempstead, Hudson Valley, New York City, Niagara Falls, Plattsburgh, Queens, Rochester, Rome/Utica, Southern Tier, Staten Island, Suffolk County, Syosset, Syracuse, Westchester): **Robert H. Root,** 57 Wynnwood Ave., Tonawanda, N. Y. 14150 (phone 716-692-2100).

NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh): **Bobby G. Suggs,** 501 Bloomfield Drive, Fayetteville, N. C. 28301 (phone 919-323-5281).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): **James M. Crawford,** 1720 9th St., S. W., Minot, N. D. 58701 (phone 701-838-0010).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Newark, Youngstown): **Chester Richardson,** 1271 Woodledge Ave., Mineral, Ohio 44440 (phone 216-652-5116).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **G. G. Atkinson,** P. O. Box 25858, Oklahoma City, Okla. 73125 (phone 405-231-6213).

OREGON (Eugene, Portland): **Zane R. Harper,** 5360 SW Dover Lane, Portland, Ore. 97225 (phone 503-244-4561).

PENNSYLVANIA (Allentown, Beaver Falls, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Johnstown, Lewistown, Philadelphia, Pittsburgh, Scranton, State College, Washington, Willow Grove, York): **Jack B. Flaig,** P. O. Box 375, Lemont, Pa. 16851 (phone 814-238-4212).

PUERTO RICO (San Juan): **Fred Brown,** 1991 Jose F. Diaz, Rio Piedras, P. R. 00928 (phone 809-790-5288).

RHODE ISLAND (Warwick): **King Odell,** 413 Atlantic Ave., Warwick, R. I. 02888 (phone 401-941-5472).

SOUTH CAROLINA (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **James Catington,** 2122 Gin Branch Rd., Sumter, S. C. 29154 (phone 803-481-2634).

SOUTH DAKOTA (Rapid City, Sioux Falls): **John E. Kittelson,** 141 N. Main, Suite 308, Sioux Falls, S. D. 57102 (phone 605-336-2498).

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): **Jack K. Westbrook,** P. O. Box 1801, Knoxville, Tenn. 37901 (phone 615-523-6000).

TEXAS (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Laredo, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **Bryan L. Murphy, Jr.,** General Dynamics, P. O. Box 748 MZ 1221, Fort Worth, Tex. 76101 (phone 817-429-0693).

UTAH (Brigham City, Clearfield, Ogden, Provo, Salt Lake City): **Jack Certain,** 2369 N. 2600 East, Layton, Utah 84041 (phone 801-777-7235).

VERMONT (Burlington): **John D. Navin,** 6 Belwood Ave., Chochester, Vt. 05446 (phone 802-863-1510).

VIRGINIA (Arlington, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **C. W. Scott,** 6368 Brampton Court, Alexandria, Va. 22304 (phone 703-370-2702).

WASHINGTON (Bellingham, Seattle, Spokane, Tacoma, Yakima): **David Anderson,** 915 E. Lake Sammamish Shore Lane, SE, Issaquah, Wash. 98027 (phone 206-342-4778).

WEST VIRGINIA (Huntington): **David Bush,** 2317 S. Walnut Drive, St. Albans, W. Va. 25177 (phone 304-722-3583).

WISCONSIN (Madison, Milwaukee): **Charles Marotske,** 7945 S. Verdev Drive, Oak Creek, Wis. 53154 (phone 414-762-4383).

WYOMING (Cheyenne): **Al Guidotti,** P. O. Box 811, Cheyenne, Wyo. 82001 (phone 307-638-3361).

by AFA—entries are due by April 12. . . . Arizona State AFA President **Meryll Frost** has been active in AFA since the beginning—**Jimmy Doolittle** appointed him second vice president until AFA's first election could be held, and Meryll served as vice president and national director for six years. . . . Robert H. Goddard Chapter President **Bob Griffin** has set as a goal the recruitment of thirty Community Partners in 1985—under his leadership the Chapter was named "California Chapter of the Year" in 1984. . . . Alabama AFAer **Brig. Gen. John R. Dyas, USAF (Ret.),** was inducted into the Alabama Aviation Hall of Fame in ceremonies held November 16 at Maxwell AFB. . . . Colorado AFA's Front Range, Silver & Gold, and Blue Barons Chapters held a joint meeting in September featuring **Brig. Gen. Gordon E. Fornell,** Special Assistant for ICBM Modernization, as speaker. Head-table guests included Front Range Chapter President **Jim Clark; Bob Grebe,** Silver & Gold President; **1st Lt. Suzanne Regis,** Protocol Officer for the Front Range Chapter; **Maj. Gen. Joe Moffitt, ANG (Ret.);** and **Bill Morris,** Colorado State AFA President. . . . **Maj. Gen. John B. Conaway,** Director of the Air National Guard, addressed a joint meeting of AFA's Chicagoland-O'Hare Chapter and the Armed Forces Communications and Electronics Association (AFCEA)—a special guest was **Lt. Charles Cantan** of the British Royal Navy, a Harrier pilot who flew a total of sixty-three combat missions over the Falklands, says Chapter President **Tom Hilquist.** ■

Coming Events

April 12–13, **Alabama State Convention,** Mobile . . . April 12–13, **South Carolina State Convention,** Shaw AFB, Sumter . . . May 17–18, **Tennessee State Convention,** Chattanooga . . . June 7–8, **Oklahoma State Convention,** Altus . . . June 14–16, **Georgia State Convention,** Savannah . . . June 21–22, **Ohio State Convention,** Cleveland . . . June 28–29, **New Jersey State Convention,** Cape May . . . July 12–13, **Colorado State Convention,** Air Force Academy . . . July 12–14, **Pennsylvania State Convention,** Pittsburgh . . . July 19–21, **Texas State Convention,** Austin . . . July 26–28, **Washington State Convention,** Bellevue . . . August 2–4, **New York State Convention,** Niagara . . . September 15–19, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.

UNIT REUNIONS

American Defenders of Bataan and Corregidor
The American Defenders of Bataan and Corregidor will hold their reunion on May 5–12, 1985, in Albuquerque, N. M. **Contact:** R. J. Dow, 6902 Prairie Rd., N. E., #907, Albuquerque, N. M. 87109. Ralph Levenberg, P. O. Box 337, Henderson, Nev. 89015.

Blackbirds
The 9th Strategic Reconnaissance Wing at Beale AFB, Calif., will host the sixth biennial Blackbirds reunion on May 17–19, 1985, at the the MGM Grand Hotel in Reno, Nev. This event is open to all military and civilian personnel who have participated in SR-71, U-2/TR-1, and KC-135Q aircraft operations. **Contact:** Blackbirds Reunion Registration, General Delivery, Civilian Post Office, Beale AFB, Calif. 95903.

Stalag Luft III
Former Stalag Luft III POWs will hold a reunion on May 2–4, 1985, in Denver, Colo. **Contact:** Bob Weinberg, Box 787, Highland Park, Ill. 60035. Phone: (312) 432-5972.

Valiant Air Command
The annual Valiant Air Command air show will be held on March 8–10, 1985, at the Tico Airport in Titusville, Fla. (west of Cape Canaveral). **Contact:** Kevin L. Quinlan, 3042 Moss Valley Pl., Winter Park, Fla. 32792.

3d Composite Squadron
Members of the 3d Composite Squadron (Lawson Field, Ga.) will hold a reunion on February 27–March 2, 1985. **Contact:** Col. Nester E. Cole, USAF (Ret.), 2732 Warwick Dr., Bloomfield Hills, Mich. 48013.

4th Military Airlift Squadron
A fiftieth-anniversary reunion will be held on March 29–31, 1985, at McChord AFB, Wash., for members of the 4th Military Airlift Squadron. **Contact:** Lt. Col. Robert M. Sweeny, USAF, 62d Military Airlift Wing (MAC), Public Affairs Div., McChord AFB, Wash. 98438. Phone: (206) 984-3751.

Class 42-B
Graduates of Class 42-B (Mather Field, Calif., and Luke Field, Ariz.) will hold their reunion on February 21–24, 1985, at the Alta Mira Hotel in Sausalito, Calif. **Contact:** R. E. Monroe, 1210 Park Newport, #215, Newport Beach, Calif. 92660. Phone: (714) 759-0111. W. E. Radtke, 214 Marinda Dr., Fairfax, Calif. 94930. Phone: (415) 454-4978.

79th Airdrome Squadron
A reunion will be held for the 79th Air-

INTERCOM

drome Squadron on June 7–9, 1985, at the Sheraton Memphis Hotel, Memphis, Tenn. **Contact:** Fred Hitchcock, Jr., 29 Blueberry Hill Lane, Sudbury, Mass. 01776. Phone: (617) 443-6679.

82d Troop Carrier Squadron
The 82d Troop Carrier Squadron, 436th Troop Carrier Group, will hold a reunion on May 3–5, 1985, at the Americana Congress Hotel in Chicago, Ill. **Contact:** Robert H. Ourant, 4295 Stratton Rd., Columbus, Ohio 43220. Phone: (614) 451-5717.

95th Bomb Group
Members of the 95th Bomb Group will hold their reunion on July 24–28, 1985, in Seattle, Wash., in conjunction with Boeing's celebration of the fiftieth anniversary of the B-17. **Contact:** M. J. "Doc" Steele, 8754 Dallas St., La Mesa, Calif. 92041. Phone: (619) 469-4446.

315th Fighter Squadron
The 315th Fighter Squadron, 324th Fighter Group, will hold a reunion on June 29, 1985, at the Holiday Inn in Wickliffe, Ohio. **Contact:** Eugene J. Orlandi, 311 Third St., East Northport, N. Y. 11731. Phone: (516) 368-9193.

454th Bomb Squadron Ass'n
Members of the 454th Bomb Squadron will celebrate their tenth reunion on May 15–19, 1985, in San Antonio, Tex. **Contact:** Joe Havrilla, 1208 Margaret St., Munhall, Pa. 15120. Phone: (412) 461-6373.

783d Bomb Squadron
The 783d Bomb Squadron, 465th Bomb Group, will hold its second reunion on August 22–26, 1985, at Wright-Patterson AFB, Ohio. **Contact:** Donald P. Kay, 2000 Scott Lane, Los Altos, Calif. 94022. Phone: (415) 969-2827.

1141st SPACTY Squadron
Members of USAF Flight Section Detachment 4 of the 1141st SPACTY Squadron who were stationed in Naples, Italy, during the 1960s or early 1970s will hold a reunion on June 22–23, 1985, at the Sheraton Inn in Colorado Springs, Colo. **Contact:** Chuck Bergeron, 9150 Diamondback Dr., RR3, Colorado Springs, Colo. 80908.

1155th Technical Operations Squadron
Former and current personnel assigned to the 1155th Technical Operations Squadron (Western Field Office) will hold a reunion on June 6–9, 1985, at the Red Lion Inn in Sacramento, Calif. **Contact:** WFO/1155th Technical Operations Squadron Reunion, P. O. Box 1035, North Highlands, Calif. 95660-1035.

4453d Combat Crew Training Wing
A reunion for all permanent party members of the 4453d Combat Crew Training Wing will be held on May 17–19, 1985, at the Green Oaks Inn in Fort Worth, Tex. **Contact:** Col. Bill D. Patton, USAF (Ret.), 2904 Castle Rock Rd., Arlington, Tex. 76011. Phone: (817) 640-1184. Col. Al Lambert, USAF (Ret.). Phone: (817) 236-7677.

41st Air Depot Group
I would like to hear from members of the 441st Quartermaster Platoon, 41st Air Depot Group, who served in Albuquerque, N. M., North Africa, and Bari, Italy (1942–45). My purpose is to plan a reunion in the spring or fall of 1985.
Please contact the address below.
LeRoy Adolph
6128 E. Alta Ave.
Fresno, Calif. 93727
Phone: (209) 255-4251

67th Fighter Squadron
I am trying to locate members of the 67th Fighter Squadron, 347th Fighter Group, for the purpose of holding a reunion in May 1985.
Please contact the address below.
Ed Young
P. O. Box 3806
Florence, S. C. 29502

94th Bomb Group Ass'n
I am searching for former members of the 94th Bomb Group for the purpose of holding a reunion in October 1985. The 94th was a B-17 unit stationed at Bury St. Edmunds, England.
Please contact the address below.
Col. Robert H. Voss,
USAF (Ret.)
4351 Balboa Dr.
Fort Worth, Tex. 76133
Phone: (817) 292-4737

170th Air Refueling Group
I would like to hear from officers and airmen of the 170th Air Refueling Group who are interested in holding a reunion in September 1985.
Please contact the address below.
Lt. Col. Jack Coughlin, NJANG
170th Air Refueling Group
McGuire AFB, N. J. 08641-6005

463d Bomb Group
I would like to hear from members of the 463d Bomb Group for the purpose of planning a reunion.
Please contact the address below.
Lt. Col. Howard W. Green,
USAF (Ret.)
602 Eunice St.
Sequim, Wash. 98382
Phone: (206) 683-6833

604th Special Operations Squadron
I am planning to hold a reunion for the 604th Special Operations Squadron around mid-summer 1985 and would like to hear from former members.
Please contact the address below.
Lt. Col. R. W. Moorehead,
USAF (Ret.)
608 Johnston Dr.
Raymore, Mo. 64083
Phone: (913) 432-7153 (W)
(816) 331-0682 (H)

Presenting...
The
Air Force Association Grandfather Clock

Due to popular demand, the Air Force Association has extended the availability of the AFA Grandfather Clock. Special arrangements have been made with the manufacturer, Pearl Grandfather Clocks, to continue to offer their convenient monthly payment plan with no down payment, or finance charge.

Special Features

The many features of the Air Force Association Grandfather Clock are those found only in the highest quality timepieces. The features include:

- Solid maple cabinet with fruitwood finish.
- Carpathian elm burl on the arched bonnet.
- Hermle key wound, cable-driven, eight day, self-adjusting beat movement designed in the Black Forest of West Germany.
- Westminster, St. Michael's and Whittington chimes and a chime silencer switch.
- Authentic rotating 29½ day moon phase dial.
- Brass-encased weights and brass pendulum.
- Beveled glass door with locking mechanism.
- Raised brass numerals and brass-toned accents.
- Solid brass registration plate diamond-etched with your three line personalized inscription and adorned with a full color re-creation of the AFA emblem in cloisonne hard-fired enamel.
- Clock measures an impressive 79" in height, 22½" in width and 12½" in depth.

Convenient Monthly Installment Plan

The original issue price of the AFA Grandfather Clock is $800 plus $62 for handling and shipping within the continental United States. *The manufacturer provides a convenient monthly installment plan with no down payment or finance charge.* You may choose to take advantage of this plan — only $40 per month in 20 monthly installments (the $62 shipping charge is added to your first month only). *Additionally, you can enjoy the clock in your home, or office, for 15 days, risk-free, before your first payment is due.* If you are not satisfied with your acquisition, you may promptly return the clock with no cost or obligation.

Order by Toll-Free Telephone

Installment plan reservations, or requests for additional information, may be placed weekdays from 9 a.m. to 5 p.m. (eastern time) by telephoning toll-free 1-800-523-0124; Pennsylvania residents only should call 1-215-687-5277 collect. Ask to speak with operator number 2503.

Please note that all orders are subject to credit approval. There is no finance charge and no down payment on the monthly installment plan. Appropriate sales tax will be added to the monthly payments of Tennessee residents only. Please allow approximately 8 weeks for delivery.

All members under age 65 now eligible to apply

RECORD BENEFITS

CURRENT BENEFIT TABLES

Including Substantial Benefit Increases for Policyholders Under Age 65
(effective June 30, 1984)

Member's Attained Age	STANDARD Premium: $10 per month Basic Benefit*	HIGH OPTION Premium: $15 per month Basic Benefit*	HIGH OPTION PLUS PLAN Premium: $20 per month Basic Benefit*
20-24	$125,000	$187,500	$250,000
25-29	110,000	165,000	220,000
30-34	80,000	120,000	160,000
35-39	65,000	97,500	130,000
40-44	40,000	60,000	80,000
45-49	25,000	37,500	50,000
50-54	18,000	27,000	36,000
55-59	12,000	18,000	24,000
60-64	9,000	13,500	18,000
65-69	4,000	6,000	8,000
70-74	2,500	3,750	5,000

AVIATION DEATH BENEFIT* (for pilots and crew members)

Non-war related: Ages 20-34—Payment of ½ the scheduled benefit. (Applies to Standard, High Option and High Option Plus Plans)
Ages 35-74—Payment of the full scheduled benefit. (Applies to Standard, High Option and High Option Plus Plans)

War related:	$15,000	$22,500	$30,000
EXTRA ACCIDENTAL DEATH BENEFIT**	$12,500	$15,000	$17,500

***AVIATION DEATH BENEFIT:** The coverage provided under the Aviation Death Benefit is paid for death which is caused by an aviation accident in which the insured is serving as pilot or crew member of the aircraft involved. Under this condition, the Aviation Death Benefit is paid in lieu of all other benefits of this coverage. Furthermore, the non-war related benefit will be paid in all cases where the death does not result from war or act of war, whether declared or undeclared.

****EXTRA ACCIDENTAL DEATH BENEFIT:** In the event of an accidental death occurring within 13 weeks of the accident, these AFA plans pay an additional lump sum benefit as shown in the tables, except as noted under AVIATION DEATH BENEFIT above.

OTHER IMPORTANT BENEFITS

COVERAGE YOU CAN KEEP. Provided you apply for coverage under age 65 (See "ELIGIBILITY") your insurance may be retained at the same low group rates to age 75.
FULL TIME, WORLD WIDE PROTECTION. The policy contains no war clause, hazardous duty restriction, combat zone waiting period or geographical limitation.
DISABILITY WAIVER OF PREMIUM. If you become totally disabled at any time prior to age 60 for at least a 9-month period, your coverage will be continued in force without further payment of premiums as long as you remain disabled.
FULL CHOICE OF SETTLEMENT OPTIONS. All standard forms of settlement options, as well as special options agreed to by the insured and United of Omaha, are available to insured members.
CONVENIENT PAYMENT PLANS. Premium payments may be made by monthly government allotment (payable to Air Force Association), or direct to AFA in quarterly, annual or semi-annual installments.
DIVIDEND POLICY. AFA's primary policy is to provide maximum coverage at the lowest possible cost. Consistent with this policy, AFA has provided year-end dividends in all but three years (during the Vietnam War) since the program was initiated in 1961, and basic coverage has been increased on seven separate occasions.

ADDITIONAL INFORMATION

Effective Date of Your Coverage. All certificates are dated and take effect on the last day of the month in which your application for coverage is approved, and coverage runs concurrently with AFA membership. AFA Group Life Insurance is written in conformity with the insurance regulations of the State of Minnesota. The insurance will be provided under the group insurance policy issued by United of Omaha to the First National Bank of Minnesota as trustees of the Air Force Association Group Insurance Trust.
EXCEPTIONS: There are a few logical exceptions to this coverage. They are:
Group Life Insurance: Benefits for suicide or death from injuries intentionally self-inflicted while sane or insane will not be effective until your coverage has been in force for 12 months.
The Accidental Death Benefit and Aviation Death Benefit shall not be effective if death results: (1) From injuries intentionally self-inflicted while sane or insane, or (2) From injuries sustained while committing a felony, or (3) Either directly or indirectly from bodily or mental infirmity, poisoning or asphyxiation from carbon monoxide, or (4) During any period a member's coverage is being continued under the waiver of premium provision, or (5) From an aviation accident, either military or civilian, in which the insured was acting as pilot or crew member of the aircraft involved, except as provided under AVIATION DEATH BENEFIT.

ELIGIBILITY

All members of the Air Force Association are eligible to apply for this coverage provided they are under age 65 at the time application for coverage is made.

*Because of certain restrictions on the issuance of group insurance coverage, applications for coverage under the group program cannot be accepted from non-active duty personnel residing in New York.

OPTIONAL FAMILY COVERAGE
PREMIUM: $2.50 per month

Member's Attained Age	Life Insurance Coverage for Spouse	Life Insurance Coverage for each child*
20-39	$20,000.00	$4,000.00
40-44	15,000.00	4,000.00
45-49	10,000.00	4,000.00
50-54	7,000.00	4,000.00
55-59	5,000.00	4,000.00
60-64	3,000.00	4,000.00
65-69	2,000.00	4,000.00
70-75	1,000.00	4,000.00

*Children under six months are provided with $250 coverage once they are 15 days old and discharged from the hospital.
Upon attaining age 21, and upon submission of satisfactory evidence of insurability, insured dependent children may replace this $4,000 group coverage (in most states) with a $10,000 permanent individual life insurance policy with guaranteed purchase options.

Please Retain This Medical Bureau Prenotification For Your Records
Information regarding your insurability will be treated as confidential. United of Omaha Life Insurance Company may, however, make a brief report thereon to the Medical Information Bureau, a nonprofit membership organization of life insurance companies, which operates an information exchange on behalf of its members. If you apply to another bureau member company for life or health insurance coverage, or a claim for benefits is submitted to such a company, the Bureau, upon request, will supply such company with the information in its file.

Upon receipt of a request from you, the Bureau will arrange disclosure of any information it may have in your file. (Medical information will be disclosed only to your attending physician.) If you question the accuracy of information in the Bureau's file, you may contact the Bureau and seek a correction in accordance with the procedures set forth in the federal Fair Credit Reporting Act. The address of the Bureau's information office is P.O. Box 105, Essex Station, Boston, Mass. 02112. Phone (617) 426-3660.

United of Omaha Life Insurance Company may also release information in its file to other life insurance companies to whom you may apply for life or health insurance, or to whom a claim for benefits may be submitted.

NOW AVAILABLE

APPLICATION FOR
AFA GROUP LIFE INSURANCE

United of Omaha

Group Policy GLG-2625
United of Omaha Life Insurance Company
Home Office Omaha Nebraska

Full name of member _____
Rank Last First Middle

Address _____
Number and Street City State ZIP Code

Date of birth (Mo. Day Yr.)	Height	Weight	Social Security Number

This insurance is available only to AFA members

☐ I enclose $18 for annual AFA membership dues (includes subscription ($14) to AIR FORCE Magazine).

☐ I am an AFA member.

Name and relationship of primary beneficiary

Name and relationship of contingent beneficiary

Please indicate below the Mode of Payment and the Plan you elect:

Mode of Payment	Plan of Insurance: Standard Plan		High Option Plan		High Option PLUS Plan	
	Member Only	Member And Dependents	Member Only	Member And Dependents	Member Only	Member And Dependents
Monthly government allotment (only for military personnel). I enclose 2 month's premium to cover the necessary period for my allotment (payable to Air Force Association) to be established.	☐ $ 10.00	☐ $ 12.50	☐ $ 15.00	☐ $ 17.50	☐ $ 20.00	☐ $ 22.50
Quarterly. I enclose amount checked.	☐ $ 30.00	☐ $ 37.50	☐ $ 45.00	☐ $ 52.50	☐ $ 60.00	☐ $ 67.50
Semi-Annually. I enclose amount checked.	☐ $ 60.00	☐ $ 75.00	☐ $ 90.00	☐ $105.00	☐ $120.00	☐ $135.00
Annually. I enclose amount checked.	☐ $120.00	☐ $150.00	☐ $180.00	☐ $210.00	☐ $240.00	☐ $270.00

Names of Dependents To Be Insured	Relationship to Member	Dates of Birth Mo. Day Yr.	Height	Weight

Have you or any dependents for whom you are requesting insurance ever had or received advice or treatment for: kidney disease, cancer, diabetes, respiratory disease, epilepsy, arteriosclerosis, high blood pressure, heart disease or disorder, stroke, venereal disease or tuberculosis? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance been confined to any hospital, sanatorium, asylum or similar institution in the past 5 years? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance received medical attention or surgical advice or treatment in the past 5 years or are now under treatment or using medications for any disease or disorder? Yes ☐ No ☐

If YOU ANSWERED "YES" TO ANY OF THE ABOVE QUESTIONS, EXPLAIN FULLY including date, name, degree of recovery and name and address of doctor. (Use additional sheet of paper if necessary.)

I apply to United of Omaha Life Insurance Company for insurance under the group plan issued to the First National Bank of Minneapolis as Trustee of the Air Force Association Group Insurance Trust. Information in this application, a copy of which shall be attached to and made a part of my certificate when issued, is given to obtain the plan requested and is true and complete to the best of my knowledge and belief. I agree that no insurance will be effective until a certificate has been issued and the initial premium paid.

I hereby authorize any licensed physician, medical practitioner, hospital, clinic or other medical or medically related facility, insurance company, the Medical Information Bureau or other organization, institution or person, that has any records or knowledge of me or my health, to give to the United of Omaha Life Insurance Company any such information. A photographic copy of this authorization shall be as valid as the original. I hereby acknowledge that I have a copy of the Medical Information Bureau's prenotification information.

Date _____, 19 ____ _____
Member's Signature

FORM 3767GL App REV. 10-79

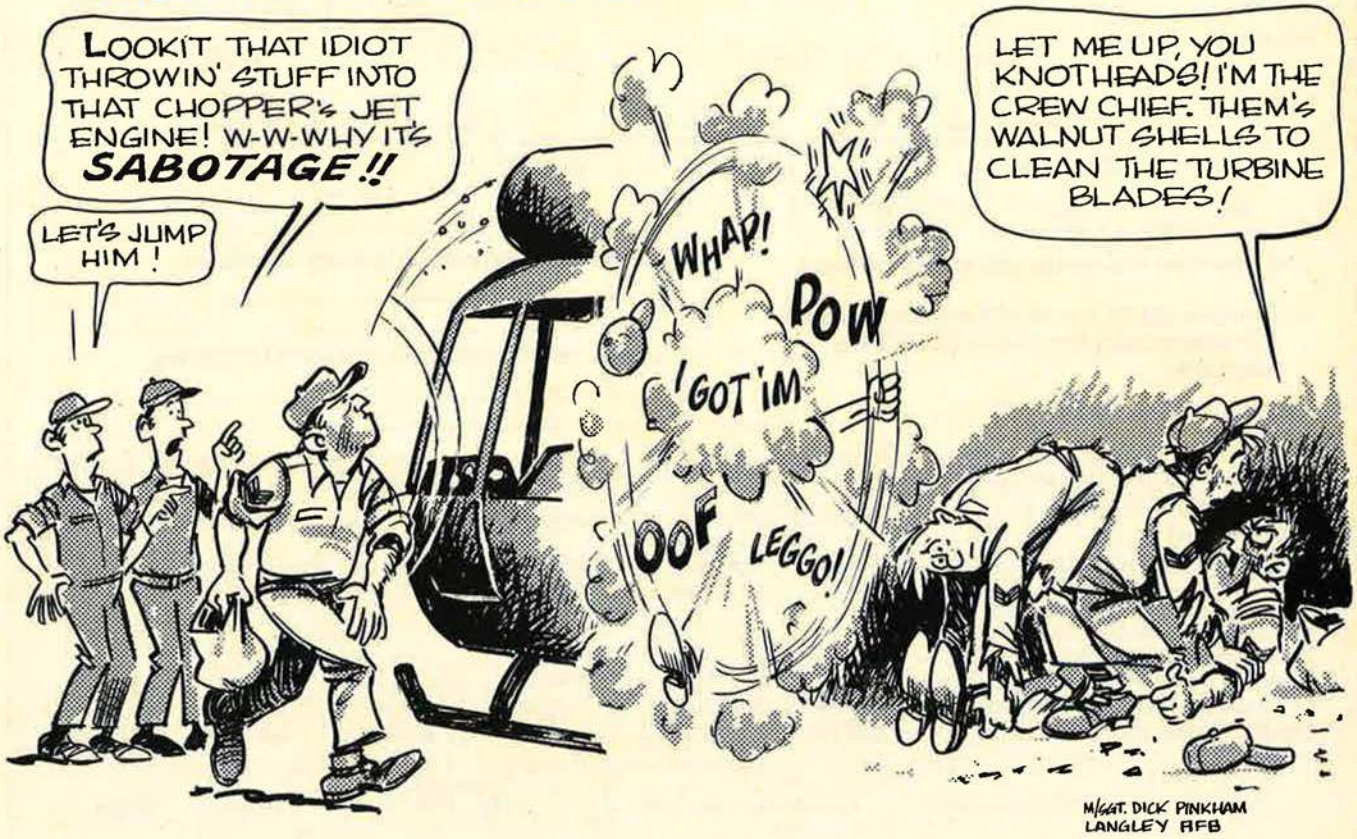
Application must be accompanied by a check or money order. Send remittance to: Insurance Division, AFA, 1501 Lee Highway, Arlington, VA 22209-1198

2-85

Bob Stevens'

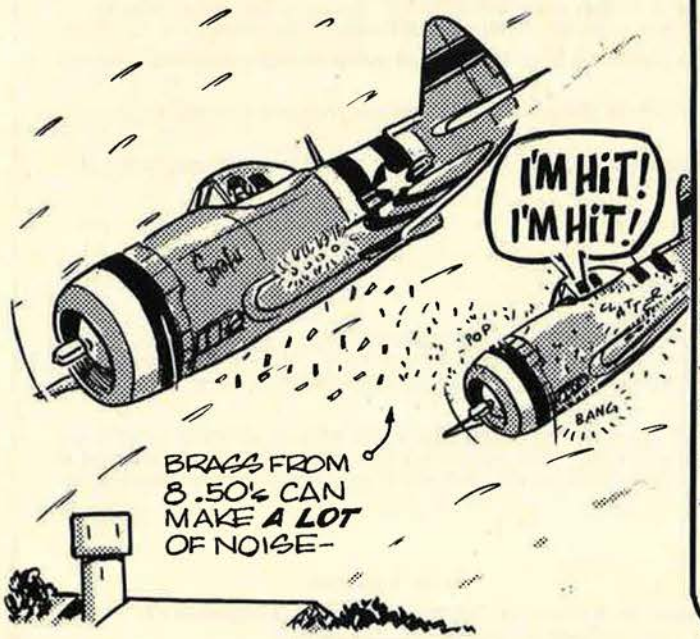
"There I was..."

TRUTH IS STRANGER (YOU KNOW THE REST). THE STORY ABOUT THE HELICOPTER ACTUALLY HAPPENED AT DANANG - AND THERE'S A COUPLE OF EX-AIRMEN FIRSTS AROUND TO PROVE IT.



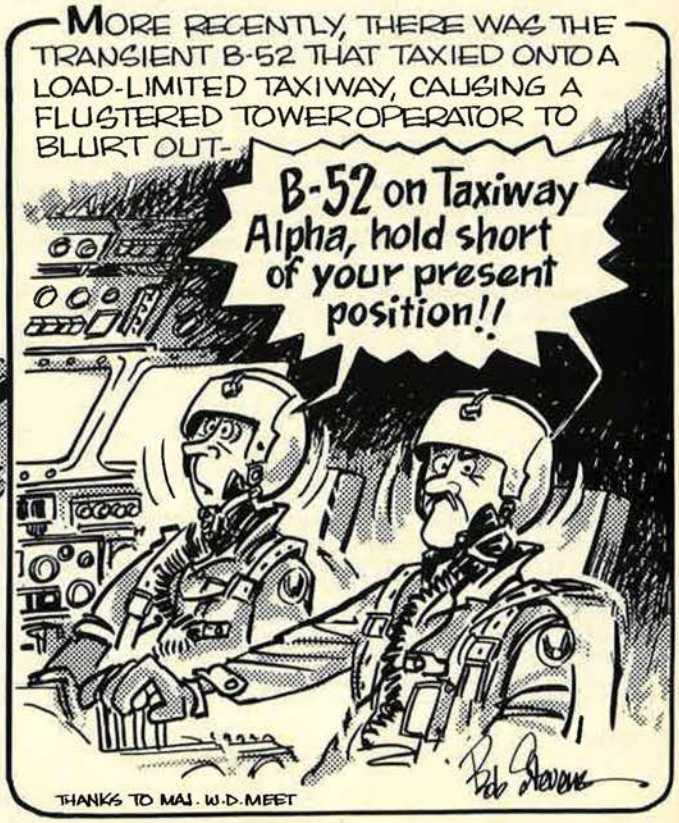
M/SGT. DICK PINKHAM
LANGLEY AFB

BACK IN THE BIG ONE, A WINGMAN'S POSITION (PARTICULARLY A GREEN ONE) SHOULD BE BEHIND -- BUT NOT ***BELOW*** -- HIS LEADER WHEN STRAFING -



BRASS FROM 8.50's CAN MAKE ***A LOT*** OF NOISE -

MORE RECENTLY, THERE WAS THE TRANSIENT B-52 THAT TAXIED ONTO A LOAD-LIMITED TAXIWAY, CAUSING A FLUSTERED TOWER OPERATOR TO BLURT OUT -



THANKS TO MAJ. W.D. MEET

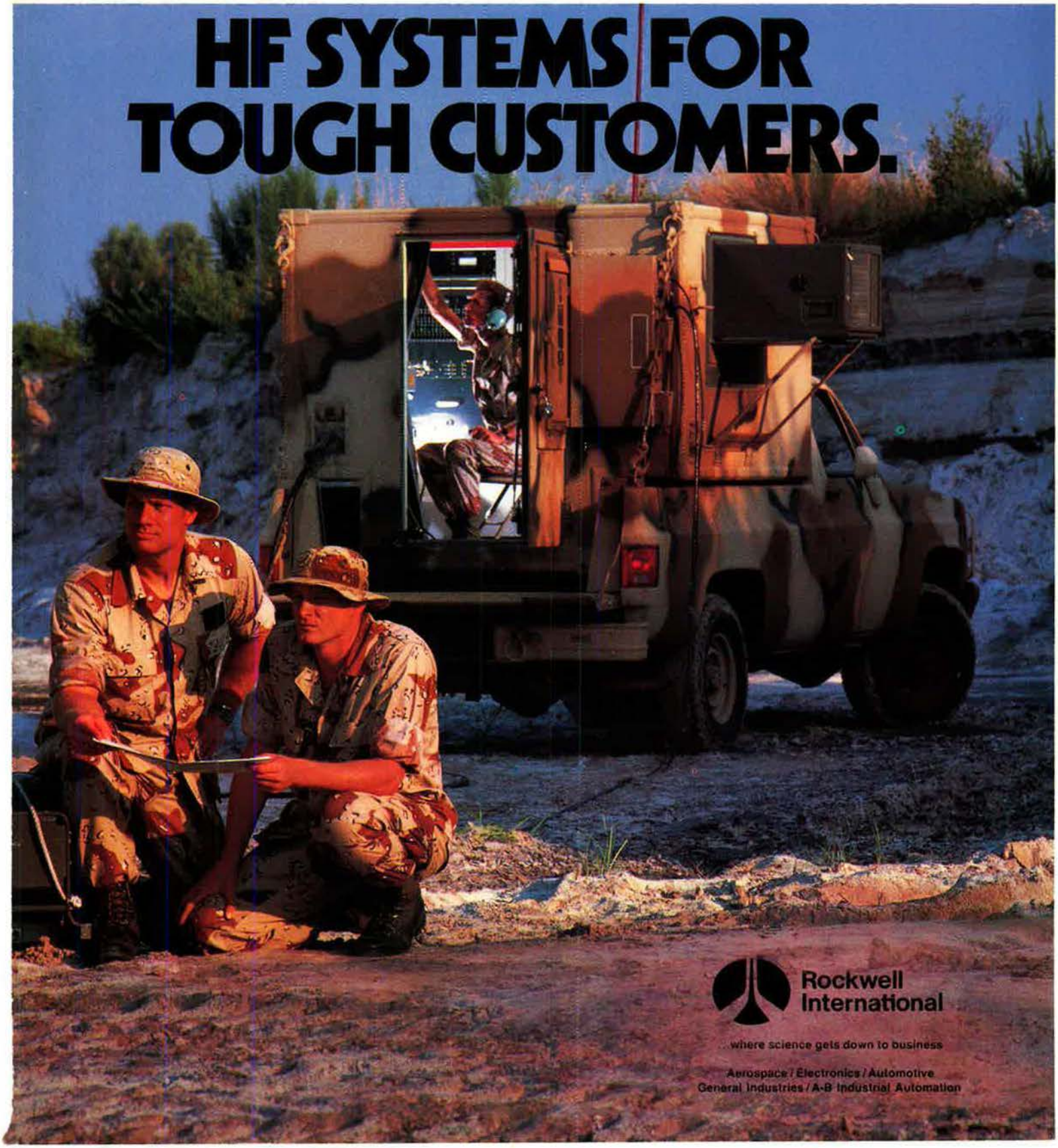
VITAL SYSTEMS HAVE TRAINED MORE MILITARY PILOTS THAN ANY OTHER SYSTEM.

Today 22 services in 19 countries use Vital visual simulation systems to train pilots in 25 types of military aircraft– front line fighters to basic trainers. In all, more than 200 Vital military and commercial systems are operating at nearly 100 sites worldwide, averaging 20 hours a day, seven days a week.
No other visual simulation system can match Vital for reliability, capability, ease of support, *and* low cost of ownership.
For more information, contact: McDonnell Douglas Electronics Company, P.O. Box 426, St. Charles, MO 63302. Telephone (314) 925-4467.

MCDONNELL DOUGLAS

COLLINS HF SYSTEMS: The AN/TSC-60(V)7 is a field-proven, non-developmental item (NDI) HF radio system with rapid-response transportability ■ Currently deployed with the U.S. Rapid Deployment Forces, the rugged TSC-60 consists of the standard S-250 shelter and Collins high performance HF radios. ■ It provides a reliable, multi-channel, full duplex communication link for voice, teletype and data transmission, allowing direct access into the global Defense Communication System. ■ The TSC-60 can be set up and operated by one person in 30 minutes. And it can be transported by land, sea or air. ■ Tri-Service interoperable and designed with P³I, the TSC-60 is designed to meet the communication demands in some of the toughest tactical environments. For information contact: Collins Defense Communications, Rockwell International, 3200 E. Renner Road, Richardson, Texas 75081. U.S.A. (214) 705-1000. Telex 795-530. ■ **Collins Defense Communications: The Integration Specialists.**

HF SYSTEMS FOR TOUGH CUSTOMERS.



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General Industries / A-B Industrial Automation